Alberto A. Guglielmone · Richard G. Robbins
Dmitry A. Apanaskevich · Trevor N. Petney
Agustín Estrada-Peña · Ivan G. Horak

The Hard Ticks of the World

(Acari: Ixodida: Ixodidae)

Springer

The Hard Ticks of the World

Alberto A. Guglielmone • Richard G. Robbins
Dmitry A. Apanaskevich • Trevor N. Petney
Agustín Estrada-Peña • Ivan G. Horak

The Hard Ticks of the World

(Acari: Ixodida: Ixodidae)

Springer

Alberto A. Guglielmone
Department of Animal Production
Instituto Nacional de Tecnología Agropecuaria
Estación Experimental Agropecuaria Rafaela
Rafaela, Argentina

Dmitry A. Apanaskevich
James H. Oliver Jr. Institute of Arthropodology and Parasitology
U.S. National Tick Collection
Georgia Southern University
Statesboro, Georgia, USA

Agustín Estrada-Peña
Department of Parasitology
Faculty of Veterinary Medicine
University of Zaragoza
Zaragoza, Spain

Richard G. Robbins
Armed Forces Pest Management Board
Office of the Deputy Under Secretary of Defense for Installations and Environment
Washington, DC, USA

Trevor N. Petney
Department of Ecology and Parasitology
Institute of Zoology
Karlsruhe Institute of Technology
Karlsruhe, Baden-Württemberg
Germany

Ivan G. Horak
Department of Veterinary Tropical Diseases
Faculty of Veterinary Science
University of Pretoria
Onderstepoort, Gauteng Province
South Africa

ISBN 978-94-007-7496-4 ISBN 978-94-007-7497-1 (eBook)
DOI 10.1007/978-94-007-7497-1
Springer Dordrecht Heidelberg New York London

Library of Congress Control Number: 2013952998

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

This work is dedicated to the memory of

Jane B. Walker (1925–2009)

doyenne of African ixodid tick taxonomy and internationally renowned expert on the Rhipicephalus *species of the world.*

Preface

The hard tick family Ixodidae currently comprises over 700 species worldwide, but information on types, developmental stages, distribution and hosts is scattered and often difficult to access. We have undertaken the task of compiling such information for each species of ixodid tick that we consider valid, believing that our summary will prove to be a valuable reference for the many people interested in ticks as organisms and also for specialists in tick-borne diseases. We fully expect that several new species of Ixodidae will have been described while this book was in press. Data for all species treated here were gleaned from a search of the world literature that concluded on 31 May 2013.

Alberto A. GUGLIELMONE is a Senior Scientist in Parasitology at the Estación Experimental Agropecuaria Rafaela, Instituto Nacional de Tecnología Agropecuaria, and Principal Scientist at the Consejo Nacional de Investigaciones Científicas y Técnicas, Argentina. Electronic mail: guglielmone.alberto@inta.gob.ar

Richard G. ROBBINS is a Civilian Entomologist and Medical Acarologist in the Information Services Division, Armed Forces Pest Management Board, Office of the Deputy Under Secretary of Defense for Installations and Environment, Washington, D.C., U.S.A. Electronic mail: richard.g.robbins.civ@mail.mil

Dmitry A. APANASKEVICH is Assistant Curator and Associate Professor at the Department of Biology, Georgia Southern University, Statesboro, Georgia, U.S.A. Electronic mail: dapanaskevich@georgiasouthern.edu

Trevor N. PETNEY is a Lecturer at the Department of Ecology and Parasitology, Institute of Zoology, Karlsruhe Institute of Technology, Karlsruhe, Germany. Electronic mail: trevor.petney@kit.edu

Agustín ESTRADA-PEÑA is a Professor in Parasitology at the Facultad de Veterinaria, Universidad de Zaragoza, Spain. Electronic mail: aestrada@unizar.es

Ivan G. HORAK is Emeritus Professor of Veterinary Ectoparasitology at the Faculty of Veterinary Science, University of Pretoria, South Africa. Electronic mail: ivan.horak@up.ca.za

Acknowledgements

We warmly thank Ms. Marta Sánchez, librarian at the Estación Experimental Agropecuaria Rafaela, Instituto Nacional de Tecnología Agropecuaria, Rafaela, Argentina; Mr. Yago Alfonso, Centro Argentino de Información Científica y Tecnológica, Ministerio de Ciencia, Tecnología e Innovación Productiva, Buenos Aires, Argentina; and Ms. Gabriela Laspina, librarian at the Servicio Centralizado de Documentacion, Centro Científico Tecnológico, Consejo Nacional de Investigaciones Científicas y Técnicas, Santa Fe, Argentina, for their heroic efforts in obtaining numerous publications from scientists and libraries around the world. Miss Evelina Tarragona, postgraduate student at the Facultad de Ciencias Veterinaria, Universidad Nacional del Litoral, Argentina, helped us in reviewing much of the literature on which this study is based.

We are grateful to the following scientists who located publications relevant to our work: Anne Baker, Natural History Museum, London, England; Lorenza Beati, United States National Tick Collection, Georgia Southern University, Statesboro, USA; Michael, J. Burridge, College of Veterinary Medicine, University of Florida, Gainesville, USA; Gennady V. Kolonin, Ministry of Natural Resources, Moscow, Russia; Marcelo, B. Labruna, Departamento de Medicina Veterinária Preventiva e Saúde Animal, Faculdade de Medicina Veterinária e Zootecnia, Universidade de São Paulo, Brazil; Francisco Márquez, Universidad de Jaen, Spain; Mariano Mastropaolo, Facultad de Ciencias Veterinarias, Universidad Nacional del Litoral, Esperanza, Argentina; Santiago Nava, Estación Experimental Agropecuaria Rafaela, Instituto Nacional de Tecnología Agropecuaria, Rafaela, Argentina; Magdalena Nowak-Chmura, Department of Invertebrate Zoology and Parasitology, Institute of Biology, Pedagogical University of Cracow, Kraków, Poland; Ifor L. Owen, National Veterinary Laboratory, National Agriculture Quarantine and Inspection Authority, Port Moresby, Papua New Guinea; Luis M. Rosalino, Universidade de Lisboa, Centro de Biologia Ambiental, Lisboa, Portugal; Matias J. P. Szabó, Faculdade de Medicina Veterinária, Universidade Federal de Uberlandia, Uberlandia, Brazil; and José M. Venzal, Facultad de Veterinaria, Universidad de la República, Salto, Uruguay.

Graeme S. Cumming, Percy Fitz Patrick Institute, University of Cape Town Rondebosch, South Africa, provided us with data from his acclaimed studies on the ecology of African ticks.

Bruce Halliday, CSIRO Entomology, Canberra, Australia, supplied several older Australian scientific papers and provided important information on ticks deposited in Australian collections.

Heloise Heyne, ARC-Onderstepoort Veterinary Institute, Onderstepoort, South Africa, provided valuable information on the distribution of Afrotropical *Ixodes* species.

Allen C.G. Heath, Wallaceville Animal Research Centre, Upper Hutt, New Zealand, provided many papers on Australasian ticks, a valuable compilation of references, and useful discussions of several tick species.

Víctor Kore, Buenos Aires, Argentina, translated the figure legends in a number of Japanese papers.

Ricardo L. Palma, Museum of New Zealand Te Papa Tongarewa, Wellington, New Zealand, provided some older New Zealand scientific papers and discussions concerning the correct usage of tick names.

Fu-Meei Yeh Robbins, wife of the second author, translated several important scientific papers written in Chinese.

Yi Sun, Institute of Microbiology and Epidemiology, Beijing, China, clarified the contents of recent Chinese tick papers.

Takeo Yamauchi, Institute of Health, Imizu, Toyama, Japan, similarly assisted us in interpreting the data on species of *Ixodes* discussed in Japanese papers and also provided many articles from the Japanese tick literature.

In Argentina, the Instituto Nacional de Tecnología Agropecuaria, the Asociación Cooperadora of the Estación Experimental Agropecuaria, and the Consejo Nacional de Investigaciones Científicas y Técnicas, generously provided financial support to Alberto A. Guglielmone.

The Integrated Consortium on Ticks and Tick-Borne Diseases of the European Union, coordinated by Frans Jongejan, encouraged and supported the initial work of Dmitry A. Apaneskevich, Agustín Estrada-Peña, Alberto A. Guglielmone and Ivan G. Horak on this project.

A collaborative project (S0805 and UID67363) financed by the Argentinean and South African governments contributed toward ongoing studies of the ixodid ticks of the world by Alberto A. Guglielmone and Ivan G. Horak.

Contents

Introduction

Ixodid or hard ticks (Acari: Ixodida: Ixodidae) are blood-feeding ectoparasites of wild and domestic terrestrial or semi-aquatic vertebrates. They occur worldwide and are capable of transmitting a broad range of human and animal pathogens. The literature on Ixodidae is voluminous but diffuse, with the result that those seeking information on a particular species, whether for research, teaching or extension work, are often at a loss as to where to turn. Herein we present summary data, with supporting references, for each of the world's hard tick species, focusing on taxonomic authorities, type depositories, known active stages, geographical distribution, hosts, and human parasitism. To this end, the following experts have contributed their specialized knowledge of ticks from the six generally accepted zoogeographic regions:

Apanaskevich, D.A.: Palearctic and Afrotropical tick species
Estrada-Peña, A.: Palearctic and Neotropical tick species
Guglielmone, A.A.: Neotropical tick species
Horak, I.G.: Afrotropical tick species
Petney, T.N.: Australasian, Palearctic and Oriental tick species
Robbins, R.G.: Nearctic and Oriental tick species

The book comprises six chapters on the major tick genera, one on the minor genera, and a concluding overview: 1 – *Ixodes*, 2 – *Haemaphysalis*, 3 – *Amblyomma*, 4 – *Rhipicephalus*, 5 – *Dermacentor*, 6 – *Hyalomma*, 7 – *Anomalohimalaya*, *Bothriocroton*, *Cosmiomma*, *Compluriscutula*, *Cornupalpatum*, *Margaropus*, *Nosomma* and *Rhipicentor*, 8 – Synopsis.

Several classifications of the Ixodidae exist with varying degrees of congruence; we have selected the arrangement of Horak et al. (2002), with the addition of the fossil genera *Compluriscutula* and *Cornupalpatum*. An addenda containing relevant information published after 31 May 2013 are included at the end of Synopsis and a list of type depository acronyms are at the end of the book. Names of taxa are also based on Horak et al. (2002) but have been amended to accord with the list of controversial tick names of Guglielmone et al. (2009) and to take into consideration

A.A. Guglielmone et al., *The Hard Ticks of the World: (Acari: Ixodida: Ixodidae)*,
DOI 10.1007/978-94-007-7497-1_1, © Springer Science+Business Media Dordrecht 2014

the online publication of Kolonin (2009). Some new names added in Guglielmone et al. (2010) are also included, as well as species described or resurrected through the end of 2009 and a few species described through 31 May 2013.

Synonymies are not fully considered in this work because several studies already cover them. Camicas et al. (1998) present long lists of synonyms for the species of Ixodidae and Argasidae. Filippova (1977, 1997) treats synonymies for ixodid ticks, other than *Hyalomma*, that are found in Russia and neighboring countries, and Walker et al. (2000) review the synonymies of all species in the genus *Rhipicephalus*. Guglielmone et al. (2009, 2010) provide a few additional synonyms and a list of resurrected species from 2003 to 2009. The series of papers by Apanaskevich and co-workers contains synonyms for most species of *Hyalomma*, and full citations for those papers appear in Chap. 6 of the present work. Guglielmone et al. (2003) present several synonyms for Neotropical ticks, together with detailed comments on names of allegedly Neotropical species that may be synonyms but require further study for clarification of their status, or that may represent *nomina nuda* or species *incertae sedis*.

Several lists of tick names have been published since Camicas et al. (1998) (Horak et al. 2002; Barker and Murrell 2004, 2008; Kolonin 2009; Nava et al. 2009; Guglielmone et al. 2010), and we address disagreements between these lists in different ways. Initially, we discuss the views of other authors at the beginning of each of our chapters, under the heading "Remarks on some invalid names," focusing on names that we regard as especially relevant. We may also describe differences of opinion after particular species names. Additionally, when an author provides relevant information for a tick species using a name currently considered a synonym or a *lapsus calami*, we note this fact in the Remarks section for that species, and a full citation is included in the corresponding References section. However, the emphasis of this book is on current valid names and the parasitic stages, distribution and hosts of each of the world's ixodid tick species; synonyms and *lapsus calamorum* are only included if relevant to any of these topics.

In summarizing the distribution of each hard tick species, we have largely adopted the zoogeographic regions proposed by Cox and Moore (2005). Thus, we use the names Afrotropical (= African, Ethiopian), Australasian, Nearctic, Neotropical, Oriental (= Indo-Malayan) and Palearctic. Of course, there are considerable differences among authors concerning the limits of these zoogeographic regions, but we define them as follows (see also Fig. 1):

Afrotropical: includes sub-Saharan Africa, Madagascar, islands close to the African continent, and a portion of the Arabian Peninsula (Asia) south to a line running east-west from the Strait of Hormuz to the Red Sea.

Australasian: Wallace's Line, which runs between Borneo and Sulawesi and through the Lombok Strait between Bali and Lombok, is considered the northwestern limit of this region. All islands east of this line through New Guinea and Australia are included in the Australasian Region, along with New Zealand, the islands between New Guinea and Australia, and the island belt from New Guinea to New Zealand.

Fig. 1 Zoogeographic regions of the world

Nearctic: from the Mexican Plateau northward into Canada and Greenland.

Neotropical: from the eastern and western flanks of the Mexican Plateau southward to southern Argentina and Chile; this region also includes the Greater and Lesser Antilles and the Galapagos Islands.

Oriental: eastern Pakistan, India, Southeast Asia, southern China and the Ryukyu islands lie within this region, which extends to Wallace's Line in the southwest (see Australasian Region). The region includes Asia south of the Himalayas in the west and south of the Yangtze River in the east. The western boundary is the Indus River Valley.

Palearctic: Europe, Asia north of the Himalayas and west of the Indus River Valley, North Africa through the Sahara, and the northern portion of the Arabian Peninsula (see Afrotropical and Oriental Regions).

A few tick species occur on islands that are not readily associated with any of the above regions, the islands themselves being part of the Oceanic Region of some authors. In such cases we simply state the ocean in which a particular island is located. One tick species, *Ixodes uriae*, is chiefly found around the poles on polar islands and continental territories, a distribution that we and other authors describe as circumpolar. It has occasionally been difficult to determine the zoogeographic affinities of ticks that occur along regional borders. This is particularly true of the Oriental and Palearctic Regions, largely because of difficulties in interpreting the literature of that area.

One of us (AEP), utilizing the analysis of Olson et al. (2001) as defined in www.worldwildlife.org/science, has attempted to associate each of the world's hard tick species with one or more ecoregions, which may be thought of as large units of the earth's surface with similar physiography and vegetation and possessing similar biotic communities, at least prior to anthropogenic change. By associating particular tick species with one or more eco-regions, we have attempted to broadly outline the world's tick habitats.

Locality records for Afrotropical ticks were compiled by three of us (IGH, DAA, AEP) and by H. Heyne; records from the Nearctic Region and the western Palearctic

(Europe) were compiled by AEP; and those from the Neotropical Region were assembled by AAG. All records are available upon request. There are no compilations of tick locality records for the Asian Palearctic, Australasian and Oriental Regions. In these cases the principal reviews of each species were used to infer that species' eco-zone(s).

Within a given genus, species are treated separately and in alphabetical order. The name of each tick is followed by its author(s), year of description and publication data. Thereafter, any problems concerning names, authors, dates or synonyms are discussed. The status of types and the acronyms for type depositories (whose definitions are presented at the end of this publication), references to type depositories, and discrepancies among authors concerning them are also provided. References for each species are included in full in this section of the text. However, since many references are shared by several species, we cite the full reference only when used the first time within a chapter on a given genus. Thereafter, the same reference is quoted as *"op. cit.* under" followed by the name of the species with which it was first used. Problems concerning tick names associated with particular hosts or localities are discussed under Remarks, together with relevant references.

The next section lists the known stages for each species of tick. There are questions concerning the validity and identification of a few species that are known only from the adult stages; however, the vast majority of male and female ixodids have been well described and are believed to represent valid species. By contrast, the preimaginal stages (larvae, nymphs) of many species are unknown or undescribed, with the result that their host relationships are also often poorly known.

Distribution by zoogeographic region(s) and eco-region(s) is followed by a section on hosts, which are listed as usual or exceptional wherever sufficient literature exists to make this distinction. The concept of usual or exceptional hosts is based not on strict statistical analysis, but on our interpretation of key references for each tick species, with the understanding that this may change when new data become available, especially for the hosts of larvae and nymphs. If a tick stage is known only from laboratory-reared specimens, or natural hosts are not known with certainty, this is noted in the corresponding Remarks section, as are those host records of larvae and nymphs for species where one or both immature stages remain undescribed. Some of these records are treated as provisionally valid, while others have been rejected, pending confirmation of the host-parasite relationship.

The host list is arranged by class, order and family and is confined to natural hosts (as opposed to laboratory hosts that, with few exceptions, are not treated here). The tick stages known from each host group appear in parentheses and are abbreviated as follows: A: adults, whether female, male or both; N: nymph; L: larva. The term "several" is used extensively throughout the text and means that more than three representatives from the corresponding host taxonomic group have been found infested with a given tick species stage. The Remarks section may contain additional information about the inclusion, exclusion or relevance of different types of hosts for a particular species.

A separate section is devoted to human infestation. The world literature contains innumerable records of ticks found on humans, but it is sometimes unclear whether

the specimens were actually feeding or simply crawling on human skin or clothing. When a tick species is not known with certainty to have fed on a human host, this fact is noted in the Remarks section.

Additionally, the Remarks section highlights unresolved issues, disagreements in the literature, or important species-specific information, such as introductions into zoogeographic regions outside a species' natural range or collections from novel hosts. Each species summary ends with a list of major references that address that species' distribution, hosts, human infestation, or any material discussed under Remarks. It will be seen that many references are cited repeatedly, but we prefer to treat each species as a unit, instead of merging all references into a single bibliography.

Our discussion of known stages focuses on those described since the review of Camicas et al. (1998); any discrepancies we have found between that work and ours are included in the Remarks section, as are, to a lesser extent, our differences with the catalogue of Kolonin (2009). Summarizing the hosts of different tick species is challenging for a range of reasons: host information is abundant in the tick literature but often diffuse, easily overlooked, or difficult to interpret, as in the case of the Asian literature, where the common names of many hosts cannot be tied to their Western equivalents. In addition, there are disagreements in the literature concerning the correct diagnoses for some tick species, which can affect host assignation. Wherever possible, we rely on an accepted authority (references provided) to settle disputes about host specificity, although we acknowledge that it is impossible to certify that all host records listed for a particular tick species are correct. As stated above, we have focused on natural hosts, but we sometimes also include tick records from captive hosts. This situation is discussed under Remarks. We decided not to tabulate the genera and species of all known hosts because doing so would have resulted in almost endless lists for several tick species, but we have provided important references to the host literature. For the purposes of this work, it is sufficient that host relationships be discussed at the family level.

In many of the papers that we have reviewed, reference is made to so-called accidental records, these presumably being cases where specimens of a given tick species are found on hosts that, according to the author, are unusual. However, it is difficult to prove that an unusual host record is accidental, because it is rarely possible to determine the consequences of such tick-host relationships. A record may be considered accidental if ticks are unable to engorge on an atypical host, but successful molting or oviposition may ultimately lead to speciation, although this would be difficult to assess. In the present work, unusual hosts are classified as exceptional hosts and are discussed under Remarks.

We have adopted the host classificatory system of Wilson and Reeder (2005) for mammals and Dickinson (2003) and Meyer de Schauensee (1982) for birds. Taxonomic data for reptiles and amphibians were downloaded from The Animal Diversity Web of the University of Michigan Museum of Zoology. Accordingly, we have grouped the principal hosts under the headings Anura, Aves, Crocodilia, Mammalia, Squamata and Testudines and Rhynchocephalia, the last-named category being the exclusive host of one species of *Amblyomma.*

At the conclusion of each chapter devoted to each genus, we present: (1) a synopsis of the known stages, hosts, distribution and instances of human infestation, focusing on the distribution of species in each zoogeographic region, and species with broad distributions (i.e., established in at least three zoogeographic regions); (2) comments on the distribution of each genus; (3) a discussion of the proportion of taxa known from regions that constituted the ancient super-continents Gondwana (Afrotropical, Australasian, Neotropical and Oriental Zoogeographic Regions) and Laurasia (Nearctic and Palearctic Zoogeographic Regions), information that may be relevant to studies of tick phylogeny and ecology; and (4) an analysis of the principal hosts and combinations of hosts for all species whose adults (male and/or female), nymphal and larval stages and natural hosts are known. Species whose larvae and nymphs are known only from laboratory-reared specimens, those for which one stage is provisionally valid, those whose adults are known only from molted nymphs, and those whose hosts are uncertain were excluded from this analysis. For our purposes, hosts were considered in absolute terms, meaning that a single collection from a definitively determined host sufficed to include that host among those of a particular tick species.

Finally, a synopsis of all species in each genus is presented. The synopsis includes ticks known to feed on humans, tick distribution by zoogeographic regions or combinations of regions, and tick-host relationships. The history of tick distribution with respect to the Gondwanan and Laurasian continents is also discussed. Tick-host relationships and their variations are also dealt with, including a discussion on tick species of all genera established in three or more zoogeographic regions, i.e., species with a widespread distribution.

References

Barker, S.C. & Murrell, A. 2004. Systematics and evolution of ticks with a list of valid genus and species names. Parasitology, 129: S15–S36.

Barker, S.C. & Murrell, A. 2008. Systematics and evolution of ticks with a list of valid genus and species names. *In* A.S. Bowman & P.A. Nuttall (editors), Ticks: biology, disease and control. Cambridge University Press, Cambridge, pp. 1–39.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Cox, C.B. & Moore, P.D. 2005. Biogeography. An ecological and evolutionary approach, 7th edition, Blackwell Publishing, Oxford, 428 pp.

Dickinson, E.C. 2003. The Howard & Moore complete checklist of the birds of the world, 3rd edition, Princeton University Press, Princeton and Oxford,1039 pp.

Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.

Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka Publishing House, St. Petersburg, 436 pp. In Russian.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Guglielmone, A.A., Robbins, R.G., Apanaskevich, D.A., Petney, T.N., Estrada-Peña, A. & Horak, I.G. 2009. Comments on controversial tick (Acari: Ixodida) species names and species described or resurrected from 2003 to 2008. Exp. Appl. Acarol., 48: 311–327.

Guglielmone, A.A., Robbins, R.G., Apanaskevich, D.A., Petney, T.N., Estrada-Peña, A., Horak, I.G., Shao, R. & Barker, S.C. 2010. The Argasidae, Ixodidae and Nuttalliellidae (Acari: Ixodida) of the world. A list of valid species names. Zootaxa, 2528: 1–28.

Horak, I.G, Camicas, J.-L. & Keirans, J.E. 2002. The Argasidae, Ixodidae and Nuttalliellidae (Acari: Ixodida): a world list of valid tick names. Exp. Appl. Acarol., 28: 27–54.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Meyer de Schauensee, R. 1982. A guide to the birds of South America. The International Council for Bird Preservation, reprinted with new addenda, 498 pp.

Nava, S., Guglielmone, A.A. & Mangold, A.J. 2009. An overview of systematics and evolution of ticks. Front. Biosci., 14: 2857–2877.

Olson, D.M., Dinerstein, E., Wikramanayake, E.D., Burgess, N.D., Powell, G.V.N., Underwood, E.C., D'Amico, J.A., Itoua, I., Strand, H.E., Morrison, J.C., Loucks, C.J., Allnut, T.F., Ricketts, T.H., Kura, Y., Lamoreux, J.F., Wettengel, W.W., Hedao, P. & Kassem, K.R. 2001. Terrestrial ecoregions of the world: a new map of life on earth. BioScience, 51: 933–938.

The Animal Diversity Web of the University of Michigan Zoological Museum. http://animaldiversity.ummz.umich.edu/

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae). A guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

Wilson, D.E. & Reeder, D.M. 2005. Mammals species of the world: a taxonomic and geographic reference, 3rd edition, The Johns Hopkins University Press, Baltimore, 2142 pp.

Part I
The Genus *Ixodes*

Remarks on Some Invalid Names

Ixodes angulatus Kishida, 1939 was described from nymphs collected in Manchuria, but Camicas et al. (1998) err in treating *I. angulatus* as a synonym of *I. pomerantzevi* because in the event of synonymy of these taxa, *I. angulatus* would prevail over *I. pomerantzevi*, which was described in 1941. Kishida's (1939) description is brief and does not designate type depositories. Further, this description does not accord with that of the nymph of *I. pomerantzevi* in Filippova (1977), nor does it resemble any species of *Ixodes* because the anal groove surrounds the anus posteriorly. Teng and Jiang (1991) treat *I. angulatus*, which they appear to have misspelled *I. angutatus*, as a synonym of *Dermacentor sinicus* Schulze, 1932. However, the illustrations in Kishida (1939) and Teng and Jiang (1991) vary in detail. Consequently, we regard *I. angulatus* as a name *incertae sedis*. This situation may change if the specimens used in the original description are found and redescribed.

Ixodes aubiensis Arthur, 1958 is allegedly described in Arthur and Burrow (1957), according to Arthur (1958), but it is not described there. *Ixodes aubiensis* is therefore a *nomen nudum.*

Ixodes hoogstraalae (Emel'yanova, Vasil'ev, Vershinina, Derevshchikov, Prokop'ev, Sonin, Sheremet'eva & Shikhorb'eev, 1978), originally named *Pholeoixodes hoogstraalae* by Emel'yanova et al. (1978), is a name without an accompanying description (*nomen nudum*) and, as stated in Carpenter and Robbins (2010), bears no relationship to *Ixodes hoogstraali*.

Ixodes poonchensis Sharma, 1993 is a name assigned to nymphs of an allegedly new species that parasitizes Rodentia: Sciuridae in the Himalayan Poonch Valley (Kashmir) (Sharma 1993). We are unaware of any formal description of this species and regard this name as a *nomen nudum.*

Ixodes robertsi Camicas, Hervy, Adam & Morel, 1998 is listed as a *nomen novum* for *I. cornuatus* Roberts, 1960, which the describers considered preoccupied by *I. cornuatus* Olenev, 1941; however, the latter name is a *nomen nudum*, as discussed in Guglielmone et al. (2009). The name *I. robertsi* is a junior objective synonym of *Ixodes cornuatus* Roberts, 1960, as stated in Halliday (2012).

A.A. Guglielmone et al., *The Hard Ticks of the World: (Acari: Ixodida: Ixodidae)*,
DOI 10.1007/978-94-007-7497-1_2, © Springer Science+Business Media Dordrecht 2014

References

Arthur, D.R. 1958. New species of *Ixodes* ticks from eastern Africa, with a description of the male and nymph of *Ixodes oldi* Nuttall, 1913. Parasitology, 48: 38–69.

Arthur, D.R. & Burrow, C. 1957. The *Ixodes rasus* group of African ticks with descriptions of four new species (Ixodoidea, Ixodidae). Bull. Mus. Comp. Zool., 116**:** 493–537.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Carpenter, T.L. & Robbins, R.G. 2010. Patronyms honoring Harry Hoogstraal (1917–1986). Syst. Appl. Acarol., 15: 187–194.

Emel'yanova, N.D., Vasil'ev, G.I., Vershinina, T.A., Derevshchikov, A.G., Prokop'ev, V.N., Sonin, V.D., Sheremetieva, O.F. & B.V. Shikhorb'eev, B.V. 1978. Migratory birds and immigrant ixodid tick species of the genus *Pholeoixodes*. *In* Transcontinental connections of migratory birds and their role in the distribution of arboviruses, papers of Symposium 1976, Novosibirsk (Akademgorodok), Nauka, Siberian Branch, Novosibirsk, pp. 280–282. In Russian, NAMRU-3 translation 1605.

Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.

Guglielmone, A.A., Robbins, R.G., Apaneskevich, D.A., Petney, T.N., Estrada-Peña, A. & Horak, I.G. 2009. Comments on controversial tick (Acari: Ixodida) species names and species described or resurrected from 2003 to 2008. Exp. Appl. Acarol., 48: 311–327.

Halliday, R.B. 2012. Superfamily Ixodoidea Dugès, 1834. *In* Australian Faunal Directory, http://www.environment.gov.au/biodiversity/abrs/on-line-resources/faunalafd/taxa/ACARI/ accessed March 1, 2012.

Kishida, K. 1939. Arachnida of Jehol. Orders: Scorpiones, Opiliones & Acarina. Rep. I. Sci. Exp. Manchoukuo, Sect. 5, Div. 1, Part 4, Art. 13: 1–49.

Sharma, B.D. 1993. Medical & veterinary arthropod-disease ecology. Ashish Publishing House, New Delhi, 335 pp.

Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.

Individual Species Accounts

1 – *I. abrocomae* Lahille, 1916 (Rev. Chil. Hist. Nat., 20: 107–108)
There is disagreement concerning the year of description of *I. abrocomae*; some authors argue that it is 1917, while others claim that it is 1916 (Guglielmone, A.A., Robbins, R.G., Apanaskevich, D.A., Petney, T.N., Estrada-Peña, A., Horak, I.G., Shao, R. & Barker, S.C. 2010. The Argasidae, Ixodidae and Nuttalliellidae (Acari: Ixodida) of the world. A list of valid species names. Zootaxa, 2528: 1–28). An inquiry to the U.S. Library of Congress failed to resolve this problem. A request to the Sociedad Chilena de Biología (publisher of Revista Chilena de Historia Natural, where the description of *I. abrocomae* was published) was not answered. We consider 1916 as the year of description of *I. abrocomae*. See comments below and also under *I. sigelos*.

Type depository: neotype (USNTC) (Guglielmone, A.A., Nava, S., Bazán-León, E.A., Vásquez, R.A. & Mangold, A.J. 2010. Redescription of the male and description of the female of *Ixodes abrocomae* Lahille, 1916 (Acari: Ixodidae). Syst. Parasitol., 77: 153–160)

Known stages: male, female

Zoogeographic Region: Neotropical

Ecoregions: Chilean matorral, Chilean mediterranean-type scrub; southern Andean steppe

Hosts: Rodentia: Abrocomidae, Cricetidae (A)

Human infestation: no

Remarks: this species was known only from the holotype male (subsequently lost); recently, however, Guglielmone et al. (2010) found new males and females, thus confirming the validity of *I. abrocomae*. See also *I. sigelos*.

A.A. Guglielmone et al., *The Hard Ticks of the World: (Acari: Ixodida: Ixodidae)*,
DOI 10.1007/978-94-007-7497-1_3, © Springer Science+Business Media Dordrecht 2014

References

Guglielmone, A.A., Nava, S., Bazán-León, E.A., Vásquez, R.A. & Mangold, A.J. 2010. Redescription of the male and description of the female of *Ixodes abrocomae* Lahille, 1916 (Acari: Ixodidae). Syst. Parasitol., 77: 153–160.

Lahille, F. 1916. Descripción de un nuevo ixódido chileno. Rev. Chil. Hist. Nat., 20: 107–108.

2 – *I. acuminatus* Neumann, 1901 (Mém. Soc. Zool. Fr., 14: 249–372)
See *I. redikorzevi* for the opinion of researchers who regard this tick as a synonym of *I. acuminatus*, and also the remarks below.

Type depository: ENV (syntypes) (Nuttall, G.H.F. & Warburton, C. 1911. Ticks. A monograph of the Ixodoidea. Part II The Ixodidae. Section II Genus I. *Ixodes* Latreille 1795. Cambridge University Press, London, pp. 133–293)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: this tick has a wide Palearctic distribution, mainly in temperate broadleaf and mixed forests

Hosts: usual hosts for larvae, nymphs and adult ticks are Rodentia: Cricetidae and Muridae. Aves are considered exceptional hosts for this species.
Mammalia (several orders) (ANL)
Passeriformes: Turdidae (A)

Human infestation: yes (Hillyard 1996)

Remarks: Kolonin (2009) regards *I. redikorzevi* as a synonym of *I. acuminatus* and does not recognize Aves as hosts of this tick. We accept the records of *I. acuminatus* from Aves in Gilot et al. (1992), Norte et al. (2012, 2013) and Tomassone et al. (2013). Heath (2013) lists reptiles as hosts of *I. acuminatus*, as a result of a transcription error (Heath, A.C.G., personal communication to Guglielmone, A.A.). See also *I. apronophorus*.

References

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Gilot, B., Couatarmanac'h, A., Guiguen, C. & Beaucournu, J.C. 1992. Bio-écologie d'*Ixodes acuminatus* Neumann, 1911. Hôtes et répartition spatio-temporelle de l'espèce en France. Ann. Parasitol. Hum. Comp., 67: 19–25.

Heath, A.C.G. 2013. Implications for New Zealand of potentially invasive ticks sympatric with *Haemaphysalis longicornis* Neumann, 1901 (Acari: Ixodidae). Syst. Appl. Acarol., 18: 1–26.

Hillyard, P.D. 1996. Ticks of North-West Europe. Keys and notes for identification of the species. Synopses of the British Fauna (New Series) (52), Field Studies Council, Shrewsbury, UK, 178 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Norte, A.C., Carvalho, I.L., Ramos, J.A., Gonçalves, M., Gern,L. & Núncio, M.S. 2012. Diversity and seasonal patterns of ticks parasitizing wild birds in western Portugal. Exp. Appl. Acarol., 58: 327–339.
Norte, A.C., Ramos, J.A., Gern, L., Núncio, M.S. & Carvalho, I.L. 2013. Birds as reservoirs for *Borrelia burgdorferi* s.l. in Western Europe: circulation of *B. turdi* and other genospecies in bird-tick cycles in Portugal. Environ. Microbiol., 15: 386–397.
Tomassone, L., Grego, E., Auricchio, D., Iori, A., Giannini, F. & Rambozzi, L. 2013. Lyme borreliosis spirochetes and spotted fever group rickettsiae in ixodid ticks from Pianosa Island, Tuscany Archipelago, Italy. Vector-Borne Zoon. Dis., 13: 84–91.

3 – *I. acutitarsus* (Karsch, 1880) (Mitt. Münch. Entomol. Ver., 4: 141–142)

Type depository: ZMB (holotype) (Moritz, M. & Fischer, S.C. 1981. Die Typen der Arachniden-Sammlung des Zoologischen Museums Berlin. Mitt. Zool. Mus. Berlin, 57: 341–364) as *Haemalastor acutitarsus*.

Known stages: male, female, nymph, larva

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: tropical, subtropical and temperate broadleaf forests

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae; usual hosts for larvae are Rodentia: Muridae and Sciuridae. Aves are considered exceptional hosts for this tick.
Carnivora: Felidae (AN)
Artiodactyla (several families), Carnivora: Ursidae; Passeriformes: Corvidae (A)
Rodentia: Cricetidae, Muridae, Sciuridae (NL)
Soricomorpha: Soricidae (L)
Carnivora: Canidae; Passeriformes: Timaliidae (stages unknown)

Human infestation: yes (Heath and Hardwick 2011 among others)

Remarks: Heath and Hardwick (2011) record the introduction of *I. acutitarsus* into the Australasian Region, but there is no evidence that this tick has become established there. Clifford et al. (1975) record a female of *I. acutitarsus* on Chiroptera, but they consider that the host may be incorrectly identified and it has not been included in our host list for this species. Kolonin (2009) does not recognize Aves as hosts for *I. acutitarsus*, possibly because it is a rare event recorded in Teng and Jiang (1991) and Mitchell and Dick (1978).

References

Chao, L.-L. & Shih, C.-M. 2012. First report of human biting activity of *Ixodes acutitarsus* (Acari: Ixodidae) collected in Taiwan. Exp. Appl. Acarol., 56: 159–164.
Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Clifford, C.M., Hoogstraal, H. & Keirans, J.E. 1975. The *Ixodes* ticks (Acarina: Ixodidae) of Nepal. J. Med. Entomol., 12: 115–137.
Heath, A.C.G. & Hardwick, S. 2011. The role of humans in the importation of ticks to New Zealand: a threat to public health and biosecurity. N. Zeal. Med. J., 124: 67–82.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Mitchell, R.M. & Dick, J.A. 1978. Ectoparasites from Nepal birds. J. Bombay Nat. Hist. Soc., 74: 264–274.
Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.
Yamaguti, N., Tipton, V.J., Keegan, H.L. & Toshioka, S. 1971. Ticks of Japan, Korea, and the Ryukyu Islands. Brigham Young Univ. Sci. Bull. Biol. Ser., 15 (1), 226 pp.
Yamauchi, T., Fukui, Y., Watanabe, M., Nakagawa, H. & Kamimura, K. 2010. Forty cases of human infestations with hard ticks (Acari: Ixodidae) in Toyama Prefecture, Japan. Med. Entomol. Zool., 61: 133–143. In Japanese.

4 – *I. affinis* Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)
See remarks below and also under *I. aragaoi* for the incorrect synonymization with *I. affinis*.

Type depositories: IBU, USNPC (syntypes) (Barros-Battesti, D.M. & Knysak, I. 1999. Catalogue of the Brazilian *Ixodes* (Acari: Ixodidae) material in the mite collection of Instituto Butantan, São Paulo, Brazil. Papéis Avulsos Zool., 41: 49–57; Salley, E.J., Lichtenfels, J.R. & Shaw, J.H. 1978. Index-catalogue of medical and veterinary zoology. Special publication 3. Checklist of types in the U.S. National Parasite Collection, United States Department of Agriculture, U. S. Government Printing Office, Washington., 230 pp.).

Known stages: male, female, nymph, larva

Zoogeographic Regions: Nearctic, Neotropical

Ecoregions: tropical and subtropical broadleaf forests (dry and moist)

Hosts: Didelphimorphia: Didelphidae (ANL)
Carnivora: Procyonidae (AN)
Artiodactyla: Cervidae (AL)
Artiodactyla: Bovidae; Carnivora: Felidae, Canidae, Ursidae (A)
Rodentia: Cricetidae, Sciuridae; Soricomorpha: Soricidae; Passeriformes: Troglodytidae, Turdidae (NL)
Lagomorpha: Leporidae (N)

Human infestation: no

Remarks: there is confusion concerning the presence (and hosts) of *I. affinis* in the southern part of this species' range because the ticks there may in fact be *I. aragaoi* or *I. pararicinus*, as discussed in Guglielmone et al. (2003). Clifford et al. (1973)

state that *I. affinis* is an exclusively Nearctic species. Reevaluation of the above tick material is needed, and our host list, as well as the ecoregions where this species is allegedly established, should be considered tentative. A record of *I. affinis* from the Palearctic Region (Japan) in Kishida (1930) is probably in error (Yamaguti et al. 1971), and we have therefore not included this region within the range of this species. Allan (2001) states that *I. affinis* was found feeding on a human, but we were unable to confirm this using the references quoted by the author. Recently, Harrison et al. (2010) found *I. affinis* crawling on humans but none of the specimens were attached. See also *I. pararicinus*.

References

Allan, S.A. 2001. Ticks (Class Arachnida: Order Acarina). *In* W.S. Samuel, M.J. Pybus & A.A. Kocan (editors), Parasitic Diseases of Wild Animals, 2nd edition. Iowa State University Press, Ames, pp. 72–106.

Clifford, C.M., Sonenshine, D.E., Keirans, J.E. & Kohls, G.M. 1973. Systematics of the subfamily Ixodinae (Acarina: Ixodidae). 1. The subgenera of *Ixodes*. Ann. Entomol. Soc. Am., 66: 489–500.

Durden, L.A. & Keirans, J.E. 1996. Nymphs of the genus *Ixodes* (Acari: Ixodidae) of the United States: taxonomy, identification key, distribution, hosts, and medical/veterinary importance. Thomas Say Publ. Entomol. Monogr. (9), 95 pp.

Fairchild, G.B., Kohls, G.M. & Tipton, V.J. 1966. The ticks of Panama (Acarina: Ixodoidea). *In* W.R. Wenzel & V.J. Tipton (editors), Ectoparasites of Panama. Field Museum of Natural History, Chicago, pp. 167–219.

Fonseca, F. da. 1960. Notes d'acarologie. XLV. Enquête acarologique au Pérou. Acarologia, 2: 1–34.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Guzmán-Cornejo, C., Robbins, R.G. & Pérez, T.M. 2007. The *Ixodes* (Acari: Ixodidae) of Mexico: parasite-host and host-parasite checklists. Zootaxa, 1553: 47–58.

Harrison, B.A., Rayburn, W.H., Toliver, M., Pouwell, E.E., Engber, B.R., Durden, L.A., Robbins, R.G., Prendergast, B.F. & Whitt, P.B. 2010. Recent discovery of widespread *Ixodes affinis* (Acari: Ixodidae) distribution in North Carolina with implications for Lyme disease studies. J. Vector Ecol., 35: 174–179.

Kishida, K. 1930. Notes on Japanese ticks of the genus *Ixodes* Latreille, 1795. Lansania, 2 (11): 1–5. In Japanese.

Oliver, J.H., Keirans, J.E., Lavender, D.R. & Hutcheson, H.J. 1987. *Ixodes affinis* Neumann (Acari: Ixodidae): new host and distribution records, description of immatures, seasonal activities in Georgia, and laboratory rearing. J. Parasitol., 73: 646–652.

Scott, J.D., Anderson, J.F. & Durden, L.A. 2012. Widespread dispersal of *Borrelia burgdorferi*- infected ticks collected from songbirds across Canada. J. Parasitol., 98: 49–59.

Yabsley, M.J., Nims, T.N., Savage, M.Y. & Durden, L.A. 2009. Ticks and tick-borne pathogens and putative symbionts of black bears (*Ursus americanus floridanus*) from Georgia and Florida. J. Parasitol., 95: 1125–1128.
Yamaguti, N., Tipton, V.J., Keegan, H.L. & Toshioka, S. 1971. Ticks of Japan, Korea, and the Ryukyu Islands. Brigham Young Univ. Sci. Bull. Biol. Ser., 15 (1), 226 pp.

5 – *I. albignaci* Uilenberg & Hoogstraal, 1969 (Ann. Parasitol. Hum. Comp., 43: 605–610)

Type depositories: USNTC (holotype, paratypes), HH, IEMVPT (paratypes) (Uilenberg, G. & Hoogstraal, H. 1969. *Ixodes albignaci* sp. n. (Ixodoidea, Ixodidae) parasite d'Insectivora et de Rodentia à Madagascar. Ann. Parasitol. Hum. Comp., 43: 605–610)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: Madagascar forests (lowland, dry and broadleaf)

Hosts: usual hosts for larvae, nymphs and adults are Afrosoricida: Tenrecidae.
Afrosoricida: Tenrecidae (ANL)
Rodentia: Muridae (A)

Human infestation: no

Reference

Uilenberg, G., Hoogstraal, H. & Klein, J.-M. 1979. Les tiques (Ixodoidea) de Madagascar et leur rôle vecteur. Arch. Inst. Pasteur Madagascar Num. Spéc., 153 pp.

6 – *I. alluaudi* Neumann, 1913 (*In* Voyage de Ch. Alluaud et R. Jeannel en Afrique orientale (1911–1912). Résultats scientifiques. A. Schulze, Paris, pp. 25–35)

Type depository: not stated (Neumann, L.G. 1913. Arachnides II Ixodidae. *In* Voyage de Ch. Alluad et R. Jeannel en Afrique orientale (1911–1912). Résultats scientifiques. A. Schulze, Paris, pp. 25–35)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: several Afrotropical ecoregions

Hosts: usual hosts for larvae, nymphs and adults are Soricomorpha: Soricidae.
Soricomorpha: Soricidae; Rodentia: Muridae (ANL)
Afrosoricida: Chrysochloridae (AL)
Lagomorpha: Leporidae; Rodentia: Bathyergidae (A, N and/or L)

Rodentia: Spalacidae (A)
Macroscelidea: Macroscelididae (N and/or L)

Human infestation: no

Remarks: Theiler (1962) and Arthur (1965) use the term "immatures" without specifying whether they are referring to larvae, nymphs or both stages.

References

Arthur, D.R. 1965. Ticks of the genus *Ixodes* in Africa. The Athlone Press, University of London, London, 348 pp.

Filippova, N.A. 2010. Uncommon zoogeographical connections in the subgenus *Exopalpiger* Schultze [sic] of the genus *Ixodes* Latreille (Acari, Ixodidae). Entomol. Rev., 90: 793–797.

Oguge, N.O., Durden, L.A., Keirans, J.E., Balami, H.D. & Schwan, T.G. 2009. Ectoparasites (sucking lice, fleas and ticks) of small mammals in southeastern Kenya. Med. Vet. Entomol., 23: 387–392.

Theiler, G. 1941. Ticks in the South African Zoological Survey Collection, Part I. *Ixodes alluaudi* Neumann 1913, a primitive tick parasite on shrews. Onderstepoort J. Vet. Sci. Anim. Ind., 17: 51–60.

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.

7 – *I. amarali* Fonseca, 1935 (Mem. Inst. Butantan, 9: 137–140)

Type depository: IBU (lectotype, paralectotypes) (Barros-Battesti and Knysak 1999, *op. cit.* under *I. affinis*)

Known stages: female, larva

Zoogeographic Region: Neotropical

Ecoregions: xeric shrublands in the Caatinga biogeograhic province; few ticks in tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Didelphimorphia: Didelphidae; usual hosts for nymphs are Didelphimorphia: Didelphidae and Rodentia: Cricetidae.
Didelphimorphia: Didelphidae; Rodentia: Cricetidae (ANL)
Rodentia: Muridae (N)
Rodentia: Echimyidae (L)

Remarks: the nymph of *I. amarali* is known (Barros-Battesti and Knysak 1999) but remains undescribed; even so, we accept its identification by these authors and by Saraiva et al. (2012).

Human infestation: no

References

Barros-Battesti, D.M. & Knysak, I. 1999. Catalogue of the Brazilian *Ixodes* (Acari: Ixodidae) material in the mite collection of Instituto Butantan, São Paulo, Brazil. Papéis Avulsos Zool., 41: 49–57.

Guglielmone, A.A., Nava, S. & Díaz, M.M. 2011. Relationships of South American marsupials (Didelphimorphia, Microbiotheria and Paucituberculata) and hard ticks (Acari: Ixodidae) with distribution of four species of *Ixodes*. Zootaxa, 3086: 1–30.

Onofrio, V.C., Barros-Battesti, D.M., Labruna, M.B. & Faccini, J.L.H. 2009. Diagnoses of and illustrated key to the species of *Ixodes* Latreille, 1795 (Acari: Ixodidae) from Brazil. Syst. Parasitol., 72: 143–157.

Saraiva, D.G., Fournier, G.F.S.R., Martins, T.F., Leal, K.P.G., Vieira, F.N., Câmara, M.V.C., Costa, C.G., Onofrio, V.C., Barros-Battesti, D.M., Guglielmone, A.A. & Labruna, M.B. 2012. Ticks (Acari: Ixodidae) associated with small terrestrial mammals in the State of Minas Gerais, southeastern Brazil. Exp. Appl. Acarol., 58: 159–166.

8 – *I. amersoni* Kohls, 1966 (J. Med. Entomol., 3: 38–40)

Type depository: USNTC (holotype) (Keirans, J.E. & Clifford, C.M. 1984. A checklist of types of Ixodoidea (Acari) in the collection of the Rocky Mountain Laboratories. J. Med. Entomol., 21: 310–320)

Known stages: female

Zoogeographic Region: central Pacific islands

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: Charadriiformes: Laridae; Pelecaniformes: Sulidae; Procellariiformes: Sternidae (A)

Human infestation: no

Remarks: Camicas et al. (1998), who regard this name as a synonym of *Scaphixodes amersoni*, list the nymph of *I. amersoni* as described, but we have been unable to find any description of it. These authors also state that *I. amersoni* is present in the Australasian Region, but the central Pacific islands are outside that zoogeographic region (see first chapter). Recently, Dietrich et al. (2011) also included Aves of the families Diomedeidae and Fregatidae as hosts for *I. amersoni*, basing their assumption on Kohls (1966). However, Kohls (1966) lists these families as hosts of *I. laysanensis*. Heath (2010) listed Charadriiformes: Sternidae as hosts for *I. amersoni*, but this record was amended in Heath et al. (2011).

References

Amerson, A.B. 1968. Tick distribution in the Central Pacific as influenced by sea bird movement. J. Med. Entomol., 5: 332–339.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Dietrich, M., Gómez-Díaz, E. & McCoy, K.D. 2011. Worldwide distribution and diversity of seabird ticks: implications for the ecology and epidemiology of tick-borne pathogens. Vector-Borne Zoon. Dis., 11: 453–470.
Heath, A.C.G. 2010. Checklist of ectoparasites of birds in New Zealand: additions and corrections. Surveillance, 37 (1): 12–17.
Heath, A.C.G., Palma, R.L., Cane, R.P. & Hardwick, S. 2011. Checklist of New Zealand ticks (Acari: Ixodidae, Argasidae). Zootaxa, 2995: 55–63.
Kohls, G.M. 1966. A new sea bird tick, *Ixodes amersoni*, from Phoenix Island (Acarina: Ixodidae). J. Med. Entomol., 3: 38–40.

9 – *I. anatis* Chilton, 1904 (Trans. Proc. N. Zeal. Inst. 1903, 36, New Ser., 19: 201–202)
Ixodes anatis is regarded as a synonym of *Ixodes apteridis* Maskell, 1897 (as *Scaphixodes apteridis*) by Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. (1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.). However, Guglielmone, A.A., Robbins, R.G., Apaneskevich, D.A., Petney, T.N., Estrada-Peña, A. & Horak, I.G. (2009. Comments on controversial tick (Acari: Ixodida) species names and species described or resurrected from 2003 to 2008. Exp. Appl. Acarol., 48: 311–327), consider *I. apteridis* to be a *nomen nudum* (although it actually should be treated as a *nomen dubium*) and validate the name *I. anatis*. The inclusion of both species names in Barker, S.C. & Murrell, A. (2008. Systematics and evolution of ticks with a list of valid genus and species names. *In* A.S. Bowman & P.A. Nuttall (editors), Ticks: biology, disease and control. Cambridge University Press, Cambridge, pp. 1–39) is an error.

Type depositories: CMC, BMNH (syntypes) (Keirans, J.E. & Hillyard, P.D. 2001. A catalogue of the type specimens of Ixodida (Acari: Argasidae, Ixodidae) deposited in the Natural History Museum, London. Occ. Pap. Syst. Entomol. (13), 74 pp.)

Known stages: male, female, nymph, larva

Zoogeographic Region: Australasian

Ecoregions: temperate forests and grasslands of New Zealand

Hosts: Struthioniformes are the usual hosts for this tick.
Struthioniformes: Apterygidae (ANL)
Anseriformes: Anatidae (AN)

Human infestation: no

Remarks: Camicas et al. (1998) state that the larva of *I. anatis* (as a synonym of *Scaphixodes apteridis*) has not been described, but it had earlier been described in Dumbleton (1953). Dumbleton (1961) includes Felidae as hosts of *I. anatis*, but the specimens constituting this record were in fact detected *ex faeces* of Felidae. Mihalca et al. (2011) regard this tick as endangered. See also *I. eudyptidis*.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Dumbleton, L.J. 1953. The ticks (Ixodoidea) of the New Zealand Sub-region. Cape Expedition. Ser. Bull. Dept. Sci. Ind. Res. Wellington, N. Zeal. (14), 28 pp.

Dumbleton, L.J. 1961. The ticks (Acarina: Ixodoidea) of sea birds in New Zealand waters. New Zeal. J. Sci., 4: 760–769.

Heath, A.C.G. 2010. A review of ectoparasites of *Apteryx* spp. (kiwi) in New Zealand, with new host records, and the biology of *Ixodes anatis* (Acari: Ixodidae). Tuhinga, 21: 147–159.

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

Nuttall, G.H.F. 1916. Notes on ticks. IV. Relating to the genus *Ixodes* and including a description of three new species and two new varieties. Parasitology, 8: 294–337.

10 – *I. andinus* Kohls, 1956 (J. Parasitol., 42: 636–649)

Type depositories: CNHM (holotype, paratypes), USNTC (paratypes) (Kohls, G.M. 1956. Eight new species of *Ixodes* from Central and South America (Acarina: Ixodidae). J. Parasitol., 42: 636–649)

Known stages: female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregion: xeric shrublands in Schura desert biogeograhic province

Hosts: Rodentia: Cricetidae (ANL)

Human infestation: no

Remarks: Filippova (2010) refers to this tick as *Ixodes andicus*, a *lapsus*.

References

Filippova, N.A. 2010. Uncommon zoogeographical connections in the subgenus *Exopalpiger* Schultze [sic] of the genus *Ixodes* Latreille (Acari, Ixodidae). Entomol. Rev., 90: 793–797.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Kohls, G.M. 1956. Eight new species of *Ixodes* from Central and South America (Acarina: Ixodidae). J. Parasitol., 42: 636–649.

11 – *I. angustus* Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)

Type depository: USNTC (neotype) (Robbins, R.G. & Keirans, J.E. 1989. *Ixodes angustus* Neumann, 1899 and *I. woodi* Bishopp, 1911 (Arachnida, Acari): proposed conservation by the replacement of the holotype of *I. angustus* by a neotype. Bull. Zool. Nomencl., 46: 167–169). The decision of Robbins and Keirans (1989) was necessary because the name *I. angustus* has been consistently applied by several workers, but the type used to describe the species (deposited in USNTC) is in fact *I. woodi*.

Known stages: male, female, nymph, larva

Zoogeographic Regions: Nearctic, Palearctic

Ecoregions: many Nearctic and Palearctic ecoregions

Hosts: usual hosts for larvae, nymphs and adults are Rodentia: Muridae and Soricomorpha: Soricidae. Aves are considered exceptional hosts for this tick.
Mammalia (several orders) (ANL)
Passeriformes: Emberizidae (stage unknown)

Human infestation: yes (Robbins and Keirans 1992)

Remarks: Estébanes-González and Cervantes (2005) assert that *I. angustus* is present in the Neotropical Region in the same paper where *I. granulatus*, a tick of the Australasian, Oriental and Palearctic Zoogeographic Regions, is also erroneously reported from the Neotropics (see *I. granulatus*). Guzmán-Cornejo et al. (2007) re-examined the specimens of *I. angustus* studied by Estébanes-González and Cervantes (2005) and concluded that they do not represent this species. Guglielmone et al. (2003) discuss several erroneous records of *I. angustus* from the Neotropical Region, some quite recent, such as Muñoz and Casanueva (2001). There are as yet no *bona fide* Neotropical records of *I. angustus*. The unusual record from Aves by Kozlovskaya et al. (1966, tick stages not specified) is not included in Kolonin (2009).

References

Estébanes-González, M.L. & Cervantes, F.A. 2005. Mites and ticks associated with some small mammals in Mexico. Int. J. Acarol., 31: 23–37.

Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Guzmán-Cornejo, C., Robbins, R.G. & Pérez, T.M. 2007. The *Ixodes* (Acari: Ixodidae) of Mexico: parasite-host and host-parasite checklists. Zootaxa, 1553: 47–58.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Kozlovskaya, O.L., Belyava, N.S. & Chernykh, P.A. 1966. Contribution to the biology of the tick *Ixodes angustus* Neum. Tezisy Dokl. 1. Akarol. Soveshch., pp. 109–110. In Russian, NAMRU-3 translation 416.
Muñoz, L.E. & Casanueva, M.E. 2001. Estado actual del conocimiento de las garrapatas (Acari: Ixodidae) asociada a *Canis familiaris* L. Gayana, 65: 193–210.
Murrell, B.P., Durden, L.A. & Cook, J.A. 2003. Host associations of the tick, *Ixodes angustus* (Acari: Ixodidae), on Alaskan mammals. J. Med. Entomol., 40: 682–685.
Robbins, R.G. & Keirans, J.E. 1992. Systematics and ecology of the subgenus *Ixodiopsis* (Acari: Ixodidae: *Ixodes*). Thomas Say Publ. Entomol. Monogr. (14), 159 pp.

12 – *I. antechini* Roberts, 1960 (Aust. J. Zool., 8: 392–485)

Type depositories: ANIC (holotype, paratypes), USNTC (paratypes) (Roberts, F.H.S. 1960. A systematic study of the Australian species of the genus *Ixodes* (Acarina: Ixodidae). Aust. J. Zool., 8: 392–485; Keirans and Clifford 1984, *op. cit.* under *I. amersoni*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Australasian

Ecoregion: southeast Australia temperate forests

Hosts: usual hosts for larvae, nymphs and adults are Dasyuromorphia: Dasyuridae. Aves are considered exceptional hosts for this tick.
Dasyuromorphia: Dasyuridae (ANL)
Procellariiformes: Procellariidae (L)

Human infestation: no

Remarks: Kolonin (2009) does not include Aves as hosts for *I. antechini*, but we regard the single record from this type of host in Roberts (1970) as valid.

References

Filippova, N.A. 2010. Uncommon zoogeographical connections in the subgenus *Exopalpiger* Schultze [sic] of the genus *Ixodes* Latreille (Acari, Ixodidae). Entomol. Rev., 90: 793–797.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Roberts, F.H.S. 1960. A systematic study of the Australian species of the genus *Ixodes* (Acarina: Ixodidae). Aust. J. Zool., 8: 392–485.
Roberts, F.H.S. 1964. The tick fauna of Tasmania. Rec. Queen Victoria Mus. Launceston New Ser. (17): 2–8.
Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.

13 – *I. apronophorus* Schulze, 1924 (Zool. Anz., 59: 281–284)

Type depository: not stated in Schulze, P. (1924. *Ixodes apronophorus* n. sp., eine neue deutsche Zecke von *Arvicola amphibius* L. Zool. Anz., 59: 281–284)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: Sarmatic mixed forests; east European forest steppe; Carpathian montane forests; few ticks in Scandinavian and Russian taiga

Hosts: Aves and Squamata are considered exceptional hosts for this tick.
Rodentia: Cricetidae, Myocastoridae; Soricomorpha: Soricidae (ANL)
Rodentia: Castoridae; Passeriformes: Muscicapidae (A)
Rodentia: Muridae; Passeriformes: Fringillidae (NL)
Artiodactyla: Suidae (N)
Squamata: Viperidae (L)
Several orders (Mammalia); Gruiformes: Rallidae; Passeriformes: Turdidae (tick stages unknown)

Human infestation: yes (Fedorov 1968, see below)

Remarks: Newson and Holmes (1968) refer to this species as *I. arvicolae* Warburton, 1926. Infestation of Aves and Squamata is an infrequent event (Fedorov 1970, 1972) and these hosts have not been included in Kolonin (2009). Ravdonikas et al. (1968) state that *I. apronophorus* does not attack humans, but we consider the record from a human in Fedorov (1968) to be valid. *Ixodes arvicolae* Warburton, 1926 is a synonym of *I. apronophorus*, but it is uncertain whether *I. arvicolae* in Rood and Burt (1965) represents *I. apronophorus* or *I. acuminatus*. Therefore, hosts included in Rood and Burt (1965) are not included in our analysis.

References

Aeschlimann, A. Büttiker, W., Diehl, P.A., Eichenberger, G., Immler, R. & Weiss, N. 1970. Présence d'*Ixodes trianguliceps* (Birula, 1895) et d'*Ixodes apronophorus* (Schulze, 1924) en Suisse (Ixodoidea; Ixodidae). Rev. Suisse Zool., 77: 527–536.

Černý, V. 1972. The tick fauna of Czechoslovakia. Folia Parasitol., 19: 87–92.

Fedorov, V.G. 1968. Ixodoidea ticks on humans in western Siberia. Med. Parazitol., 37: 615–616. In Russian, NAMRU-3 translation 390.

Fedorov, V.G. 1970. Bloodsucking ticks on amphibians and reptiles in western Siberia. Tezisy Dokl. 2. Akarol. Sovesch. (2): 185–186. In Russian, NAMRU-3 translation 1493.

Fedorov, V.G. 1972. Ticks of the superfamily Ixodoidea of birds and their nests in western Siberia. *In* A. Cherepanov & L.A. Mater (editors), Transcontinental associations of migratory birds and their role in distribution of arboviruses. 5. Simp. Isuch. Roli Pereletn. Ptits Rasp. Arbovirus, Novosibirsk, Jul. 1969, pp. 384–388. In Russian, NAMRU-3 translation 1494.

Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.
Grebenyuk, R.V. 1966. Ixodid ticks (Parasitiformes, Ixodidae) of Kirgizia. Akademii Nauk Kirgizkoy SSR, Instituta Biologii, Frunze, 328 pp. In Russian.
Hillyard, P.D. 1996. Ticks of North-West Europe. Keys and notes for identification of the species. Synopses of the British Fauna (New Series) (52), Field Studies Council, Shrewsbury, UK, 178 pp.
Kadulski, S. 1998. Ectoparasites of the beaver *Castor fiber* L. from Popileno. Wiad. Parazytol., 44: 729–736.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Newson, R.M. & Holmes, R.G. 1968. Some ectoparasites of the coypu (*Myocastor coypus*) in eastern England. J. Anim. Ecol., 37: 471–481.
Ravdonikas, O.V., Solovey, E.A., Chumakov, M.P., Korsh, I.V. & Ivanov, D.I. 1968. Omsk hemorrhagic fever natural foci in the light of landscape distribution area properties of this disease. Mat. 3 Nauch. Soveshch. Probl. Med. Geogr., November 1968, Leningrad, pp. 152–154. In Russian, NAMRU-3 translation 1458.
Rood, J.P. & Burt, E.T. 1965. Host relationships of *Ixodes arvicolae* Warburton on the Scilly Isles. Parasitology, 55: 595–599.
Siuda, K., Szczesniak-Zarzycka, J., Dutkiewic, Z. & Derylo, A. 1982. Data on knowledge of the tick fauna (Ixodides) of some mammals in Poland. Wiad. Parazytol., 28: 63–67.

14 – *I. arabukiensis* Arthur, 1959 (Rev. Zool. Bot. Afr., 59: 137–157)
Kolonin, G.V. (2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/), does not include this species in his list of ixodid ticks but provides no reason for this exclusion. He is probably following Camicas et al. (1998, *op. cit.* under *I. anatis*), who regard *I. arabukiensis* as a synonym of *I. djaronensis*, but we agree with Guglielmone et al. (2009, *op. cit.* under *I. anatis*), who consider both species tentatively valid pending type comparison.

Type depositories: CNHM (holotype), USNTC (paratypes) (Arthur, D.R. 1965. Ticks of the genus *Ixodes* in Africa. The Athlone Press, University of London, London, 348 pp.; Keirans and Clifford 1984, *op. cit.* under *I. amersoni*)

Known stages: female

Zoogeographic Region: Afrotropical

Ecoregion: northern Zanzibar-Inhambane coastal forests

Hosts: Carnivora: Herpestidae (A)

Human infestation: no

Remarks: see *I. djaronensis*

Reference

Arthur, D.R. 1965. Ticks of the genus *Ixodes* in Africa. The Athlone Press, University of London, London, 348 pp.

15 – *I. aragaoi* Fonseca, 1935 (Mem. Inst. Butantan, 9: 131–135)
Kolonin (2009, *op. cit.* under *I. arabukiensis*) does not regard this species as valid, but has referred to it under *I. parariciunus* as "? *I. aragaoi*." However, the validity of *I. aragaoi* is sound. Durden, L.A. & Keirans, J.E. (1996. Nymphs of the genus *Ixodes* (Acari: Ixodidae) of the United States: taxonomy, identification key, distribution, hosts, and medical/veterinary importance. Thomas Say Publ. Entomol. Monogr. (9), 95 pp.) consider *I. aragaoi* to be a synonym of *I. affinis* and this synonymy was accepted in a recent publication (Guzmán-Cornejo, C. & Robbins, R.G. 2010. The genus *Ixodes* (Acari: Ixodidae) in Mexico: adult identification keys, diagnoses, hosts and distribution. Rev. Mex. Biodiversidad, 81: 289–298). Nevertheless, *I. aragaoi* remains a valid species, as demonstrated in Onofrio, V.C., Barros-Battesti, D.M., Labruna, M.B. & Faccini, J.L.H. (2009. Diagnoses of and illustrated key to the species of *Ixodes* Latreille, 1795 (Acari: Ixodidae) from Brazil. Syst. Parasitol., 72: 143–157). See also *I. parariciunus*.

Type depositories: IBU, USNTC (syntypes) (Barros-Battesti and Knysak 1999, *op. cit.* under *I. affinis*; Keirans and Clifford 1984. *op. cit.* under *I. amersoni*) as *I. ricinus aragaoi*

Known stages: male, female

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical moist broadleaf forests; few ticks in tropical and subtropical grasslands

Hosts: Artiodactyla: Cervidae; Carnivora: Canidae, Felidae (A)
Didelphimorphia: Didelphidae; Rodentia: Cricetidae (NL)

Human infestation: no

Remarks: the larva and nymph of *I. aragaoi* remain undescribed, but records of these stages from the hosts in Pinter (2007) are regarded as provisionally valid.

References

Arzua, M., Onofrio, V.C. & Barros-Battesti, D.M. 2005. Catalogue of the tick collection (Acari, Ixodida) of the Museu de História Natural Capão da Imbuia, Curitiba, Paraná, Brazil. Rev. Bras. Zool., 22: 623–632.

Durden, L.A. & Keirans, J.E. 1996. Nymphs of the genus *Ixodes* (Acari: Ixodidae) of the United States: taxonomy, identification key, distribution, hosts, and medical/veterinary importance. Thomas Say Publ. Entomol. Monogr. (16), 95 pp.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Guimaraes, J.H., Tucci, E.D. & Barros-BattestI, D.M. 2001. Ectoparasitos de importancia veterinaria. Pleiade-FAPESP, Sao Paulo, 218 pp.

Labruna, M.B., Jorge, R.S.P., Sana, D.A., Jácomo, A.T.A., Kashivakura, C.K., Furtado, M.M., Ferro, C., Pérez, S.A., Silveira, L., Santos, T.S., Marques, S.R., Morato, R.G., Nava, A., Adania, C.H., Teixeira, R.H.F., Gomes, A.A.B., Conforti,

V.A., Azevedo, F.C.C., Prada, C.S., Silva, J.C.R., Batista, A.F., Marvulo, M.F.V., Morato, R.L.G., Alho, C.J.R., Pinter, A., Ferreira, P.M., Ferreira, F. & Barros-Battesti, D.M. 2005. Ticks (Acari: Ixodida) on wild carnivores in Brazil. Exp. Appl. Acarol., 36: 149–163.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Onofrio, V.C., Barros-Battesti, D.M., Labruna, M.B. & Faccini, J.L.H. 2009. Diagnoses of and illustrated key to the species of *Ixodes* Latreille, 1795 (Acari: Ixodidae) from Brazil. Syst. Parasitol., 72: 143–157.

Pinter, A. 2007. Aspectos ecológicos da febre maculosa brasileira em um foco endêmico no Estado de São Paulo. Tese de doutorado. Univ. São Paulo, Fac. Med. Vet. Zoot., 86 pp.

16 – *I. arboricola* Schulze & Schlottke, 1929 (Sber. Abh. Naturf. Ges. Rostock 1927–1929, 2: 95–110)

The year of description of *I. arboricola* is accepted as 1930 by some authors and 1929 by others. Guglielmone et al. (2010, *op. cit.* under *I. abrocomae*) consider 1930 to be correct. Recently, one of us (TNP) noted that the date of publication of the issue that contains the description of *I. arboricola* is November 30, 1929. See also remarks below.

Type depository: not stated in the description

Known stages: male, female, nymph, larva

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: temperate broadleaf and mixed forests

Hosts: Mammalia are considered exceptional hosts for this tick.
Aves (several orders) (ANL)
Carnivora: Mustelidae; Chiroptera: Vespertilionidae; Rodentia: Muridae (tick stages unknown)

Human infestation: no

Remarks: this tick is morphologically variable (Haarløv 1962; Clifford and Hoogstraal 1965), which may indicate that more than one species is included under the name *I. arboricola*. Teng and Jiang (1991) and Camicas et al. (1998) state that this species, designated as *Pholeoixodes arboricola*, is found only in the Palearctic Region. However, Chen et al. (2010) provide records of *I. arboricola* from the Oriental Region (Guangxi Province, China). Records of *I. arboricola* from Mammalia (Martyn 1988; Yu et al. 1997) are infrequent and are not included in Kolonin (2009).

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.
Clifford, C.M. & Hoogstraal, H. 1965. The occurrence of *Ixodes arboricola* Schulze and Schlottke (Ixodoidea: Ixodidae) in Africa on northward migrating birds. J. Med. Entomol., 2: 37–40.
Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.
Gembitsky, A.S. 1966. On finding *Ixodes arboricola* P. Sch. and Schl. in birds' nests. Zool. Zh., 45: 1881–1882. In Russian, NAMRU-3 translation 226.
Haarløv, N. 1962. Variation in the ixodid tick, *Ixodes arboricola* Schulze & Schlottke 1929. Parasitology, 52: 425–439.
Jaenson, T.G.T., Talleklint, L., Lundqvist, L., Olsen, B., Chirico, J. & Mejlon, H. 1994. Geographical distribution, host associations, and vector roles of ticks (Acari: Ixodidae, Argasidae) in Sweden. J. Med. Entomol., 31: 240–256.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Martyn, K.P. 1988. Provisional atlas of the ticks (Ixodoidea) of the British Isles. Biological Records Centre, Natural Environment Research Council, UK, 62 pp.
Monerris, M., Paredes-Esquivel, C. & Miranda, M.A. 2011. New records of tick fauna from the Balearic Islands (Spain) (Acari: Ixodidae). Bol. Soc. Española Entomol., 35: 477–481.
Papadopoulos, B., Humair, P.F., Aeschlimann, A., Vaucher, C. & Büttiker, W. 2001. Ticks on birds in Switzerland. Acarologia, 42: 3–19.
Schilling, F., Böttcher, M. & Walter, G. 1981. Probleme des Zeckenbefalls bei Nestlingen des Wanderfalken (*Falco peregrinus*). J. Ornithol., 122: 359–367.
Sixl, W. & Nosek, J. 1972. Zur medizinischen Bedeutung der Zecken Österreichs. Mitt. Abt. Zool. Landesmus. Joanneum, 1: 29–50.
Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.
Yu, X., Yr, R.-Y & Gong, Z.-D. 1997. The tick fauna of Xinjiang. Xinjiang Scientific, Technological and Medical Publishing House, Urumqi, China, 168 pp. In Chinese.

17 – *I. arebiensis* Arthur, 1956 (Rev. Zool. Bot. Afr., 54: 295–315)

Type depository: MRCB (holotype) (Arthur 1965, *op. cit.* under *I. arabukiensis*)

Known stages: female

Zoogeographic Region: Afrotropical

Ecoregion: northern Congolian forest-savanna mosaic

Hosts: unknown

Human infestation: no

Remarks: Cumming (1998) records several hosts for this tick, but they are in fact the hosts of *I. aulacodi*, as listed by Theiler (1962).

References

Arthur, D.R. 1965. Ticks of the genus *Ixodes* in Africa. The Athlone Press, University of London, London, 348 pp.

Cumming, G.S. 1998. Host preference in African ticks (Acari: Ixodida): a quantitative data set. Bull. Entomol. Res., 88: 379–406.

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

18 – *I. asanumai* Kitaoka, 1973 (Natl. Inst. Anim. Health Q., 13: 137–141)

Type depositories: NSM (holotype, paratype), NIAH (paratypes) (Kitaoka, S. 1973. *Ixodes asanumai* sp.n. (Ixodoidea, Ixodidae) from the Amami-Oshima Islands and Miyake Island, Japan. Natl. Inst. Anim. Health Q., 13: 137–141)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregion: Taiheiyo evergreen forests

Hosts: usual hosts for larvae, nymphs and adults are Squamata: Lacertidae. Carnivora are considered exceptional hosts for this tick.
Squamata: Lacertidae (ANL)
Carnivora: Canidae (A)

Human infestation: yes (Okino et al. 2010)

Remarks: Camicas et al. (1998) list the larva and nymph as undescribed, but both stages had earlier been described in Hayashi and Hasegawa (1983). Kolonin (2009) states that the natural hosts for larvae and nymphs of this tick are unknown, failing to acknowledge the important contributions of Hayashi and Hasegawa (1984) in this matter.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Hayashi, F. & Hasegawa, M. 1983. Immature stages and reproductive characteristics of the lizard tick, *Ixodes asanumai* (Acarina: Ixodidae). Appl. Entomol. Zool., 18: 315–323.

Hayashi, F. & Hasegawa, M. 1984. Selective parasitism of the tick *Ixodes asanumai* (Acarina: Ixodidae) and its influence on the host lizard *Eumeces okadae* in Miyake-jima, Izu islands. Appl. Entomol. Zool., 19: 181–191.

Kitaoka, S. 1973. *Ixodes asanumai* sp. n. (Ixodoidea, Ixodidae) from the Amami-Oshima Islands and Miyake Island, Japan. Natl. Inst. Anim. Health Q., 13: 137–141.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Okino, T., Ushirogawa, H., Matoba, K. & Hatsushika, R. 2010. Bibliographical studies on human cases of hard tick (Acarina: Ixodidae) bites in Japan: (6) Cases of infestation with rare tick species. Kawasaki Med. J., 36: 121–126. In Japanese.

19 – *I. aulacodi* Arthur, 1956 (Rev. Zool. Bot. Afr., 54: 295–315)

Type depository: MRCB (holotype) (Arthur 1965, *op. cit.* under *I. arabukiensis*)

Known stages: female, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: usual hosts for larvae, nymphs and adults are Rodentia: Thryonomyidae.
Rodentia: Thryonomyidae (ANL)
Rodentia: Hystricidae; Bovidae: Artiodactyla; Carnivora: Viverridae (A)
Passeriformes: Cisticolidae (N)
Rodentia: Muridae; Soricomorpha: Soricidae; Galliformes: Numididae (L)
Carnivora: Herpestidae (stage unknown)

Human infestation: no

Remarks: Kolonin (2009) regards the male as the only undescribed stage of *I. aulacodi*, but we have also been unable to find a description of the nymph. There are, however, several records of nymphs that we consider provisionally valid in the references below.

References

Aeschlimann, A. 1967. Biologie et écologie des tiques (Ixodoidea) de Côte d'Ivoire. Acta Trop.,24: 281–405.

Elbl, A. & Anastos, G. 1966. Ixodid ticks (Acarina, Ixodidae) of Central Africa. Vol. II. Genus *Ixodes* Latreille, 1795. Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (146), 205 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Morel, P.-C. 1966. Sur quelques larves d'*Ixodes* Latreille, 1796 [sic], d'Afrique (Acariens: Ixodoidea). Acarologia, 8: 208–221.

Morel, P.-C. & Mouchet, J. 1965. Les tiques du Cameroun (Ixodidae et Argasidae) (2e. note). Ann. Parasitol. Hum. Comp., 40: 477–496.

Ntiamoa-Baidu, Y., Carr-Saunders, C., Matthews, B.E., Preston, P.M. & Walker, A.R. 2005. Ticks associated with wild mammals in Ghana. Bull. Entomol. Res., 95: 205–219.

Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.

20 – *I. auriculaelongae* Arthur, 1958 (Parasitology, 48: 38–69)

Type depository: BMNH (holotype, paratype) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: female

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: Rodentia: Muridae; Soricomorpha: Soricidae (A)

Human infestation: no

Remarks: Matthysse and Colbo (1987) state that shrews, small rodents and larger mammals are hosts for *I. auriculaelongae*. However, in the literature we have been unable to verify hosts other than Muridae and Soricidae for this species. It is likely that Matthyse and Colbo (1987) confused *I. auriculaelongae* with another species because they based their statement partly on Walker (1974), but this author does not discuss *I. auriculaelongae*.

References

Colbo, M.H. & MacLeod, J. 1976. Ecological studies of ixodid ticks (Acari, Ixodidae) in Zambia. II. Ticks found on small mammals and birds. Bull. Entomol. Res., 66: 489–500.

Matthysse, J.G. & Colbo, M.H. 1987. The ixodid ticks of Uganda. Entomological Society of America, College Park, Maryland, 426 pp.

Walker, J.B. 1974. The ixodid ticks of Kenya. A review of present knowledge of their hosts and distribution. Commonwealth Institute of Entomology, London, 220 pp.

21 – *I. auritulus* Neumann, 1904 (Arch. Parasitol., 8: 444–464)
Ixodes zealandicus Dumbleton, 1961, a tick that is generally regarded either as a synonym or a subspecies of *I. auritulus*, is incorrectly recorded as *I. zealandicus* Dumbleton, 1953 instead of *I. zealandicus* Dumbleton, 1961 by Camicas et al. (1998, *op. cit.* under *I. anatis*) and Barker and Murrell (2008, *op. cit.* under *I. anatis*), who consider it a valid species. Dumbleton, L.J. (1973. Additions to the New Zealand tick fauna. Tuatara, 20: 65–74) spelled the name of this taxon *I. auritulus zealandious*. See remarks below.

Type depositories: MNHN, ENV (syntypes) (Neumann, L.G. 1904. Notes sur les ixodidés. II. Arch. Parasitol., 8: 444–464; Nuttall and Warburton 1911, *op. cit.* under *I. acuminatus*), as *I. thoracicus* Neumann, 1899, a name preoccupied by *I. thoracicus* Koch, 1844 and renamed *I. auritulus*. A recent search by one of us (AEP) in MNHN failed to locate types in this collection.

Known stages: male, female, nymph, larva

Zoogeographic Regions: Afrotropical, Australasian, Nearctic, Neotropical

Ecoregions: many ecoregions, matching the extensive distribution of this species group (see below)

Hosts: Rodentia are considered exceptional hosts for this tick.
Aves (several orders) (ANL)
Rodentia: Cricetidae (NL)
Rodentia: Sciuridae (N)

Human infestation: no

Remarks: Arthur (1960), Roberts (1970), Jones et al. (1972) and González-Acuña et al. (2005) regard *I. auritulus* as a catchall name for a tick species group. Guglielmone et al. (2006) inadvertently ignore the Nearctic Region when discussing the distribution of this species. Roberts (1970) describes morphological differences between Australasian and New Zealand specimens of the *I. auritulus* complex and also points out the variation in Avian host utilization by this tick in the different regions of the world in which it is established. Additionally, there are morphological differences in the description of this species by various authors (Cooley and Kohls 1945; Arthur 1960; Dumbleton 1961; Roberts 1970; Keirans and Clifford 1978; Barros-Battesti et al. 2003). A study of *I. auritulus* specimens from across its vast range will be necessary in order to clarify this species' actual status. Infestation of Rodentia: Cricetidae and Sciuridae with *I. auritulus* is a rare event (Bequaert 1945; Bishopp and Trembley 1945; Jones et al. 1972) and a vague record of *I. auritulus* from Rodentia: Dasyproctidae in Arzua et al. (1994) has not been included in our host list for this tick. See also *I. conepati*, *I. kerguelenensis* and *I. luciae*.

References

Arthur, D.R. 1960. A review of some ticks (Acarina: Ixodidae) of sea birds. Part II. The taxonomic problems associated with the *Ixodes auritulus – percavatus* group of species. Parasitology, 50: 199–226.

Arzua, M., Barros, D.M., Linardi, P.M. & Botelho, J.M. 1994. Noteworthy records of *Ixodes auritulus* Neumann, 1904 (Acari, Ixodida) on birds from Paraná, southern Brazil. Mem. Inst. Oswaldo Cruz, 89: 129.

Barros-Battesti, D.M., Arzua, M., Pichorim, M. & Keirans, J.E. 2003. *Ixodes* (*Multidentatus*) *paranaensis* n. sp. (Acari: Ixodidae) a parasite of *Streptoprocne biscutata* (Sclater, 1865) (Apodiformes: Apodidae) birds in Brazil. Mem. Inst. Oswaldo Cruz, 98: 93–102.

Bequaert, J.C. 1945. The ticks, or Ixodoidea, of the northeastern United States and eastern Canada. Entomol. Am., 25: 73–232.

Bishopp, F.C. & Trembley, H.L. 1945. Distribution and hosts of certain North American ticks. J. Parasitol., 31: 1–54.

Cooley, R.A. & Kohls, G.M. 1945. The genus *Ixodes* in North America. Natl. Inst. Health Bull. (184), 246 pp.

Dietrich, M., Gómez-Díaz, E. & McCoy, K.D. 2011. Worldwide distribution and diversity of seabird ticks: implications for the ecology and epidemiology of tick-borne pathogens. Vector-Borne Zoon. Dis., 11: 453–470.

Dumbleton, L.J. 1961. The ticks (Acarina: Ixodoidea) of sea birds in New Zealand waters. New Zeal. J. Sci., 4: 760–769.

González-Acuña, D., Venzal, J.M., Keirans, J.E., Robbins, R.G., Ippi, S. & Guglielmone, A.A. 2005. New host and locality records for the *Ixodes auritulus* (Acari: Ixodidae) species group, with a review of host relationships and distribution in the Neotropical Zoogeographic Region. Exp. Appl. Acarol., 37: 147–156.

Guglielmone, A.A., Venzal, J.M., González-Acuña, D., Nava, S., Hinojosa, A. & Mangold, A.J. 2006. The phylogenetic position of *Ixodes stilesi* Neumann, 1911 (Acari: Ixodidae): morphological and preliminary molecular evidences from 16SrDNA sequences. Syst. Parasitol., 65: 1–11.

Heath, A.C.G. 2010. Checklist of ectoparasites of birds in New Zealand: additions and corrections. Surveillance, 37 (1): 12–17.

Jones, E.K., Clifford, C.M., Keirans, J.E. & Kohls, G.M. 1972. The ticks of Venezuela (Acarina: Ixodoidea) with a key to the species of *Amblyomma* in the Western Hemisphere. Brigham Young Univ. Sci. Bull. Biol. Ser., 17 (4), 40 pp.

Keirans, J.E. & Clifford, C.M. 1978. The genus *Ixodes* in the United States: a scanning electron microscope study and key to the adults. J. Med. Entomol. (Suppl. 2), 149 pp.

Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.

Scott, J.D., Anderson, J.F. & Durden, L.A. 2012. Widespread dispersal of *Borrelia burgdorferi*- infected ticks collected from songbirds across Canada. J. Parasitol., 98: 49–59.

22 – *I. australiensis* Neumann, 1904 (Arch. Parasitol., 8: 444–464)

Type depositories: BMNH, ENV (syntypes) (Nuttall and Warburton 1911, *op. cit.* under *I. acuminatus*). However, Keirans and Hillyard (2001, *op. cit.* under *I. anatis*) do not list types of this tick in BMNH.

Known stages: male, female, nymph

Zoogeographic Region: Australasian

Ecoregions: southwest Australia woodlands; Tasmanian forests

Hosts: Diprotodontia: Potoroidae (ANL)
Artiodactyla: Bovidae, Suidae; Carnivora: Canidae; Diprotodontia: Macropodidae (A)

Human infestation: no

Remarks: the larva of *I. australiensis* has not been described, but we regard the record of larvae on Potoroidae in Roberts (1964) as provisionally valid. Kolonin (2009) lists *I. australiensis* as a parasite of humans, but Roberts (1970) only refers to ticks that were crawling on humans.

References

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Li, A.Y., Adams, P.J., Abdad, M.Y. & Fenwick, S.G. 2010. High prevalence of *Rickettsia gravesii* sp. nov. in *Amblyomma triguttatum* collected from feral pigs. Vet. Microbiol., 146: 59–62.

Roberts, F.H.S. 1960. A systematic study of the Australian species of the genus *Ixodes* (Acarina: Ixodidae). Aust. J. Zool., 8: 392–485.
Roberts, F.H.S. 1964. The tick fauna of Tasmania. Rec. Queen Victoria Mus. Launceston New Ser. (17): 2–8.
Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.

23 – *I. baergi* Cooley & Kohls, 1942 (Publ. Health Rep. U.S. Publ. Health Serv., 57: 1869–1972)

Type depositories: USNTC (holotype, paratypes), USNPC (paratype) (Keirans and Clifford 1984, *op. cit.* under *I. amersoni*; Salley et al. 1978, *op. cit.* under *I. affinis*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Nearctic

Ecoregions: desert and xeric shrublands; temperate forests

Hosts: Passeriformes: Hirundinidae (ANL)

Human infestation: yes (Walker et al. 1998)

References

Durden, L.A. & Keirans, J.E. 1996. Nymphs of the genus *Ixodes* (Acari: Ixodidae) of the United States: taxonomy, identification key, distribution, hosts, and medical/veterinary importance. Thomas Say Publ. Entomol. Monogr. (9), 95 pp.
Keirans, J.E., Durden, L.A. & Hopla, C.E. 1993. Description of immature stages of *Ixodes* (*Pholeoixodes*) *baergi* (Acari: Ixodidae), a parasite of cliff swallows in the United States. J. Med. Entomol., 30: 735–739.
Walker, E.D., Stobierski, M.G., Poplar, M.L., Smith, T.W., Murphy, A.J., Smith, P.C., Schmitt, S.M., Cooley, T.M. & Kramer, C.M. 1998. Geographic distribution of ticks (Acari: Ixodidae) in Michigan, with emphasis on *Ixodes scapularis* and *Borrelia burgdorferi*. J. Med. Entomol., 35: 872–882.

24 – *I. bakeri* Arthur & Clifford, 1961 (Proc. Entomol. Soc. Wash., 63: 272–275)

Type depository: MCZ (holotype) (Arthur 1965, *op. cit.* under *I. arabukiensis*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: montane and lowland Fynbos and Renosterbosveld. The holotype of *I. bakeri* was collected in central Zambezian miombo woodlands

Hosts: Macroscelidea: Macroscelididae are considered exceptional hosts for this tick.
Soricomorpha: Soricidae; Rodentia: Muridae (ANL)
Macroscelidea: Macroscelididae (A)

Human infestation: no

Remarks: Fourie et al. (2005) use the term "straggler" for a female of *I. bakeri* found on Macroscelidea.

References

Clifford, C.M., Walker, J.B. & Keirans, J.E. 1976. *Ixodes* (*Afrixodes*) *bakeri* Arthur & Clifford, 1961 (Acarina: Ixodidae): description of the male and immature stages from rodents and insectivores and notes on its biology in South Africa. Onderstepoort J. Vet. Res., 43: 105–112.

Fourie, L.J., Horak, I.G. & Woodall, P.F. 2005. Elephant shrews as hosts of immature ixodid ticks. Onderstepoort J. Vet. Res., 72: 293–301.

Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.

25 – *I. banksi* Bishopp, 1911 (Proc. Biol. Soc. Wash., 24: 197–208)

Type depositories: USNTC, BMNH (syntypes) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Nearctic

Ecoregions: temperate broadleaf and mixed forests

Hosts: usual hosts for nymphs and adults are Rodentia: Castoridae.
Rodentia: Castoridae, Cricetidae; Carnivora: Mustelidae (AN)

Human infestation: yes (Walker et al. 1998; Merten and Durden 2000)

Remarks: this species is morphologically very close to *I. cookei*, and the diagnosis of *I. banksi* in Cooley and Kohls (1945) on Carnivora (Canidae and Mephitidae) has been changed to *I. cookei* (Gregson 1956). Randolph and Eads (1946) present a record from Procyonidae that requires confirmation. None of these hosts have been included in the list above. Kolonin (2009) states that all parasitic stages have been found on hosts, but we were unable to find host field records for larvae of *I. banksi* – the larva of this tick is known only from laboratory-reared specimens (Hays and Lawrence 1957).

References

Cooley, R.A. & Kohls, G.M. 1945. The genus *Ixodes* in North America. Natl. Inst. Health Bull. (184), 246 pp.

Durden, L.A. & Keirans, J.E. 1996. Nymphs of the genus *Ixodes* (Acari: Ixodidae) of the United States: taxonomy, identification key, distribution, hosts, and medical veterinary importance. Thomas Say Publ. Entomol. Monogr. (9), 95 pp.

Gregson, J.D. 1956. The Ixodoidea of Canada. Can. Dept. Agric. Sci. Serv. Entomol. Div. Publ. (930), 92 pp.

Hays, K.L. & Lawrence, W.H. 1957. *Ixodes banksi* Bishopp (Acarina: Ixodidae) I. Description of the male and larva. J. Parasitol., 43: 213–216.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Merten, H.A. & Durden, L.A. 2000. A state-by-state survey of ticks recorded from humans in the United States. J. Vector Ecol., 25: 102–113.
Randolph, N. M. & Eads, R.B. 1946. An ectoparasitic survey of mammals from Lavaca County, Texas. Ann. Entomol. Soc. Am., 39: 597–601.
Walker, E.D., Stobierski, M.G., Poplar, M.L., Smith, T.W., Murphy, A.J., Smith, P.C., Schmitt, S.M., Cooley, T.M. & Kramer, C.M. 1998. Geographic distribution of ticks (Acari: Ixodidae) in Michigan, with emphasis on *Ixodes scapularis* and *Borrelia burgdorferi*. J. Med. Entomol., 35: 872–882.

26 – *I. bedfordi* Arthur, 1959 (Rev. Zool. Bot. Afr., 59: 137–157)

Type depository: OVI (holotype, paratypes) (Arthur, D.R. 1959. The *Ixodes nairobiensis* complex of species with descriptions of four new species (Ixodoidea: Ixodidae). Rev. Zool. Bot. Afr., 59: 137–157)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregion: montane grasslands and shrublands

Hosts: Rodentia: Muridae (A)

Human infestation: no

References

Arthur, D.R. 1965. Ticks of the genus *Ixodes* in Africa. The Athlone Press, University of London, London, 348 pp.
Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.

27 – *I. bequaerti* Cooley & Kohls, 1945 (Natl. Inst. Health Bull. (184), 246 pp.)

Type depositories: MCZ (holotype, paratypes), USNTC (paratypes) (Cooley, R.A. & Kohls, G.M. 1945. The genus *Ixodes* in North America. Natl. Inst. Health Bull. (184), 246 pp.)

Known stages: female

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical coniferous, moist broadleaf forests

Hosts: Passeriformes: Emberizidae; Trogoniformes: Trogonidae (A)

Human infestation: no

Remarks: Clifford et al. (1973) and Camicas et al. (1998) regard *I. bequaerti* as a Nearctic tick. However, the few records that are available for this species are consistent with localities in the Neotropical Region, as reported in Kohls and Clifford (1966) and Guglielmone et al. (2003).

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Clifford, C.M., Sonenshine, D.E., Keirans, J.E. & Kohls, G.M. 1973. Systematics of the subfamily Ixodinae (Acarina: Ixodidae). 1. The subgenera of *Ixodes*. Ann. Entomol. Soc. Am., 66: 489–500.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Guzmán-Cornejo, C. & Robbins, R.G. 2010. The genus *Ixodes* (Acari: Ixodidae) in Mexico: adult identification keys, diagnoses, hosts and distribution. Rev. Mex. Biodiversidad, 81: 289–298.

Kohls, G.M. & Clifford, C.M. 1966. Three new species of *Ixodes* from Mexico and description of the male of *I. auritulus auritulus* Neumann, *I. conepati* Cooley and Kohls, and *I. lasallei* Méndez and Ortiz (Acarina: Ixodidae). J. Parasitol., 52: 810–820.

28 – *I. berlesei* Birula, 1895 (Izv. Imp. Akad. Nauk, Ser. 5, 2 (4): 353–364)
Morel, P.-C. (2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD-EMVT, 1342 pp.) is of the opinion that *I. caledonicus* and *I. semenovi* are synonyms or very close to *I. berlesei* (all these taxa are classified as belonging to genus *Scaphixodes*), but he did not elaborate. We retain all these ticks as separate species. Filippova, N.A. & Panova, I.V. (1975. Little-known parasite of wild birds, *Ixodes caledonicus* Nuttall, 1910, in the fauna of USSR (Ixodoidea, Ixodidae). Parazitologiya, 9: 339–347. In Russian) describe the morphological differences between *I. berlesei* and *I. caledonicus*.

Type depository: ZIAC (holotype) (Filippova, N.A. 2008. Type specimens of argasid and ixodid ticks (Ixodoidea: Argasidae, Ixodidae) in the collection of the Zoological Institute, Russian Academy of Sciences (St. Petersburg). Entomol. Rev., 88: 1002–1011)

Known stages: female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: montane grasslands and xeric shrublands

Hosts: Apodiformes: Apodidae (ANL)
Passeriformes: Emberizidae (AL)
Passeriformes: Corvidae, Passeridae (NL)
Columbiformes: Columbidae; Falconiformes: Falconidae; Passeriformes (several families) (stages unknown)

Human infestation: no

Remarks: Camicas et al. (1998) state that the male of *I. berlesei* (classified as *Scaphixodes berlesei*) has been described, but we have failed to locate this descrip-

tion. Filippova (2008) and Kolonin (2009) state that the male is unknown and we agree. The descriptions of the larva and nymph of this species by Clifford et al. (1975) are tentative; there are better descriptions of the sub-adult stages of *I. berlesei* in Filippova (1977), and these differ in some respects from those of Clifford et al. (1975).

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Clifford, C.M., Hoogstraal, H. & Keirans, J.E. 1975. The *Ixodes* ticks (Acarina: Ixodidae) of Nepal. J. Med. Entomol., 12: 115–137.

Chunikhin, S.P. 1967. *Ixodes berlesei* Bir. An ixodid tick species new for western Siberia. Zool. Zh., 46: 1256–1258. In Russian, NAMRU-3 translation 291.

Emchuk, E.M. 1960. Ixodid ticks. 1. External and internal structure, ecology, systematics, distribution and economic importance of ixodid ticks. Fauna Ukrayiny, 25: 1–163. In Russian.

Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.

Filippova, N.A. 2008. Type specimens of argasid and ixodid ticks (Ixodoidea: Argasidae, Ixodidae) in the collection of the Zoological Institute, Russian Academy of Sciences (St. Petersburg). Entomol. Rev., 88: 1002–1011.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Prokop'ev, V.N., Stupina, A.G. & Emel'yanova, N.D. 1979. Certain results and prospects of studying parasitic ticks and mites in Buryat ASSR. Trudy Parazit. Zhivot. Vred. Rast. Pribaikal. Zabaikal., Ulan-ude, pp. 94–102. In Russian, NAMRU-3 translation 1741.

Voltzit, O.V. 1997. New faunistic records of the ixodid ticks from eastern regions of Russia in collections of the Zoological Museum of the Moscow State University. Description of the nymph of *Ixodes* (*Monoixodes*) *maslovi*. Parazitologiya, 31: 265–268. In Russian.

29 – *I. bivari* Santos Dias, 1990 (Bol. Soc. Port. Entomol., 4–15 (117): 153–170)
Kolonin (2009, *op. cit.* under *I. arabukiensis*) excludes this species from his list, where it is designated "? *I. bivari*" below *I. ventalloi* without further elaboration. One of us (AEP) examined the types of *I. bivari* and found that they differed from *I. ventalloi* in the morphology of the basis capituli. Therefore, we have no reason to invalidate *I. bivari*.

Type depositories: CZIICT (holotype, paratypes), BMNH (paratype) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: male, female, nymph

Zoogeographic Region: Palearctic

Ecoregion: known only from the type locality in southwest Iberian mediterranean sclerophyllous and mixed forests

Hosts: Lagomorpha: Leporidae (A)

Human infestation: no

Remarks: Camicas et al. (1998) list pholeophilic (burrowing) mammals as hosts for the immature stages of *I. bivari*, but Santos Dias (1990) does not record hosts for the nymph, the only sub-adult stage of this species that is known, and we are unaware of any additional records for this tick.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Santos Dias, J.A.T. 1990. Mais dois novos ixodídeos (Acarina, Ixodoidea) para a fauna de Portugal. Bol. Soc. Port. Entomol., 4–15 (117): 153–170.

30 – *I. boliviensis* Neumann, 1904 (Arch. Parasitol., 8: 444–464)
See *I. diversifossus*.

Type depository: ENV (syntypes) (Nuttall and Warburton 1911, *op. cit.* under *I. acuminatus*)

Known stages: male, female, nymph

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical broadleaf forests; few ticks in coniferous forests

Hosts: Aves are considered exceptional hosts for this tick.
Carnivora: Procyonidae (ANL)
Artiodactyla: Bovidae, Cervidae; Carnivora: Canidae; Galliformes: Cracidae (AN)
Mammalia (several orders); Galliformes: Phasianidae (A)

Human infestation: yes (Guzmán-Cornejo et al. 2007)

Remarks: the larva of *I. boliviensis* remains undescribed, but we consider a record from Procyonidae in Fairchild et al. (1966) provisionally valid. Kolonin (2009) ignores the few records of *I. boliviensis* from Aves in Cooley and Kohls (1945) and Guzmán-Cornejo et al. (2007). Cooley and Kohls (1945) referred to this tick as *I. bicornis*.

References

Blair, P.J., Jiang, J., Schoeler, G.B., Moron, C., Anaya, E., Céspedes, M., Cruz, C., Felices, V., Guevara, C., Mendoza, L., Villaseca, P., Summer, J.W., Richards, A.L. & Olson, J.G. 2004. Characterization of spotted fever group Rickettsiae in flea and tick specimens from northern Peru. J. Clin. Microbiol., 42: 4961–4967.

Cooley, R.A. & Kohls, G.M. 1945. The genus *Ixodes* in North America. Natl. Inst. Health Bull. (184), 246 pp.
Fairchild, G.B., Kohls, G.M. & Tipton, V.J. 1966. The ticks of Panama (Acarina: Ixodoidea). *In* W.R. Wenzel & V.J. Tipton (editors), Ectoparasites of Panama. Field Museum of Natural History, Chicago, pp. 167–219.
Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.
Guzmán-Cornejo, C., Robbins, R.G. & Pérez, T.M. 2007. The *Ixodes* (Acari: Ixodidae) of Mexico: parasite-host and host-parasite checklists. Zootaxa, 1553: 47–58.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Neumann, L.G. 1904. Notes sur les ixodidés. II. Arch. Parasitol., 8: 444–464.

31 – *I. brewsterae* Keirans, Clifford & Walker, 1982 (J. Med. Entomol., 19: 309–329)

Type depositories: USNTC (holotype, paratypes), BMNH (paratype), OVI (paratypes) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Carnivora: Herpestidae.
Carnivora: Herpestidae; Carnivora: Felidae (A)

Human infestation: no

Remarks: see *I. oldi*.

Reference

Keirans, J.E., Clifford, C.M. & Walker, J.B. 1982. The *Ixodes* (*Afrixodes*) *oldi* group (Acari: Ixodidae) from sub-Saharan Africa with descriptions of five new species. J. Med. Entomol., 19: 309–329.

32 – *I. browningi* Arthur, 1956 (Rev. Zool. Bot. Afr., 54: 295–315)

Type depository: BMNH (holotype, paratypes) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregion: northeastern Congolian lowland forests

Hosts: usual hosts for adult ticks are Rodentia: Sciuridae.
Rodentia: Sciuridae, Muridae (A)

Human infestation: no

Reference

Elbl, A. & Anastos, G. 1966. Ixodid ticks (Acarina, Ixodidae) of Central Africa. Vol. II. Genus *Ixodes* Latreille, 1795. Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (146), 205 pp.

33 – *I. brumpti* Morel, 1965 (Ann. Parasitol. Hum. Comp., 40: 215–218)

Type depository: IP (holotype) (Morel, P.-C. 1965. Description de *Ixodes brumpti* n. sp. (Acariens, Ixodoidea) des Damans du Harrar Éthiopie). Ann. Parasitol. Hum. Comp., 40: 215–218). See remarks below

Known stages: female

Zoogeographic Region: Afrotropical

Ecoregions: Ethiopian montane grasslands and lowlands

Hosts: Hyracoidea: Procaviidae (A)

Human infestation: no

Remarks: Morel (1965) and Camicas et al. (1998) considered the female of *I. ugandanus djaronensis* from Hyracoidea in Nuttall and Warburton (1911) to be *I. brumpti*, but Keirans (1985) reclassified it as *I. procaviae*. A comparison of specimens is necessary to resolve this problem.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Morel, P.-C. 1965. Description de *Ixodes brumpti* n. sp. (Acariens, Ixodoidea) des Damans du Harrar (Éthiopie). Ann. Parasitol. Hum. Comp., 40: 215–218.

Nuttall, G.H.F. & Warburton, C. 1911. Ticks, a monograph of the Ixodoidea. Part II The Ixodidae. Section II Genus I. *Ixodes* Latreille 1795. Cambridge University Press, London, pp. 133–293.

34 – *I. brunneus* Koch, 1844 (Arch. Naturgersch., 10: 217–239)

Considerable taxonomic difficulties are associated with the name *I. brunneus*. This is apparently due to an incorrect diagnosis of this tick in Nuttall and Warburton (1911, *op. cit.* under *I. acuminatus*) who regard *I. frontalis* as a synonym of *I. brunneus*. This view was supported by some European workers although it appears to be erroneous (Cooley and Kohls 1945, *op. cit.* under *I. bequaerti*). See also remarks below.

Type depository: ZMB (holotype) (Moritz and Fischer 1981, *op. cit.* under *I. acutitarsus*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Nearctic, Neotropical

Ecoregions: several ecoregions in the Nearctic Region. The Neotropical record of *I. brunneus* is from an unknown locality in Venezuela, and we were consequently unable to determine the ecoregion.

Hosts: usual hosts for larvae, nymphs and adults are Passeriformes (several families).
Passeriformes (several families) (ANL)
Galliformes: Odontophoridae (AN)
Piciformes: Rhampastidae; Strigiformes: Strigidae (A)
Galliformes: Phasianidae (L)
Columbiformes: Columbidae (stages unknown)

Human infestation: yes (Williams et al. 1999; Merten and Durden 2000)

Remarks: Keirans and Webster (1981) state that other than one *bona fide* record of *I. brunneus* from Venezuela, other collections of this species originated from localities in the Nearctic Region. The Venezuelan record, listed by Cooley and Kohls (1945), is from a non-inmigratory bird; consequently, *I. brunneus* is provisionally considered to be present in the Neotropics. There are several confusing reports concerning *I. brunneus*. For example, Ringuelet (1947) found that allegedly Argentinian *I. brunneus* were in fact *I. neuquenensis*, while Anastos and Smith (1947) noted that the Old World *I. brunneus* depicted by Nuttall and Warburton (1911) lacked characters typically associated with this species. Guegan and Vermeil (1971) regard *I. brunneus* as a synonym of *I. pari* (the latter name is in fact a synonym of *I. frontalis*), which would imply a Palearctic distribution. Goddard (2008) states that *I. brunneus* does not bite humans, but we consider tentatively valid the records on humans in Williams et al. (1999) and Merten and Durden, (2000). Kolonin (2009) also mentions the presence of this species in Ukraine (Palearctic Region). We regard these records as doubtful, or the result of accidental introductions or infestations on migratory birds without subsequent colonization by this tick. We maintain that *I. brunneus* is chiefly a Nearctic species with a single valid record from the Neotropical Region. Mullen et al. (1999) found *I. brunneus* on a paralyzed dove (Columbidae), but the tick stage(s) were not specified. See also above.

References

Anastos, G. & Smith, C.N. 1957. The male, nymph, and larva of *Ixodes brunneus* Koch (Acarina: Ixodidae). J. Parasitol., 43: 535–541.

Bishopp, F.C. & Trembley, H.L. 1945. Distribution and hosts of certain North American ticks. J. Parasitol., 31: 1–54.

Clifford, C.M., Anastos, G. & Elbl, A. 1961. The larval ixodid ticks of the eastern United States (Acarina: Ixodidae). Misc. Publ. Entomol. Soc. Am., 2: 213–237.
Cooley, R.A. & Kohls, G.M. 1945. The genus *Ixodes* in North America. Natl. Inst. Health Bull. (184), 246 pp.
Furman, D.P. & Loomis, E.C. 1984. The ticks of California (Acari: Ixodida). Bull. Calif. Insect Surv., 25: 1–239.
Goddard, J. 2008. The bird tick, *Ixodes brunneus* Koch (Acari: Ixodidae): a rare and unusual tick in Mississippi. J. Mississippi Acad. Sci., 53: 246–249.
Guegan, J. & Vermeil, C. 1971. *Ixodes arboricola* Schultze [sic] et Schlottke 1929 compléments à l'étude du stade larvaire. Acarologia, 13: 36–46.
Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.
Keirans, J.E. & Brewster, B.E. 1981. The Nuttall and British Museum (Natural History) tick collections: lectotype designations for ticks (Acarina: Ixodoidea) described by Nuttall, Warburton, Cooper and Robinson. Bull. Br. Mus. Nat. Hist. (Zool.), 41: 153–178.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Merten, H.A. & Durden, L.A. 2000. A state-by-state survey of ticks recorded from humans in the United States. J. Vector Ecol., 25: 102–113.
Mullen, G., Anderson, R. & Nolan, P. 1999. Tick paralysis in wild birds: a cyclic phenomenon? Highlights Agric. Res., 46: 19–20.
Nuttall, G.H.F. & Warburton, C. 1911. Ticks, a monograph of the Ixodoidea. Part II The Ixodidae. Section II Genus I. *Ixodes* Latreille 1795. Cambridge University Press, London, pp. 133–293.
Ringuelet, R. 1947. La supuesta presencia de *Ixodes brunneus* Koch en la Argentina y descripción de una nueva garrapata *Ixodes neuquenensis* nov. sp. Notas Mus. La Plata, 12: 207–216.
Scott, J.D., Anderson, J.F. & Durden, L.A. 2012. Widespread dispersal of *Borrelia burgdorferi*- infected ticks collected from songbirds across Canada. J. Parasitol., 98: 49–59.
Sonenshine, D.E. & Stout, I.J. 1970. A contribution to the ecology of ticks infesting wild birds and rabbits in the Virginia-North Carolina piedmont (Acarina: Ixodidae). J. Med. Entomol., 7: 645–654.
Williams, D.C., Wills, W., Durden, L.A. & Gray, E.W. 1999. Ticks of South Carolina (Acari: Ixodoidea). J. Vector Ecol., 24: 224–232.

35 – *I. calcarhebes* Arthur & Zulu, 1980 (Syst. Parasitol., 1: 241–244)

Type depository: PRUL (holotype) (Arthur, D.R. & Zulu, F.P. 1980. *Ixodes calcarhebes* n. sp. from Zambia. Syst. Parasitol., 1: 241–244)

Known stages: female

Zoogeographic Region: Afrotropical

Ecoregion: the exact locality of the only known specimen is not included in the description.

Hosts: Rodentia: Muridae (A)

Human infestation: no

Reference

Arthur, D.R. & Zulu, F.P. 1980. *Ixodes calcarhebes* n. sp. from Zambia. Syst. Parasitol., 1: 241–244.

36 – *I. caledonicus* Nuttall, 1910 (Parasitology, 3: 408–416)
See *I. berlesei*

Type depository: BMNH (lectotype, paralectotypes) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregion: temperate conifer forests

Hosts: Aves (several orders) (ANL)

Human infestation: no

References

Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.

Jaenson, T.G.T. & Jensen, J.-K. 2007. Records of ticks (Acari, Ixodidae) from the Faroe Islands. Norw. J. Entomol., 54: 11–15.

Jaenson, T.G.T., Talleklint, L., Lundqvist, L., Olsen, B., Chirico, J. & Mejlon, H. 1994. Geographical distribution, host associations, and vector roles of ticks (Acari: Ixodidae, Argasidae) in Sweden. J. Med. Entomol., 31: 240–256.

37 – *I. canisuga* Johnston, 1849 (Hist. Berwickshire Nat. Club, 2: 362–373)
The authors Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect of fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese) and Kolonin (2009, *op. cit.* under *I. arabukiensis*) regard *I. canisuga* as a synonym of *I. crenulatus* but do not elaborate. We agree with Guglielmone et al. (2010, *op. cit.* under *I. abrocomae*), who consider *I. canisuga* valid. See also comments below.

Type depository: BMNH (neotype) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: temperate grasslands, savannas and shrublands; temperate broadleaf forests

Hosts: usual hosts for larvae, nymphs and adults are Carnivora: Canidae. Aves are considered exceptional hosts for this tick.
Carnivora: Canidae, Felidae, Mustelidae (ANL)
Perissodactyla: Equidae (AL)
Artiodactyla: Bovidae, Suidae; Carnivora: Herpestidae; Rodentia: Sciuridae (A)
Artiodactyla: Cervidae; Strigiformes: Strigidae (N)
Passeriformes: Passeridae (L)
Erinaceomorpha: Erinaceidae; Lagomorpha: Leporidae; Passeriformes (several families) (stages unknown)

Human infestation: no

Remarks: Hillyard (1996) cautions about confusion of this species with other taxa of the subgenus *Pholeoixodes*, to which *I. canisuga* belongs, especially alleged *I. canisuga* specimens collected from birds. Filippova and Uspenskaya (1973) note the possibility of confusing *I. canisuga* with *Ixodes kaiseri*, and Keirans (1985) states that this tick has been confused with several species of *Ixodes*. Additional studies are needed to clearly define *I. canisuga* and related species (see above). Meanwhile, occasional determinations of *I. canisuga* from Aves should be regarded as only tentatively valid. Morel (2003), who lists Leporidae and Sciuridae as hosts of this species, classifies it as *Pholeoixodes canisuga*.

References

Filippova, N.A. & Uspenskaya, I.G. 1973. *Ixodes kaiseri* Arthur 1957 (Ixodidae) species taxonomic status. Parazitologiya, 7: 297–306. In Russian, NAMRU-3 translation 636.

Hillyard, P.D. 1996. Ticks of North-West Europe. Keys and notes for identification of the species. Synopses of the British Fauna (New Series) (52), Field Studies Council, Shrewsbury, UK, 178 pp.

Jaenson, T.G.T., Talleklint, L., Lundqvist, L., Olsen, B., Chirico, J. & Mejlon, H. 1994. Geographical distribution, host associations, and vector roles of ticks (Acari: Ixodidae, Argasidae) in Sweden. J. Med. Entomol., 31: 240–256.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Manilla, G. & Sobrero, L. 1982. Zecche ed uccelli in Italia. Nota I: lista delle specie. Riv. Parassitol., 43: 241–252.

Martyn, K.P. 1988. Provisional atlas of the ticks (Ixodoidea) of the British Isles. Biological Records Centre, Natural Environment Research Council, UK, 62 pp.

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Silva, M.M., Formosinho, P., Melo, P., Santos, A. & Filipe, A.R. 2001. Ixodídeos (Acari: Ixodidae) parasitas de aves silváticas em Portugal. Rev. Port. Ciênc. Vet., 96: 197–199.

Sobrino, R., Millán, J., Oleaga, A., Gortázar, C., de la Fuente, J. & Ruiz-Fons, F. 2012. Ecological preferences of exophilic and endophilic ticks (Acari: Ixodidae)

parasitizing wild carnivores in the Iberian Peninsula. Vet. Parasitol., 184: 248–257.
Toutoungi, L.N., Gern, L., Aeschlimann, A. & Debrot, S. 1991. À propos du genre *Pholeoixodes*, parasite des carnivores en Suisse. Acarologia, 32: 311–328.

38 – *I. capromydis* Černý, 1966 (Poeyana Ser. A (24), 9 pp.)

Type depositories: IBAC (holotype, paratypes), IPCAS (paratypes) (Černý, V. 1966. Nueva especie de garrapata del género *Ixodes* Latreille (Ixodoidea, Ixodidae) en la jutía conga de la isla de Pinos. Poeyana Ser. A (24), 9 pp.)

Known stages: male, female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregion: Cuban pine forests

Hosts: Rodentia: Capromyidae (ANL)

Human infestation: no

References

Černý, V. 1966. Nueva especie de garrapata del género *Ixodes* Latreille (Ixodoidea, Ixodidae) en la jutía conga de la isla de Pinos. Poeyana Ser. A (24): 1–9.
Černý, V., Sixl, W. & Waltinger, H. 1975. Scanning electron microscopic studies of the morphology of *Ixodes capromydis* nymph and adults. Folia Parasitol., 22: 141–143.
Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

39 – *I. catherinei* Keirans, Clifford & Walker, 1982 (J. Med. Entomol., 19: 309–329)

Type depositories: OVI (holotype, paratypes), USNTC (paratypes) (Keirans, J.E., Clifford, C.M. & Walker, J.B. 1982. The *Ixodes* (*Afrixodes*) *oldi* group (Acari: Ixodidae) from sub-Saharan Africa with descriptions of five new species. J. Med. Entomol., 19: 309–329)

Known stages: female

Zoogeographic Region: Afrotropical

Ecoregions: Drakensberg montane grasslands

Hosts: Lagomorpha: Leporidae (A)

Human infestation: no

Remarks: see *I. oldi*.

References

Keirans, J.E., Clifford, C.M. & Walker, J.B. 1982. The *Ixodes* (*Afrixodes*) *oldi* group (Acari: Ixodidae) from sub-Saharan Africa with descriptions of five new species. J. Med. Entomol., 19: 309–329.

Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.

40 – *I. cavipalpus* Nuttall & Warburton, 1908 (Proc. Cambridge Phil. Soc, 1907, 14: 392–416)

Type depository: BMNH (lectotype, paralectotypes) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: male, female, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands; tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Artiodactyla: Bovidae (ANL)
Several orders (Mammalia) (A)

Human infestation: yes (Keirans 1985)

Remarks: although the nymph of *I. cavipalpus* has not been described, we accept as provisionally valid the collection of this stage from Bovidae by Horak (1982). Noh (1965) reported *I. cavipalpus* from the Palearctic Region, and this has been repeated in subsequent publications (Shin 2008; Sames et al. 2009), but we believe that Palearctic records of this tick require confirmation. Consequently, we consider *I. cavipalpus* an exclusively Afrotropical species.

References

Arthur, D.R. 1965. Ticks of the genus *Ixodes* in Africa. The Athlone Press, University of London, London, 348 pp.

Horak, I.G. 1982. Parasites of domestic and wild animals in South Africa. XV. The seasonal prevalence of ectoparasites on impala and cattle in the northern Transvaal. Onderstepoort J. Vet. Res., 49: 85–93.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Noh, Y.T. 1965. A taxonomic study on ticks in Korea (I) The genus *Ixodes*. Korean J. Zool., 7: 73–76.

Norval, R.A.I., Spickett, A.M. & Clifford, C.M. 1987. The ticks of Zimbabwe. XVI. The genus *Ixodes*. Zimbabwe Vet. J., 18: 1–10.

Sames, W.J., Kim, H.-C. & Klein, T.A. 2009. Perspectives on scrub typhus, tick-borne pathogens, and hantavirus in the Republic of Korea. U.S. Army Med. Dept. J. (Jul.-Sep. 2009): 40–49.

Shin, S.S. 2008. Vector-borne diseases of dogs in Korea. Proc. 3rd. Canine Vector-Borne Dis. Symp., April 2008, Wiesbaden, Germany, pp. 104–111.
Walker, J.B. 1974. The ixodid ticks of Kenya. A review of present knowledge of their hosts and distribution. Commonwealth Institute of Entomology, London, 220 pp.
Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.
Yeoman, G.H. & Walker, J. B. 1967. The ixodid ticks of Tanzania. A study of the zoogeography of the Ixodidae of an East African country. Commonwealth Institute of Entomology, London, 215 pp.

41 – *I. ceylonensis* Kohls, 1950 (J. Parasitol., 36: 319–321)

Type depositories: USNTC (holotype), BMNH (paratype) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregions: Sri Lanka dry-zone evergreen forests; north western Ghats moist deciduous forests

Hosts: usual hosts for adult ticks are Rodentia: Muridae; usual hosts for larvae and nymphs are Rodentia: Muridae and Soricomorpha: Soricidae. Aves are considered exceptional hosts for this tick.
Rodentia: Muridae (ANL)
Carnivora: Felidae, Herpestidae; Primates: Cercopithecidae (AN)
Artiodactyla: Bovidae (A)
Rodentia: Sciuridae; Soricomorpha: Soricidae (NL)
Passeriformes: Alaudidae (N)

Human infestation: no

Remarks: the record of nymphs of *I. ceylonensis* on Alaudidae in Seneviratna (1965) should be considered tentative. This odd record is ignored in Kolonin (2009). See also *I. petauristae*.

References

Bhat, H.R. & Sreenivasan, M.A. 1981. Further records of the ticks of some reptilian and mammalian hosts in the Kyasanur Forest disease area, Karnataka, India. Ind. J. Parasitol., 5: 207–210.
Boshell, J. & Rajagopalan, P.K. 1968. Observations on the experimental exposure of monkeys, rodents and shrews to infestation of ticks in forest in Kyasanur Forest disease area. Ind. J. Med. Res., 56 (4) (Suppl.): 573–588.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Rajagopalan, P.K. & Boshell, J. 1966. Hosts and life cycle of *Ixodes ceylonensis* Kohls, 1950, with descriptions of its male, nymph and larva. J. Parasitol., 52: 1203–1209.

Rajagopalan, P.K. & Sreenivasan, M.A. 1981. Ixodid ticks on cattle and buffaloes in the Kyasanur Forest disease area of Karnataka State. Ind. J. Med. Res., 73: 880–889.
Rajagopalan, P.K., Patil, A.P. & Boshell, J. 1968. Ixodid ticks on their mammalian hosts in the Kyasanur Forest disease area of Mysore State, India, 1961–1964. Ind. J. Med. Res., 56: 510–526.
Seneviratna, P. 1965. The Ixodoidea (ticks) of Ceylon. Parts II and III. Ceylon Vet. J., 13: 28–54.

42 – *I. chilensis* Kohls, 1956 (J. Parasitol., 42: 636–649)

Type depository: USNTC (holotype) (Keirans and Clifford 1984, *op. cit.* under *I. amersoni*)

Known stages: female

Zoogeographic Region: Neotropical

Ecoregion: Valdivian temperate forest

Hosts: unknown

Human infestation: no

Remarks: Tagle (1971) speculates that the only known specimen of *I. chilensis*, the female holotype, was collected from a horse, but there is no evidence to support this statement.

References

Kohls, G.M. 1956. Eight new species of *Ixodes* from Central and South America (Acarina: Ixodidae). J. Parasitol., 42: 636–649.
González-Acuña, D. & Guglielmone, A.A. 2005. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of Chile. Exp. Appl. Acarol., 35: 147–163.
Tagle, I. 1971. Ixodoidea en Chile. Bol. Chil. Parasitol., 26: 46–49.

43 – *I. colasbelcouri* Arthur, 1957 (J. Parasitol., 43: 474–483)

Type depositories: USNTC (holotype, paratypes), BMNH, HH, AR (paratypes) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregion: Madagascar subhumid forests

Hosts: usual hosts for adult ticks are Rodentia: Muridae.
Rodentia: Muridae (ANL)
Afrosoricida: Tenrecidae (AL)
Rodentia: Nesomyidae (A)

Human infestation: no

Reference

Uilenberg, G., Hoogstraal, H. & Klein, J.-M. 1979. Les tiques (Ixodoidea) de Madagascar et leur rôle vecteur. Arch. Inst. Pasteur Madagascar Num. Spéc., 153 pp.

44 – *I. collocaliae* Schulze, 1937 (Orn. Mber., 45 (3): 78–80)

Type depository: USNTC (type) [sic] (Keirans and Clifford 1984, *op. cit.* under *I. amersoni*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Australasian, Oriental

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: Apodiformes: Apodidae (ANL)

Human infestation: no

References

Petney, T.N. & Keirans, J.E. 1994. Ticks of the genus *Ixodes* in South-East Asia. Trop. Biomed., 11: 123–134.

Wilson, N. 1964. Description of male, nymph and larva and redescription of female of *Ixodes collocaliae* Schulze. Pacific Insects, 6: 300–308.

Wilson, N. 1970. New distributional records of ticks from Southeast Asia and the Pacific (Metastigmata: Argasidae, Ixodidae). Oriental Insects, 4: 37–46.

45 – *I. columnae* Takada & Fujita, 1992 (J. Acarol. Soc. Jap., 1: 37–44)
This name is not included in Camicas et al. (1998, *op. cit.* under *I. anatis*), but no explanation is given for its omission.

Type depository: FMS (holotype, paratypes) (Takada, N. & Fujita, H. 1992. Description of *Ixodes columnae* sp. nov., associated with a nymphal sp. N2 and a larval sp. L1 (Acarina: Ixodidae). J. Acarol. Soc. Jap., 1: 37–44)

Known stages: female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: temperate broadleaf and mixed forests; temperate conifer forests

Hosts: Rodentia: Sciuridae (ANL)
Galliformes: Phasianidae (NL)
Rodentia: Muridae, Cricetidae; Passeriformes (several families) (L)
Passeriformes: Emberizidae; Piciformes: Picidae (N and/or L)
Passeriformes: Sylviidae (stages unknown)

Human infestation: yes (Takada and Fujita 1992)

Remarks: Yamauchi (2001) uses the term "immature stages" without specifying whether larvae, nymphs or both stages of *I. columnae* were found on Piciformes and Passeriformes: Emberizidae. The only avian host for *I. columnae* recognized in Kolonin (2009) is Phasianidae.

References

Ishiguro, F., Takada, N., Masuzawa, T. & Fukui, T. 2000. Prevalence of Lyme disease *Borrelia* spp. in ticks from migratory birds on the Japanese mainland. Appl. Environ. Microbiol., 66: 982–986.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Takada, N. & Fujita, H. 1992. Description of *Ixodes columnae* sp. nov., associated with a nymphal sp. N2 and a larval sp. L1 (Acarina: Ixodidae). J. Acarol. Soc. Jap., 1: 37–44.

Yamauchi, T. 2001. A bibliographical survey of host-parasite relationships between birds and ticks from Japan. Bull. Hoshizaki Green Found., 5: 271–308. In Japanese.

46 – *I. conepati* Cooley & Kohls, 1943 (Pan-Pacif. Entomol., 19: 139–147)

Type depository: USNTC (holotype, paratypes) (Keirans and Clifford 1984, *op. cit*. under *I. amersoni*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Nearctic

Ecoregion: temperate conifer forests

Hosts: Rodentia: Sciuridae (ANL)
Carnivora: Mephitidae (AN)
Carnivora: Procyonidae (stage unknown)

Human infestation: no

Remarks: Guglielmone et al. (2003) state that the Chilean (Neotropical) collection site of *I. conepati* in Doss et al. (1978) actually applies to *I. auritulus*.

References

Custer, J.W. & Pence, D.B. 1979. Ectoparasites of the ringtail, *Bassariscus astutus*, from West Texas. J. Med. Entomol., 15: 132–133.

Doss, M.A., Farr, M.M., Roach, K.F. & Anastos, G. 1978. Index-catalogue of medical and veterinary zoology. Special publication 3. Ticks and tick borne diseases. IV. Geographical distribution of ticks. United States Department of Agriculture, U. S. Government Printing Office, Washington, 648 pp.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Keirans, J.E. & Clifford, C.M. 1974. *Ixodes* (*Pholeoixodes*) *conepati* Cooley & Kohls (Acarina: Ixodidae): description of the immature stages from rock squirrels in Texas. J. Med. Entomol., 11: 367–369.

Kohls, G.M. & Clifford, C.M. 1966. Three new species of *Ixodes* from Mexico and description of the male of *I. auritulus auritulus* Neumann, *I. conepati* Cooley and Kohls, and *I. lasallei* Méndez and Ortiz (Acarina: Ixodidae). J. Parasitol., 52: 810–820.

47 – *I. confusus* Roberts, 1960 (Aust. J. Zool., 8: 392–485)

Type depositories: QM (holotype, paratype), ANIC (paratypes) (Roberts 1960, *op. cit* under *I. antechini*)

Known stages: male, female

Zoogeographic Region: Australasian

Ecoregion: Einasleigh upland savanna

Hosts: Diprotodontia: Macropodidae; Artiodactyla: Bovidae; Perissodactyla: Equidae (A)
Aves (unknown orders) (N (L?))
Carnivora: Felidae (N?)

Human infestation: yes (Roberts 1970)

Remarks: Camicas et al. (1998) state that the nymph of *I. confusus* is known, but we have been unable to locate any description of it. Determinations of specimens from Felidae and Aves as *I. confusus* by Talbot (1970) and Pruett-Jones and Pruett-Jones (1991), respectively, are tentative, but we regard them as provisionally valid. Pruett-Jones and Pruett-Jones (1991) describe finding nymphs and "immature" ticks on Aves; whether by "immature" they meant larvae is unknown. None of these hosts are included in Kolonin (2009), probably because of the uncertainty of the diagnoses.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Pruett-Jones, M. & Pruett-Jones, S. 1991. Analysis and ecological correlates of tick burden in a New Guinean avifauna. *In* J.E. Loye & M. Zuk (editors), Bird-parasite interactions. Ecology, evolution and behaviour. Oxford University Press, Oxford, pp. 154–176.

Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.

Talbot, N. 1970. Helminth and arthropod parasites of the domestic cat in Papua and New Guinea. Aust. Vet. J., 46: 370–372, 1970.

48 – *I. cookei* Packard, 1869 (First Annual Report of the Trustees of the Peabody Academy of Sciences, Appendix, pp. 56–69)

Type depository: MCZ (holotype) (Cooley and Kohls 1945, *op. cit.* under *I. bequaerti*), Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. (2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.) state that the original name for this tick species is *I. angustus cookei* (a *lapsus* for *I. hexagonus cookei*), but this is an error – the original name is *I. cookei*.

Known stages: male, female, nymph, larva

Zoogeographic Regions: Nearctic, Neotropical

Ecoregions: temperate broadleaf and mixed forests; few ticks in xeric shrublands

Hosts: Aves and Mammalia (Phocidae) are considered exceptional hosts for this tick.
Mammalia (several orders) (ANL)
Strigiformes: Strigidae (N)
Passeriformes: Emberizidae (L)
Carnivora: Phocidae; Passeriformes: Turdidae (stages unknown)

Human infestation: yes (Walker et al. 1998 among others)

Remarks: Guglielmone et al. (2003) state that *I. cookei* is found only in the Nearctic Region, but Montiel-Parra et al. (2007) present valid records for the Neotropical Region. Chamberlin (1937) provides a record of *I. cookei* (stage not specified) from Passeriformes: Turdidae that we consider provisionally valid. Additionally, Rand et al. (2007) describe a *bona fide* but unusual record of *I. cookei* (stage not specified) from Phocidae. This record and those from Aves in Chamberlin (1937) and Hyland et al. (2000) are ignored in Kolonin (2009). See also *I. banksi*.

References

Bequaert, J.C. 1945. The ticks, or Ixodoidea, of the northeastern United States and eastern Canada. Entomol. Am., 25: 73–232.

Bishopp, F.C. & Trembley, H.L. 1945. Distribution and hosts of certain North American ticks. J. Parasitol., 31: 1–54.

Chamberlin, W.J. 1937. The ticks of Oregon. Agric. Exp. Stn. Bull. (349), 34 pp.

Clifford, C.M., Anastos, G. & Elbl, A. 1961. The larval ixodid ticks of the eastern United States (Acarina: Ixodidae). Misc. Publ. Entomol. Soc. Am., 2: 213–237.

Cooley, R.A. & Kohls, G.M. 1945. The genus *Ixodes* in North America. Natl. Inst. Health Bull. (184), 246 pp.

Gregson, J.D. 1956. The Ixodoidea of Canada. Can. Dept. Agric. Sci. Serv. Entomol. Div. Publ. (930), 92 pp.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication

of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.
Hyland, K.E., Bernier, J., Markowski, D., MacLachlan, A., Amr, Z., Pitocchelli, J., Myers, J. & Hu, R. 2000. Records of ticks (Acari: Ixodidae) parasitizing birds (Aves) in Rhode Island, USA. Int. J. Acarol., 26: 183–192.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Montiel-Parra, G., Fuentes-Moreno, H. & Vargas, M. 2007. Primer registro de *Ixodes cookei* (Acari: Ixodidae) para México. Rev. Mex. Biodiversidad, 78: 205–206.
Rand, P.W., Lacombe, E.H., Dearborn, R., Cahill, B., Elias, S., Lubelczyk, C.B., Beckett, G.A. & Smith, R.P. 2007. Passive surveillance in Maine, an area emergent for tick-borne diseases. J. Med. Entomol., 44: 1118–1129.
Tugwell, P. & Lancaster, J.L. 1962. Results of a tick-host study in northwest Arkansas. J. Kansas Entomol. Soc., 35: 202–211.
Walker, E.D., Stobierski, M.G., Poplar, M.L., Smith, T.W., Murphy, A.J., Smith, P.C., Schmitt, S.M., Cooley, T.M. & Kramer, C.M. 1998. Geographic distribution of ticks (Acari: Ixodidae) in Michigan, with emphasis on *Ixodes scapularis* and *Borrelia burgdorferi*. J. Med. Entomol., 35: 872–882.

49 – *I. cooleyi* Aragão & Fonseca, 1951 (Mem. Inst. Oswaldo Cruz, 49: 567–574)
This species is considered doubtful by Clifford, C.M., Sonenshine, D.E., Keirans, J.E. & Kohls, G.M. (1973. Systematics of the subfamily Ixodinae (Acarina: Ixodidae). 1. The subgenera of *Ixodes*. Ann. Entomol. Soc. Am., 66: 489–500), but there is no sound reason to declare *I. cooleyi* invalid.

Type depository: IBU (syntypes) (Barros-Battesti and Knysak 1999, *op. cit.* under *I. affinis*)

Known stages: female

Zoogeographic Region: Neotropical

Ecoregion: montane grasslands and shrublands

Hosts: Rodentia: Ctenomyidae (A)

Human infestation: no

References

Barros-Battesti, D.M. & Knysak, I. 1999. Catalogue of the Brazilian *Ixodes* (Acari: Ixodidae) material in the mite collection of Instituto Butantan, São Paulo, Brazil. Papéis Avulsos Zool., 41: 49–57.
Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

50 – *I. copei* Wilson, 1980 (Int. J. Acarol., 6: 157–162)

Type depository: USNTC (holotype), NWC (paratypes) (Wilson, N. 1980. Records of ticks from Jamaica with the description of *Ixodes* (*Ixodes*) *copei* n. sp. from the mockingbird, *Mimus polyglottos* (Acari: Ixodidae). Int. J. Acarol., 6: 157–162)

Known stages: female, larva

Zoogeographic Region: Neotropical

Ecoregion: Jamaican moist forests

Hosts: Passeriformes: Mimidae (A)
Passeriformes: Turdidae (L)

Human infestation: no

References

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Wilson, N. 1980. Records of ticks from Jamaica with the description of *Ixodes* (*Ixodes*) *copei* n. sp. from the mockingbird, *Mimus polyglottos* (Acari: Ixodidae). Int. J. Acarol., 6: 157–162.

51 – *I. cordifer* Neumann, 1908 (Notes Leyden Mus., 30: 73–91)

Type depository: LMNH (holotype) (Nuttall and Warburton 1911, *op. cit*. under *I. acuminatus*). Roberts, F.H.S. (1970. Australian ticks. CSIRO, Melbourne, 267 pp.) states that the holotype of *I. cordifer* had been sent to BM and from there delivered to F.H.S. Roberts, who does not indicate that it was returned to LMNH. It is thus not certain where the type is actually held.

Known stages: male, female, nymph

Zoogeographic Region: Australasian

Ecoregion: Cape York Peninsula tropical savannah; tropical rain forests

Hosts: Primates: Tarsiidae (ANL)
Diprotodontia: Phalangeridae, Petauridae, Macropodidae (A)
Rodentia: Muridae (NL)
Dasyuromorphia: Dasyuridae; Passeriformes (several families) (N)

Human infestation: no

Remarks: Camicas et al. (1998) list the larva of *I. cordifer* as described, but we have been unable to locate its description. The nymph is poorly described in Schulze (1935). Durden et al. (2008) state that the identification of the larva and nymph of *I. cordifer* should be considered tentative, as well as that of a male tick found on *Ailurops* (Phalangeridae). We regard all these findings as provisionally valid. Records from Primates: Tarsiidae in Durden et al. (2008) are not included in Kolonin (2009).

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Durden, L.A., Merker, S. & Beati, L. 2008. The tick fauna of Sulawesi, Indonesia (Acari: Ixodoidea: Argasidae and Ixodidae). Exp. App. Acarol., 45: 85–110.

Hoogstraal, H. 1982. Ticks (Acari: Ixodoidea): a preliminary study. Monogr. Biol., 42: 537–544.

Jackson, J. 1998. A new host record for *Ixodes holocyclus* Neumann and *Ixodes cordifer* Neumann (Acarina: Ixodidae) in Australia. Aust. J. Entomol., 37: 113–114.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Schulze, P. 1935. Zur vergleichenden Anatomie der Zecken. Z. Morphol. Ökol. Tiere, 30: 1–40.

52 – *I. cornuae* Arthur, 1960 (Parasitology, 50: 199–226)
See remarks below

Type depository: MNHN (syntypes) (Arthur, D.R. 1960. A review of some ticks (Acarina: Ixodidae) of sea birds. Part II. The taxonomic problems associated with the *Ixodes auritulus-percavatus* group of species. Parasitology, 50: 199–226), states that this species was originally identified by Neumann as *I. auritulus*.

Known stages: female, nymph

Zoogeographic Region: Neotropical

Ecoregions: western Ecuador moist forests; Magellanic subpolar forests

Hosts: Galliformes: Phasianidae (AN)

Human infestation: no

Remarks: Arthur (1960) cautions that his description of the nymph of *I. cornuae* might actually apply to another species in the *I. auritulus* group.

References

Arthur, D.R. 1960. A review of some ticks (Acarina: Ixodidae) of sea birds. Part II. The taxonomic problems associated with the *Ixodes auritulus-percavatus* group of species. Parasitology, 50: 199–226.

González-Acuña, D. & Guglielmone, A.A. 2005. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of Chile. Exp. Appl. Acarol., 35: 147–163.

53 – *I. cornuatus* Roberts, 1960 (Aust. J. Zool., 8: 392–485)
Camicas et al. (1998, *op. cit.* under *I. anatis*) assert that *I. cornuatus* Olenev, 1941 takes precedence over *I. cornuatus* Roberts, 1960. However, Olenev, N.O. (1941. The geographical distribution and certain features of the ecology of the ticks *Ixodes* under the condition of the North-West of the USSR. 3 Soveshch. Parazitol. Probl.: 39–40. In Russian) provides no formal description of *I. cornuatus* (which he proposed as a new variety of *I. persulcatus*). Consequently, there is no argument for contesting the validity of *I. cornuatus* Roberts, 1960, as already stated in Guglielmone

et al. (2009, *op. cit.* under *I. anatis*). See also "Remarks on some invalid names" at the beginning of this chapter for *Ixodes robertsi* as a synonym of *I. cornuatus* Roberts, 1960. Kolonin (2009, *op. cit.* under *I. arabukiensis*) believes that this species may be a variety of *I. holocyclus*, probably based on the statement by Roberts (1970, *op. cit.* under *I. cordifer*) that *I. cornuatus* and also *I. myrmecobii* may be subspecies of *I. holocyclus*. Again, see "remarks on some invalid names" at the beginning of this chapter for *I. robertsi* as a synonym of *I. cornuatus*.

Type depositories: NM (holotype, paratypes), ANIC (paratypes), TM (paratypes) (Roberts 1960, *op. cit* under *I. antechini*)

Known stages: male, female, larva

Zoogeographic Region: Australasian

Ecoregions: southeast Australia temperate forests; Tasmanian temperate rain forests

Hosts: Rodentia: Muridae (ANL)
Carnivora: Canidae (AL)
Carnivora: Felidae; Diprotodontia: Phascolarctidae, Vombatidae (A)
Diprotodontia: Macropodidae; Peramelemorphia: Peramelidae; Passeriformes: Cracticidae (NL)
Diprotodontia: Potoroidae (N)
Diprotodontia: Phalangeridae; Passeriformes: Acanthizidae (L)

Human infestation: yes (Roberts 1970)

Remarks: Camicas et al. (1998) and Kolonin (2009) state that there is no description of the larva of *I. cornuatus*, but Kemp (1980) recorded a few morphological features of this stage, and later Jackson et al. (2002) provided additional morphological characteristics of the larva. With the exception of the larval record on Canidae in Jackson et al. (2007), all records of nymphs and larvae above are from Roberts (1964), who judged them to be tentative.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Jackson, J., Beveridge, I., Chilton, N.B., Andrews, R.H. & Dixon, B. 2002. Morphological comparison of the adult and larval stages of the Australian ticks *Ixodes holocyclus* Neumann, 1899 and *I. cornuatus* Roberts, 1960. Syst. Appl. Acarol., 7: 91–108.

Jackson, J., Beveridge, I., Chilton, N.B. & Andrews, R.H. 2007. Distribution of the paralysis ticks *Ixodes cornuatus* and *Ixodes holocyclus* in south-eastern Australia. Aust. Vet. J., 85: 420–424.

Kemp, D.H. 1980. Identity of Australian paralysis ticks. Proc. 56th Annu. Conf. Aust. Vet. Assoc., May 1979, Townsville, Queensland, pp. 73–74.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Roberts, F.H.S. 1960. A systematic study of the Australian species of the genus *Ixodes* (Acarina: Ixodidae). Aust. J. Zool., 8: 392–485.
Roberts, F.H.S. 1964. The tick fauna of Tasmania. Rec. Queen Victoria Mus. Launceston New Ser. (17): 2–8.
Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.
Song, S., Shao, R., Atwell, R., Barker, S. & Vankan, D. 2011. Phylogenetic and phylogeographic relationships in *Ixodes holocyclus* and *Ixodes cornuatus* (Acari: Ixodidae) inferred from COX1 and ITS2 sequences. Int. J. Parasitol., 41: 871–880.

54 – *I. cornutus* Lotozkyi, 1956 (Doklady Akad. Nauk Tajik. SSR, 19: 27–29. In Russian)
See remarks below.

Type depository: ZIAC (holotype) (Filippova 2008, *op. cit*. under *I. berlesei*)

Known stage: female

Zoogeographic Region: Palearctic

Ecoregion: Central Asian desert

Hosts: Carnivora: Mustelidae (A)

Human infestation: no

Remarks: Camicas et al. (1998) treat *I. cornutus* as a synonym of *I. rugicollis* (in the genus *Pholeoixodes*), but this species is considered valid in Filippova (1977), Kolonin (2009) and Guglielmone et al. (2010), and it is regarded as provisionally valid here.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.
Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.
Guglielmone, A.A., Robbins, R.G., Apanaskevich, D.A., Petney, T.N., Estrada-Peña, A., Horak, I.G., Shao, R. & Barker, S.C. 2010. The Argasidae, Ixodidae and Nuttalliellidae (Acari: Ixodida) of the world: a list of valid species names. Zootaxa, 2528: 1–28.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

55 – *I. corwini* Keirans, Clifford & Walker, 1982 (J. Med. Entomol., 19: 309–329)

Type depositories: USNTC (holotype, paratypes), BMNH, OVI (paratypes) (Keirans and Hillyard 2001, *op. cit*. under *I. anatis*)

Known stages: male, female, nymph

Zoogeographic Region: Afrotropical

Ecoregions: subtropical moist broadleaf forests; montane fynbos and renosterbosveld

Hosts: Carnivora: Herpestidae, Mustelidae, Viverridae (AN)

Human infestation: no

Remarks: Horak et al. (1987) record *I. corwini* from domestic dogs, and Horak et al. (2010) record nymphs and adults from domestic cats, but the senior author of these publications is now convinced that these identifications were incorrect, and we have excluded Canidae and Felidae from our list of hosts, although Canidae (based on Horak et al. 1987) are included in Walker (1991). See also *I. oldi*.

References

Horak, I.G., Jacot Guillarmod, A., Moolman, L.C. & De Vos, V. 1987. Parasites of domestic and wild animals in South Africa. XXII. Ixodid ticks on domestic dogs and on wild carnivores. Onderstepoort J. Vet. Res., 54: 573–580.

Horak, I.G., Heyne, H. & Donkin, E.F. 2010. Parasites of domestic and wild animals in South Africa. XLVIII. Ticks (Acari: Ixodidae) infesting domestic cats and wild felids in southern Africa. Onderstepoort J. Vet. Res., 77, doi:10.4102/ojvr.v77i1.3

Keirans, J.E., Clifford, C.M. & Walker, J.B. 1982. The *Ixodes* (*Afrixodes*) *oldi* group (Acari: Ixodidae) from sub-Saharan Africa with descriptions of five new species. J. Med. Entomol., 19: 309–329.

Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.

56 – *I. crenulatus* Koch, 1844 (*In* Deutschlands Crustaceen, Myriapoden und Arachniden. Ein Beitrag zur deutschen Fauna. Herausgegeben von Herrich-Schaäffer, Regensburg, part 39)
See *I. canisuga*, *I. kaiseri* and *I. prokopjevi*.

Type depository: we have been unable to locate depositories for the types of *I. crenulatus*.

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: temperate broadleaf and mixed forests; montane grasslands and shrublands; temperate grasslands, savannas and shrublands

Hosts: usual hosts for larvae, nymphs and adults are Rodentia (several families), Carnivora: Canidae, Felidae and Mustelidae; and Lagomorpha: Leporidae.
Rodentia (several families); Carnivora: Canidae, Felidae, Mustelidae; Erinaceomorpha: Erinaceidae; Lagomorpha: Leporidae (ANL)
Artiodactyla: Bovidae (AN)

Aves (several orders) (NL)
Lagomorpha: Ochotonidae; Perissodactyla: Equidae

Human infestation: yes (Filippova 1977)

Remarks: Camicas et al. (1998) list the nymph of *I. crenulatus*, under the name *Pholeoixodes crenulatus*, as undescribed, but there is a description in Filippova (1977). Teng and Jiang (1991) include several Passeriformes as hosts of the adults of *I. crenulatus*, but it is uncertain whether their specimens belong to this species or to *Ixodes canisuga* (a synonym of *I. crenulatus* according to these authors), and we have not taken them into account in our host list. Kolonin (2009) ignores Aves as hosts for *I. crenulatus*, but there are *bona fide* records on such hosts in the references below.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Emchuk, E.M. 1960. Ixodid ticks. 1. External and internal structure, ecology, systematics, distribution and economic importance of ixodid ticks. Fauna Ukrayiny, 25: 1–163. In Russian.

Feider, Z. 1964. Les connaissances actuelles sur les Acariens de Roumanie (Ixodides, Gamasides et Trombiculides). Acarologia (Fasc. Hors Sér.): 262–274.

Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.

Grebenyuk, R.V. 1966. Ixodid ticks (Parasitiformes, Ixodidae) of Kirgizia. Akademii Nauk Kirgizkoy SSR, Instituta Biologii, Frunze, 328 pp. In Russian.

Grebenyuk, R.V. & Berendyayeva, E.L. 1955. On the question of distribution and numbers of ixodid ticks on marmots in Kirgizia. Trud. Inst. Zool. Parasitol. Akad. Nauk SSR (4): 107–105. In Russian, NAMRU-3 translation 130.

Gusev, V.M., Bednyy, S.N., Guseva, A.A., Labunets, N.F. & Bakeyev, N.N. 1961. The ecological groups of birds on the Caucasus and their role in the life cycle of ticks and fleas. Trudy Nauch.-Issled. Protiv. Inst. Kavk. Zakav. (5): 217–267. In Russian.

Gusev, V.M., Guseva, A.A., Petrosyan, E.A. & Eygelis, Yu. K. 1962. The role of birds in the spread of ticks and fleas (material collected in Azerbaijan SSR). Zool. Zh., 41: 905–912. In Russian, NAMRU-3 translation 83.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Serdjukova, G.V. 1956. Ixodid ticks of the fauna of USSR. Opred. Faune SSSR. Zool. Inst. Akad. Nauk SSSR (64), 121 pp. In Russian.

Siuda, K. 1993. Ticks of Poland (Acari: Ixodidae) Part II. Taxonomy and distribution. Polskie Towarystwo Parazytologiczne, Warsaw, 381 pp.

Teng, K.-F. 1982. Acarina: Ixodidae. *In* Insects of Xizang (Tibet) Volume II, Institute of Zoology, Academia Sinica, pp. 449–461. In Chinese, translation by Robbins, F.-M.Y.

Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese

57 – *I. cuernavacensis* Kohls & Clifford, 1966 (J. Parasitol., 52: 810–820)

Type depository: USNTC (holotype) (Keirans and Clifford 1984, *op. cit.* under *I. amersoni*)

Known stages: female

Zoogeographic Region: Nearctic

Ecoregion: Balsas dry forests

Hosts: Apodiformes: Apodidae (A)

Human infestation: no

Remarks: Clifford et al. (1973) and Camicas et al. (1998) state that *I. cuernavacensis* is present in the Neotropical Region, but the only collection record is from the Nearctic Zoogeographic Region, as noted in Guglielmone et al. (2003).

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Clifford, C.M., Sonenshine, D.E., Keirans, J.E. & Kohls, G.M. 1973. Systematics of the subfamily Ixodinae (Acarina: Ixodidae). 1. The subgenera of *Ixodes*. Ann. Entomol. Soc. Am., 66: 489–500.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Guzmán-Cornejo, C. & Robbins, R.G. 2010. The genus *Ixodes* (Acari: Ixodidae) in Mexico: adult identification keys, diagnoses, hosts and distribution. Rev. Mex. Biodiversidad, 81: 289–298.

Kohls, G.M. & Clifford, C.M. 1966. Three new species of *Ixodes* from Mexico and description of the male of *I. auritulus auritulus* Neumann, *I. conepati* Cooley and Kohls, and *I. lasallei* Méndez and Ortiz (Acarina: Ixodidae). J. Parasitol., 52: 810–820.

58 – *I. cumulatimpunctatus* Schulze, 1943 (Zool. Anz., 142: 121–141)

Type depository: ZMB (syntypes) (Moritz and Fischer 1981, *op. cit.* under *I. acutitarsus*) as *Ixodes rasus cumulatimpunctatus*

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical moist broadleaf forests; tropical and subtropical grasslands, savannas and shrublands

Hosts: Mammalia (several orders) (ANL)
Cuculiformes: Cuculidae (AN)

Galliformes: Phasianidae (N)
Galliformes: Numididae; Passeriformes: Turdidae (L)

Human infestation: no

Remarks: Aeschlimann (1967) lists humans as a host of *I. cumulatimpunctatus*, but in the text of his paper he clearly states that the specimen was not attached. Consequently, we do not consider this tick a human parasite.

References

Aeschlimann, A. 1967. Biologie et écologie des tiques (Ixodoidea) de Côte d'Ivoire. Acta Trop., 24: 281–405.
Morel, P.-C. 1966. Sur quelques larves d'*Ixodes* Latreille, 1796 [sic], d'Afrique (Acariens: Ixodoidea). Acarologia, 8: 208–221.
Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.
Ntiamoa-Baidu, Y., Carr-Saunders, C., Matthews, B.E., Preston, P.M. & Walker, A.R. 2005. Ticks associated with wild mammals in Ghana. Bull. Entomol. Res., 95: 205–219.

59 – *I. dampfi* Cooley, 1943 (Rev. Soc. Mex. Hist. Nat., 4: 21–24)

Type depositories: USNTC (holotype, paratype), MCZ (paratype) (Cooley, R.A. 1943. *Ixodes dampfi* n. sp., nueva garrapata de México (Acarina: Ixodidae). Rev. Soc. Mex. Hist. Nat., 4: 21–24)

Known stages: female

Zoogeographic Region: Nearctic

Ecoregion: Sierra Madre pine-oak forests

Hosts: Rodentia: Geomyidae (A)

Human infestation: no

References

Cooley, R.A. & Kohls, G.M. 1945. The genus *Ixodes* in North America. Natl. Inst. Health Bull. (184), 246 pp.
Guzmán-Cornejo, C. & Robbins, R.G. 2010. The genus *Ixodes* (Acari: Ixodidae) in Mexico: adult identification keys, diagnoses, hosts and distribution. Rev. Mex. Biodiversidad, 81: 289–298.

60 – *I. daveyi* Nuttall, 1913 (Parasitology, 6: 131–138)

Type depository: BMNH (holotype) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregion: southern African bushveld

Hosts: Aves (several orders); Hyracoidea: Procaviidae (A)

Human infestation: no

Remarks: although Camicas et al. (1998) state that the male of *I. daveyi* (classified as *Scaphixodes daveyi*) has not been described, there is a description in Keirans et al. (1972). Camicas et al. (1998) probably followed Morel (1976), who pointed out that there were morphological differences that made it difficult to associate the male of *I. daveyi* in Keirans et al. (1972) with the females of *I. daveyi* found on the same host. We consider the male described in Keirans et al. (1972) to be provisionally valid. Arthur (1965) lists a record of females of *I. daveyi* from Procaviidae, but this was not confirmed by Walker (1991). We regard this record as tentatively valid, but Kolonin (2009) does not include it in his list of valid tick names. Cumming (1998) inadvertently lists Insectivora as hosts of *I. daveyi* (Cumming, G. personal communication to Guglielmone, A.A.).

References

Arthur, D.R. 1965. Ticks of the genus *Ixodes* in Africa. The Athlone, Press University of London, London, 348 pp.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Clifford, C.M. & Walker, J.B. 1966. Host and distribution records for several species of the genus *Ixodes* (Acarina: Ixodidae) that occur in East Africa. Rev. Zool. Bot. Afr., 74: 155–168.

Cumming, G.S. 1998. Host preference in African ticks (Acari: Ixodida): a quantitative data set. Bull. Entomol. Res., 88: 379–406.

Elbl, A. & Anastos, G. 1966. Ixodid ticks (Acarina, Ixodidae) of Central Africa. Vol. II. Genus *Ixodes* Latreille, 1795. Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (146), 205 pp.

Keirans, J.E., Backhurst, G.C. & Clifford, C.M. 1972. Description of the male of *Ixodes walkerae* with notes on the female and description of the males of *Ixodes daveyi* and *Ixodes thomasae* (Acarina: Ixodidae). Rev. Zool. Bot. Afr., 85: 59–66.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Morel, P.-C. 1976. Contribution à la connaissance de la distribution des tiques (Acariens, Ixodidae et Amblyommidae) en Afrique éthiopienne continentale. Annexe cartographique. Institut d'Élevage et de Médecine Vétérinaire des Pays Tropicaux, Paris, 326 pp.

Norval, R.A.I., Spickett, A.M. & Clifford, C.M. 1987. The ticks of Zimbabwe. XVI. The genus *Ixodes*. Zimbabwe Vet. J., 18: 1–10.

Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.

61 – *I. dawesi* Arthur, 1956 (Rev. Zool. Bot. Afr., 54: 295–315)

Type depository: MRCB (holotype, paratype) (Arthur 1965, *op. cit.* under *I. arabukiensis*)

Known stages: female

Zoogeographic Region: Afrotropical

Ecoregion: central Zambezian miombo woodlands

Hosts: Afrosoricida: Tenrecidae (A)

Human infestation: no

Remarks: Colbo (1973) records the presence of a nymph of *I. dawesi* on Muridae, but this diagnosis was changed to *Ixodes* sp. in Colbo and MacLeod (1976). Durden and Keirans (1996) regard *I. dawesi* as an endangered species.

References

Arthur, D.R. 1965. Ticks of the genus *Ixodes* in Africa. The Athlone Press, University of London, London, 348 pp.

Colbo, M.H. 1973. Ticks of Zambian wild animals: a preliminary checklist. Puku (7): 97–105.

Colbo, M.H. & MacLeod, J. 1976. Ecological studies of ixodid ticks (Acari, Ixodidae) in Zambia. II. Ticks found on small mammals and birds. Bull. Entomol. Res., 66: 489–500.

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.

62 – *I. dendrolagi* Wilson, 1967 (J. Parasitol., 53: 847–851)

Type depositories: AMNH (holotype, paratypes), BM, ANIC (paratypes) (Wilson, N. 1967. *Ixodes dendrolagi* (Metastigmata: Ixodidae), a new species of tick from tree kangaroos (Marsupialia: Macropodidae) in New Guinea. J. Parasitol., 53: 847–851); however, Halliday, B. 2008 in a personal communication to Guglielmone, A.A., was unable to locate type specimens of *I. dendrolagi* in ANIC.

Known stages: male, female

Zoogeographic Region: Australasian

Ecoregion: northern New Guinea montane rain forests

Hosts: Diprotodontia: Macropodidae (A)

Human infestation: no

Remarks: Mihalca et al. (2011) regard *I. dendrolagi* as an endangered species.

References

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

Wilson, N. 1967. *Ixodes dendrolagi* (Metastigmata: Ixodidae), a new species of tick from tree kangaroos (Marsupialia: Macropodidae) in New Guinea. J. Parasitol., 53: 847–851.

63 – *I. dentatus* Marx, 1899 (*In* Neumann, Mém. Soc. Zool. Fr., 12: 107–294)

Type depository: USNTC (holotype) (Keirans and Clifford 1984, *op. cit.* under *I. amersoni*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Nearctic

Ecoregions: temperate broadleaf and mixed forests

Hosts: usual hosts for larvae, nymphs and adults are Lagomorpha: Leporidae.
Lagomorpha: Leporidae (ANL)
Carnivora: Procyonidae (A)
Didelphimorphia: Didelphidae; Rodentia: Cricetidae; Passeriformes (several families) (NL)
Artiodactyla: Bovidae; Rodentia: Muridae (N)
Rodentia: Sciuridae (L)
Galliformes: Odontophoridae (stage unknown)

Human infestation: yes (Merten and Durden 2000)

Remarks: a record by Santos Dias (1958) of *I. dentatus* from the Neotropical country Costa Rica is considered a misidentification by Guglielmone et al. (2003) and we concur. See also *I. diversifossus*.

References

Bequaert, J.C. 1945. The ticks, or Ixodoidea, of the northeastern United States and eastern Canada. Entomol. Am., 25: 73–232.

Bishopp, F.C. & Trembley, H.L. 1945. Distribution and hosts of certain North American ticks. J. Parasitol., 31: 1–54.

Clifford, C.M., Anastos, G. & Elbl, A. 1961. The larval ixodid ticks of the eastern United States (Acarina: Ixodidae). Misc. Publ. Entomol. Soc. Am., 2: 213–237.

Cooney, J.C. & Burgdorfer, W. 1974. Zoonotic potential (Rocky Mountain spotted fever and tularemia) in the Tennessee valley region. I. Ecological studies of ticks infesting mammals in Land Between the Lakes. Am. J. Trop. Med. Hyg., 23: 99–108.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Hamer, S.A., Goldberg, T.L., Kitron, U.D., Brawn, J.D., Anderson, T.K., Loss, S.R., Walker, E.D. & Hamer, G.L. 2012. Wild birds and urban ecology of ticks and tick-borne pathogens, Chicago, Illinois, USA, 2005–2010. Emerg. Inf. Dis., 18: 1589–1595.

Keirans, J.E. & Lacombe, E.H. 1998. First records of *Amblyomma americanum*, *Ixodes* (*Ixodes*) *dentatus*, and *Ixodes* (*Ceratixodes*) *uriae* (Acari: Ixodidae) from Maine. J. Parasitol., 84: 629–631.

Koch, H.G. & Dunn, J.E. 1980, Ticks collected from small and medium-sized wildlife hosts in Le Flore County, Oklahoma. Southwest. Entomol., 5: 214–221.

Kollars, T.M. 1992. New host of *Ixodes dentatus* (Acari: Ixodidae), and first record in Tennessee. J. Med. Entomol., 29: 715–716.

Lockhart, J.M., Davidson, W.R., Stallknecht, D.E., Dawson, J.E. & Little, S.E. 1997. Natural history of *Ehrlichia chaffeensis* (Rickettsiales: Ehrlichieae) in the piedmont physiographic province of Georgia. J. Parasitol., 83: 887–894.

Merten, H.A. & Durden, L.A. 2000. A state-by-state survey of ticks recorded from humans in the United States. J. Vector Ecol., 25: 102–113.

Santos Dias, J.A.T. 1958. Notas ixodológicas. V. Acerca de alguns ixodídeos do Museu do Hamburgo. Mem. Estud. Mus. Zool. Univ. Coimbra (253), 32 pp.

Scott, J.D., Anderson, J.F. & Durden, L.A. 2012. Widespread dispersal of *Borrelia burgdorferi*- infected ticks collected from songbirds across Canada. J. Parasitol., 98: 49–59.

Stafford, K.C., Bladen, V.C. & Magnarelli, L.A. 1995. Ticks (Acari: Ixodidae) infesting wild birds (Aves) and white-footed mice in Lyme, CT. J. Med. Entomol., 32: 453–466.

64 – *I. dicei* Keirans & Ajohda, 2003 (Int. J. Acarol., 29: 63–67)

Type depository: USNTC (holotype, paratypes) (Keirans, J.E. & Ajohda, S. 2003. *Ixodes* (*Ixodes*) *dicei*, a new tick species (Acari: Ixodida: Ixodidae) from a lagomorph in a restricted high-altitude habitat in Talamanca, Costa Rica. Int. J. Acarol., 29: 63–67)

Known stages: male, female

Zoogeographic Region: Neotropical

Ecoregion: Isthmian forests of Costa Rica

Hosts: Lagomorpha: Leporidae (A)

Human infestation: no

Reference

Keirans, J.E. & Ajohda, S. 2003. *Ixodes* (*Ixodes*) *dicei*, a new tick species (Acari: Ixodida: Ixodidae) from a lagomorph in a restricted high-altitude habitat in Talamanca, Costa Rica. Int. J. Acarol., 29: 63–67.

65 – *I. diomedeae* Arthur, 1958 (Parasitology, 48: 124–130)

Type depository: SAIMR (holotype) (Arthur 1965, *op. cit.* under *I. arabukiensis*). Originally identified as *I. rothschildi* in Zumpt, F. (1952. The ticks of sea birds. Australian National Antarctic Research Expedition Reports, Series B, Volume 1, Zoology, pp. 12–20). Hänel, C. & Heyne, H. (2008. Ticks of the Tristan da Cunha Archipelago (Acarina: Ixodidae: Argasidae). Beitr. Entomol., 58: 121–134) continue to refer to this species as *I. rothschildi*.

Known stages: female

Zoogeographic Region: island in the Atlantic Ocean

Ecoregion: sea island tundra

Hosts: Procellariiformes: Diomedeidae (A)

Human infestation: no

Remarks: Mihalca et al. (2011) regard *I. diomedeae* as an endangered species. See also *I. rothschildi*.

References

Arthur, D.R. 1965. Ticks of the genus *Ixodes* in Africa. The Athlone Press, University of London, London, 348 pp.

Dietrich, M., Gómez-Díaz, E. & McCoy, K.D. 2011. Worldwide distribution and diversity of seabird ticks: implications for the ecology and epidemiology of tick-borne pathogens. Vector-Borne Zoon. Dis., 11: 453–470.

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

66 – *I. diversifossus* Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)

Kolonin (2009, *op. cit.* under *I. arabukiensis*) does not recognize this species, which he refers to as "? *I. diversifossus*" below the name *I. boliviensis*. These species are very similar, as discussed in Guglielmone et al. (2009, *op. cit.* under *I. anatis*), and type comparison will be required to determine whether *I. boliviensis* is a synonym of *I. diversifossus* or a valid name. Therefore, we regard both species as valid. See also remarks below.

Type depository: USNPC (type) [sic] (Salley et al. 1978, *op. cit.* under *I. affinis*)

Known stages: female

Zoogeographic Region: Nearctic

Ecoregion: deserts and xeric shrublands

Hosts: Carnivora: Procyonidae (A)

Human infestation: no

Remarks: there is a record of *I. diversifossus* from Aves (*Colinus*) in Peters (1936), but Bequaert (1945) determined that the specimens were in fact *I. dentatus*. We consider both determinations doubtful, and Aves have been excluded from our host lists for each species. Keirans and Clifford (1978) state that *I. dentatus* and *I. spinipalpis* have often been confused with *I. diversifossus*, a tick known only from the specimens used in its original description.

References

Bequaert , J.C. 1945. The ticks or Ixodoidea, of the northeastern United States and eastern Canada. Entomol. Am., 25: 73–232.

Cooley, R.A. & Kohls, G.M. 1945. The genus *Ixodes* in North America. Natl. Inst. Health Bull. (184), 246 pp.

Keirans, J.E. & Clifford, C.M. 1978. The genus *Ixodes* in the United States: a scanning electron microscope study and key to the adults. J. Med. Entomol. (Suppl. 2), 149 pp.

Peters, H.S. 1936. A list of external parasites from birds of the eastern part of the United States. Bird-Banding, 7: 9–27.

67 – *I. djaronensis* Neumann, 1907 (Wiss. Ergebn. Schwed. Zool. Exped. Kilimandjaro, Meru Deutsch-Ostafrikas 1905–1906 (Sjöstedt), 20: 17–30)
See *I. arabukiensis* and remarks below.

Type depository: NRS (lectotype, paralectotypes) (Morel, P.-C. 1965. Redescription of *Ixodes djaronensis* Neumann, 1907 (Acariens, Ixodoidea). Acarologia, 7: 274–280), as *I. ugandanus djaronensis*.

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: Carnivora: Viverridae (A)

Human infestation: no

Remarks: Arthur (1965) states that the record of a female of *I. ugandanus djaronensis* from Hyracoidea in Nuttall and Warburton (1911) needs to be confirmed, whereas Morel (1965a) treats the specimen in Nuttall and Warburton (1911) as a new species, later described as *I. brumpti* in Morel (1965b), and Keirans (1985) identifies the female of *I. ugandanus djaronensis* on Hyracoidea in Nuttall and Warburton (1911) as *I. procaviae* (see also *I. brumpti*). Kolonin (2009) lists Herpestidae as hosts for this species, probably because he considers *I. arabukiensis*, which infests Herpestidae, to be a synonym of *I. djaronensis*. We do not believe that *I. djaronensis* infests any of these hosts. Camicas et al. (1998) vaguely refer to the hosts of this species as “non-ungulate mammals”.

References

Arthur, D.R. 1965. Ticks of the genus *Ixodes* in Africa. The Athlone Press, University of London, London, 348 pp.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Morel, P.-C. 1965a. Redescription of *Ixodes djaronensis* Neumann, 1907 (Acariens, Ixodoidea). Acarologia, 7: 274–280.

Morel, P.-C. 1965b. Description de *Ixodes brumpti* n. sp. (Acariens, Ixodoidea) des Damans du Harrar (Éthiopie). Ann. Parasitol. Hum. Comp., 40: 215–218.

Nuttall, G.H.F. & Warburton, C. 1911. Ticks, a monograph of the Ixodoidea. Part II The Ixodidae. Section II Genus I. *Ixodes* Latreille 1795. Cambridge University Press, London, pp. 133–293.

68 – *I. domerguei* Uilenberg & Hoogstraal, 1965 (J. Med. Entomol., 2: 258–260)
The name *I. domergui* Morel, 1966 is a synonym of *I. domerguei*. The studies of Uilenberg, G. & Hoogstraal, H.H. (1965. *Ixodes domerguei* n. sp. (Ixodoidea: Ixodidae), the Madagascar bird ixodid. J. Med. Entomol., 2: 258–260) and Morel, P.-C. (1966. Description de *Ixodes* (*Scaphixodes*) *domergui* n. sp. de Madagascar. Acarologia, 8: 200–207) describe the same species and in both cases honor the collector, C.A. Domergue.

Type depository: USNTC (holotype) (Keirans and Clifford 1984, *op. cit.* under *I. amersoni*)

Known stages: female

Zoogeographic Region: Afrotropical

Ecoregion: Madagascar subhumid forests

Hosts: Passeriformes: Ploceidae, Vangidae (A)

Human infestation: no

Reference

Uilenberg, G., Hoogstraal, H. & Klein, J.-M. 1979. Les tiques (Ixodoidea) de Madagascar et leur rôle vecteur. Arch. Inst. Pasteur Madagascar Num. Spéc., 153 pp.

69 – *I. downsi* Kohls, 1957 (Proc. Entomol. Soc. Wash., 59: 257–264)

Type depository: USNTC (holotype, paratypes) (Keirans and Clifford 1984, *op. cit.* under *I. amersoni*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical broadleaf forests; xeric shrublands

Hosts: Caprimulgiformes: Steatornithidae (A)
Chiroptera: Phyllostomidae (L)

Human infestation: no

Remarks: Kolonin (2008) states that the adults of *I. downsi* feed exclusively on Aves. However, this statement is based on the fact that the only host record for *I. downsi* females is avian. González-Acuña et al. (2008) analyzed the few records of this tick from environments shared by Caprimulgiformes and Chiroptera and concluded that additional evidence is needed to support the view that Aves are the principal hosts for *I. downsi*. We agree with this opinion. All the nymphal records of this tick lack host data (Kohls 1957; González-Acuña et al. 2008).

References

González-Acuña, D., Nava, S., Mangold, A.J. & Guglielmone, A.A. 2008. *Ixodes downsi* Kohls, 1957 in Venezuela. Syst. Appl. Acarol., 13: 39–42.

Kohls, G.M. 1957. *Ixodes downsi*, a new species of tick from a cave in Trinidad, British West Indies (Acarina-Ixodidae). Proc. Entomol. Soc. Wash., 59: 257–264.

Kolonin, G.V. 2008. Birds as hosts of ixodid ticks (Acarina: Ixodidae). Entomol. Rev., 88: 1012–1015.

Wilson, N. & Baker, W.W. 1988. *Ixodes downsi* (Acari: Ixodidae) from Peru. Proc. Entomol. Soc. Wash., 91: 54.

70 – *I. drakensbergensis* Clifford, Theiler & Baker, 1975 (Onderstepoort J. Vet. Res., 42: 33–40)

Type depositories: OVI (holotype, paratypes), USNTC, BMNH (paratypes) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: Drakensberg montane grasslands, woodlands and forests

Hosts: Artiodactyla: Bovidae (ANL)

Human infestation: no

References

Clifford, C.M., Theiler, G. & Baker, M. 1975. *Ixodes* (*Afrixodes*) *drakensbergensis* n. sp. from domestic and wild animals in Natal, Republic of South Africa. Onderstepoort J. Vet. Res., 42: 33–40.

Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.

71 – *I. eadsi* Kohls & Clifford, 1964 (J. Parasitol., 50: 466–470)

Type depository: USNTC (holotype, paratypes) (Keirans and Clifford 1984, *op. cit*. under *I. amersoni*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Nearctic

Ecoregion: Gulf Coast prairies and marshes

Hosts: Rodentia: Heteromyidae (ANL)
Rodentia: Cricetidae, Muridae (L)

Human infestation: no

Remarks: Allan (2001) states that *I. eadsi* was found on Soricidae, but we have been unable to confirm this from the references listed by the author, and this family is not included in our host list.

References

Allan, S.A. 2001. Ticks (Class Arachnida: Order Acarina). *In* W.S. Samuel, M.J. Pybus & A.A. Kocan (editors), Parasitic Diseases of Wild Animals, 2nd edition. Iowa State University Press, Ames, pp. 72–106.

Eads, R.B., Treviño, H.A. & Campos, E.G. 1965. Ectoparasites of the spiny pocket mouse, *Liomys irroratus texensis* Merriam. Southwest. Nat., 10: 17–21.

Guzmán-Cornejo, C. & Robbins, R.G. 2010. The genus *Ixodes* (Acari: Ixodidae) in Mexico: adult identification keys, diagnoses, hosts and distribution. Rev. Mex. Biodiversidad, 81: 289–298.

Kohls, G.M. & Clifford, C.M. 1964. *Ixodes eadsi*, a new species of tick from rodents in southern Texas (Acarina: Ixodidae). J. Parasitol., 50: 466–470.

72 – *I. eastoni* Keirans & Clifford, 1983 (J. Med. Entomol., 20: 90–98)

Type depository: USNTC (holotype, paratypes) (Keirans and Clifford 1984, *op. cit*. under *I. amersoni*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Nearctic

Ecoregion: Northern Great Plains steppe

Hosts: usual hosts for larvae, nymphs and adults are Rodentia: Cricetidae.
Rodentia: Cricetidae (ANL)
Rodentia: Dipodidae (A)
Rodentia: Sciuridae; Soricomorpha: Soricidae (L)

Human infestation: no

Remarks: Kolonin (2009) states that the principal hosts of *I. eastoni* are Muridae, but they are, in fact, members of the family Cricetidae.

References

Keirans, J.E. & Clifford, C.M. 1983. *Ixodes* (*Pholeoixodes*) *eastoni* n. sp. (Acari: Ixodidae), a parasite of rodents and insectivores in the Black Hills of South Dakota, USA. J. Med. Entomol., 20: 90–98.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Robbins, R.G. & Keirans, J.E. 1992. Systematics and ecology of the subgenus *Ixodiopsis* (Acari: Ixodidae: *Ixodes*). Thomas Say Publ. Entomol. Monogr. (14), 159 pp.

73 – *I. eichhorni* Nuttall, 1916 (Parasitology, 8: 294–337)

Type depository: BMNH (lectotype, paralectotypes) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*), as *I. eichorni*.

Known stages: female, nymph

Zoogeographic Regions: Australasian, Oriental

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: Galliformes: Phasianidae; Passeriformes: Turdidae (A)
Coraciiformes: Alcedinidae (N)

Human infestation: yes (Keirans 1985)

Remarks: Camicas et al. (1998) state that the larva of *I. eichhorni* (classified as *Scaphixodes eichhorni*) has been described, but we have been unable to locate a description of this stage. Kohls (1957) named this tick *I. mindanensis* Kohls, 1950.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.
Hoogstraal, H. 1982. Ticks (Acari: Ixodoidea): a preliminary study. Monogr. Biol., 42: 537–544.
Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.
Kohls, G.M. 1957. Insects of Micronesia. Acarina. Ixodoidea. Insects Micronesia, 3: 85–104.
Petney, T.N. & Keirans, J.E. 1994. Ticks of the genus *Ixodes* in South-East Asia. Trop. Biomed., 11: 123–134.

74 – *I. eldaricus* Dzhaparidze, 1950 (Soobshch. Akad. Nauk Gruz. SSR, 2: 117–121. In Russian)

Type depository: IZG (holotype) (Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: Pontic steppe; Caucasus mixed forests; Kazakh steppe

Hosts: usual hosts for adult ticks are Passeriformes (several families); usual hosts for larvae and nymphs are Passeriformes (several families) and Rodentia: Muridae.
Aves (several orders) (ANL)
Carnivora: Canidae (A)
Rodentia (several families); Soricomorpha: Soricidae; Chiroptera: Rhinolophidae (NL)

Human infestation: no

Remarks: Arthur (1959) named this species *I. tatei* Arthur, 1959. Filippova (1974) cautions about confusing *I. eldaricus* with *I. gibbosus*, *I. redikorzevi* and *I. ricinus*, which may have a bearing on reports of the hosts associated with *I. eldaricus* and related species.

References

Arthur, D.R. 1959. *Ixodes tatei* n. sp. from Iraq (Acarina: Ixodidae). Parasitology, 49: 108–110.

Filippova, N.A. 1974. *Ixodes eldaricus* and its distribution in southern USSR. Parazitologiya, 8: 504–514. In Russian, NAMRU-3 translation 1554.

Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.

Nowak-Chmura, M. 2012. *Ixodes eldaricus* Djaparidze, 1950 (Ixodidae) on migrating birds – reported first time in Poland. Vet. Parasitol., 186: 399–402.

Yeruham, I., Hadani, A., Galker, F. & Rosen, S. 1995. The occurrence of *Ixodes eldaricus* (Dzhaparidze, 1950) [sic] (Acarina: Ixodidae) in Israel. Acarologia, 36: 191–193.

75 – *I. elongatus* Bedford, 1929 (15th Annual Report of the Director of the Veterinary Services, Department of Agriculture, Union South of Africa, pp. 493–499)

Type depository: OVI (holotype) (Arthur 1965, *op. cit.* under *I. arabukiensis*)

Known stages: female

Zoogeographic Region: Afrotropical

Ecoregions: southern Africa bushveld; highveld grasslands

Hosts: Macroscelidea: Macroscelididae (ANL)
Rodentia: Muridae; Soricomorpha: Soricidae (A)

Human infestation: no

Remarks: Camicas et al. (1998) state that the male of *I. elongatus* has been described, but we have been unable to locate any description of this stage. Although the larva and nymph have not been described, Theiler (1962) states that immature stages collected from Macroscelidea are probably those of *I. elongatus*. We regard this record as provisionally valid.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Norval, R.A.I., Spickett, A.M. & Clifford, C.M. 1987. The ticks of Zimbabwe. XVI. The genus *Ixodes*. Zimbabwe Vet. J., 18: 1–10.

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.

76 – *I. eudyptidis* Maskell, 1885 (Trans. Proc. N. Zeal. Inst., 17: 19–20)

Type depository: CMC (syntypes) (Nuttall, G.H.F. 1916. Notes on ticks. IV. Relating to the genus *Ixodes* and including a description of three new species and two new varieties. Parasitology, 8: 294–337)

Known stages: male, female, nymph, larva

Zoogeographic Region: Australasian

Ecoregions: southwest Australasian woodlands; Tasmanian and New Zealand forests (coastal vegetation)

Hosts: Charadriiformes: Laridae; Sphenicifomes: Sphenicidae (ANL)
Pelecaniformes: Phalacrocoracidae (NL)
Pelecaniformes: Sulidae (N)
Anseriformes: Anatidae; Charadriiformes: Sternidae; Procellariiformes: Pelecanoididae, Procellariidae (stages unknown)

Human infestation: no

Remarks: we regard engorged nymphs found in soil and debris associated with nests of Phalacrocoracidae as having fed on these birds (Heath and Cane 2010). Bishop and Heath (1998) recorded Apterygidae as hosts for *I. eudyptidis* (tick stage not identified), but Heath (2010) later indicated that the ticks were in fact *I. anatis*. Roberts (1964) has a record of an *I. eudyptidis* female on Strigiformes: Strigidae that has not been included in our host list because Roberts (1970) himself treats it as doubtful. It was, however, included in the list of Green and Munday (1971). Halliday (2012) states that *I. eudyptidis* has been misidentified as *I. percavatus*. See also *I. percavatus*.

References

Bishop, D.M. & Heath, A.C.G. 1998. Checklist of ectoparasites of birds in New Zealand. Surveillance: 25 (spec. issue): 13–29.

Dumbleton, L.J. 1961. The ticks (Acarina: Ixodoidea) of sea birds in New Zealand waters. New Zeal. J. Sci., 4: 760–769.

Green, R.H. & Munday, B.L. 1971. Parasites of Tasmanian native and feral fauna Part 1, Arthropoda. Rec. Queen Victoria Mus. (41), 16 pp.
Halliday, R. B. 2012. Superfamily Ixodoidea Dugès, 1834. *In* Australian Faunal Directory, http://www.environment.gov.au(biodiversity/abrs/on-line-resources/faunalafd/taxa/ACARI/ accessed March 1, 2012
Heath, A.C.G. 2006. Observations on *Ixodes eudyptidis* Maskell (Acari: Ixodidae), *Ornithodoros capensis* Neumann (Acari: Argasidae), and other tick parasites of sea birds of New Zealand. Syst. Appl. Acarol., 11: 131–140.
Heath, A.C.G. 2010. Checklist of ectoparasites of birds in New Zealand: additions and corrections. Surveillance, 37 (1): 12–17.
Heath, A.C.G. & Cane, R.P. 2010. A new species of *Ixodiphagus* (Hymenoptera: Chalcidoidea: Encyrtidae) parasitizing seabird ticks in New Zealand. N. Zeal. J. Zool., 37: 147–155.
Roberts, F.H.S. 1960. A systematic study of the Australian species of the genus *Ixodes* (Acarina: Ixodidae). Aust. J. Zool., 8: 392–485.
Roberts, F.H.S. 1964. The tick fauna of Tasmania. Rec. Queen Victoria Mus. Launceston New Ser. (17): 2–8.
Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.

77 – *I. euplecti* Arthur, 1958 (Parasitology, 48: 38–69)

Type depository: CNMH (holotype) (Arthur 1965, *op. cit*. under *I. arabukiensis*)

Known stages: female

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands; savannas and shrublands; montane grasslands and shrublands

Hosts: Passeriformes (several families) (A)

Human infestation: no

Reference

Hoogstraal, H. & Wassef, H.Y. 1983. Hosts and distribution of the bird-parasitizing tick *Ixodes* (*Ixodes*) *euplecti* in Africa. J. Parasitol., 69: 1179–1181.

78 – *I. evansi* Arthur, 1956 (Rev. Zool. Bot. Afr., 54: 295–315)

Type depository: MRCB (holotype, paratype) (Arthur, D.R. 1956. Six new species of *Ixodes* ticks from the Belgian Congo (Ixodoidea, Ixodidae). Rev. Zool. Bot. Afr., 54: 295–315)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregion: southern Congolian forest-savanna mosaic

Hosts: Artiodactyla: Bovidae (A)

Human infestation: no

Reference

Arthur, D.R. 1965. Ticks of the genus *Ixodes* in Africa. The Athlone Press, University of London, London, 348 pp.

79 – *I. fecialis* Warburton & Nuttall, 1909 (Parasitology, 2: 57–76)

Type depository: BMNH (holotype) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Australasian

Ecoregions: southwest Australia savannah; southeast Australia temperate savannah; Tasmanian central highland forests

Hosts: Rodentia: Muridae (ANL)
Dasyuromorphia: Dasyuridae; Peramelemorphia: Peramelidae (AN)
Carnivora: Felidae; Diprotodontia: Potoroidae (A)
Dasyuromorphia: Myrmecobiidae (N)
Carnivora: Canidae; Diprotodontia: Macropodidae, Phalangeridae; Perissodactyla: Equidae (stages unknown)

Human infestation: yes (Roberts 1970)

References

Filippova, N.A. 2010. Uncommon zoogeographical connections in the subgenus *Exopalpiger* Schultze [sic] of the genus *Ixodes* Latreille (Acari, Ixodidae). Entomol. Rev., 90: 793–797.

Jackson, J., Chilton, N.B., Beveridge, I., Morris, M. & Andrews, R.H. 2000. Genetic variation within the ticks *Ixodes holocyclus* and *I. cornuatus* from South-eastern Australia. Int. J. Parasitol., 30: 1159–1166.

Lee, J.Y., Ryan, U.M., McInnes, L.M., Forshaw, D., Friend, J.A. & Irwin, P.J. 2009. *Theileria gilberti* n. sp. (Apicomplexa: Theileriidae) in the Gilbert's potoroo (*Potorous gilbertii*). J. Eukaryot. Microbiol., 56: 290–295.

Owen, I.L. 2011. Parasites of animals in Papua New Guinea recorded at the National Veterinary Laboratory: a catalogue, historical review and zoogeographical affiliations. Zootaxa, 3143: 1–163.

Roberts, F.H.S. 1960. A systematic study of the Australian species of the genus *Ixodes* (Acarina: Ixodidae). Aust. J. Zool., 8: 392–485.

Roberts, F.H.S. 1969. The larvae of Australian Ixodidae (Acarina: Ixodoidea). J. Aust. Entomol. Soc., 8: 37–78.

Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.

80 – *I. festai* Tonelli-Rondelli, 1926 (Res. Biol., 1 (4): 45–58)
See remarks below.

Type depository: MRSN (holotype) (Gilot, B. & Pérez, C. 1978. Individualisation et caractérisation de deux *Ixodes* actuellement confondus: *I. festai* Rondelli, 1926, *I. ventalloi* Gil Collado, 1936. (Acarina, Ixodidae). Rev. Suisse Zool., 85: 143–149)

Known stages: male, female

Zoogeographic Region: Palearctic

Ecoregions: mediterranean woodlands and forests

Hosts: Carnivora are considered exceptional hosts for this tick.
Galliformes: Phasianidae; Passeriformes: Turdidae; Carnivora: Canidae (A)

Human infestation: no

Remarks: considerable confusion exists concerning *I. festai* and *I. ventalloi* records, as discussed in Petney et al. (1996). Host records published prior to Gilot and Pérez (1978) have been excluded from our host list above because of diagnostic uncertainty. Camicas et al. (1998) list the larva and nymph of *I. festai* as described, but we agree with Pérez-Eid (2007), who maintains that these stages are undescribed. The male of *I. festai* was recently redescribed by Contini et al. (2011). Foxi et al. (2011) report infestation of Lagomorpha with *I. festai* (stage unknown), and Papadopoulos et al. (2001) report nymphal infestation of Aves, but we feel that these records require confirmation and they have therefore not been included in our host list for this tick. Kolonin (2009) ignores a record of *I. festai* on Canidae in Gilot and Pérez (1978), but we regard this record as valid.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Contini, C., Palmas, C., Seu, V., Stancampiano, L. & Usai, F. 2011. Redescription of the male of *Ixodes festai* Rondelli, 1926 (Ixodida: Ixodidae) on specimens from Sardinia (Italy). Parasite, 18: 235–240.

Foxi, C., Cabras, P., Chisu, V., Vento, L., Masala, G. & Satta, G. 2011. A survey on tick species in Sardinia, Italy. Ticks Tick-borne Pathogens Int. Conf., August-September 2010, Zaragoza, Spain, p. 216.

Gilot, B. & Pérez, C. 1978. Individualisation et caractérisation de deux *Ixodes* actuellement confondus: *I. festai* Rondelli, 1926, *I. ventalloi* Gil Collado, 1936. (Acarina, Ixodidae). Rev. Suisse Zool., 85: 143–149.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Papadopoulos, B., Humair, P.F., Aeschlimann, A., Vaucher, C. & Büttiker, W. 2001. Ticks on birds in Switzerland. Acarologia, 42: 3–19.

Pérez-Eid, C. 2007. Les tiques. Identification, biologie, importance médicale et vétérinaire. Editions Tec & Doc, Paris, 314 pp.

Petney, T.N., Beichel, E., Maiwald, M. & Hassler, D. 1996. *Ixodes ventalloi*: a new tick record for Germany. Appl. Parasitol., 37: 96–98.

81 – *I. filippovae* Černý, 1961 (Zool. Zh., 40: 184–188. In Russian)
Kolonin (2009, *op. cit.* under *I. arabukiensis*) does not include this species in his list of ixodid ticks of the world. He is probably following Filippova (1977, *op. cit* under *I. eldaricus*), who regards *I. filippovae* as a synonym of *I. crenulatus*. The specific status of *I. filippovae* may indeed be questionable, but we agree with Guglielmone et al. (2010, *op. cit.* under *I. abrocomae*) in treating this species as provisionally valid, pending further studies.

Type depository: not stated (Černý, V. 1961. On the diagnosis of the tick *Ixodes hexagonus* Leach by its larvae and nymphs. Zool. Zh., 40: 184–188. In Russian)

Known stages: female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregion: insufficient information exists on the distribution of *I. filippovae* to define the ecoregion(s) of this species.

Hosts: usual hosts for larvae, nymphs and adults are Rodentia: Sciuridae.
Rodentia: Sciuridae (ANL)
Carnivora (families not stated)

Human infestation: no

References

Černý, V. 1961. On the diagnosis of the tick *Ixodes hexagonus* Leach by its larvae and nymphs. Zool. Zh., 40: 184–188. In Russian.
Morel, P.-C. & Aubert, M.F.A. 1975. Contribution à la connaisssaince de *Pholeoixodes rugicollis* (Schulze et Schlottke, 1929) (Acariens, Ixodina). Cah. ORSTOM Sér. Entomol. Med. Parasitol., 13: 99–109.

82 – *I. fossulatus* Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)
Clifford et al. (1973, *op. cit.* under *I. cooleyi*) doubt the validity of *I. fossulatus*, but we consider this species valid.

Type depository: ZMB (holotype) (Moritz and Fischer 1981, *op. cit.* under *I. acutitarsus*)

Known stages: female

Zoogeographic Region: Neotropical

Ecoregion: eastern Cordillera Real montane forests

Hosts: unknown

Human infestation: no

Remarks: Kishida's (1930) records of *I. fossulatus* in the Palearctic Zoogeographic Region (Japan) are considered misidentifications (Yamaguti et al. 1971); consequently, the Palearctic has not been included in the distribution of this tick.

References

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Kishida, K. 1930. Notes on Japanese ticks of the genus *Ixodes* Latreille, 1795. Lansania, 2 (11): 1–5. In Japanese.

Yamaguti, N., Tipton, V.J., Keegan, H.L. & Toshioka, S. 1971. Ticks of Japan, Korea, and the Ryukyu Islands. Brigham Young Univ. Sci. Bull. Biol. Ser., 15 (1), 226 pp.

83 – *I. frontalis* (Panzer, 1798) (*In Faunae Insectorum Germanicae Initia. Deutschlands Insecten*, Nürnberg, parts 49–60)

Horak, I.G., Camicas, J.-L. & Keirans, J.E. (2002. The Argasidae, Ixodidae and Nuttalliellidae (Acari: Ixodida): a world list of valid tick names. Exp. Appl. Acarol., 28: 27–54) record the authority as Panzer, 1798 instead of (Panzer, 1798), but this is an error because the original name for this species was *Acarus frontalis*. See also *I. brunneus*.

Type depository: unknown (Guglielmone et al. 2003, *op. cit.* under *I. cookei*) as *Acarus frontalis*

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: western European broadleaf forests; Atlantic mixed forests; Alps conifer and mixed forests; English lowlands beech forests

Hosts: usual hosts for larvae, nymphs and adult ticks are Passeriformes: Turdidae. Carnivora are considered exceptional hosts for this tick.
Aves (several orders) (ANL)
Carnivora: Mustelidae (A)

Human infestation: yes (Gilot et al. 1977)

Remarks: Neotropical records of *I. frontalis* from Chile and Colombia (as *I. frontalis sulcatus*, a name *incertae sedis* in the latter country) by Neumann (1911) are considered misidentifications by Guglielmone et al. (2003), and we concur. Wilson (1970) determined larvae and nymphs collected on Aves in the Philippines (Oriental Region) as probably *I. frontalis*, but we have excluded this region from the distribution of *I. frontalis*, pending confirmation of this diagnosis. Carnivores are not included as hosts of *I. frontalis* in Kolonin (2009), but we regard the odd records from such hosts in Gilot (1984) and Tovornik (1991) as valid. Bravo (2011) mentions *Oryctolagus cuniculi* (Leporidae) as a host of *I. frontalis*, but we have been unable to confirm this statement from the references provided by that author, and this host is therefore excluded from the above list.

References

Bravo, L.G. 2011. Conejo – *Oryctolagus cuniculi* (Linnaeus, 1758). *In* A. Salvador & J. Cassinello (editors), Enciclopedia virtual de los vertebrados españoles. Museo Nacional de Ciencias Naturales, Madrid, 25 pp.

Doby, J.M. 1998. Contribution à la connaissance de la biologie de *Ixodes* (*Trichotoixodes*) *pari* Leach (= *I. frontalis*) (Panzer) (Acari: Ixodidae), tique spécifique des oiseaux. Acarologia, 39: 315–324.

Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.

Gilot, B. 1984. Premier inventaire des Ixodidae (Acarina, Ixodoidea) parasites d'oiseaux dans les Alpes françaises et leur avant-pays. Données écologiques sur quelques espèces peu connues. Riv. Parassitol., 1: 303–318.

Gilot, B., Beaucournu, J. & Chastel, J. 1977. Collecte "au drapeau" et fixation sur l'homme d'*Ixodes* (*Trichotoixodes*) *frontalis* (Panzer, 1795). Parasite, 2: 197–199.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Jameson, L.J., Morgan, P.J., Medlock, J.M., Watola, G. & Vaux, A.G.C. 2012. Importation of *Hyalomma marginatum*, vector of Crimean-Congo haemorrhagic fever, into the United Kingdom by migratory birds. Tick Tick-borne Dis., 3: 95–99.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Neumann, L.G. 1911. Ixodidae. Das Tierreich (26), 169 pp.

Tovornik, D. 1991. Data on ticks *Ixodes frontalis* (Panzer, 1798) and *Ixodes arboricola* Schulze et Schlottke, 1929 found on birds in Yugoslavia. Biol. Vestn., 39: 157–164.

Wilson, N. 1970. New distributional records of ticks from Southeast Asia and the Pacific (Metastigmata: Argasidae, Ixodidae). Oriental Insects, 4: 37–46.

84 – *I. fuscipes* Koch, 1844 (Arch. Naturgesch., 10: 217–239)
See remarks below.

Type depositories: ZMB (holotype), ENV (paratypes) (Moritz and Fischer 1981, *op. cit.* under *I. acutitarsus*; Nuttall and Warburton 1911, *op. cit.* under *I. acuminatus*)

Known stages: female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical moist broadleaf forests; few ticks in mangroves and central Andean wet puna

Hosts: Rodentia: Dasyproctidae (ANL)
Passeriformes (several families) (AN)
Rodentia: Cuniculidae (A)

Rodentia: Sciuridae (NL)
Didelphimorphia: Didelphidae (N)
Carnivora: Felidae; Rodentia: Cricetidae (stages unknown)

Human infestation: no

Remarks: Neumann (1899) identifies this species as *I. spinosus* Neumann, 1899, while Cooley and Kohls (1945) treat *I. fuscipes* as a doubtful species. However, subsequent studies by Fairchild et al. (1966) and other workers have proved the validity of this Neotropical taxon.

References

Arzua, M., Onofrio, V.C. & Barros-Battesti, D.M. 2005. Catalogue of the tick collection (Acari, Ixodida) of the Museu de História Natural Capão da Imbuia, Curitiba, Paraná, Brazil. Rev. Bras. Zool., 22: 623–632.

Barros-Battesti, D.M. & Knysak, I. 1999. Catalogue of the Brazilian *Ixodes* (Acari: Ixodidae) material in the mite collection of Instituto Butantan, São Paulo, Brazil. Papéis Avulsos Zool., 41: 49–57.

Cooley, R.A. & Kohls, G.M. 1945. The genus *Ixodes* in North America. Natl. Inst. Health Bull. (184), 246 pp.

Fairchild, G.B., Kohls, G.M. & Tipton, V.J. 1966. The ticks of Panama (Acarina: Ixodoidea). *In* W.R. Wenzel & V.J. Tipton (editors), Ectoparasites of Panama. Field Museum of Natural History, Chicago, pp. 167–219.

Gazêta, G.S., Carvalho, R.W., Almeida, A.B. & Costa, J.N. 2003. Relationship between ticks and fleas recovered from small rodents from the Serra dos Órgaos mountain range, Rio de Janeiro State, Brazil. Entomol. Vectores, 10: 379–390.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Neumann, L.G. 1899. Révision de la famille des ixodidés (3e mémoire). Mém. Soc. Zool. Fr., 12: 107–294.

Neumann, L.G. 1911. Ixodidae. Das Tierreich (26), 169 pp.

Onofrio, V.C., Barros-Battesti, D.M., Labruna, M.B. & Faccini, J.L.H. 2009. Diagnoses of and illustrated key to the species of *Ixodes* Latreille, 1795 (Acari: Ixodidae) from Brazil. Syst. Parasitol., 72: 143–157.

85 – *I. fynbosensis* Apanaskevich, Horak, Mathee & Matthee, 2010 (J. Parasitol., 97, 389–398, 2011, doi:10.1645/GE-2366.1, available online from February 25, 2010)

Type depository: USNTC (holotype, paratypes), IGHTC, ZIAC, OVI (paratypes) (Apanaskevich, D.A., Horak, I.G., Matthee, C.A. & Matthee, S. 2011. A new species of *Ixodes* (Acari: Ixodidae), from South African mammals. J. Parasitol., 97, 389–398, doi:10.1645/GE-2366.1, available online from February 25, 2010)

Known stages: female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregion: montane fynbos and renosterbosveld

Hosts: usual hosts for larvae and nymphs are Rodentia: Muridae.
Rodentia: Muridae (ANL)
Carnivora: Canidae (A)
Soricomorpha: Soricidae (NL)

Human infestation: no

Reference

Apanaskevich, D.A., Horak, I.G., Matthee, C.A. & Matthee, S. 2011. A new species of *Ixodes* (Acari: Ixodidae) from South African mammals. J. Parasitol., 97: 389–398.

86 – *I. galapagoensis* Clifford & Hoogstraal, 1980 (Proc. Entomol. Soc. Wash., 82: 378–383)

Type depository: USNTC (holotype, paratypes) (Keirans and Clifford 1984, *op. cit*. under *I. amersoni*)

Known stages: male, female, nymph

Zoogeographic Region: Neotropical

Ecoregion: Galapagos Islands scrubland mosaic

Hosts: Rodentia: Cricetidae (AN)

Human infestation: no

Remarks: Durden and Keirans (1996) regard *I. galapagoensis* and its hosts as at risk of extinction.

References

Clifford, C.M. & Hoogstraal, H. 1980. A new species of *Ixodes* parasitizing the rice rat in the Galapagos (Ixodoidea: Ixodidae). Proc. Entomol. Soc. Wash., 82: 378–383.

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.

87 – *I. ghilarovi* Filippova & Panova, 1988 (*In* La systématique des insectes et acarines, Académie des Sciences de l' URSS Horae Societatis. Entomologicae Unionis Soveticae, Nauka, Leningrad, pp. 212–217. In Russian)

Type depository: ZIAC (holotype, paratypes) (Filippova 2008, *op. cit*. under *I. berlesei*)

Known stages: female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregion: Caucasus mixed forests

Hosts: Rodentia: Cricetidae (ANL)

Rodentia: Muridae; Soricomorpha: Soricidae (NL)

Human infestation: no

Remarks: Camicas et al. (1998) state that the known stages of *I. ghilarovi* are the female and larva, but Filippova and Panova (1988) had earlier described the nymph. Camicas et al. (1998) record no hosts for this species, which is incorrect, while Kolonin (2009) ignores Soricomorpha as hosts for *I. ghilarovi* in Filippova and Stekolnikov (2007).

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Filippova, N.A. 2010. Uncommon zoogeographical connections in the subgenus *Exopalpiger* Schultze [sic] of the genus *Ixodes* Latreille (Acari, Ixodidae). Entomol. Rev., 90: 793–797.

Filippova, N.A. & Panova, I.V. 1988. *Ixodes ghilarovi* sp. n.- a new relict species of the ixodid ticks (Ixodoidea: Ixodidae). Sist. Nasekomyh. Kleschei, 70: 212–217. In Russian.

Filippova, N.A. & Panova, I.V. 1989. Description of female and larva of the relict species *Ixodes ghilarovi* (Ixodoidea). Parazitologiya, 23: 419–422. In Russian.

Filippova, N.A. & Stekolnikov, A.A. 2007. Materials on the preimaginal stages of the ticks collected from small mammals in western and northern Caucasus (Acari: Ixodidae). Parazitologiya, 41: 3–22. In Russian.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

88 – *I. gibbosus* Nuttall, 1916 (Parasitology, 8: 294–337)

Type depository: BMNH (lectotype, paralectotypes) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*), as *I. ricinus gibbosus*

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: mediterranean forests, woodlands and scrub

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Artiodactyla: Bovidae; Perissodactyla: Equidae (ANL)
Artiodactyla: Camelidae; Carnivora (unknown family); Erinaceomorpha: Erinaceidae; Lagomorpha: Leporidae; Aves (unknown orders) (A)
Passeriformes: Turdidae (N)
Carnivora: Canidae (stage unknown)

Human infestation: yes (Saratsiotis 1970; Morel 2003)

Remarks: Morel and Pérez (1977) state that Aves are "sometimes" infested with adults of *I. gibbosus*, but they do not identify the Aves (and Carnivores) that were parasitized. Chochlakis et al. (2012) found *I. gibbosus* on Canidae, but the tick stage was not provided. Morel (2003) states that diagnoses by Neumann (1901) of *I. ricinus* in Rhodos (Rhodes, Greece) from Squamata: Lacertidae correspond in fact to *I. gibbosus*, while Morel and Pérez (1977) consider larvae and nymphs of this tick "ubiquistes" without further elaboration. We believe that these statements require confirmation and therefore ignored them when compiling our host list for *I. gibbosus*.

References

Bursali, A., Keskin, A. & Tekin, S. 2012. A review of the ticks (Acari: Ixodida) of Turkey: species diversity, hosts and geographical distribution. Exp. Appl. Acarol., 57: 91–104.

Chochlakis, D., Ioannou, I., Sandalakis, V., Dimitriou, T., Kassinis, N., Papadopoulos, B., Tselentis, Y. & Psaroulaki, A. 2012. Spotted fever group *Rickettsiae* in ticks in Cyprus. Microb. Ecol., 63: 314–323.

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Morel, P.-C. & Pérez, C. 1977. Morphologie des stases préimaginales des Ixodidae *s. str.* d'Europe occidentale VI. – Les nymphes des *Ixodes s. str.* Acarologia, 19: 579–586.

Neumann, L. G. 1901. Revision de la famille des ixodidés. Mém. Soc. Zool. Fr., 14: 249–372

Saratsiotis, A. 1970. Étude morphologique et observations biologiques sur *Ixodes gibbosus* Nuttall, 1916. Ann. Parasitol. Hum. Comp., 45: 661–675.

89 – *I. granulatus* Supino, 1897 (Atti. Soc. Veneto-Trentina Sci. Nat. Residente Padova Ser 2, 3: 230–238)

Ixodes kempi Nuttall, 1913, a junior synonym of *I. granulatus*, as discussed in Guglielmone et al. (2009, *op. cit.* under *I. anatis*), is regarded as valid in Camicas et al. (1988, *op. cit.* under *I. anatis*) and Barker and Murrell (2008, *op. cit.* under *I. anatis*). Chao, L.-L., Wu, W.-J. & Shih, C.-M. (2009. Molecular analysis of *Ixodes granulatus*, a possible vector tick for *Borrelia burgdorferi* senus lato in Taiwan. Exp. Appl. Acarol., 48: 329–344) found considerable molecular divergence between Taiwanese populations of *I. granulatus* and extra-island populations (Lanyu Island and Malaysia), implying that more than one taxon may be represented under the name *I. granulatus*.

Type depositories: GM, BMNH (syntypes) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Australasian, Oriental, Palearctic

Ecoregions: many ecoregions in Australasian, Oriental and Palearctic Zoogeographic Regions

Hosts: Squamata are considered exceptional hosts.
Mammalia (several orders) (ANL)
Squamata: Scincidae; Passeriformes: Timaliidae, Turdidae (A)
Passeriformes: Sylviidae (N and/or L)

Human infestation: yes (Durden et al. 2008)

Remarks: Estébanes-González and Cervantes (2005) report the presence of *I. granulatus* in the Neotropical Region, but Guzmán-Cornejo et al. (2007) concluded that this diagnosis was erroneous and it has not been listed as a Neotropical tick. Tanskul et al. (1983) use the term "immatures" without specifying whether they found larvae, nymphs or both stages of *I. granulatus* on hosts. Other than Mammalia, Kolonin (2009) does not mention hosts for this tick.

References

Anastos, G. 1950. The scutate ticks, or Ixodidae, of Indonesia. Entomol. Am., 30: 1–144.

Bochkov, A.V., Abramov, A.V., Durden, L.A., Apanaskevich, D.A., Stekolnikov, A.A., Stanyukovich, M.K., Gnophanxay, S. & Tikhonov, A.N. 2011. Arthropod symbiotes of *Laonastes aenigmamus* (Rodentia: Diatomyidae). J. Parasitol., 97: 352–353.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Domrow, R. & Nadchatram, M. 1963. Two field collections of Malayan ticks and mites. Malayan Nat. J., 17: 145–164.

Durden, L.A., Merker, S. & Beati, L. 2008. The tick fauna of Sulawesi, Indonesia (Acari: Ixodoidea: Argasidae and Ixodidae). Exp. App. Acarol., 45: 85–110.

Estébanes-González, M.L. & Cervantes, F.A. 2005. Mites and ticks associated with some small mammals in Mexico. Int. J. Acarol., 31: 23–37.

Guzmán-Cornejo, C., Robbins, R.G. & Pérez, T.M. 2007. The *Ixodes* (Acari: Ixodidae) of Mexico: parasite-host and host-parasite checklists. Zootaxa, 1553: 47–58.

Ishibashi, O., Niizuma, J., Miura, A., Iizuka, S., Fujita, H., Ogura, G., Sakashita, M., Ganeko, H., Sunagawa, K. & Nakada, T. 2009. Survey of parasitic ixodid ticks on small Asian mongoose on Okinawajima Island, Japan. Jap. J. Zoo Wild. Med., 14: 51–57.

Kohls, G.M. 1957. Malaysian parasites. XVIII. Ticks (Ixodoidea) of Borneo and Malaya. Malaya (28): 65–94.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Noh, Y.T. 1965. A taxonomic study on ticks in Korea (I) The genus *Ixodes*. Korean J. Zool., 7: 73–76.

Schulze, P. 1934. Über eine Zeckenausbeute von Kleinsäugern aus Java. Z. Parasitenkd., 7: 167–171.

Tanskul, P., Stark, H.E. & Inlao, I. 1983. A checklist of ticks of Thailand (Acari: Metastigmata: Ixodoidea). J. Med. Entomol., 20: 330–341.
Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.
Xu, R. & Li, K. 1997. A collection of ticks from Guizhou, China. Syst. Appl. Acarol., 2: 245–246.
Yamaguti, N., Tipton, V.J., Keegan, H.L. & Toshioka, S. 1971. Ticks of Japan, Korea, and the Ryukyu Islands. Brigham Young Univ. Sci. Bull. Biol. Ser., 15 (1), 226 pp.

90 – *I. gregsoni* Lindquist, Wu & Redner, 1999 (Can. Entomol., 131: 151–170)

Type depositories: CNC (holotype, paratypes), USNTC (paratypes) (Lindquist, E.E., Wu, K.W. & Redner, J.H. 1999. A new species of the tick genus *Ixodes* (Acari: Ixodidae) parasitic on mustelids (Mammalia: Carnivora) in Canada. Can. Entomol., 131: 151–170)

Known stages: male, female, nymph, larva

Zoogeographic Region: Nearctic

Ecoregions: Great Lakes temperate broadleaf and mixed forests; northern Appalachian forests

Hosts: usual hosts for larvae, nymphs and adults are Carnivora: Mustelidae.
Carnivora: Mustelidae (ANL)
Carnivora: Felidae (A)

Human infestation: no

Remarks: Felidae are not included as hosts of *I. gregsoni* in Kolonin (2009), but we consider the record from this type of host in Lubelczyk et al. (2007) valid.

References

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Lindquist, E.E., Wu, K.W. & Redner, J.H. 1999. A new species of the tick genus *Ixodes* (Acari: Ixodidae) parasitic on mustelids (Mammalia: Carnivora) in Canada. Can. Entomol., 131: 151–170.
Lubelczyk, C.B., Hanson, T., Lacombe, E.H., Holman, M.S. & Keirans, J.E. 2007. First U.S. record of the hard tick *Ixodes* (*Pholeoixodes*) *gregsoni* Lindquist, Wu, and Redner. J. Parasitol., 93: 718–719.

91 – *I. guatemalensis* Kohls, 1956 (J. Parasitol., 42: 636–649)

Type depositories: CNMH (holotype), USNTC (paratype) (Kohls 1956, *op. cit.* under *I. andinus*). Types of this species are not listed for USNTC by Keirans and Clifford (1984, *op. cit.* under *I. amersoni*).

Known stages: male, female

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical coniferous and broadleaf forests

Hosts: Rodentia: Cricetidae, Sciuridae; Carnivora: Mustelidae; Soricomorpha: Soricidae (A)

Human infestation: no

Remarks: Camicas et al. (1998) list only the female of *I. guatemalensis* as described, but the male was subsequently described by Keirans and Eckerlin (2005).

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Keirans, J.E. & Eckerlin, R.P. 2005. Description of the male and redescription of the female of *Ixodes* (*Ixodes*) *guatemalensis* and description of the male, nymph and larva of *Ixodes* (*Afrixodes*) *moreli* and redescription of the female (Acari: Ixodida: Ixodidae). Int. J. Acarol., 31: 259–268.

92 – *I. hearlei* Gregson, 1941 (Can. Entomol., 73: 220–228)

Type depositories: CNC (holotype, paratypes), USNTC (paratypes) (Gregson, J.D. 1941. Two new species of ticks from British Columbia (Ixodidae). Can. Entomol., 73: 220–228)

Known stages: male, female, nymph

Zoogeographic Region: Nearctic

Ecoregion: temperate conifer forests

Hosts: usual hosts for larvae, nymphs and adults are Rodentia: Sciuridae.
Rodentia: Sciuridae (ANL)
Carnivora: Procyonidae (stage unknown)

Human infestation: no

Remarks: the larva of *I. hearlei* remains undescribed, but we regard records of this stage in Gregson (1956) as provisionally valid. Durden and Keirans (1996) state that Procyonidae are hosts for *I. hearlei*, but Kolonin (2009) ignores this type of host.

References

Durden, L.A. & Keirans, J.E. 1996. Nymphs of the genus *Ixodes* (Acari: Ixodidae) of the United States: taxonomy, identification key, distribution, hosts, and medical/veterinary importance. Thomas Say Publ. Entomol. Monogr. (9), 95 pp.

Gregson, J.D. 1956. The Ixodoidea of Canada. Can. Dept. Agric. Sci. Serv. Entomol. Div. Publ. (930), 92 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

93 – *I. heinrichi* Arthur, 1962 (Parasitology, 52: 207–209)

Type depository: MCZ (holotype) (Arthur 1965, *op. cit.* under *I. arabukiensis*)

Known stages: female

Zoogeographic Region: Afrotropical

Ecoregion: Angolan montane forest-grassland mosaic

Hosts: Passeriformes: Sylviidae (A)

Human infestation: no

Reference

Arthur, D.R. 1965. Ticks of the genus *Ixodes* in Africa. The Athlone Press, University of London, London, 348 pp.

94 – *I. hexagonus* Leach, 1815 (Trans. Linn. Soc. Lond., 11: 306–400)

Type depository: BMNH (syntypes) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: many Palearctic ecoregions

Hosts: usual hosts for larvae, nymphs and adults are Erinaceomorpha: Erinaceidae
Mammalia (several orders) (ANL)
Passeriformes: Turdidae (AN)
Galliformes: Phasianidae (A)
Passeriformes: Corvidae, Paridae, Sturnidae (N)
Strigiformes: Strigidae (L)
Several orders (Aves) (tick stages unknown)

Human infestation: yes (Bursali et al. 2012)

Remarks: Vogelsang and Cordero (1939) state that *I. hexagonus* was collected from cattle in the Neotropical country of Uruguay. This is considered a misidentification by Guglielmone et al. (2003), and we agree. Similarly, the several records of *I. hexagonus* from Taiwan are in error, as noted by Robbins (2005). The name *Ixodes hexagonus* in Hewitt (1915) and Hearle (1938) actually refers to *Ixodes rugosus* (Nearctic), as stated in Gregson (1956). Obviously, we regard *I. hexagonus* as a Palearctic species. Morel (2003), who found this species on Strigiformes, classifies it as *Pholeoixodes hexagonus*. See also *I. kaiseri*.

References

Arthur, D.R. 1947. Observations on *Ixodes hexagonus* Leach, 1815 (Acarina: Ixodidae). Entomol. Monthly Mag., 83: 69–76.

Arthur, D.R. 1953. The host relationships of *Ixodes hexagonus* Leach in Britain. Parasitology, 43: 227–238.

Arthur, D.R. 1963. British ticks. Butterworths, London, 213 pp.

Bailly-Choumara, H., Morel, P.-C. & Rageau, J. 1974. Première contribution au catalogue des tiques du Maroc (Acari, Ixodoidea). Bull. Soc. Sci. Phil. Nat. Maroc, 54: 71–80.

Bursali, A., Keskin, A. & Tekin, S. 2012. A review of the ticks (Acari: Ixodida) of Turkey: species diversity, hosts and geographical distribution. Exp. Appl. Acarol., 57: 91–104.

Estrada Peña, A., Lucientes Curdi, J., Castillo Hernández, J.A., Sánchez Acedo, C. & Galmes Femenias, M. 1984. *Alectoris rufa*, nuevo hospedador para *Ixodes ventalloi* e *Ixodes* (*Pholeoixodes*) *hexagonus* en España. Rev. Ibér. Parasitol., 44: 215–216.

Filippova, N.A. 1961. Contribution to the taxonomy of ticks of the *crenulatus* group (Ixodidae, *Ixodes*, *Pholeoixodes*). Parazitol. Sborn. Zool. Inst. Akad. Nauk SSSR, 20: 226–247. In Russian, translation by Knowles, Z.

Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.

Gregson, J.D. 1956. The Ixodoidea of Canada. Can. Dept. Agric. Sci. Serv. Entomol. Div. Publ. (930), 92 pp.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Hearle, E. 1938. The ticks of British Columbia. Sci. Agric., 18: 341–354.

Hewitt, C.G. 1915. A contribution to a knowledge of Canadian ticks. Trans. R. Soc. Can. Ser. 3, 9: 225–239.

Jaenson, T.G.T., Talleklint, L., Lundqvist, L., Olsen, B., Chirico, J. & Mejlon, H. 1994. Geographical distribution, host associations, and vector roles of ticks (Acari: Ixodidae, Argasidae) in Sweden. J. Med. Entomol., 31: 240–256.

Lenssen, J., Wijnvel, M., Conijn, A., Luijten, A. & Jongejan, F. 2011. Het "tickbuster" survey. Tijdschr. Diergeneeskd., 136: 508–511.

Martyn, K.P. 1988. Provisional atlas of the ticks (Ixodoidea) of the British Isles. Biological Records Centre, Natural Environment Research Council, UK, 62 pp.

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Moretti, A., Grelloni, V., Principato, M., Leonardo, L., Moretta, I., Salvatori, R. & Agnetti, F. 2007. On the presence of parasites in nutria (*Myocastor coypus*, Molina, 1782) living in the Umbrian territory (central Italy): bio-sanitary evaluations. Ig. Mod., 127: 75–90.

Robbins, R.G. 2005. The ticks (Acari: Ixodida: Argasidae, Ixodidae) of Taiwan: a synonymic checklist. Proc. Entomol. Soc. Wash., 107: 245–253.

Rosalino, L.M., Rodrigues, M., Santos-Silva, M. & Santos-Reis, M. 2007. Unusual findings on host-tick interactions through carnivore scat analysis. Exp. Appl. Acarol., 43: 293–302.

Santos-Dias, J.A.T., Núncio, M.S. & Gonçalves, A.C.-B. 1994. Contribuição para a elaboração de um inventário da fauna ixodoideológica (Acarina-Ixodoidea) de Portugal. Garcia de Orta Ser. Zool., 20: 49–68.
Starkoff, O. & Cagnolati G.C. 1962. Nuove osservazioni faunistiche e biologiche sulle zecche italiane. Parassitologia, 4: 31–37.
Vogelsang, E.G. & Cordero, E.H. 1939. Sobre una pequeña colección de garrapatas (Ixodidae) de la Argentina, Paraguay y Uruguay. Rev. Med. Vet. Parasitol., 1: 115–116.

95 – *I. himalayensis* Dhanda & Kulkarni, 1969 (J. Parasitol., 55: 667–672)

Type depositories: VRC (holotype, paratypes), IM, BMNH, USNTC (paratypes) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: female, nymph, larva

Zoogeographic Region: Oriental

Ecoregion: western Himalayan alpine shrub and meadows

Hosts: usual hosts for larvae, nymphs and adults are Rodentia: Muridae.
Rodentia: Muridae (ANL)
Soricomorpha: Soricidae (NL)

Human infestation: no

Remarks: the record of Clifford et al. (1975) from Soricidae is compatible with *I. himalayensis* or a species close to it; therefore, this record is regarded as tentatively valid.

References

Clifford, C.M., Hoogstraal, H. & Keirans, J.E. 1975. The *Ixodes* ticks (Acarina: Ixodidae) of Nepal. J. Med. Entomol., 12: 115–137.
Dhanda, V. & Kulkarni, S.M. 1969. *Ixodes himalayensis* sp. n. (Acarina: Ixodidae) parasitizing small mammals in Himachal Pradesh, India. J. Parasitol., 55: 667–672.

96 – *I. hirsti* Hassall, 1931 (J. Parasitol., 17: 232)

Type depository: NM (syntypes) (Hirst, S. 1930. On a new species of tick (*Ixodes victoriensis*, sp. n.) from Victoria, Australia. Ann. Mag. Nat. Hist. Ser., 10, 5: 575–576), as *I. victoriensis* Hirst, 1930, a name preoccupied by *Ixodes victoriensis* Nuttall, 1916 and consequently renamed.

Known stages: male, female, nymph, larva

Zoogeographic Region: Australasian

Ecoregions: southeast and southwest Australia temperate savanna; Tasmanian forest

Hosts: Diprotodontia: Phascolarctidae (AN)

Carnivora: Canidae, Felidae; Diprotodontia (several families); Rodentia: Muridae (A) Passeriformes (several families) (NL)

Human infestation: Cameron and Rowley (1999) found a tick that may be *I. hirsti* feeding on a human.

Remarks: Camicas et al. (1998) list the larva and nymph of *I. hirsti* as undescribed. Recently, however, both stages were described by Laan et al. (2011), who consider their description of the nymph presumptive, although it is treated as valid here. There are sound records from Aves in Chapman et al. (2009) and Oorebeek and Kleindorfer (2009), but these authors do not state whether the birds were infested by larvae, nymphs or both stages. These records are not included in Kolonin (2009). Laan et al. (2011) list the records of *I. hirsti* from Aves under the heading "adults *Ixodes hirsti*," but no adults of this tick have been found on Aves.

References

Cameron, R.J. & Rowley, M.P. 1999. Tick paralysis requires prolonged observation. Med. J. Aust., 171: 334–335.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chapman, T.W., Marando, L., Oorebeek, M. & Kleindorfer, S. 2009. Genetic structure in ixodid ticks from Kangaroo Island and the South Australia mainland. Aust. J. Entomol., 48: 40–46.

Jackson, J., Chilton, N.B., Beveridge, I., Morris, M. & Andrews, R.H. 2000. Genetic variation within the ticks *Ixodes holocyclus* and *I. cornuatus* from South-eastern Australia. Int. J. Parasitol., 30: 1159–1166.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Laan, B., Handasyde, K. & Beveridge, I. 2011. Observations on the biology and distribution of the tick *Ixodes hirsti* Hassall, 1931 (Acari: Ixodoidea). Proc. R. Soc. Victoria, 123: 198–214.

Oorebeek, M. & Kleindorfer, S. 2009. The prevalence and intensity of tick infestation in passerines from South Australia. Emu, 109: 121–125.

Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.

97 – ***I. holocyclus*** Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)
See *I. cornuatus*, *I. myrmecobii* and remarks below.

Type depositories: USPNC, ZMB, BMNH, ZSH (syntypes) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*). However, Salley et al. (1978, *op. cit.* under *I. affinis*) do not list types of *I. holocyclus* in USNPC. Neumann, L.G. (1899. Révision de la famille des ixodidés (3^{e} mémoire). Mém. Soc. Zool. Fr., 12: 107–294) regards a nymph collected from a squirrel in India as part of the syntype series of *I. holocyclus*, but this nymph is not *I. holocyclus*, as discussed in Keirans and Hillyard (2001, *op. cit.* under *I. anatis*).

Known stages: male, female, nymph, larva

Zoogeographic Region: Australasian

Ecoregions: Australasian temperate broadleaf and mixed forests

Hosts: Carnivora: Felidae; Dasyuromorphia: Dasyuridae; Diprotodontia: Macropodidae, Phalangeridae; Peramelemorphia: Peramelidae (ANL)
Artiodactyla: Bovidae (AN)
Carnivora: Canidae (AL)
Diprotodontia: Petauridae, Phascolarctidae, Vombatidae (A)
Diprotodontia: Potoroidae; Rodentia: Muridae; Passeriformes: Melephagidae, Cracictidae, Ptilonorhynchidae (NL)
Cuculiformes: Cuculidae; Passeriformes: Acanthizidae (L)
Mammalia (several orders); Aves (several orders) (stages unknown)

Human infestation: yes (Okino et al. 2007)

Remarks: Geevarghese et al. (1997) and Ghosh et al. (2007) continue to maintain that *I. holocyclus* is found in eastern India (Oriental Region), but this is an error, as discussed in Roberts (1960) and Keirans and Hillyard (2001). Roberts (1960, 1970) presents the most extensive list of hosts of *I. holocyclus*, but no information is provided concerning the tick stages found on them. Adamantos et al. (2005) and Okino et al. (2007) found *I. holocyclus* in the Palearctic Region, but there is no evidence that this species has become established there. Baxter et al. (2009) report a tentative diagnosis of larvae of *I. holocyclus* from dogs, while Beninati et al. (2009) report an uncertain record of a nymph of this tick from a dog or a cow; these records await confirmation and have not been included in our host list above. The record of a nymph from Bovidae is from Sutherst and Moorhouse (1972).

References

Adamantos, S., Boag, A. & Church, D. 2005. Australian tick paralysis in a dog imported into the UK. Aust. Vet. J., 83: 352–353.

Barnes, T.S., Goldizen, A.W., Morton, J.M. & Coleman, G.T. 2010. Parasites of the brush-tailed rock-wallaby (*Petrogale penicillata*). J. Wildl. Dis., 46: 218–228.

Baxter, C.G., Vogelnest, L.J. & Doggett, S.L. 2009. Dermatoses caused by infestations of immature *Ixodes* spp. on dogs and cats in Sydney, Australia. Aust. Vet. J., 87: 182–187.

Beninati, T., Riegler, M., Vilcins, I.-M.E., Sacchi, L., McFadyen, R., Krockenberger, M., Bandi, C., O'Neill, S.L. & Lo, N. 2009. Absence of the symbiont *Candidatus* Midichloria mitochondrii in the mitochondria of the tick *Ixodes holocyclus*. FEMS Microbiol. Lett., 299: 241–247.

Clunies Ross, I. 1924. The bionomics of *Ixodes holocyclus* Neumann, with a redescription of the adult and nymphal stages and a description of the larvae. Parasitology, 16: 365–381.

Doube, B.M. 1979. Cattle and the paralysis tick *Ixodes holocyclus*. Aust. Vet. J., 51: 511–515.

Doube, B.M. 1979. Seasonal patterns of abundance and host relationships of the Australian paralysis tick, *Ixodes holocyclus* Neumann (Acarina: Ixodidae), in southeastern Queensland. Aust. J. Ecol., 4: 345–360.

Geevarghese, G., Fernandes, S. & Kulkarni, S.M. 1997. A checklist of Indian ticks (Acari: Ixodoidea). Ind. J. Anim. Sci., 67: 566–574.

Ghosh, S., Bansal, G.C., Gupta, S.C., Ray, D., Khan, M.Q., Irshad, H., Shahiduzzaman, Md., Seitzer, U. & Ahmed, J.S. 2007. Status of tick distribution in Bangladesh, India and Pakistan. Parasitol. Res., 101 (Suppl. 2): 207–216.

Jackson, J. 1998. A new host record for *Ixodes holocyclus* Neumann and *Ixodes cordifer* Neumann (Acarina: Ixodidae) in Australia. Aust. J. Entomol., 37: 113–114.

Jackson, J., Chilton, N.B., Beveridge, I., Morris, M. & Andrews, R.H. 2000. Genetic variation within the ticks *Ixodes holocyclus* and *I. cornuatus* from South-eastern Australia. Int. J. Parasitol., 30: 1159–1166.

Keirans, J.E. & Hillyard, P.D. 2001. A catalogue of the type specimens of Ixodida (Acari: Argasidae, Ixodidae) deposited in The Natural History Museum, London. Occ. Pap. Syst. Entomol. (13), 74 pp.

Lorch, D., Fisher, D.O. & Spratt, D.M. 2007. Variation in ectoparasite infestation on the brown antechinus *Antechinus stuartii*, with regard to host, habitat and environmental parameters. Aust. J. Zool., 55: 169–176.

Okino, T. Ushirogawa, H., Matoba, K. & Hatsushika, R. 2007. A bibliographical study of human cases of hard tick (Acarina: Ixodidae) bites received abroad and found in Japan. Kawasaki Med. J., 33: 189–194.

Roberts, F.H.S. 1954. A note on the distribution of the paralysis tick, *Ixodes holocyclus* Neumann, in Victoria. Aust. Vet. J., 30: 144.

Roberts, F.H.S. 1960. A systematic study of the Australian species of the genus *Ixodes* (Acarina: Ixodidae). Aust. J. Zool., 8: 392–485.

Roberts, F.H.S. 1969. The larvae of Australian Ixodidae (Acarina: Ixodoidea). J. Aust. Entomol. Soc., 8: 37–78.

Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.

Sutherst, R.W. & Moorhouse, D.E. 1972. The seasonal incidence of ixodid ticks on cattle in an elevated area of south-eastern Queensland. Aust. J. Agric. Res., 23: 195–204.

98 – *I. hoogstraali* Arthur, 1955 (Parasitology, 45: 128–130)

Type depositories: USNTC (holotype, paratypes), BMNH, HH, OVI, ZIAC (paratypes) (Filippova 2008, *op. cit.* under *I. berlesei*; Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: female

Zoogeographic Region: Afrotropical

Ecoregion: southwestern Arabian montane woodlands

Hosts: Rodentia: Muridae (A)

Human infestation: no

References

Arthur, D.R. 1965. Ticks of the genus *Ixodes* in Africa. The Athlone Press, University of London, London, 348 pp.
Hoogstraal, H. & Kaiser, M.N. 1959. Ticks (Ixodoidea) of Arabia with special reference to the Yemen. Fieldiana Zool., 39: 297–322.

99 – *I. howelli* Cooley & Kohls, 1938 (Publ. Health Rep. U.S. Publ. Health Serv., 53: 1616–1621)

Type depository: USNTC (holotype) (Keirans and Clifford 1984, *op. cit.* under *I. amersoni*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Nearctic

Ecoregions: temperate conifer forest; few ticks in temperate grasslands, savannas and shrublands

Hosts: usual hosts for larvae, nymphs and adults are Passeriformes: Hirundinidae.
Passeriformes: Hirundinidae (ANL)
Passeriformes: Fringillidae (AN)
Falconiformes: Falconidae (N)

Human infestation: no

Remarks: the diagnosis of a nymph of this tick collected from Falconidae by Kohls and Ryckman (1962) is tentative.

References

Durden, L.A. & Keirans, J.E. 1996. Nymphs of the genus *Ixodes* (Acari: Ixodidae) of the United States: taxonomy, identification key, distribution, hosts, and medical/veterinary importance. Thomas Say Publ. Entomol. Monogr. (9), 95 pp.
Kohls, G.M. & Ryckman, R.E. 1962. New distributional records of ticks associated with cliff swallows, *Petrochelidon* spp., in the United States. J. Parasitol., 48: 507–508
Webb, J.P., Bennett, S.G. & Challet, G.L. 1990. The larval ticks of the genus *Ixodes* Latreille (Acari: Ixodidae) of California. Bull. Soc. Vector Ecol., 15: 73–124.

100 – *I. hyatti* Clifford, Hoogstraal & Kohls, 1971 (J. Med. Entomol., 8: 430–438)

Type depositories: USNTC (holotype, paratypes), BMNH, HH (paratypes) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Oriental, Palearctic

Ecoregion: tropical and subtropical moist broadleaf forests

Hosts: usual hosts for larvae, nymphs and adults are Lagomorpha: Ochotonidae.
Lagomorpha: Ochotonidae; Rodentia: Muridae (ANL)
Rodentia: Sciuridae (AN)
Rodentia: Cricetidae (N)

Human infestation: no

Remarks: Camicas et al. (1998) state that *I. hyatti* is found only in the Oriental Region, but a report from Sichuan (China) by Teng and Jiang (1991), also included in Chen et al. (2010), is consistent with the Palearctic Region. Durden and Keirans (1996) regard *I. hyatti* as an endangered species.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Clifford, C.M., Hoogstraal, H. & Keirans, J.E. 1975. The *Ixodes* ticks (Acarina: Ixodidae) of Nepal. J. Med. Entomol., 12: 115–137.

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.

Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.

Yu, X., Yr, R.-Y & Gong, Z.-D. 1997. The tick fauna of Xinjiang. Xinjiang Scientific, Technological and Medical Publishing House, Urumqi, China, 168 pp. In Chinese.

101 – *I. hydromyidis* Swan, 1931 (Parasitology, 23: 485–487)

Type depositories: WAM, CDS (syntypes) (Swan, D.C. 1931. On a new species of *Ixodes* (*Ix. hydromyidis*) from Western Australia. Parasitology, 23: 485–487)

Known stages: female, nymph, larva

Zoogeographic Region: Australasian

Ecoregion: southwest Australia woodlands

Hosts: Rodentia: Muridae (ANL)

Human infestation: no

References

Roberts, F.H.S. 1969. The larvae of Australian Ixodidae (Acarina: Ixodoidea). J. Aust. Entomol. Soc., 8: 37–78.

Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.

102 – *I. jacksoni* Hoogstraal, 1967 (J. Med. Entomol., 4: 37–41)

Type depositories: USNTC (holotype, paratypes), CMC (paratypes) (Hoogstraal, H. 1967. *Ixodes jacksoni* n. sp. (Ixodoidea: Ixodidae), a nest parasite of the spotted cormorant, *Phalacrocorax punctatus* (Sparrman), in New Zealand. J. Med. Entomol., 4: 37–41)

Known stages: male, female, nymph, larva

Zoogeographic Region: Australasian

Ecoregion: New Zealand Cantebury-Otago Tussock grasslands

Hosts: Pelecaniformes: Phalacrocoracidae (ANL)

Human infestation: no

Remarks: Camicas et al. (1998) list the larva of *I. jacksoni* (under the name *Ceratixodes jacksoni*) as undescribed, but there is a description in Dumbleton (1973).

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Dietrich, M., Gómez-Díaz, E. & McCoy, K.D. 2011. Worldwide distribution and diversity of seabird ticks: implications for the ecology and epidemiology of tick-borne pathogens. Vector-Borne Zoon. Dis., 11: 453–470.

Dumbleton, L.J. 1973. Additions to the New Zealand tick fauna. Tuatara, 20: 65–74.

Hoogstraal, H. 1967. *Ixodes jacksoni* n. sp. (Ixodoidea: Ixodidae), a nest parasite of the spotted cormorant, *Phalacrocorax punctatus* (Sparrman), in New Zealand. J. Med. Entomol., 4: 37–41.

103 – *I. jellisoni* Cooley & Kohls, 1938 (Publ. Health Rep. U.S. Publ. Health Serv., 53: 1616–1621)

Type depository: USNTC (holotype) (Keirans and Clifford 1984, *op. cit.* under *I. amersoni*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Nearctic

Ecoregion: temperate conifer forests

Hosts: usual hosts for larvae, nymphs and adults are Rodentia: Heteromyidae.
Rodentia: Heteromyidae (ANL)
Carnivora: Felidae; Rodentia: Geomyidae, Sciuridae (A)
Rodentia: Cricetidae (L)
Carnivora: Canidae (stage unknown)

Human infestation: no

Remarks: Allan (2001) states that *I. jellisoni* was found feeding on humans, but we have been unable to confirm this from the references quoted by the author. Kolonin (2009) ignores records from Carnivora, but we accept the findings of Furman and Loomis (1984) and Fitzgerald and Kennedy (2008) from these hosts.

References

Allan, S.A. 2001. Ticks (Class Arachnida: Order Acarina). *In* W.S. Samuel, M.J. Pybus & A.A. Kocan (editors), Parasitic Diseases of Wild Animals, 2nd edition. Iowa State University Press, Ames, pp. 72–106.

Fitzgerald, D. & Kennedy, M. 2008. Surveillance of ticks on dogs in Alberta, Canada. Proc. 6th Int. Conf. Ticks Tick-borne Pathog., September 2008, Buenos Aires, Argentina, p. 283.

Furman, D.P. & Loomis, E.C. 1984. The ticks of California (Acari: Ixodida). Bull. Calif. Insect Surv., 25: 1–239.

Johnson, D.E. 1966. Ticks of Dugway Proving Ground and vicinity and their host associations. Utah Acad. Proc., 43: 49–66.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Lane, R.S., Peavey, C.A., Padgett, K.A. & Hendson, M. 1999. Life history of *Ixodes* (*Ixodes*) *jellisoni* (Acari: Ixodidae) and its vector competence for *Borrelia burgdorferi* sensu lato. J. Med. Entomol., 36: 329–340.

104 – *I. jonesae* Kohls, Sonenshine & Clifford, 1969 (J. Parasitol., 55: 447–452)

Type depositories: USNTC (holotype, paratypes), FMNH (paratypes) (Kohls, G.M., Sonenshine, D.E. & Clifford, C.M. 1969. *Ixodes* (*Exopalpiger*) *jonesae* sp. n. (Acarina: Ixodidae), a parasite of rodents in Venezuela. J. Parasitol., 55: 447–452)

Known stages: male, female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregion: montane grasslands and shrublands

Hosts: usual hosts for nymphs and adult ticks are Rodentia: Cricetidae.
Rodentia: Cricetidae (ANL)
Paucituberculata: Caenolestidae (L)

Human infestation: no

References

Filippova, N.A. 2010. Uncommon zoogeographical connections in the subgenus *Exopalpiger* Schultze [sic] of the genus *Ixodes* Latreille (Acari, Ixodidae). Entomol. Rev., 90: 793–797.

Guglielmone, A.A. & Nava, S. 2011. Rodents of the subfamily Sigmodontinae (Myomorpha: Cricetidae) as hosts for South American hard ticks (Acari: Ixodidae) with hypotheses on life history. Zootaxa, 2904: 45–65.

Jones, E.K., Clifford, C.M., Keirans, J.E. & Kohls, G.M. 1972. The ticks of Venezuela (Acarina: Ixodoidea) with a key to the species of *Amblyomma* in the Western Hemisphere. Brigham Young Univ. Sci. Bull. Biol. Ser., 17 (4), 40 pp.

105 – *I. kaiseri* Arthur, 1957 (J. Parasitol., 43: 578–585)
Sonenshine, D.E., Gohls, G.L. & Clifford, C.M. (1969. *Ixodes crenulatus* Koch, 1844. Synonymy with *I. kaiseri* Arthur, 1957, and redescription of the male, female, nymph and larva (Acarina: Ixodidae). Acarologia, 11: 193–206) regard *I. kaiseri* as a synonym of *I. crenulatus*, but we agree with Filippova, N.A. & Uspenskaya, I.G. (1973. *Ixodes kaiseri* Arthur, 1957 (Ixodidae) species taxonomic status. Parazitologiya, 7: 297–306. In Russian, NAMRU-3 translation 636), who soundly rejected such synonymization.

Type depositories: USNTC (holotype), BMNH, FMNH, AR, HH, CNHM (paratypes) (Keirans and Hillyard 2001, *op. cit*. under *I. anatis*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: Pontic steppe; Caucasus mixed forests; eastern mediterranean conifer-sclerophyllous-broadleaf forests

Hosts: Carnivora: Canidae, Felidae, Mustelidae; Erinaceomorpha: Erinaceidae (ANL) Carnivora: Hyaenidae; Rodentia: Hystricidae (AN)

Human infestation: no

Remarks: Kolonin (2009) cites only Carnivora as hosts for all stages of *I. kaiseri*, but we regard the records of larvae, nymphs and adults of *H. kaiseri* from Erinaceomorpha in Theodor and Costa (1967) as valid. Filippova and Uspenskaya (1973) present information for separating *I. kaiseri* from *I. canisuga*, *I. crenulatus* and *I. hexagonus*, species that have often been confused with *I. kaiseri*, rendering host profiles suspect. See also *I. canisuga*.

References

Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.
Filippova, N.A. & Uspenskaya, I.G. 1973. *Ixodes kaiseri* Arthur 1957 (Ixodidae) species taxonomic status. Parazitologiya, 7: 297–306. In Russian, NAMRU-3 translation 636.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Theodor, O. & Costa, M. 1967. A survey of the parasites of wild mammals and birds in Israel. Part one. Ectoparasites. The Israel Academy of Sciences and Humanities, Jerusalem, 119 pp.

106 – *I. kashmiricus* Pomerantzev, 1948 (Parazitol. Sborn. Zool. Inst. Akad. Nauk SSSR, 10: 20–24. In Russian)

This species is spelled *I. kaschmiricus* in the original description, but Horak et al. (2002, *op. cit.* under *I. eldaricus*) and others use the name *I. kashimiricus* (a *lapsus*). Filippova (2008, *op. cit.* under *I. berlesei*) uses the name *I. kashmiricus*. Guglielmone et al. (2009, *op. cit.* under *I. anatis*) defend the use of *kaschmiricus*, but the correct spelling is *kashmiricus*, after an earlier amendment by Pomerantzev, B.I. (1950, Ixodid ticks (Ixodidae). Fauna USSR, Zool. Inst. Acad. Sci. USSR New Ser. (41), 224 pp. In Russian), which has been recognized in Guglielmone et al. (2010, *op. cit.* under *I. abrocomae*).

Type depository: ZIAC (lectotype, paralectotype) (Filippova 2008, *op. cit.* under *I. berlesei*). Originally named *I. persulcatus kaschmiricus* (*lapsus*).

Known stages: male, female, nymph, larva

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: Tian Shan foothill arid steppe; Karakoram-West Tibetan Plateau alpine steppe

Hosts: Squamata are considered exceptional hosts for this tick.
Artiodactyla: Bovidae; Carnivora: Canidae (A)
Rodentia: Muridae; Squamata: Agamidae (N)
Carnivora: Mustelidae (stage unknown)

Human infestation: yes (Hoogstraal 1970)

Remarks: Camicas et al. (1998) state that this species is found only in the Oriental Region, but there are Palearctic localities in Teng (1986), Kolonin (2009) and Chen et al. (2010). The larva of *I. kashmiricus* is known only from laboratory-reared specimens (Kolonin 2009). Camicas et al. (1998) list the nymph of this tick as undescribed, but there is a description in Filippova (1977). Records of *I. kashmiricus* (tick stage unknown) from Mustelidae in Hoogstraal (1970) and nymphs from Agamidae in Sharma (1993) are not included in Kolonin (2009), but we treat these records as provisionally valid. Rao et al. (1973) refer to this species as *I. kaschmericus* (a *lapsus*).

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.

Hoogstraal, H. 1970. Human infestation by ticks (Ixodidae) in the Himalaya. *In* K.S. Sing & B.K. Tandan (editors), H.D. Srivastava commemoration volume. Division of Parasitology of the Indian Veterinary Research Institute, Izatnagar, pp. 75–89.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Pomerantzev, B.I. 1948. New ticks of the family Ixodidae. Parazitol. Sborn. Zool. Inst. Akad. Nauk SSSR, 10: 20–24. In Russian, NAMRU-3 translation 177.
Rao, T.R., Dhanda, V., Bhat, H.R. & Kulkarni, S.M. 1973. A survey of haematophagous arthropods in western Himalayas, Sikkim and Hill Districts of West Bengal. A general account. Ind. J. Med. Res., 61: 1421–1461.
Sharma, B.D. 1993. Medical & veterinary arthropod-disease ecology. Ashish Publishing House, New Delhi, 335 pp.
Teng, K.-F. 1986. Studies on the genus *Ixodes* in China (Acari: Ixodidae). Acta Zootax. Sin., 11: 46–53. In Chinese.

107 – *I. kazakstani* Olenev & Sorokoumov, 1934 (Vestnik Microbiol., 13: 73–75)

Type depository: ZIAC (holotype) (Filippova 2008, *op. cit.* under *I. berlesei*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: temperate grasslands, savannas and shrublands

Hosts: usual hosts for larvae, nymphs and adults are Lagomorpha: Leporidae and Galliformes: Phasianidae.
Lagomorpha: Leporidae; Galliformes: Phasianidae (ANL)
Artiodactyla: Bovidae (A)
Rodentia: Cricetidae, Dipodidae, Muridae (NL)
Soricomorpha: Soricidae; Rodentia: Gliridae (stages unknown)

Human infestation: yes (Filippova 1977)

References

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.
Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.
Grebenyuk, R.V. 1966. Ixodid ticks (Parasitiformes, Ixodidae) of Kirgizia. Akademii Nauk Kirgizkoy SSR, Instituta Biologii, Frunze, 328 pp. In Russian.
Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.
Serdjukova, G.V. 1956. Ixodid ticks of the fauna of USSR. Opred. Faune SSSR. Zool. Inst. Akad. Nauk SSSR (64), 121 pp. In Russian.

108 – *I. kerguelenensis* André & Colas-Belcour, 1942 (Bull. Mus. Natl. Hist. Nat., 14: 261–263)
Ixodes zumpti Arthur, 1960, a junior synonym of *I. kerguelenensis*, as discussed in Guglielmone et al. (2009, *op. cit.* under *I. anatis*), is regarded as valid in Barker and Murrell (2008, *op. cit.* under *I. anatis*) and Kolonin (2009, *op. cit.* under *I. arabukiensis*). *Ixodes pterodromae* Arthur, 1960 is also a synonym of *I. kerguelenensis*

(Wilson, N. 1970. Acarina: Metastigmata: Ixodidae of South Georgia, Heard and Kerguelen. Pacific Insects Monogr., 23: 78–88), but both these names continue to appear in recent studies (Barbosa, A. & Palacios, M.J. 2009. Health of Atlantic birds: a review of their parasites, pathogens and diseases. Polar Biol., 32: 1095–1115). See also remarks below.

Type depository: MNHN (syntypes) (Wilson, N. 1970. Acarina: Metastigmata: Ixodidae of South Georgia, Heard and Kerguelen. Pacific Insects Monogr., 23: 78–88) as *I. canisuga kerguelenensis*

Known stages: male, female, nymph, larva

Zoogeographic Region: Australasian and islands in the Atlantic, Indian and Pacific Oceans

Ecoregions: several coastal ecological regions

Hosts: Procellariiformes: Procellariidae; Sphenisciformes: Spheniscidae (ANL)
Procellariiformes: Diomedeidae (AN)
Procellariiformes: Pelecanoididae (A)
Psittaciformes: Strigopidae (stage unknown)

Human infestation: no

Remarks: our host profile for *I. kerguelenensis* is largely based on Wilson (1970), who also discusses the confusion between this species and *I. percavatus* and *I. auritulus*. Hänel and Heyne (2008) refer to this species as *I. zumpti*. Walker (1991) provides a vague record of this species (as *Ixodes pterodromae*) from a feral cat, while Green and Munday (1971) cite a record from Passeriformes; both records need confirmation and neither has been included in our host list above.

References

Dietrich, M., Gómez-Díaz, E. & McCoy, K.D. 2011. Worldwide distribution and diversity of seabird ticks: implications for the ecology and epidemiology of tick-borne pathogens. Vector-Borne Zoon. Dis., 11: 453–470.

Green, R.H. & Munday, B.L. 1971. Parasites of Tasmanian native and feral fauna Part 1, Arthropoda. Rec. Queen Victoria Mus. (41), 16 pp.

Hänel, C. & Heyne, H. 2008. Ticks of the Tristan da Cunha Archipelago (Acarina: Ixodidae: Argasidae). Beitr. Entomol., 58: 121–134.

Heath, A.C.G. 2010. Checklist of ectoparasites of birds in New Zealand: additions and corrections. Surveillance, 37 (1): 12–17.

Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.

Wilson, N. 1970. Acarina: Metastigmata: Ixodidae of South Georgia, Heard and Kerguelen. Pacific Insects Monogr., 23: 78–88.

109 – *I. kingi* Bishopp, 1911 (Proc. Biol. Soc. Wash., 24: 197–208)
See remarks below.

Type depository: USNTC (lectotype, paralectotypes) (Keirans and Clifford 1984, *op. cit.* under *I. amersoni*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Nearctic

Ecoregions: temperate grasslands, savannas and shrublands

Hosts: usual hosts for larvae, nymphs and adults are Carnivora (several families) and Rodentia (several families).
Carnivora (several families); Rodentia (several families) (ANL)
Lagomorpha: Leporidae (AL)
Lagomorpha: Ochotonidae (NL)

Human infestation: yes (Salkeld et al. 2006)

Remarks: Gregson (1971) found differences in morphology and host utilization in populations of *I. kingi* that are geographically separated, concluding that these populations are undergoing evolutionary divergence. According to Salkeld et al. (2006), Lagomorpha are hosts for *I. kingi*, but this is not recorded in Kolonin (2009).

References

Gregson, J.D. 1971. Studies on two populations of *Ixodes kingi* Bishopp (Ixodidae). Can. J. Zool., 49: 591–597.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Salkeld, D.J., Eisen, R.J., Antolin, M.F., Stapp, P. & Eisen, L. 2006. Host usage and seasonal activity patterns of *Ixodes kingi* and *I. sculptus* (Acari: Ixodidae) nymphs in a Colorado prairie landscape, with a summary of published North American host records for all life stages. J. Vector Ecol., 31: 168–180.

110 – *I. kohlsi* Arthur, 1955 (J. Parasitol., 41: 18–23)

Type depositories: USNTC (holotype, paratypes), BMNH (paratypes) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Australasian

Ecoregions: southeast Australia temperate forests; Tasmanian temperate forests (coastal vegetation)

Hosts: usual hosts for larvae, nymphs and adults are Sphenisciformes: Spheniscidae.
Sphenisciformes: Spheniscidae (ANL)
Pelecaniformes: Phalacrocoracidae; Procellariiformes: Procellariidae (A)
Pelecaniformes: Sulidae; Charadriiformes: Sternidae (stages unknown)

Human infestation: yes (Roberts 1970)

Remarks: Halliday (2012) notes that *I. kohlsi* has been confused with *I. percavatus*. See *I. percavatus*.

References

Dietrich, M., Gómez-Díaz, E. & McCoy, K.D. 2011. Worldwide distribution and diversity of seabird ticks: implications for the ecology and epidemiology of tick-borne pathogens. Vector-Borne Zoon. Dis., 11: 453–470.

Halliday, R. B. 2012. Superfamily Ixodoidea Dugès, 1834. *In* Australian Faunal Directory, http://www.environment.gov.au/biodiversity/abrs/on-line-resources/faunalafd/taxa/ACARI/ accessed March 1, 2012

Roberts, F.H.S. 1960. A systematic study of the Australian species of the genus *Ixodes* (Acarina: Ixodidae). Aust. J. Zool., 8: 392–485.

Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.

111 – *I. kopsteini* (Oudemans, 1926) (Entomol. Ber., 7 (148): 67)
Horak et al. (2002, *op. cit.* under *I. frontalis*) designate the authority as Oudemans, 1926 instead of (Oudemans, 1926), but this species was originally classified in *Eschatocephalus*.

Type depository: probably in LMNH but not stated in the original article (Oudemans, A.C. 1925. Acarologische aanteekeningen, LXXIX. Entomol. Ber., 7 (146): 26–34) as *Eschatocephalus ropsteini* emended to *kopsteini* in Oudemans, A.C. (1926. Acarologische aanteekeningen, LXXX. Entomol. Ber., 7 (148): 67)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Afrotropical, Australasian, Oriental

Ecoregions: several Afrotropical, Australasian and Oriental ecological regions

Hosts: Chiroptera: Molossidae, Pteropodidae, Vespertilionidae (ANL)
Chiroptera: Emballonuridae (stage unknown)

Human infestation: no

References

Hoogstraal, H. 1982. Ticks (Acari: Ixodoidea): a preliminary study. Monogr. Biol., 42: 537–544.

Robbins, R.G., Bangs, N.J. & Keirans, J.E. 2004. First report of *Ixodes kopsteini* Oudemans [sic] (Acari: Ixodida: Ixodidae) from the Kingdom of Cambodia, with a summary of known hosts of this tick in continental southeastern Asia. Proc. Entomol. Soc. Wash., 106: 472–474.

112 – *I. kuntzi* Hoogstraal & Kohls, 1965 (J. Med. Entomol., 2: 209–214)
See remarks below.

Type depositories: USNTC (holotype, paratypes), BM, BMNH, FMNH, HH (paratypes) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: Taiwan subtropical evergreen forests; western Himalayan alpine shrub and meadows

Hosts: usual hosts for larvae, nymphs and adult ticks are Rodentia: Sciuridae.
Rodentia: Muridae, Sciuridae (ANL)
Passeriformes: Muscicapidae, Sittidae (N)
Passeriformes: Timaliidae, Turdidae (L)

Human infestation: no

Remarks: Camicas et al. (1998) state that this tick is found only in the Oriental Region, but some of the records from Nepal in Clifford et al. (1975) properly lie within the Palearctic Region. However, Clifford et al. (1975) regard the Nepal records as tentative since only the male of *I. kuntzi* was described. We consider the presence of *I. kuntzi* in the Palearctic Region and the description of the male provisionally valid.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Clifford, C.M., Hoogstraal, H. & Keirans, J.E. 1975. The *Ixodes* ticks (Acarina: Ixodidae) of Nepal. J. Med. Entomol., 12: 115–137.

Hoogstraal, H. & Kohls, G.M. 1965. Description, hosts, and ecology of *Ixodes kuntzi* n. sp., Kuntz's Taiwan flying squirrel tick (Ixodoidea: Ixodidae). J. Med. Entomol., 2: 209–214.

113 – *I. laguri* Olenev, 1929 (Dokl. Akad. Nauk SSSR, A (21): 489–494. In Russian) Filippova (1977, *op. cit.* under *I. eldaricus*) analyzed the morphology of several populations of *I. laguri* and described four subspecies of this tick, probably implying that *I. laguri* comprises more than one taxon.

Type depository: ZIAC (holotype) (Filippova 2008, *op. cit.* under *I. berlesei*) as *I. redikorzevi lagurae*

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: temperate broadleaf and mixed forests; temperate grasslands, savannas and shrublands

Hosts: Rodentia: Cricetidae, Muridae, Sciuridae; Soricomorpha: Soricidae (ANL)
Carnivora: Mustelidae; Rodentia: Gliridae (A)
Rodentia: Spalacidae (NL)
Rodentia: Dipodidae (N)
Carnivora: Canidae, Felidae; Erinaceomorpha: Erinaceidae (stages unknown)

Human infestation: yes (Bursali et al. 2012)

Remarks: there is a record of *I. laguri* from Aves in Zil'fyan et al. (1960) that we believe requires confirmation; therefore, Aves are provisionally excluded as hosts of this tick.

References

Arthur, D.R. 1957. Studies of exotic *Ixodes* ticks (Ixodoidea, Ixodidae) from United States Navy and Army activities. Parasitology, 43: 681–694.

Bursali, A., Keskin, A. & Tekin, S. 2012. A review of the ticks (Acari: Ixodida) of Turkey: species diversity, hosts and geographical distribution. Exp. Appl. Acarol., 57: 91–104.

Černý, V. 1990. Occurrence of the tick *Ixodes laguri* Ol., on the territory of Czechoslovakia. Folia Parasitol., 37: 92.

Emchuk, E.M. 1960. Ixodid ticks. 1. External and internal structure, ecology, systematics, distribution and economic importance of ixodid ticks. Fauna Ukrayiny, 25: 1–163. In Russian.

Fedorov, V.G. 1968. Ixodoidea ticks on humans in western Siberia. Med. Parazitol., 37: 615–616. In Russian, NAMRU-3 translation 390.

Feider, Z. 1964. Les connaissances actuelles sur les Acariens de Roumanie (Ixodides, Gamasides et Trombiculides). Acarologia (Fasc. Hors Sér.): 262–274.

Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.

Filippova, N.A. 2008. Type specimens of argasid and ixodid ticks (Ixodoidea: Argasidae, Ixodidae) in the collection of the Zoological Institute, Russian Academy of Sciences (St. Petersburg). Entomol. Rev., 88: 1002–1011.

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Serdjukova, G.V. 1956. Ixodid ticks of the fauna of USSR. Opred. Faune SSSR. Zool. Inst. Akad. Nauk SSSR (64), 121 pp. In Russian.

Zil'fyan, V.N., Avetisyan, G.A. & Ovasapyan, O.V. 1960. On the acarine fauna of birds of Armenia. Trudy Armyan. Protiv. Sta. (1): 463–478. In Russian.

114 – *I. lasallei* Méndez Arocha & Ortiz, 1958 (Mem. Soc. Cienc. Nat. La Salle, 18: 196–208)

Type depository: MHNLS (holotype, paratypes) (Méndez Arocha, M. & Ortiz, I. 1958. Revisión de las garrapatas venezolanas del género *Ixodes* Latreille, 1795 y estudio de un nuevo *Amblyomma* (Acarina: Ixodidae). Mem. Soc. Cienc. Nat. La Salle, 18: 196–208)

Known stages: male, female

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical moist forests

Hosts: usual hosts for larvae, nymphs and adults are Rodentia: Cuniculidae and Dasyproctidae.

Rodentia: Cuniculidae, Dasyproctidae; Didelphimorphia: Didelphidae (ANL)
Carnivora: Felidae (A)

Human infestation: no

Remarks: Camicas et al. (1998) list the nymph of *I. lasallei* as described, but no such description exists, as previously noted in Guglielmone et al. (2003). The larva of this tick also remains undescribed. Consequently, we consider the records of nymphs in Jones et al. (1972) and the records of larvae and nymphs in Fairchild et al. (1966) and Guerrero (1996) as only provisionally valid. Jones et al. (1972) present a probable determination of *I. lasallei* from Cricetidae, but until further evidence is forthcoming we have elected to exclude this family from the host list above.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Fairchild, G.B., Kohls, G.M. & Tipton, V.J. 1966. The ticks of Panama (Acarina: Ixodoidea). *In* W.R. Wenzel & V.J. Tipton (editors), Ectoparasites of Panama. Field Museum of Natural History, Chicago, pp. 167–219.

Guerrero, R. 1996. Las garrapatas de Venezuela (Acarina: Ixodoidea). Listado de especies y claves para su identificación. Bol. Dir. Malariología Saneamiento Amb., 36: 1–24.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Guglielmone, A.A., Nava, S. & Díaz, M.M. 2011. Relationships of South American marsupials (Didelphimorphia, Microbiotheria and Paucituberculata) and hard ticks (Acari: Ixodidae) with distribution of four species of *Ixodes*. Zootaxa, 3086: 1–30.

Jones, E.K., Clifford, C.M., Keirans, J.E. & Kohls, G.M. 1972. The ticks of Venezuela (Acarina: Ixodoidea) with a key to the species of *Amblyomma* in the Western Hemisphere. Brigham Young Univ. Sci. Bull. Biol. Ser., 17 (4), 40 pp.

115 – *I. latus* Arthur, 1958 (Parasitology, 48: 38–69)

Type depository: MCZ (holotype, paratypes) (Arthur 1965, *op. cit.* under *I. arebiensis*)

Known stages: female

Zoogeographic Region: Afrotropical

Ecoregions: eastern Miombo woodlands; central Zambezian Miombo woodlands

Hosts: Rodentia: Sciuridae; Hyracoidea: Procaviidae; Artiodactyla: Bovidae (A)

Human infestation: no

References

Arthur, D.R. 1965. Ticks of the genus *Ixodes* in Africa. The Athlone Press, University of London, London, 348 pp.

Clifford, C.M. & Walker, J.B. 1966. Host and distribution records for several species of the genus *Ixodes* (Acarina: Ixodidae) that occur in East Africa. Rev. Zool. Bot. Afr., 74: 155–168.

116 – *I. laysanensis* Wilson, 1964 (J. Med. Entomol., 1: 165–168)

Type depositories: BM (holotype, paratypes), USNTC (paratypes) (Wilson, N. 1964. *Ixodes laysanensis*, a new species of tick from birds on Laysan Island (Metastigmata: Ixodidae). J. Med. Entomol., 1: 165–168)

Known stages: male, female, nymph, larva

Zoogeographic Region: central Pacific islands

Ecoregion: Hawaiian high island tropical moist forests

Hosts: Charadriiformes: Scolopacidae, Laridae; Pelecaniformes: Fregatidae, Sulidae; Procellariiformes: Procellariidae (AN)
Procellariiformes: Diomedeidae (N)
Passeriformes: Drepanididae, Sturnidae (L)
Passeriformes: Fringillidae (stage unknown)

Human infestation: no.

Remarks: Camicas et al. (1998), who classify this species as *Scaphixodes laysanensis*, state that this tick inhabits the Australasian Region, but, in our opinion, the central Pacific islands lie beyond that region (see the introductory chapter). Amerson (1968) found this tick crawling on a human, but we do not consider humans as hosts of *I. laysanensis*. Amerson (1968) also lists Anseriformes: Anatidae as hosts of *I. laysanensis*, but Kohls (1966), who analyzed the tick collection of Amerson, did not include Anatidae as hosts of this species and this family has not been included in our host list. See also *I. amersoni*.

References

Amerson, A.B. 1968. Tick distribution in the Central Pacific as influenced by sea bird movement. J. Med. Entomol., 5: 332–339.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Dietrich, M., Gómez-Díaz, E. & McCoy, K.D. 2011. Worldwide distribution and diversity of seabird ticks: implications for the ecology and epidemiology of tick-borne pathogens. Vector-Borne Zoon. Dis., 11: 453–470.

Durden, L.A. & Keirans, J.E. 1996. Nymphs of the genus *Ixodes* (Acari: Ixodidae) of the United States: taxonomy, identification key, distribution, hosts, and medical/veterinary importance. Thomas Say Publ. Entomol. Monogr. (9), 95 pp.

Kohls, G.M. 1966. A new sea bird tick, *Ixodes amersoni*, from Phoenix Island (Acarina: Ixodidae). J. Med. Entomol., 3: 38–40.
Kohls, G.M. & Clifford, C.M. 1967. The male and larva of *Ixodes laysanensis* Wilson with notes on rearing (Acarina, Ixodidae). J. Med. Entomol., 4: 83–86.
Wilson, N. 1964. *Ixodes laysanensis*, a new species of tick from birds on Laysan island (Metastigmata: Ixodidae). J. Med. Entomol., 1: 165–168.

117 – *I. lemuris* Arthur, 1957 (Parasitology, 47: 544–559)

Type depository: BMNH (holotype) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregion: Madagascar subhumid forests

Hosts: Primates: Cheirogaleidae (ANL)
Primates: Lemuridae; Rodentia: Muridae (A)

Human infestation: no

Remarks: this species was previously known from only two specimens, one collected from Lemuridae and the other from Muridae (Uilenberg et al. 1979), but Blanco et al. (2013) collected several specimens and described the male, the nymph and the larva of *I. lemuris*. Camicas et al. (1998) ignore Muridae as hosts of this species. Durden and Keirans (1996) regard *I. lemuris* as an endangered species.

References

Blanco, M.B., Elfawal, M.A., Durden, L.A., Beati, L., Xu, G., Godfrey, L.R. & Rich, S.M. 2013. Genetic diversity of ixodid ticks parasitizing eastern mouse and dwarf lemurs in Madagascar, with descriptions of the larva, nymph and male of *Ixodes lemuris* (Acari: Ixodidae). J. Parasitol., 90: 11–18.
Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.
Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.
Uilenberg, G., Hoogstraal, H. & Klein, J.-M. 1979. Les tiques (Ixodoidea) de Madagascar et leur rôle vecteur. Arch. Inst. Pasteur Madagascar Num. Spéc., 153 pp.

118 – *I. lewisi* Arthu***r***, 1965 (*In* Ticks of the genus *Ixodes* in Africa. The Athlone Press, University of London, London, 348 pp.)

Type depositories: BMNH (holotype, paratypes), SM (paratypes?) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*). The latter authors are uncertain whether paratypes of *I. lewisi* are indeed deposited in SM.

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregions: *Acacia-Commiphora* bushlands and thickets

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Artiodactyla: Bovidae (ANL)
Artiodactyla: Giraffidae; Carnivora: Canidae, Felidae; Hyracoidea: Procaviidae (A)

Human infestation: no

Remarks: Camicas et al. (1998) list the nymph of *I. lewisi* as described, and Clifford et al. (1973) identify it in collected material, but we have been unable to find any formal description of this stage. The diagnosis of larvae and nymphs by Clifford and Walker (1966) is tentative and the hosts involved have provisionally been included in the host list above.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Clifford, C.M. & Walker, J.B. 1966. Host and distribution records for several species of the genus *Ixodes* (Acarina: Ixodidae) that occur in East Africa. Rev. Zool. Bot. Afr., 74: 155–168.

Clifford, C.M., Sonenshine, D.E., Keirans, J.E. & Kohls, G.M. 1973. Systematics of the subfamily Ixodinae (Acarina: Ixodidae). 1. The subgenera of *Ixodes*. Ann. Entomol. Soc. Am., 66: 489–500.

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Tandon, S.K., 1991. The ixodid ticks of Zambia (Acarina: Ixodidae). A study of distribution, ecology and host relationships. Occ. Paper Rec. Zool. Survey Ind., 134: 175 pp.

Walker, J.B. 1974. The ixodid ticks of Kenya. A review of present knowledge of their hosts and distribution. Commonwealth Institute of Entomology, London, 220 pp.

119 – *I. lividus* Koch, 1844 (Arch. Naturgesch., 10: 217–239)

Type depository: BMNH (presumably a syntype) [sic] (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*) originally named *Ixodes plumbeus* Leach, 1815, a name preoccupied by *Ixodes plumbeus* (Panzer, 1795) in Fabricius, J.C. (1805. *Systema Antliatorum*: *secundum ordines*, *genera*, *species adiectis synonymis*, *locis*, *observationibus*, *descriptionibus*. Carolum Reichard, Brunsvigae, 372 pp.) and consequently renamed.

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: temperate broadleaf and mixed forests

Hosts: usual hosts for larvae, nymphs and adults are Passeriformes: Hirundinidae.
Passeriformes: Hirundinidae (ANL)
Coraciiformes: Alcedinidae (AL)
Coraciiformes: Meropidae; Passeriformes: Paridae (NL)
Passeriformes: Passeridae (L)
Passeriformes: Alaudidae (stage unknown)

Human infestation: no

Remarks: Stolbov (1966) refers to this tick as *I. plumbeus*.

References

Fedorov, V.G. 1972. Ticks of the superfamily Ixodoidea of birds and their nests in western Siberia. *In* A. Cherepanov & L.A. Mater (editors), Transcontinental associations of migratory birds and their role in distribution of arboviruses. 5. Simp. Isuch. Roli Pereletn. Ptits Rasp. Arbovirus, Novosibirsk, Jul. 1969, pp. 384–388. In Russian, NAMRU-3 translation 1494.

Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.

Gilot, B. 1984. Premier inventaire des Ixodidae (Acarina, Ixodoidea) parasites d'oiseaux dans les Alpes françaises et leur avant-pays. Données écologiques sur quelques espéces peu connues. Riv. Parassitol., 1: 303–318.

Krištofík, J., Mašán, P. & Šustek, Z. 1996. Ectoparasites of bee-eater (*Merops apiaster*) and arthropods in its nests. Biologia (Brastislava), 51: 557–570.

Stolbov, N. M. 1966. On the ecology and distribution of *Ixodes plumbeus* Leach ticks in natural infection foci in western Siberia. Tezisy Dokl. 1. Akarol. Soveshch., pp. 203–204. In Russian, NAMRU-3 translation 396.

Ulmanen, I., Saikku, P., Vikberg, P. & Sorjonen, J. 1977. *Ixodes lividus* (Acari) in sand martin colonies in Fennoscandia. Oikos, 28: 20–26.

120 – *I. longiscutatus* Boero, 1944 (Rev. Asoc. Méd. Arg., 58: 353–354)
Ixodes uruguayensis Kohls & Clifford, 1967, a recognized synonym of *I. longiscutatus*, as discussed in Guglielmone et al. (2009, *op. cit.* under *I. anatis*), is incorrectly regarded as valid in Barker and Murrell (2008, *op. cit.* under *I. anatis*).

Type depository: CB, but probably lost (Guglielmone et al. 2003, *op. cit.* under *I. cookei*, Keirans and Clifford 1984, *op. cit.* under *I. amersoni*). This species was originally named *I. longiscutatum*.

Known stages: female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical broadleaf forests; few ticks in temperate savannas and dry broadleaf forests

Hosts: usual hosts for larvae and nymphs are Rodentia: Cricetidae.

Rodentia: Caviidae (ANL)
Rodentia: Cricetidae (NL)
Artiodactyla: Bovidae; Perissodactyla: Equidae (A)

Human infestation: no

Remarks: Camicas et al. (1998) list the male of *I. longiscutatus* as described, but this is not the case, as corroborated by Venzal et al. (2008). The nymph and larva are considered unknown; however, these stages were described by Kohls and Clifford (1967) under the name *I. uruguayensis* and were later recognized as the larva and nymph of *I. longiscutatus* (Venzal et al. 2008). The latter authors doubt an alleged record of this tick from Didelphimorphia in Ivancovich and Luciani (1992), and such hosts are not included in our host list above. Infestation of Artiodactyla and Perissodactyla by *I. longiscutatus* appears to be an infrequent event.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Ivancovich, J.C. & Luciani, C.A. 1992. Las garrapatas de Argentina. Monografía de la Asociación Argentina de Parasitología Veterinaria, Buenos Aires, 95 pp.

Kohls, G.M. & Clifford, C.M. 1967. *Ixodes* (*Haemixodes*) *uruguayensis*, new subgenus, new species (Acarina: Ixodidae) from small rodents in Uruguay. Ann. Entomol. Soc. Am., 60: 391–394.

Venzal, J.M., Nava, S, Beldoménico, P.M., Barros-Battesti, D.M., Estrada-Peña, A. & Guglielmone, A.A. 2008. Hosts and distribution of *Ixodes longiscutatus* Boero, 1944. Syst. Appl. Acarol., 13: 102–108.

121 – *I. loricatus* Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)
See remarks below.

Type depositories: ENV, BMNH (syntypes) (Nuttall and Warburton 1911, *op. cit.* under *I. acuminatus*), but Keirans and Hillyard (2001, *op. cit.* under *I. anatis*) do not mention its presence in the BMNH.

Known stages: male, female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregions: wide range of ecoregions within the Neotropical Zoogeographic Region

Hosts: usual hosts for adult ticks are Didelphimorphia: Didelphidae; usual hosts for larvae and nymphs are Didelphimorphia: Didelphidae and Rodentia: Cricetidae. All other hosts are exceptional for this tick.
Didelphimorphia: Didelphidae; Rodentia: Cricetidae (ANL)
Rodentia: Muridae (AN)
Mammalia (several orders) (A)

Human infestation: no

Remarks: *Ixodes didelphidis* Fonseca & Aragão, 1952 has been treated as a valid species by Brazilian workers, but Labruna et al. (2002) clearly show that it is a synonym of *I. loricatus*.

Guglielmone et al. (2011) determined that several localities and host records of *I. loricatus* are doubtful, erroneous or due to faulty labeling. Kolonin (2009) considers Didelphidae to be the principal hosts for larvae and nymphs of *I. loricatus*, but field data show the importance of Rodentia as hosts of the subadult stages (Nava et al. 2004). Serra-Freire et al. (2011) report human infestations with *I. loricatus*, but this requires confirmation and these records have not been included in our host list above. See also *I. luciae*.

References

Aragão, H. B. 1918. Notas ixodológicas. Rev. Mus. Paulista, 10: 375–417.

Arzua, M., Onofrio, V.C. & Barros-Battesti, D.M. 2005. Catalogue of the tick collection (Acari, Ixodida) of the Museu de História Natural Capão da Imbuia, Curitiba, Paraná, Brazil. Rev. Bras. Zool., 22: 623–632.

Barros-Battesti, D.M. & Knysak, I. 1999. Catalogue of the Brazilian *Ixodes* (Acari: Ixodidae) material in the mite collection of Instituto Butantan, São Paulo, Brazil. Papéis Avulsos Zool., 41: 49–57.

Cooley, R.A. & Kohls, G.M. 1945. The genus *Ixodes* in North America. Natl. Inst. Health Bull. (184), 246 pp.

Fonseca, F. da & Aragão, H. B. 1952. Notas de ixodología. II. Uma nova espécie do gênero *Amblyomma* e uma nova espécie do gênero *Ixodes* (Acari, Ixodidae). Mem. Inst. Oswaldo Cruz, 50: 713–726.

Guglielmone, A.A., Nava, S. & Díaz, M.M. 2011. Relationships of South American marsupials (Didelphimorphia, Microbiotheria and Paucituberculata) and hard ticks (Acari: Ixodidae) with distribution of four species of *Ixodes*. Zootaxa, 3086: 1–30.

Keirans, J.E. 1982. The tick collection (Acarina: Ixodoidea) of the Hon. Nathaniel Charles Rothschild deposited in the Nuttall and general collections of the British Museum (Natural History). Bull. Br. Mus. (Nat. Hist.) Zool. Ser., 42: 1–36.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Labruna, M.B., Marrelli, L.T., Heinemann, M.B., Fava, A.B., Cortez, A., Soares, R.M., Sakamoto, S.M., Richtzenhain, L.J., Marinotti, O. & Schumaker, T.T.S. 2002. Taxonomic status of *Ixodes didelphidis* (Acari: Ixodidae). J. Med. Entomol., 39: 135–142.

Nava, S., Lareschi, M., Beldoménico, P.M., Zerpa, C., Venzal, J.M., Mangold, A.J. & Guglielmone, A.A. 2004. Sigmodontinae rodents as hosts for larvae and nymphs of *Ixodes loricatus* Neumann, 1899 (Acari: Ixodidae). Parasite, 11: 411–414.

Serra-Freire, N.M., Sena, L.M.M. & Borsoi, A.B.P. 2011. Parasitismo humano por carrapatos na Mata Atlántica, Rio de Janeiro, Brasil. EntomoBrasilis, 4: 67–72.

122 – *I. loveridgei* Arthur, 1958 (Parasitology, 48: 38–69)

Type depository: MCZ (holotype, paratype) (Arthur 1965, *op. cit.* under *I. arabukiensis*)

Known stages: male, female, nymph

Zoogeographic Region: Afrotropical

Ecoregion: eastern Miombo woodlands

Hosts: Rodentia: Nesomyidae (A)

Human infestation: no

Remarks: Arthur (1965) states on page 199 that *I. loveridgei* is known only from the holotype female and a male from *Cricetomys gambianus*, but Arthur (1958) had himself also described the nymph (a specimen with a damaged dorsum) and this description is repeated in Arthur (1965) on page 198. Camicas et al. (1998) and Kolonin (2009) state that the nymph feeds on the same host as the adults, but this is not specified in any of Arthur's papers. Consequently, we consider the host of the nymph of *I. loveridgei* to be undetermined.

References

Arthur, D.H. 1958. New species of *Ixodes* ticks from eastern Africa, with a description of the male and nymph of *Ixodes oldi* Nuttall, 1913. Parasitology, 48: 38–69.

Arthur, D.R. 1965. Ticks of the genus *Ixodes* in Africa. The Athlone Press, University of London, London, 348 pp.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Ntiamoa-Baidu, Y., Carr-Saunders, C., Matthews, B.E., Preston, P.M. & Walker, A.R. 2004. An updated list of the ticks of Ghana and an assessment of the distribution of the ticks of Ghanaian wild mammals in different vegetation zones. Bull. Entomol. Res., 94: 245–260.

123 – *I. luciae* Sénevet, 1940 (6° Congr. Int. Entomol., Madrid, Spain, September 1935, pp. 891–898)

Type depository: probably in IPG but not stated in the original description (Guglielmone et al. 2003, *op. cit.* under *I. cookei*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical moist broadleaf forests; few ticks in dry broadleaf forests, temperate grasslands and xeric shrublands

Hosts: usual hosts for adult ticks are Didelphimorphia: Didelphidae; usual hosts for larvae and nymphs are Didelphimorphia: Didelphidae and Rodentia: Cricetidae. All other hosts are exceptional for this tick.
Didelphimorphia: Didelphidae (ANL)
Carnivora: Canidae; Rodentia: Cuniculidae (A)
Rodentia: Cricetidae (NL)
Artiodactyla: Cervidae (N)
Rodentia: Echimyidae; Soricomorpha: Soricidae (L)

Human infestation: no

Remarks: Guglielmone et al. (2003) state that the larva and nymph of *I. luciae* are undescribed. They were subsequently described by Onofrio et al. (2010). Santos Dias (1989) cites a record of *I. luciae* from the Palearctic Region, but this species failed to become established there. Ivancovich and Luciani (1992) record *I. luciae* feeding on a human; however, Guglielmone et al. (2011) re-examined the specimens classified as *I. luciae* by those authors and found that they were in fact *I. loricatus* or *I. auritulus*. No *Ixodes* tick labeled as feeding on a human was found in the corresponding collection; therefore, we do not list humans as hosts of *I. luciae*. Jones et al. (1972) provide records of larvae classified as "probably *I. luciae*" from Soricomorpha and Rodentia: Echimyidae, and these have provisionally been included in our host list above. Luz et al. (2013) record "rat" as hosts of adult *I. luciae*, but Onofrio et al. (2010), who examined the same ticks, listed no hosts for these specimens and "rat" is therefore not included in our host list for *I. luciae*. The same authors record larvae and nymphs of *I. luciae* from Chiroptera, but they consider this host unlikely. Chiroptera have not been included in our list of hosts of *I. luciae*.

References

Díaz, M.M., Nava, S., Venzal, J.M., Sánchez, N. & Guglielmone, A.A. 2007. Tick collections from the Peruvian Amazon, with new host records for species of *Ixodes* Latreille, 1795 (Acari: Ixodidae) and *Ornithodoros* Koch, 1844 (Acari: Argasidae). Syst. Appl. Acarol., 12: 127–133.

Everard, C.O.R. & Tikasingh, E.S. 1973. Ecology of the rodents, *Proechimys guyannensis trinitatis* and *Oryzomys capito velutinus*, on Trinidad. J. Mammal., 54: 875–886.

Fonseca, F. da. 1959. Notas de acarología. XLVI. Acarofauna zooparasita na Bolivia. Mem. Inst. Butantan, 29: 89–141.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Guglielmone, A.A., Nava, S. & Díaz, M.M. 2011. Relationships of South American marsupials (Didelphimorphia, Microbiotheria and Paucituberculata) and hard ticks (Acari: Ixodidae) with distribution of four species of *Ixodes*. Zootaxa, 3086: 1–30.

Guzmán-Cornejo, C., García-Prieto, L., Acosta-Gutiérrez, R., Falcón-Ordaz, J. & León- Paniagua, L. 2012. Metazoarios parásitos de *Tlacuatzin canescens* y *Marmosa mexicana* (Mammalia: Didelphimorphia) de México. Rev. Mex. Biodiversidad, 83: 557–561.

Ivancovich, J.C. & Luciani, C.A. 1992. Las garrapatas de Argentina. Monografía de la Asociación Argentina de Parasitología Veterinaria, Buenos Aires, 95 pp.

Jones, E.K., Clifford, C.M., Keirans, J.E. & Kohls, G.M. 1972. The ticks of Venezuela (Acarina: Ixodoidea) with a key to the species of *Amblyomma* in the Western Hemisphere. Brigham Young Univ. Sci. Bull. Biol. Ser., 17 (4), 40 pp.

Luz, H.R., Faccini, J.L.H., Landulfo, G.A., Sampaio, J.S., Neto, S.F.C., Famadas, K.M., Onofrio, V.C., & Barros-Battesti, D.M. 2013. New host records of *Ixodes luciae* (Acari: Ixodidae) in the State of Pará. Rev. Bras. Parasitol. Vet., 22 (1): 152–154.

Méndez Arocha, M. & Ortiz, I. 1958. Revisión de las garrapatas venezolanas del género *Ixodes* Latreille, 1795 y estudio de un nuevo *Amblyomma* (Acarina: Ixodidae). Mem. Soc. Cienc. Nat. La Salle, 18: 196–208.

Onofrio, V.C., Labruna, M.B., Faccini, J.L.H. & Barros-Battesti, D.M. 2010. Description of immature stages and redescription of adults of *Ixodes luciae* Sénevet (Acari: Ixodidae). Zootaxa, 2495: 53–64.

Santos Dias, J.A.T. 1989. Ixodídeos (Acarina-Ixodoidea) em no Museu Zoológico de Amsterdão. García de Orta Ser. Zool., 13: 75–87.

Serra-Freire, N.M., Amorim, M., Gazêta, G.S., Guerim, L. & Desidério, M.H.G. 1996. Ixodofauna de cervídeos no Brasil. Rev. Bras. Cienc. Vet., 3: 51–54.

124 – *I. lunatus* Neumann, 1907 (Notes Leyden Mus., 29: 88–100)

Type depository: LMNH (holotype) (Nuttall and Warburton 1911, *op. cit*. under *I. acuminatus*)

Known stages: female

Zoogeographic Region: Afrotropical

Ecoregion: Madagascar lowland forests

Hosts: usual hosts for adult ticks are Afrosoricida: Tenrecidae.

Afrosoricida: Tenrecidae; Rodentia: Nesomyidae (A)

Human infestation: no

Remarks: there are several records of *I. lunatus* on hosts other than those listed above, but according to Uilenberg et al. (1979) they are dubious or the result of confusion with other species of *Ixodes*, and we have not included them in the list of hosts of *I. lunatus*. Durden and Keirans (1996) regard this tick as an endangered species.

References

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.

Uilenberg, G., Hoogstraal, H. & Klein, J.-M. 1979. Les tiques (Ixodoidea) de Madagascar et leur rôle vecteur. Arch. Inst. Pasteur Madagascar Num. Spéc., 153 pp.

125 – *I. luxuriosus* Schulze, 1935 (Z. Morphol. Ökol. Tiere, 30: 1–40)
Camicas et al. (1998, *op. cit.* under *I. anatis*) and Guglielmone et al. (2010, *op. cit.* under *I. abrocomae*), among others, state that *I. luxuriosus* was described in 1932. However, the description in Schulze, P. (1932. Ueber die Körpergliederung der Zecken, die Zusammensetzung des Gnathosoma und die Beziehungen der Ixodoidea zu den fossilen Anthracomarti. Sitzungs. Abh. Naturf. Gesel. Rostock, 3: 104–126) is not properly presented there (*nomen nudum*), and the valid description of *I. luxuriosus* was actually published in Schulze, P. (1935. Zur vergleichenden Anatomie der Zecken. Z. Morphol. Öekol. Tiere, 30: 1–40.)

Type depository: Schulze, P. (1935, *op. cit.* above) states that the type specimens of *I. luxuriosus* were deposited in the ZMB, but they are not listed in Moritz and Fischer (1981, *op. cit.* under *I. acutitarsus*).

Known stages: female

Zoogeographic Region: Australasian

Ecoregion: New Guinea lowland rain forests

Hosts: Dasyuromorphia: Dasyuridae; Diprotodontia: Phalangeridae; Peramelemorphia: Peramelidae; Rodentia: Muridae (A)
Carnivora: Felidae; Diprotodontia: Macropodidae, Petauridae; Monotremata: Tachyglossidae (stages unknown)

Human infestation: no

Remarks: Camicas et al. (1998) list the larva and nymph of *I. luxuriosus* as described, and Clifford et al. (1973) identify them in collected material (no hosts specified), but we have been unable to locate any formal descriptions of these stages. Kohls (1960) identifies as *I. steini* female ticks from Dasyuridae, but in a *separata* corrected by the author it is stated that the ticks are in fact *I. luxuriosus*. We accept this amendment as valid.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Clifford, C.M., Sonenshine, D.E., Keirans, J.E. & Kohls, G.M. 1973. Systematics of the subfamily Ixodinae (Acarina: Ixodidae). 1. The subgenera of *Ixodes*. Ann. Entomol. Soc. Am., 66: 489–500.

Hoogstraal, H. 1982. Ticks (Acari: Ixodoidea): a preliminary study. Monogr. Biol., 42: 537–544.

Kohls, G.M. 1960. *Ixodes* (*Endopalpiger*) *zaglossi*, n. sp. from the long-beaked echidna of New Guinea (Acarina, Ixodidae). Acarologia, 2: 447–452.

Owen, I.L. 2011. Parasites of animals in Papua New Guinea recorded at the National Veterinary Laboratory: a catalogue, historical review and zoogeographical affiliations. Zootaxa, 3143: 1–163.

Pruett-Jones, M. & Pruett-Jones, S. 1991. Analysis and ecological correlations of tick burden in a New Guinean avifauna. *In* J.E. Loye & M. Zuk (editors), Bird-parasite interactions. Ecology, evolution and behaviour. Oxford University Press, Oxford, pp. 154–176.

126 – *I. macfarlanei* Keirans, Clifford & Walker, 1982 (J. Med. Entomol., 19: 309–329)

Type depositories: USNTC (holotype, paratypes), BMNH (paratypes) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregions: Victoria Basin forest-savanna mosaic; northeastern Congolian lowland forests

Hosts: Carnivora: Viverridae; Artiodactyla: Bovidae (A)

Human infestation: no

Remarks: see *I. oldi*.

Reference

Keirans, J.E., Clifford, C.M. & Walker, J.B. 1982. The *Ixodes* (*Afrixodes*) *oldi* group (Acari: Ixodidae) from sub-Saharan Africa with descriptions of five new species. J. Med. Entomol., 19: 309–329.

127 – *I. malayensis* Kohls, 1962 (Proc. Entomol. Soc. Wash., 64: 103–105)

Type depository: USNTC (holotype) (Keirans and Clifford 1984, *op. cit.* under *I. amersoni*)

Known stages: female

Zoogeographic Region: Oriental

Ecoregion: peninsular Malaysian rain forests

Hosts: Scandentia: Tupaiidae (A)

Human infestation: no

References

Kohls, G.M. 1962. A new species of *Ixodes* from Malaya (Acarina: Ixodidae). Proc. Entomol. Soc. Wash., 64: 103–105.

Petney, T.N. & Keirans, J.E. 1994. Ticks of the genus *Ixodes* in South-East Asia. Trop. Biomed., 11: 123–134.

128 – *I. marmotae* Cooley & Kohls, 1938 (Publ. Health Rep. U.S. Publ. Health Serv., 53: 2174–2181)

Type depository: USNTC (holotype, paratypes) (Keirans and Clifford 1984, *op. cit*. under *I. amersoni*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Nearctic

Ecoregion: temperate conifer forests

Hosts: usual hosts for larvae, nymphs and adults are Rodentia: Sciuridae.
Rodentia: Sciuridae (ANL)
Rodentia: Erethizontidae (A)
Rodentia: Cricetidae (N)

Human infestation: no

References

Allred, D.M., Beck, D.E. & White, L.D. 1960. Ticks of the genus *Ixodes* in Utah. Brigham Young Univ. Sci. Bull. Biol. Ser., 1 (4), 42 pp.
Cooley, R.A. & Kohls, G.M. 1945. The genus *Ixodes* in North America. Natl. Inst. Health Bull. (184), 246 pp.
Durden, L.A. & Keirans, J.E. 1996. Nymphs of the genus *Ixodes* (Acari: Ixodidae) of the United States: taxonomy, identification key, distribution, hosts, and medical/veterinary importance. Thomas Say Publ. Entomol. Monogr. (9), 95 pp.
Gregson, J.D. 1956. The Ixodoidea of Canada. Can. Dept. Agric. Sci. Serv. Entomol. Div. Publ. (930), 92 pp.

129 – *I. marxi* Banks, 1908 (Tech. Ser. Bur. Entomol. U.S. Dept. Agric. (15), 61 pp.)

Type depository: USNTC (lectotype) (Keirans and Clifford 1984, *op. cit*. under *I. amersoni*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Nearctic

Ecoregions: northeastern American temperate broadleaf and mixed forests

Hosts: usual hosts for larvae, nymphs and adults are Rodentia: Sciuridae. Aves are considered exceptional hosts for this tick.
Rodentia: Sciuridae (ANL)
Lagomorpha: Leporidae (AN)
Carnivora: Procyonidae, Canidae (A)
Carnivora: Felidae (N)
Soricomorpha: Soricidae (L)
Artiodactyla: Bovidae; Carnivora: Mustelidae; Rodentia: Cricetidae; Passeriformes (unknown family) (stages unknown)

Human infestation: yes (Merten and Durden 2000)

Remarks: recently, Rand et al. (2007) considerably expanded the range of hosts of *I. marxi* to Carnivora (Mustelidae), Artiodactyla and Aves, but tick stages found on these hosts were not reported.

References

Bequaert, J.C. 1945. The ticks, or Ixodoidea, of the northeastern United States and eastern Canada. Entomol. Am., 25: 73–232.

Clifford, C.M., Anastos, G. & Elbl, A. 1961. The larval ixodid ticks of the eastern United States (Acarina: Ixodidae). Misc. Publ. Entomol. Soc. Am., 2: 213–237.

Cooley, R.A. & Kohls, G.M. 1945. The genus *Ixodes* in North America. Natl. Inst. Health Bull. (184), 246 pp.

Cudmore, W.W. 1985. Nest associates and ectoparasites of the eastern wood rat, *Neotoma floridanus*, in Indiana. Can. J. Zool., 64: 353–357.

Durden, L.A. & Keirans, J.E. 1996. Nymphs of the genus *Ixodes* (Acari: Ixodidae) of the United States: taxonomy, identification key, distribution, hosts, and medical/veterinary importance. Thomas Say Publ. Entomol. Monogr. (9), 95 pp.

Gregson, J.D. 1956. The Ixodoidea of Canada. Can. Dept. Agric. Sci. Serv. Entomol. Div. Publ. (930), 92 pp.

Jones, G.S. & Thomas, H.H. 1980. Ticks from mammals from Prince Edward Island, New Brunswick, northern Nova Scotia, and Gaspé Peninsula, Quebec. Can. J. Zool., 58: 1394–1397.

Merten, H.A. & Durden, L.A. 2000. A state-by-state survey of ticks recorded from humans in the United States. J. Vector Ecol., 25: 102–113.

Rand, P.W., Lacombe, E.H., Dearborn, R., Cahill, B., Elias, S., Lubelczyk, C.B., Beckett, G.A. & Smith, R.P. 2007. Passive surveillance in Maine, an area emergent for tick-borne diseases. J. Med. Entomol., 44: 1118–1129.

130 – *I. maslovi* Emel'yanova & Kozlovskaya, 1967 (Parazitologiya, 1: 489–494. In Russian)

Camicas et al. (1998, *op. cit.* under *I. anatis*) and Kolonin (2009, *op. cit.* under *I. arabukiensis*) regard *I. maslovi* as an abnormal form of *I. persulcatus* but provide no evidence for this opinion. However, Guglielmone et al. (2009, *op. cit.* under *I. anatis*) consider *I. maslovi* a valid name, and we concur.

Type depository: ZIAC (holotype, paratypes) (Filippova 2008, *op. cit.* under *I. berlesei*)

Known stages: male, female, nymph

Zoogeographic Region: Palearctic

Ecoregion: Okhotsk-Manchurian taiga

Hosts: unknown

Human infestation: no

References

Emel'yanova, N.D. & Kozlovskaya, O.L. 1967. A new species and subgenus of the genus *Ixodes* Latr. (Parasitiformes, Ixodidae) from the Far East of the USSR. Parazitologiya, 1: 489–494. In Russian, NAMRU-3 translation 272.

Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.

Voltzit, O.V. 1997. New faunistic records of the ixodid ticks from eastern regions of Russia in collections of the Zoological Museum of the Moscow State University. Description of the nymph of *Ixodes* (*Monoixodes*) *maslovi*. Parazitologiya, 31: 265–268. In Russian.

131 – *I. matopi* Spickett, Keirans, Norval & Clifford, 1981 (Onderstepoort J. Vet. Res., 48: 23–30)

Type depositories: OVI (holotype, paratypes), BMNH, USNTC (paratypes) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: Zambezian and Mopane woodlands

Hosts: Artiodactyla: Bovidae (ANL)

Hyracoidea: Procaviidae; Lagomorpha: Leporidae (NL)

Human infestation: no

Remarks: Camicas et al. (1998) state that the nymph and larva of *I. matopi* have not been described, but they were described in Spickett et al. (1981).

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Colborne, J., Norval, R.A.I. & Spickett, A.M. 1981. Ecological studies on *Ixodes* (*Afrixodes*) *matopi* Spickett, Keirans, Norval & Clifford, 1980 (Acarina: Ixodidae). Onderstepoort J. Vet. Res., 48: 31–35.

Norval, R.A.I., Spickett, A.M. & Clifford, C.M. 1987. The ticks of Zimbabwe. The genus *Ixodes*. Zimbabwe Vet. J., 18: 1–10.

Spickett, A.M., Keirans, J.E., Norval, R.A.I. & Clifford, C.M. 1981. *Ixodes* (*Afrixodes*) *matopi* n. sp. (Acarina: Ixodidae): a tick found aggregating on pre-orbital gland scent marks of the klipspringer in Zimbabwe. Onderstepoort J. Vet. Res., 48: 23–30.

132 – *I. mexicanus* Cooley & Kohls, 1942 (Rev. Soc. Mex. Hist. Nat., 3: 149–154)

Type depository: USNTC (holotype, paratype) (Keirans and Clifford 1984, *op. cit.* under *I. amersoni*)

Known stages: female

Zoogeographic Region: Nearctic

Ecoregion: trans-Mexican volcanic belt pine-oak forests

Hosts: Passeriformes: Emberizidae, Troglodytidae (A)

Human infestation: no

Remarks: Clifford et al. (1973) and Camicas et al. (1998) state that this tick is found in the Neotropical Zoogeographic Region, but *I. mexicanus* is present in eastern Michoacán (Mexico), which lies within the Nearctic Region according to Guglielmone et al. (2003), and we concur.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Clifford, C.M., Sonenshine, D.E., Keirans, J.E. & Kohls, G.M. 1973. Systematics of the subfamily Ixodinae (Acarina: Ixodidae). 1. The subgenera of *Ixodes*. Ann. Entomol. Soc. Am., 66: 489–500.

Cooley, R.A. & Kohls, G.M. 1945. The genus *Ixodes* in North America. Natl. Inst. Health Bull. (184), 246 pp.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Guzmán-Cornejo, C. & Robbins, R.G. 2010. The genus *Ixodes* (Acari: Ixodidae) in Mexico: adult identification keys, diagnoses, hosts and distribution. Rev. Mex. Biodiversidad, 81: 289–298.

133 – *I. minor* Neumann, 1902 (Arch. Parasitol., 6: 109–128)
See remarks below.

Type depository: MNHN, but apparently lost (Guglielmone et al. 2003, *op. cit.* under *I. cookei*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Nearctic, Neotropical

Ecoregions: temperate conifer forests of Florida; few ticks in tropical and subtropical conifer forests

Hosts: Carnivora and Lagomorpha are considered exceptional hosts for this tick.
Rodentia: Cricetidae, Muridae, Sciuridae (ANL)
Carnivora: Mephitidae; Passeriformes (several families) (NL)
Lagomorpha: Leporidae (stage unknown)

Human infestation: no

Remarks: Cooley and Kohls (1945) regard *I. minor* as a doubtful Neotropical species, but subsequent studies by Clifford et al. (1961) substantiate the validity of this species and also its distribution in the Nearctic Region, where it was previously known as *I. bishoppi* Smith and Gouck, 1947. Shah et al. (2004) report "poultry" as hosts for this tick, based on Durden et al. (1997) and Kinsey et al. (2000), but none of these authors listed domesticated or game birds as hosts of *I. minor*. Morlan (1952) discusses this tick under the synonym *Ixodes bishoppi*.

References

Clark, K.L., Oliver, J.H., Grego, J.M., James, A.M., Durden, L.A. & Banks, C.W. 2001. Host associations of ticks parasitizing rodents at *Borrelia burgdorferi* enzootic sites in South Carolina. J. Parasitol., 87: 1379–1386.

Clifford, C.M., Anastos, G. & Elbl, A. 1961. The larval ixodid ticks of the eastern United States (Acarina: Ixodidae). Misc. Publ. Entomol. Soc. Am., 2: 213–237.

Cooley, R.A. & Kohls, G.M. 1945. The genus *Ixodes* in North America. Natl. Inst. Health Bull. (184), 246 pp.

Durden, L.A. & Keirans, J.E. 1996. Nymphs of the genus *Ixodes* (Acari: Ixodidae) of the United States: taxonomy, identification key, distribution, hosts, and medical/veterinary importance. Thomas Say Publ. Entomol. Monogr. (9), 95 pp.

Durden, L.A., McLean, R.G., Oliver, J.H., Ubico, S.R. & James, A.M. 1997. Ticks, Lyme disease spirochetes, trypanosomes and antibody to encephalitis viruses in wild birds from coastal Georgia and South Carolina. J. Parasitol., 83: 1178–1182.

Durden, L.A., Oliver, J.H. & Kinsey, A.A. 2001. Ticks (Acari: Ixodidae) and spirochetes (Spirochaetaceae: Spirochaetales) recovered from birds on a Georgia barrier island. J. Med. Entomol., 38: 231–236.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Kinsey, A.A., Durden, L.A. & Oliver, J.H. 2000. Tick infestations of birds in coastal Georgia and Alabama. J. Parasitol., 86: 251–254.

Morlan, H.B. 1952. Host relationships and seasonal abundance of some southwest Georgia ectoparasites. Am. Midland Nat., 48: 74–93.

Sha, A.H., Khan, M.N., Iqbal, Z. & Sajid, M.S. 2004. Tick infestation in poultry. Int. J. Agr. Biol., 6: 1162–1165.

Tedders, S.H., Keirans, J.E., Williams, D.C. & Gwinn, T.A. 1992. First report of *Ixodes minor* Neumann (Acari: Ixodidae) from South Carolina. J. Med. Entomol., 29: 282–283.

134 – *I. minutae* Arthur, 1959 (Rev. Zool. Bot. Afr., 59: 137–157)

Type depository: OVI (holotype) (Arthur 1959, *op. cit.* under *I. bedfordi*)

Known stages: female

Zoogeographic Region: Afrotropical

Ecoregion: southern Miombo woodlands

Hosts: Rodentia: Muridae (A)

Human infestation: no

Reference

Arthur, D.R. 1965. Ticks of the genus *Ixodes* in Africa. The Athlone Press, University of London, London, 348 pp.

135 – *I. mitchelli* Kohls, Clifford & Hoogstraal, 1970 (J. Med. Entomol., 7: 348–352)

Type depositories: USNTC (holotype, paratypes), FMNH (paratypes) (Kohls, G.M., Clifford, C.M. & Hoogstraal, H. 1970. *Ixodes* (*Scaphixodes*) *mitchelli*, n. sp. (Acarina: Ixodidae), a tick parasitizing pheasants and partridges in high mountains of Nepal. J. Med. Entomol., 7: 348–352)

Known stages: female, nymph, larvae

Zoogeographic Region: Palearctic

Ecoregions: western Himalayan alpine shrub and meadows

Hosts: Galliformes: Phasianidae (ANL)

Human infestation: no

Remarks: Mitchell (1979) listed all the hosts of Nepalese ticks, including *I. mitchelli* (tick stages not stated), collected from Muridae between 1966 and 1970. This host family is not included in the study of Nepalese ticks by Clifford et al. (1975), and consequently it has not been included in our host list of this species. Camicas et al. (1998), who classify this species as *Scaphixodes mitchelli*, state that this tick is found only in the Oriental Region, but we maintain that the collection localities for *I. mitchelli* lie within the Palearctic Region.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Clifford, C.M., Hoogstraal, H. & Keirans, J.E. 1975. The *Ixodes* ticks (Acarina: Ixodidae) of Nepal. J. Med. Entomol., 12: 115–137.

Mitchell, R.M. 1979. A list of ectoparasites from Nepalese mammals, collected during the Nepal ectoparasite program. J. Med. Entomol., 16: 227–233.

136 – *I. monospinosus* Saito, 1967 (Acta Med. Biol., 15: 107–112)

Dana, A.N. (2009. Diagnosis and treatment of tick infestation and tick-borne diseases with cutaneous manifestations. Dermatol. Ther., 22: 293–326) use the name *I. monospinus*, probably referring to *I. monospinosus*.

Type depository: MZD (holotype) (Saito, Y. 1967. Studies on ixodid ticks. IX. *Ixodes monospinosus* n. sp. from man in Nigata Prefecture, Japan (Ixodoidea: Ixodidae). Acta Med. Biol., 15: 107–112)

Known stages: female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregion: Nihonkai montane deciduous forests

Hosts: Artiodactyla: Bovidae, Cervidae; Carnivora: Ursidae (A)

Rodentia: Muridae; Soricomorpha: Talpidae (NL)

Rodentia: Cricetidae (L)

Human infestation: yes (Yamauchi et al. 2010)

Remarks: Camicas et al. (1998) list the male of *I. monospinosus* as described but consider the larva and nymph undescribed. We have been unable to locate any description of the male. On the other hand, the larva of *I. monospinosus* had been earlier described by Takada and Fujita (1978), and more recently the nymph as well (Fujita and Takada 2007). In fact, the nymph of this tick had previously been described in Takada and Yamaguchi (1974) and Takada and Fujita (1978) as the nymph of *Ixodes* sp. N1. This information on *I. monospinosus* was provided with the assistance of Prof. Takeo Yamauchi, Toyama Institute of Health, whom we warmly acknowledge.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Fujita, H. & Takada, N. 1979. Some unassociated tick species in the northern part of Honshu, Japan, with the keys to immatures stages. Annu. Rep. Ohara Gen. Hosp., 22: 13–19. In Japanese.

Fujita, H. & Takada, N. 2007. Identification of immature ticks in Japan. *In* Organization Committee of SADI (editor), Acari and Emerging/ Reemerging Diseases. Zenkoku Nosom Kyoiku Kyokai Publishing Company, Tokyo, pp. 53–68. In Japanese, Spanish translation of legends of figures by Kori, V.

Kitaoka, S., Morii, T. & Fujisaki, K. 1975. Consideration on the grazing cattle-tick relationship in Japan, with special reference to large wild mammals and the deer-tick ecosystem in the Tanzawa Mountains. Bull. Natl. Inst. Anim. Health, 70: 35–42.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Nakajima, S., Adachi, M., Matsuno, K., Ebina, J., Ueda, Y., Yano, H. & Yoshida, Y. 1992. Ixodid ticks infesting wild mammals in Kyoto Prefecture. Ann. Rep. Kyoto Prefectural Inst. Hyg. Envir. Sci., 37: 51–58. In Japanese.

Saito, Y. 1967. Studies on ixodid ticks. IX. *Ixodes monospinosus* n. sp. from man in Niigata Prefecture, Japan (Ixodoidea: Ixodidae). Acta Med. Biol., 15: 107–112.

Takada, N. 1990. A pictorial review of medical acarology in Japan. Kinpodo Press, Kyoto, 122 pp. In Japanese, translation of the legends of figures by Kore, V.

Takada, N. & Fujita, H. 1978. Studies on ixodid fauna in the northern part of Honshu, Japan 4. An inclusive survey of the tick fauna during the past ten years. Annu. Rep. Ohara Gen. Hosp., 21: 19–34. In Japanese.

Takada N. & Yamaguchi, T. 1974. Studies on ixodid fauna in the northern part of Honshu, Japan 1. Ixodid ticks (Ixodidae) parasitic on wild mammals and some cases of human infestation. Jap. J. San. Zool., 25, 35–40. In Japanese.

Tsunoda, T., Chinone, S. & Yamazaki, K. 2001. Ticks of the Asiatic black bear, *Ursus thibetanus*, in the Okutuma Mts., central Japan. Bull. Ibaraki Nat. Mus., (4): 101–102.

Yamauchi, T., Fukui, Y., Watanabe, M., Nakagawa, H. & Kamimura, K. 2010. Forty cases of human infestations with hard ticks (Acari: Ixodidae) in Toyama Prefecture, Japan. Med. Entomol. Zool., 61: 133–143. In Japanese.

137 – *I. montoyanus* Cooley, 1944 (Bol. Of. Sanit. Pan-Am., 23: 804–806)

Type depositories: USNTC (holotype, paratype), USNM, MCZ, FCM (paratypes) (Cooley, R.A. 1944. *Ixodes montoyanus* (Ixodidae) a new tick from Colombia. Bol. Of. Sanit. Pan-Am., 23: 804–806)

Known stages: male, female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregion: Magdalena Valley montane forests

Hosts: usual hosts for larvae, nymphs and adult ticks are Artiodactyla: Cervidae.

Artiodactyla: Cervidae (ANL)

Carnivora: Procyonidae (A)

Human infestation: no

Remarks: Mihalca et al. (2011) regard *I. montoyanus* as an endangered species.

References

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Keirans, J.E. 1973. *Ixodes* (*I.*) *montoyanus* Cooley (Acarina: Ixodidae): first description of the male and immature stages, with records from deer in Colombia and Venezuela. J. Med. Entomol., 10: 249–254.

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

138 – *I. moreli* Arthur, 1957 (Ann. Parasitol. Hum. Comp., 32: 547–550)

Type depository: LFE (holotype) (Keirans, J.E. & Eckerlin, R.P. 2005. Description of the male and redescription of the female of *Ixodes* (*Ixodes*) *guatemalensis* and description of the male, nymph and larva of *Ixodes* (*Afrixodes*) *moreli* and redescription of the female (Acari: Ixodida: Ixodidae). Int. J. Acarol., 31: 259–268)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: eastern Guinean forests; Cross-Sanaga-Bioko coastal forests

Hosts: Artiodactyla: Bovidae (ANL)
Carnivora: Felidae, Viverridae, Nandiniidae; Rodentia: Thryonomyidae (A)

Human infestation: no

Remarks: Camicas et al. (1998) list the female of *I. moreli* as the only stage described. The male, nymph and larva were subsequently described by Keirans and Eckerlin (2005).

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Keirans, J.E. & Eckerlin, R.P. 2005. Description of the male and redescription of the female of *Ixodes* (*Ixodes*) *guatemalensis* and description of the male, nymph and larva of *Ixodes* (*Afrixodes*) *moreli* and redescription of the female (Acari: Ixodida: Ixodidae). Int. J. Acarol., 31: 259–268.

Morel, P.-C. 1963. La reserve naturelle intégrale du Mont Nimba. II. Tiques (Acarina: Ixodidae). Mém. Inst. Fr. Afr. Noire (66): 33–40.

Ntiamoa-Baidu, Y., Carr-Saunders, C., Matthews, B.E., Preston, P.M. & Walker, A.R. 2005. Ticks associated with wild mammals in Ghana. Bull. Entomol. Res., 95: 205–219.

139 – *I. moscharius* Teng, 1982 (*In* Insects of Xizang (Tibet) Volume II, Institute of Zoology, Academia Sinica, pp. 449–461. In Chinese)
Camicas et al. (1998, *op. cit.* under *I. anatis*) erroneously accepted the year of description of *I. moscharius* as 1979.

Type depository: IZAS (holotype, paratypes) (Teng, K.-F. 1982. Acarina: Ixodidae. *In* Insects of Xizang (Tibet) Volume II, Institute of Zoology, Academia Sinica, pp. 449–461. In Chinese, translation by Robbins, F.-M. Y.)

Known stages: male, female

Zoogeographic Region: Palearctic

Ecoregion: temperate conifer forests

Hosts: Artiodactyla: Moschidae (A)

Human infestation: no

Remarks: Camicas et al. (1998) list only the female as described, but Teng (1982) had previously described the male and female of *I. moscharius*. Camicas et al. (1998) state that this tick is an Oriental species, but collection records indicate that it is exclusively Palearctic. Mihalca et al. (2011) regard *I. moscharius* as an endangered species.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

Teng, K.-F. 1982. Acarina: Ixodidae. *In* Insects of Xizang (Tibet) Volume II, Institute of Zoology, Academia Sinica, pp. 449–461. In Chinese, translation by Robbins, F.-M. Y.

140 – *I. moschiferi* Nemenz, 1968 (Khumbu Himal., 3: 19–26)
Ixodes rangtangensis Teng, 1973, a junior synonym of *I. moschiferi* as discussed in Guglielmone et al. (2009, *op. cit.* under *I. anatis*), is regarded as a valid name in Barker and Murrell (2008, *op. cit.* under *I. anatis*). The authors Luo, J., Li, C. & Zheng, Y. (2009. The investigation of sucking lice and ticks in Sanjiangyuan area. Chin. J. Vector Biol. Contr., 20: 182. In Chinese) still consider the name *I. rangtangensis* valid.

Type depositories: ZMM (holotype, paratypes), NC (paratype) (Nemenz, H. 1968. *Ixodes moschiferi* nov. spec. aus Nepal und seine Stellung unter den fissicoxaten *Ixodes*-Arten (Acari: Ixodoidea). Khumbu Himal., 3: 19–26)

Known stages: male, female

Zoogeographic Region: Palearctic

Ecoregions: montane grasslands and shrublands

Hosts: Artiodactyla: Moschidae (A)

Human infestation: no

Remarks: Camicas et al. (1998) state that this species is found only in the Oriental Region, but the type locality is Palearctic. Teng and Jiang (1991) and Chen et al.

(2010) also record this tick from Palearctic localities in China. Consequently, we consider *I. moschiferi* a Palearctic species. Mihalca et al. (2011) regard this species as endangered.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

Nemenz, H. 1968. *Ixodes moschiferi* nov. spec. aus Nepal und seine Stellung unter den fissicoxaten *Ixodes*-Arten (Acari: Ixodoidea). Khumbu Himal., 3: 19–26.

Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.

141 – *I. muniensis* Arthur & Burrow, 1957 (Bull. Mus. Comp. Zool., 116: 493–537)

Type depositories: MCZ (holotype, paratypes), USNTC (paratype) (Arthur 1965, *op. cit.* under *I. arabukiensis*; Keirans and Clifford 1984, *op. cit.* under *I. amersoni*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: Artiodactyla: Bovidae; Carnivora: Canidae, Herpestidae; Rodentia: Nesomyidae (ANL)
Artiodactyla: Giraffidae, Suidae; Carnivora: Viverridae (A)
Carnivora: Felidae (AL)
Hyracoidea: Procaviidae; Primates: Hominidae (N)
Rodentia: Muridae, Sciuridae (L)

Human infestation: yes (Aeschlimann 1967)

Remarks: Camicas et al. (1998) list ungulates as the only hosts for this tick species, but the references below reveal a far broader host spectrum.

References

Aeschlimann, A. 1967. Biologie et écologie des tiques (Ixodoidea) de Côte d'Ivoire. Acta Trop., 24: 281–405.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Elbl, A. & Anastos, G. 1966. Ixodid ticks (Acarina, Ixodidae) of Central Africa. Vol. II. Genus *Ixodes* Latreille, 1795. Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (146), 205 pp.
Matthysse, J.G. & Colbo, M.H. 1987. The ixodid ticks of Uganda. Entomological Society of America, College Park, Maryland, 426 pp.
Morel, P.-C. 1966. Sur quelques larves d'*Ixodes* Latreille, 1796 [sic], d'Afrique (Acariens: Ixodoidea). Acarologia, 8: 208–221.
Ntiamoa-Baidu, Y., Carr-Saunders, C., Matthews, B.E., Preston, P.M. & Walker, A.R. 2005. Ticks associated with wild mammals in Ghana. Bull. Entomol. Res., 95: 205–219.

142 – *I. muris* Bishopp & Smith, 1937 (Proc. Entomol. Soc. Wash., 39: 133–138)

Type depository: USNTC (holotype, paratypes) (Keirans and Clifford 1984, *op. cit*. under *I. amersoni*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Nearctic

Ecoregions: temperate broadleaf and mixed forests

Hosts: usual hosts for larvae, nymphs and adults are Rodentia: Cricetidae. Aves are considered exceptional hosts for adults of this tick.
Mammalia (several orders); Passeriformes: Emberizidae (ANL)
Galliformes: Phasianidae; Passeriformes: Parulidae, Turdidae (AN)
Passeriformes: Troglodytidae (A)
Galliformes: Odontophoridae; Passeriformes: Icteridae (NL)
Passeriformes (several families); Charadriiformes: Laridae, Scolopacidae (N)

Human infestation: yes (Lacombe et al. 1999)

Remarks: Aves are ignored as hosts of adult *I. muris* in Kolonin (2009), but we accept the few records from such hosts provided by, among others, Bequaert (1945), Spielman et al. (1979), Scharf and Walker (2002) and Scott et al. (2012).

References

Anastos, G. 1947. Hosts of certain New York ticks. Psyche, 54: 178–180.
Bequaert, J.C. 1945. The ticks or Ixodoidea, of the northeastern United States and eastern Canada. Entomol. Am., 25: 73–232.
Bishopp, F.C. & Trembley, H.L. 1945. Distribution and hosts of certain North American ticks. J. Parasitol., 31: 1–54.
Good, N.E. 1972. Tick locality and host records from Long Island and southeastern New York State. Entomol. News, 83: 165–168.
Good, N.E. 1973. Ticks of eastern Long Island: notes on host relations and seasonal distribution. Ann. Entomol. Soc. Am., 66: 240–242.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Lacombe, E.H., Rand, P.W. & Smith, R.P. 1999. Severe reaction in domestic animals following the bite of *Ixodes muris* (Acari: Ixodidae). J. Med. Entomol., 36: 227–232.

Scharf, W.C. 2004. Immature ticks on birds: temporal abundance and reinfestation. Northeast. Nat., 11: 143–150.

Scharf, W.C. & Walker, E.D. 2002. New host records for *Ixodes muris* (Acarina: Ixodidae) from Michigan birds. Great Lakes Entomol., 35: 113–114.

Scott, J.D., Fernando, K., Banerjee, S.N., Durden, L.A., Byrne, S.K., Banerjee, M., Mann, R.B. & Morshed, M.G. 2001. Birds disperse ixodid (Acari: Ixodidae) and *Borrelia burgdorferi*-infected ticks in Canada. J. Med. Entomol., 38: 493–500.

Scott, J.D., Lee, M.-K., Fernando, K., Durden, L.A., Jorgensen, D.R., Mak, S. & Morshed, M.G. 2010. Detection of Lyme disease spirochete, *Borrelia burgdorferi* sensu lato, including three novel genotypes in ticks (Acari: Ixodidae) collected from songbirds (Passeriformes) across Canada. J. Vector Ecol., 35: 124–139.

Scott, J.D., Anderson, J.F. & Durden, L.A. 2012. Widespread dispersal of *Borrelia burgdorferi*- infected ticks collected from songbirds across Canada. J. Parasitol., 98: 49–59.

Spielman, A., Clifford, C.M., Piesman, J. & Corwin, M.D. 1979. Human babesiosis on Nantucket Island, USA: description of the vector, *Ixodes* (*Ixodes*) *dammini*, n. sp. (Acarina: Ixodidae). J. Med. Entomol., 15: 218–234.

143 – *I. murreleti* Cooley & Kohls, 1945 (Natl. Inst. Health Bull. (184), 246 pp.)

Type depository: USNTC (holotype) (Keirans and Clifford 1984, *op. cit.* under *I. amersoni*)

Known stages: female

Zoogeographic Region: Nearctic

Ecoregion: Gulf of California xeric scrub

Hosts: Charadriiformes: Alcidae (A)

Human infestation: no

Remarks: Mihalca et al. (2011) regard *I. murreleti* as an endangered species.

References

Dietrich, M., Gómez-Díaz, E. & McCoy, K.D. 2011. Worldwide distribution and diversity of seabird ticks: implications for the ecology and epidemiology of tick-borne pathogens. Vector-Borne Zoon. Dis., 11: 453–470.

González-Acuña, D., Venzal, J.M., Keirans, J.E., Robbins, R.G., Ippi, S. & Guglielmone, A.A. 2005. New host and locality records for the *Ixodes auritulus* (Acari: Ixodidae) species group, with a review of host relationships and distribution in the Neotropical Zoogeographic Region. Exp. Appl. Acarol., 37: 147–156.

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

144 – *I. myospalacis* Teng, 1986 (Acta Zootax. Sin., 11: 46–53. In Chinese)

Type depository: IZAS (holotype, paratype). This information is inferred from the publication of Teng, K.-F. (1986. Studies on the genus *Ixodes* in China (Acari: Ixodidae). Acta Zootax. Sin., 11: 46–53. In Chinese) by Keirans, J.E. & Robbins, R.G. (1999. A world checklist of genera, subgenera, and species of ticks (Acari: Ixodida) published from 1973–1997. J. Vector Ecol., 24: 115–129)

Known stages: female, nymph

Zoogeographic Region: Palearctic

Ecoregions: Tibetan Plateau alpine shrublands and meadows

Hosts: Rodentia: Spalacidae (AN)

Human infestation: no

References

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.
Teng, K.-F. 1986. Studies on the genus *Ixodes* in China (Acari: Ixodidae). Acta Zootax. Sin., 11: 46–53. In Chinese.

145 – *I. myotomys* Clifford & Hoogstraal, 1970 (J. Med. Entomol., 7: 122–123)

Type depository: USNTC (holotype) (Keirans and Clifford 1984, *op. cit.* under *I. amersoni*)

Known stages: female

Zoogeographic Region: Afrotropical

Ecoregion: succulent South African Karoo

Hosts: Carnivora: Felidae (A (N?))
Rodentia: Muridae (A)

Human infestation: no

Remarks: nymphs probably but not definitely belonging to *I. myotomys* have been found on Felidae (Horak et al. 2010).

References

Clifford, C.M. & Hoogstraal, H. 1970. *Ixodes myotomys* n. sp., a nest parasite of *Myotomys* (Rodentia: Muridae) in Little Namaqualand, the Republic of South Africa (Acarina: Ixodidae). J. Med. Entomol., 7: 122–123.

Horak, I.G., Heyne, H. & Donkin, E.F. 2010. Parasites of domestic and wild animals in South Africa. XLVIII. Ticks (Acari: Ixodidae) infesting domestic cats and wild felids in southern Africa. Onderstepoort J. Vet. Res., 77, doi:10.4102/ojvr.v77i1.3

146 – *I. myrmecobii* Roberts, 1962 (J. Entomol. Soc. Queensland, 1: 42–43)
Kolonin (2009, *op. cit.* under *I. arabukiensis*) feels that *I. myrmecobii* may be a variant of *I. holocyclus*, probably based on a statement of Roberts (1970, *op. cit.* under *I.cornuatus*), who believes that this species and also *I. cornuatus* may be subspecies of *I. holocyclus*.

Type depository: ANIC (holotype, paratype) (Roberts, F.H.S. 1962. *Ixodes* (*Sternalixodes*) *myrmecobii* sp. n. from the numbat, *Myrmecobius fasciatus fasciatus* Waterhouse, in Western Australia (Ixodidae: Acarina). J. Entomol. Soc. Queensland, 1: 42–43)

Known stages: female

Zoogeographic Region: Australasian

Ecoregions: Esperance mallee (southwestern Australia); southwest Australia savanna.

Hosts: Mammalia (several orders) (A)

Human infestation: no

Reference

Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.

147 – *I. nairobiensis* Nuttall, 1916 (Parasitology, 8: 294–337)

Type depository: BMNH (holotype) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: female

Zoogeographic Region: Afrotropical

Ecoregions: southern Miombo woodlands; southern Africa bushveld

Hosts: Soricomorpha: Soricidae (AN)
Artiodactyla: Bovidae, Suidae; Carnivora: Canidae, Herpestidae, Viverridae; Rodentia: Muridae (A)

Human infestation: no

Remarks: Camicas et al. (1998) list the nymph and larva as described, and Clifford et al. (1973) identify these stages in collected material, but we have been unable to locate any formal description of either stage. Although the nymph of *I. nairobiensis* is apparently undescribed, we regard the finding of nymphs of this tick on Soricidae in Elbl and Anastos (1966) as provisionally valid.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Clifford, C.M., Sonenshine, D.E., Keirans, J.E. & Kohls, G.M. 1973. Systematics of the subfamily Ixodinae (Acarina: Ixodidae). 1. The subgenera of *Ixodes*. Ann. Entomol. Soc. Am., 66: 489–500.

Elbl, A. & Anastos, G. 1966. Ixodid ticks (Acarina, Ixodidae) of Central Africa. Vol. II. Genus *Ixodes* Latreille, 1795. Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (146), 205 pp.

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

148 – *I. nchisiensis* Arthur, 1958 (Parasitology, 48: 38–69)

Type depository: MCZ (holotype but lost, paratypes) (Keirans et al. 1982, *op. cit.* under *I. catherinei*)

Known stages: male, female, larva

Zoogeographic Region: Afrotropical

Ecoregions: western Congolian forest-savanna mosaic; southern Miombo woodlands; central Zambezian Miombo woodlands

Hosts: usual hosts for larvae, nymphs and adults are Soricomorpha: Soricidae.
Soricomorpha: Soricidae (ANL)
Rodentia: Muridae (AN)
Macroscelidea: Macroscelididae (A)

Human infestation: no

Remarks: Kolonin (2009) states that the larva of *I. nchisiensis* has not been described, but there is a description of this stage in Morel (1966). There is no description of the nymph of *I. nchisiensis*, but we regard the record of this stage on Soricidae and Muridae in Morel (2003) as provisionally valid. See also *I. oldi*.

References

Keirans, J.E., Clifford, C.M. & Walker, J.B. 1982. The *Ixodes* (*Afrixodes*) *oldi* group (Acari: Ixodidae) from sub-Saharan Africa with descriptions of five new species. J. Med. Entomol., 19: 309–329.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Morel, P.-C. 1966. Sur quelques larves d'*Ixodes* Latreille, 1796 [sic], d'Afrique (Acariens: Ixodoidea). Acarologia, 8: 208–221.

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Uilenberg, G., Estrada-Peña, A. & Thal, J. 2013. Ticks of the Central African Republic. Exp. Appl. Acarol., 60: 1–40.

149 – *I. nectomys* Kohls, 1956 (J. Parasitol., 42: 636–649)

Type depository: CNHM (holotype) (Kohls 1956, *op. cit.* under *I. andinus*)

Known stages: male

Zoogeographic Region: Neotropical

Ecoregion: southwest Amazon moist forest

Hosts: Rodentia: Cricetidae (A)

Human infestation: no

References

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Kohls, G.M. 1956. Eight new species of *Ixodes* from Central and South America (Acarina: Ixodidae). J. Parasitol., 42: 636–649.

150 – *I. neitzi* Clifford, Walker & Keirans, 1977 (Onderstepoort J. Vet. Res., 44: 143–149)

Ixodes donarthuri Santos Dias 1980 is regarded as a synonym of *I. neitzi*, as discussed in Guglielmone et al. (2009, *op. cit.* under *I. anatis*). However, Barker and Murrell (2008, *op. cit.* under *I. anatis*) include both names in their list.

Type depositories: OVI (holotype, paratypes), BMNH, USNTC (paratypes) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregion: highveld grasslands of South Africa

Hosts: Artiodactyla: Bovidae (A)

Human infestation: no

References

Clifford, C.M., Walker, J.B. & Keirans, J.E. 1977. *Ixodes* (*Afrixodes*) *neitzi*, n. sp. (Acarina: Ixodidae) from the mountain reedbuck in South Africa. Onderstepoort J. Vet. Res., 44: 143–150.

Norval, R.A.I., Spickett, A.M. & Clifford, C.M. 1987. The ticks of Zimbabwe. XVI. The genus *Ixodes*. Zimbabwe Vet. J., 18: 1–10.

151 – *I. nesomys* Uilenberg & Hoogstraal, 1969 (Ann. Parasitol. Hum. Comp., 44: 97–100)

Type depositories: USNTC (holotype), UC (paratype) (Uilenberg and Hoogstraal 1969, *op. cit.* under *I. albignaci*)

Known stages: female

Zoogeographic Region: Afrotropical

Ecoregion: Madagascar dry deciduous forests

Hosts: Rodentia: Nesomyidae (A)

Human infestation: no

Reference

Uilenberg, G., Hoogstraal, H. & Klein, J.-M. 1979. Les tiques (Ixodoidea) de Madagascar et leur rôle vecteur. Arch. Inst. Pasteur Madagascar Num. Spéc., 153 pp.

152 – *I. neuquenensis* Ringuelet, 1947 (Notas Mus. La Plata, 12: 207–216)

Type depository: USNTC (neotype) (Guglielmone, A.A., Venzal, J.M, Amico, G, Mangold, A.J. & Keirans, J.E. 2004. Description of the nymph and larva and redescription of the female of *Ixodes neuquenensis* Ringuelet, 1947 (Acari: Ixodidae), a parasite of the endangered species *Dromiciops gliroides* Thomas, 1847 (Microbiotheria: Microbiotheriidae). Syst. Parasitol., 57: 211–219). This tick was originally named *Ixodes brunneus* in Boero, J.J. (1945. *Ixodes brunneus* Koch 1844. Nueva especie para la acarofauna argentina. Rev. Med. Vet. (Buenos Aires), 27: 128–130).

Known stages: female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregion: Valdivian temperate forest in Argentina and Chile

Hosts: Microbiotheria: Microbiotheriidae (ANL)

Human infestation: no

Remarks: Camicas et al. (1998) state that the nymph of *I. neuquenensis* is the only described stage of this species. However, their reference is to Ringuelet (1947), who described as the nymph of *I. neuquenensis* a tick belonging to another undetermined species, as discussed in Guglielmone et al. (2004). The latter authors described the larva and nymph and redescribed the female of *I. neuquenensis*. Daciuk et al. (1981) allegedly found the male of *I. neuquenensis* parasitizing wild Canidae in Argentina, but the specimens were in fact *Amblyomma tigrinum*, as stated in Guglielmone and Nava (2005). Guglielmone et al. (2004) regard this tick and its host as at risk of extinction. See also *I. brunneus*.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Daciuk, J., Cicchino, A.C., Mauri, R. & Capri, J.J. 1981. Notas faunísticas y bio-ecológicas de Península Valdés y Patagonia. XXIV. Artrópodos ectoparásitos de mamíferos y aves colectadas en la Península Valdés y alrededores (provincia de Chubut, Argentina). Physis, Secc. C, 39 (97): 41–48.

Guglielmone, A.A. & Nava, S. 2005. Las garrapatas de la familia Argasidae y de los géneros *Dermacentor*, *Haemaphysalis*, *Ixodes* y *Rhipicephalus* (Ixodidae) de la Argentina: distribución y hospedadores. Rev. Inv. Agropec., 34 (2): 123–141.

Guglielmone, A.A., Venzal, J.M, Amico, G, Mangold, A.J. & Keirans, J.E. 2004. Description of the nymph and larva and redescription of the female of *Ixodes neuquenensis* Ringuelet, 1947 (Acari: Ixodidae), a parasite of the endangered species *Dromiciops gliroides* Thomas, 1847 (Microbiotheria: Microbiotheriidae). Syst. Parasitol., 57: 211–219.

Ringuelet, R. 1947. La supuesta presencia de *Ixodes brunneus* Koch en la Argentina y descripción de una nueva garrapata *Ixodes neuquenensis* nov. sp. Notas Mus. La Plata, 12: 207–216.

153 – *I. nicolasi* Santos Dias, 1982 (An. Fac. Cienc. Porto, 63: 119–123)

Kolonin (2009, *op. cit.* under *I. arabukiensis*) does not include this species in his list but gives no reason for this omission. Guglielmone et al. (2010, *op. cit.* under *I. abrocomae*) consider *I. nicolasi* a valid species.

Type depository: MHNM (holotype) (Santos Dias, J.A.T. 1982. A new species of tick (Acarina-Ixodoidea) from a grey duiker (*Sylvicapra grimmia*) of Mozambique. *Ixodes nicolasi* n. sp. An. Fac. Cienc. Porto, 63: 119–123)

Known stages: female

Zoogeographic Region: Afrotropical

Ecoregion: southern Zanzibar-Inhambane coastal forest mosaic

Hosts: Artiodactyla: Bovidae (A)

Human infestation: no

Reference

Santos Dias, J.A.T. 1982. A new species of tick (Acarina-Ixodoidea) from a grey duiker (*Sylvicapra grimmia*) of Mozambique. *Ixodes nicolasi* n. sp. An. Fac. Cienc. Porto, 63: 119–123.

154 – *I. nipponensis* Kitaoka & Saito, 1967 (Natl. Inst. Anim. Health Q., 7: 74–83)

Type depositories: NIAH (holotype, paratypes), MZD, ZIAC (paratypes) (Kitaoka, S. & Saito, Y. 1967. *Ixodes nipponensis* n. sp. (Ixodoidea, Ixodidae), a common cattle tick in Japan. Natl. Inst. Anim. Health Q., 7: 74–83; Filippova 2008, *op. cit.* under *I. berlesei*). See also *I. ovatus*.

Known stages: male, female, nymph, larvae

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: temperate broadleaf and mixed forests

Hosts: Carnivora: Felidae, Mustelidae (AN)
Artiodactyla: Bovidae, Cervidae; Carnivora: Canidae, Ursidae (A)
Lagomorpha: Leporidae (AL)
Rodentia: Cricetidae, Muridae, Sciuridae; Soricomorpha: Soricidae; Squamata: Lacertidae; Passeriformes: Sylviidae, Turdidae (NL)
Perissodactyla: Equidae; Passeriformes: Emberizidae (N)
Soricomorpha: Talpidae (L)
Passeriformes: Emberizidae, Motacillidae (N and/or L)

Human infestation: yes (Yamauchi et al. 2010)

Remarks: Camicas et al. (1998) list the nymph of *I. nipponensis* as undescribed, but it had earlier been described by Kitaoka and Saito (1967). It is uncertain whether Kang et al. (2013) collected larvae, nymphs or both stages of *I. nipponensis* from Passeriformes (Emberizidae and Motacillidae).

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.

Fujita, H. & Takada, N. 1978. Studies on ixodid fauna in the northern part of Honshu, Japan. 3. Preliminary notes on *Ixodes nipponensis* (Ixodoidea; Ixodidae) found on the small reptile *Takydromus tachydromoides*. Jap. J. Sanit. Zool., 29: 269–271.

Ishihara, T. & Fujisaki, K. 1990. The tick parasitic on horses pasturing in Aomori and Iwate Prefectures, Japan. Jap. J. Sanit. Zool., 41: 405–410. In Japanese.

Kakuda, H., Shiraishi, S. & Uchida, T.A. 1989. Ticks from wild mammals in the Kyushu District including Okinawa Prefecture, Japan. J. Fac. Agr. Kyushu Univ., 33: 267–273.

Kang, J.-G., Kim, H.-C., Choi, C.-Y., Nam, H.-Y., Chae, H.-Y., Chong, S.-T., Klein, T.A., Ko, S. & Chae, J.-S. 2013. Molecular detection of *Anaplasma*, *Bartonella*, and *Borrelia* species in ticks collected from migratory birds from Hong-do Island, Republic of Korea. Vector- Borne Zoon. Dis., 13: 215–225.

Kim, H.C., Han, S.H., Chong, S.T., Klein, T.A., Choi, C.-Y., Nam, H.-Y., Chae, H.-Y., Lee, H., Ko, S., Kang, J.-G. & Chae, J.-S. 2011. Ticks collected from selected mammalian hosts surveyed in the Republic of Korea during 2008–2009. Korean J. Parasitol., 49: 331–335.

Kitaoka, S. & Saito, Y. 1967. *Ixodes nipponensis* n. sp. (Ixodoidea, Ixodidae), a common cattle tick in Japan. Natl. Inst. Anim. Health Q., 7: 74–83.

Miyamoto, K., Nakao, M, Fujita, H. & Sato, F. 1993. The ixodid ticks on migratory birds in Japan and the isolation of Lyme disease spirochetes from bird-feeding ticks. Jap. J. Sanit. Zool., 44: 315–326.

Takada, N. & Fujita, H. 1978. Studies on ixodid fauna in the northern part of Honshu, Japan 4. An inclusive survey of the tick fauna during the past ten years. Annu. Rep. Ohara Gen. Hosp., 21: 19–34. In Japanese.

Takada, N. & Yamaguchi, T. 1974. Studies on ixodid fauna in the northern part of Honshu, Japan. 1. Ixodid ticks (Ixodidae) parasitic on wild mammals and some cases of human infestation. Jap. J. Sanit. Zool., 25: 35–40. In Japanese.

Yamaguti, N., Tipton, V.J., Keegan, H.L. & Toshioka, S. 1971. Ticks of Japan, Korea, and the Ryukyu Islands. Brigham Young Univ. Sci. Bull. Biol. Ser., 15 (1), 226 pp.

Yamauchi, T. 2001. A bibliographical survey of host-parasite relationships between birds and ticks from Japan. Bull. Hoshizaki Green Found., 5: 271–308. In Japanese.

Yamauchi, T., Fukui, Y., Watanabe, M., Nakagawa, H. & Kamimura, K. 2010. Forty cases of human infestations with hard ticks (Acari: Ixodidae) in Toyama Prefecture, Japan. Med. Entomol. Zool., 61: 133–143. In Japanese.

Yamauchi, T., Yano, S., Yamamoto, T., Yamamoto, E. & Miyamoto, T. 2013. Ticks (Acari: Ixodidae) from medium-sized to large mammals in Ehime Prefecture, Japan. Exp. Appl. Acarol., 60: 263–270.

155 – *I. nitens* Neumann, 1904 (Arch. Parasitol., 8: 444–464)

Type depository: BMNH (syntypes) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: female, nymph

Zoogeographic Region: Oriental

Ecoregion: Christmas and Cocos Islands tropical forests

Hosts: Rodentia: Muridae (AN)

Human infestation: no

Remarks: Camicas et al. (1998) state that the nymph of this species is undescribed; in fact, Neumann's (1904) description is extremely poor, and consequently the nymph of *I. nitens* may be considered undescribed. Kolonin (2009) believes that the male of *I. nitens* has been described, but we have been unable to locate its description. Nuttall and Warburton (1911) state that the type locality is Christmas Island in the Pacific Ocean, but Keirans (1985) affirms that the type locality is Christmas Island in the Indian Ocean, and we accept this view as correct. Mihalca et al. (2011) regard this species as extinct.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.
Neumann, L.G. 1904. Notes sur les ixodidés. II. Arch. Parasitol., 8: 444–464.
Nuttall, G.H.F. & Warburton, C. 1911. Ticks, a monograph of the Ixodoidea. Part II. Ixodidae. Section II. Genus I. *Ixodes* Latreille 1795. Cambridge at the University Press, London, pp. 133–293.

156 – *I. nuttalli* Lahille, 1913 (Bol. Minist. Agric. Arg., 16: 278–289)

Type depositories: CL (lost) Guglielmone et al. (2003, *op. cit.* under *I. cookei*) state that the types of *I. nuttalli* were in CL and BMNH. However, this species was described from one male deposited in CL, as discussed in Nuttall (1916, *op. cit.* under *I. eudyptidis*). The current location of CL is unknown.

Known stages: male, female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregions: low monte temperate grasslands, savannas and shrublands

Hosts: Rodentia: Chinchillidae (ANL)

Human infestation: no

References

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.
Nuttall, G.H.F. 1916. Notes on ticks. IV. Relating to the genus *Ixodes* and including a description of three new species and two new varieties. Parasitology, 8: 294–337.

157 – *I. nuttallianus* Schulze, 1930 (Zool. Anz., 90: 294–303)

Type depository: BMNH (lectotype, paralectotypes) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*) as *I. ricinoides* Nuttall, 1913. Schulze , P. (1930. Über einige Verwandte von *Ixodes ricinus* L. aus Ostasien. *Zool. Anz.*, 90: 294–303) considered this name preoccupied by *Acarus ricinoides* (Linnaeus, 1758) in De Geer (1778. Mémoire pour servir à l'histoire des insectes, volume 7, P. Hesselberg, Stockholm, 950 pp.) because Schulze (1930) held that the name "*ricinoides* De Geer" [sic] was a synonym of *Ixodes ricinus*. He therefore replaced *Ixodes ricinoides* Nuttall, 1913 with *Ixodes nuttallianus*.

Known stages: male, female

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: southeast Tibet shrublands and meadows; Tibetan Plateau alpine shrublands and meadows

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Artiodactyla: Bovidae, Cervidae, Moschidae; Carnivora: Canidae (A)

Human infestation: no

References

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.
Clifford, C.M., Keirans, J.E. & Hoogstraal, H. 1971. *Ixodes* (*Ixodes*) *nuttallianus* Schulze: redescription of female, description of male, and hosts and ecology in Nepal (Acarina: Ixodidae). J. Med. Entomol., 8: 439–442.
Clifford, C.M., Hoogstraal, H. & Keirans, J.E. 1975. The *Ixodes* ticks (Acarina: Ixodidae) of Nepal. J. Med. Entomol., 12: 115–137.
Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese

158 – *I. occultus* Pomerantzev, 1946 (Opred. Fauna SSSR Zool. Inst. Akad. Nauk SSSR (26), 28 pp. In Russian)

Type depository: ZIAC (holotype) (Filippova 2008, *op. cit*. under *I. berlesei*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: Kazakh semi-desert; central Asian southern xeric shrublands

Hosts: Squamata are considered exceptional hosts for this tick.
Rodentia: Muridae (ANL)
Rodentia: Cricetidae, Sciuridae; Carnivora: Mustelidae; Soricomorpha: Soricidae; Squamata: Viperidae (stages unknown)

Human infestation: no

Remarks: the record in Ushakova (1960) of *I. occultus* from Squamata is not included in Kolonin (2009).

References

Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Maslennikova, Z.P., Morozova, I.V. & Bibikova, V.A. 1964. Ticks, Ixodoidea of mammals in the Desert Sary-Ishik-Otrau. Trudy Inst. Zool. Akad. Nauk Kazakh. SSR, 22: 166–173. In Russian.
Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.
Ushakova, G.V. 1960. Ecological-faunistic survey of ticks of the lower Ili River. Trudy Inst. Zool. Akad. Nauk Kazkh. SSR, 14: 148–161. In Russian.

159 – *I. ochotonae* Gregson, 1941 (Can. Entomol., 73: 220–228)

Type depositories: CNC (holotype, paratypes), USNTC (paratype) (Robbins, R.G. & Keirans, J.E. 1992. Systematics and ecology of the subgenus *Ixodiopsis* (Acari: Ixodidae: *Ixodes*). Thomas Say Publ. Entomol. Monogr. (14), 159 pp.)

Known stages: male, female, nymph, larva

Zoogeographic Region: Nearctic

Ecoregions: Columbia Plateau; conifer forest of northwest coast; few ticks in Middle Rockies-Blue Mountains

Hosts: usual hosts for adult ticks are Lagomorpha: Ochotonidae; usual hosts for larvae and nymphs are Lagomorpha: Ochotonidae and Rodentia: Cricetidae. Canidae are considered exceptional hosts for this tick.
Lagomorpha: Ochotonidae; Rodentia: Cricetidae (ANL)
Rodentia: Sciuridae (AL)
Rodentia: Geomyidae (A)
Carnivora: Canidae (stage unknown)

Human infestation: no

Remarks: Kolonin (2009) does not include Canidae as hosts for *I. ochotonae*, although there is an odd record from this type of host in Robbins and Keirans (1992).

References

Foley, J.E., Nieto, N.C., Adjemian, J., Dabritz, H. & Brown, R.N. 2008. *Anaplasma phagocytophilum* infection in small hosts of *Ixodes* ticks, western United States. Emerg. Inf. Dis., 14: 1147–1150. **Note:** information on hosts is in an online "technical appendix."

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Robbins, R.G. & Keirans, J.E. 1992. Systematics and ecology of the subgenus *Ixodiopsis* (Acari: Ixodidae: *Ixodes*). Thomas Say Publ. Entomol. Monogr. (14), 159 pp.

160 – *I. okapiae* Arthur, 1956 (Rev. Zool. Bot. Afr., 54: 295–315)

Type depositories: MCZ (holotype, paratypes), USNTC (paratype) (Arthur 1965, *op. cit.* under *I. arabukiensis*; Keirans and Clifford 1984, *op. cit.* under *I. amersoni*)

Known stages: female

Zoogeographic Region: Afrotropical

Ecoregion: northeastern Congolian lowland forests

Hosts: Artiodactyla: Giraffidae (A)

Human infestation: no

Remarks: Durden and Keirans (1996) regard *I. okapiae* as an endangered species.

References

Arthur, D.R. 1965. Ticks of the genus *Ixodes* in Africa. The Athlone Press, University of London, London, 348 pp.
Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.

161 – *I. oldi* Nuttall, 1913 (Parasitology, 6: 131–138)
See remarks below.

Type depository: BMNH (lectotype, paralectotypes) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: male, female, nymph

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: Soricomorpha: Soricidae (ANL)
Carnivora: Herpestidae, Viverridae; Rodentia: Muridae (AN)
Artiodactyla: Bovidae; Carnivora: Canidae, Felidae; Rodentia: Nesomyidae (A)
Macroscelidea: Macroscelididae; Pholidota: Manidae; Rodentia: Sciuridae, Spalacidae (N)

Human infestation: no

Remarks: considerable difficulties may be encountered when differentiating species of the *I. oldi* group, specifically *I. oldi* and *I. vanidicus*, as discussed by Morel (2003), who considered it probable that these names are in fact synonyms. Keirans et al. (1982) have adequately defined this complex of eight species (*brewsterae*, *catherinei*, *corwini*, *macfarlanei*, *nchisiensis*, *oldi*, *vanidicus* and *zairensis*), but revision of collections of *I. oldi* is still necessary in order to verify the status of specimens and confirm their host relationships. Kolonin (2009) states that the immature stages of *I. oldi* are unknown, but we regard the description of the nymph in Arthur (1958) as provisionally valid, as well as the records of larvae from Soricidae in Elbl and Anastos (1966).

References

Aeschlimann, A. 1967. Biologie et écologie des tiques (Ixodoidea) de Côte d'Ivoire. Acta Trop., 24: 281–405.
Arthur, D.H. 1958. New species of *Ixodes* ticks from eastern Africa, with a description of the male and nymph of *Ixodes oldi* Nuttall, 1913. Parasitology, 48: 38–69.
Elbl, A. & Anastos, G. 1966. Ixodid ticks (Acarina, Ixodidae) of Central Africa. Vol. II. Genus *Ixodes* Latreille, 1795. Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (146), 205 pp.
Keirans, J.E., Clifford, C.M. & Walker, J.B. 1982. The *Ixodes* (*Afrixodes*) *oldi* group (Acari: Ixodidae) from sub-Saharan Africa with descriptions of five new species. J. Med. Entomol., 19: 309–329.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Morel, P.-C. 1976. Contribution à la connaissance de la distribution des tiques (Acariens, Ixodidae et Amblyommidae) en Afrique éthiopienne continentale. Annexe cartographique. Institut d'Élevage et de Médecine Vétérinaire des Pays Tropicaux, Paris, 326 pp.
Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

162 – *I. ornithorhynchi* Lucas, 1846 (Ann. Soc. Entomol. Fr. Ser. 2, 4: 53–64)

Type depository: MNHN (syntypes) (Nuttall and Warburton 1911, *op. cit.* under *I. acuminatus*)

Known stages: female, nymph, larva

Zoogeographic Region: Australasian

Ecoregions: eastern and southeast Australasian temperate forests

Hosts: Monotremata: Ornithorhynchidae (ANL)

Human infestation: no

Remarks: Camicas et al. (1998) state that the male is known, but we have found no description of it. Roberts (1970) considers the record of a female from Squamata: Scincidae doubtful, and we have not included it in our host list. Durden and Keirans (1996) regard *I. ornithorhynchi* as an endangered species.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.
Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.
Macgregor, J.W., Holyoake, C.S., Munks, S.A., Robertson, I.D. & Warren, K.S. 2010. Preliminary investigation into the prevalence of mucormycosis in the platypus (*Ornithorhynchus anatinus*) in three catchments in north-west Tasmania. Aust. Vet. J., 88: 190–196.
Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.

163 – *I. ovatus* Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)
Based on the morphological variation found across its range, Hoogstraal, H., Clifford, C.M., Saito, Y. & Keirans, J.E. (1973. *Ixodes* (*Partipalpiger*) *ovatus* Neumann, subgen. nov.: identity, hosts, ecology, and distribution (Ixodoidea: Ixodidae). J. Med. Entomol., 10: 157–164) feel that *I. ovatus* may represent a species group. See also *I. siamensis*

Type depositories: ZSH, ENV (syntypes) (Nuttall and Warburton 1911, *op. cit.* under *I. acuminatus*). These authors referred to this species as *I. ricinus ovatus*. The type series of *I. ovatus* also contains *I. ricinus*, according to Neumann, L.G. (1911.

Ixodidae. Das Tierreich (26), 169 pp.), but Morel , P.-C. (1963. Identité d'*Ixodes ovatus* Neumann, 1899 (Acariens, Ixodoidea). Ann. Parasitol. Hum. Comp., 38: 925–928) identified the supposed *I. ricinus* specimens as *I. persulcatus*, while Yamaguti, N., Tipton, V.J., Keegan, H.L. & Toshioka, S. (1971. Ticks of Japan, Korea, and the Ryukyu Islands. Brigham Young Univ. Sci. Bull. Biol. Ser., 15 (1), 226 pp.) state that they might be *I. nipponensis*.

Known stages: male, female, nymph, larva

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: several Oriental and Palearctic ecoregions

Hosts: Aves are considered exceptional hosts for this tick.
Rodentia: Muridae; Lagomorpha: Leporidae, Ochotonidae (ANL)
Carnivora: Ursidae (AN)
Mammalia (several orders); Galliformes: Phasianidae (A)
Carnivora: Mustelidae; Soricomorpha: Soricidae, Talpidae; Rodentia: Cricetidae (NL)
Scandentia: Tupaiidae; Passeriformes: Emberizidae (N)

Human infestation: yes (Heath and Hardwick 2011 among others)

Remarks: Heath and Hardwick (2011) record the introduction of *I. ovatus* into the Australasian Region, but there is no evidence that this tick has become established there. A few records of *I. ovatus* from Aves appear in Yamauchi (2001), but these are ignored in Kolonin (2009). Dhanda and Rao (1964) refer to this species as *I. japonensis* Neumann, 1904.

References

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Dhanda, V. & Rao, T.R. 1964. A report on a collection of ixodid ticks made in the North East Frontier Agency, India. Ind. J. Med. Res., 52: 1139–1153.

Fujimoto, K., Yamaguti, N. & Takahashi, M. 1986. Ecological studies on ixodid ticks. 1. Ixodid ticks on vegetations and wild animals at the low mountain zone lying south-western part of Saitama Prefecture. Jap. J. Sanit. Zool., 37: 325–331. In Japanese.

Heath, A.C.G. & Hardwick, S. 2011. The role of humans in the importation of ticks to New Zealand: a threat to public health and biosecurity. N. Zeal. Med. J., 124: 67–82.

Hoogstraal, H., Clifford, C.M., Saito, Y. & Keirans, J.E. 1973. *Ixodes* (*Partipalpiger*) *ovatus* Neumann, subgen. nov.: identity, hosts, ecology, and distribution (Ixodoidea: Ixodidae). J. Med. Entomol., 10: 157–164.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Inokuma, H., Parola, P., Raoult, D. & Brouqui, P. 2001. Molecular survey of *Ehrlichia* infection in ticks from animals in Yamaguchi Prefecture, Japan. Vet. Parasitol., 99: 335–339.

Takada, N. & Fujita, H. 1978. Studies on ixodid fauna in the northern part of Honshu, Japan 4. An inclusive survey of the tick fauna during the past ten years. Annu. Rep. Ohara Gen. Hosp., 21: 19–34. In Japanese.

Teng, K.-F. 1982. Acarina: Ixodidae. *In* Insects of Xizang (Tibet) Volume II, Institute of Zoology, Academia Sinica, pp. 449–461. In Chinese, translation by Robbins, F.-M. Y.

Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.

Xu, R. & Li, K. 1997. A collection of ticks from Guizhou, China. Syst. Appl. Acarol., 2: 245–246.

Yamaguti, N., Tipton, V.J., Keegan, H.L. & Toshioka, S. 1971. Ticks of Japan, Korea, and the Ryukyu Islands. Brigham Young Univ. Sci. Bull. Biol. Ser., 15 (1), 226 pp.

Yamauchi, T. 2001. A bibliographical survey of host-parasite relationships between birds and ticks from Japan. Bull. Hoshizaki Green Found., 5: 271–308. In Japanese.

Yamauchi, T., Fukui, Y., Watanabe, M., Nakagawa, H. & Kamimura, K. 2010. Forty cases of human infestations with hard ticks (Acari: Ixodidae) in Toyama Prefecture, Japan. Med. Entomol. Zool., 61: 133–143. In Japanese

Yamauchi, T., Agetsuma, N., Araki, A. & Fukushima, M. 2012. Ixodid ticks collected from the raccoon dog *Nyctereutes procyonoides albus* and the common raccoon *Procyon lotor* in southern Hokkaido, Japan. Int. J. Acarol., 38: 214–216.

Yamauchi, T., Yano, S., Yamamoto, T., Yamamoto, E. & Miyamoto, T. 2013. Ticks (Acari: Ixodidae) from medium-sized to large mammals in Ehime Prefecture, Japan. Exp. Appl. Acarol., 60: 263–270.

164 – *I. pacificus* Cooley & Kohls, 1943 (Pan-Pacif. Entomol., 19: 139–147)

Type depository: USNTC (holotype, paratypes), MCZ, DEP (paratypes) (Cooley, R.A. & Kohls, G.M. 1943. *Ixodes californicus* Banks, 1904, *Ixodes pacificus* n. sp., and *Ixodes conepati* n. sp. Pan-Pac. Entomol., 19: 139–147)

Known stages: male, female, nymph, larva

Zoogeographic Region: Nearctic

Ecoregions: mediterranean forests, woodlands and scrub; few ticks in temperate conifer forests

Hosts: Aves are considered exceptional hosts for adults of *I. pacificus*, and Squamata are exceptional hosts for adults of this tick.
Mammalia (several orders); Galliformes: Phasianidae; Passeriformes: Emberizidae, Troglodytidae; Squamata: Anguidae (ANL)
Aves (several orders, but most records are from various families of Passeriformes); Squamata (several families) (NL)

Human infestation: yes (Heath and Hardwick 2011 among others)

Remarks: Doss et al. (1974) listed *I. pacificus* as present in French Guiana (Neotropical Region), based on information provided by Floch et al. (1955). However, the latter authors were merely citing differences between *I. pacificus* and

I. luciae and did not actually provide a record of *I. pacificus* from the Neotropics. Joyce (1961), Heath (2001) and Jameson et al. (2010), among others, report the introduction of *I. pacificus* into remote Pacific islands, the Australasian and the Palearctic Regions, but there is no evidence that it has become established there. Recent records of *I. pacificus* on Galliformes in Pakistan (Khattak et al. 2012) are considered erroneous. Allred et al. (1960) found a nymph and a female of *I. pacificus* in a nest of Corvidae (identified as "magpie nest"), an indication that the hosts of this species are uncertain. Parasitism of Aves and Squamata by adult *I. pacificus* is an infrequent event (Castro and Wright 2007), and these hosts are not included in Kolonin (2009).

References

Allred, D.M., Beck, D.E. & White, L.D. 1960. Ticks of the genus *Ixodes* in Utah. Brigham Young Univ. Sci. Bull. Biol. Ser., 1 (4), 42 pp.

Castro, M.B. & Wright, S.A. 2007. Vertebrate hosts of *Ixodes pacificus* (Acari: Ixodidae) in California. J. Vector Ecol., 32: 140–149.

Doss, M.A., Farr, M.M., Roach, K.F. & Anastos, G. 1974. Index-catalogue of medical and veterinary zoology. Special publication 3. Ticks and tick borne diseases. I. Genera and species of ticks. Part 2. Genera H-N. United States Department of Agriculture, U. S. Government Printing Office, Washington, 593 pp.

Floch, H., Fauran, P. & Alexandre, A 1955. Ixodidés de la Guyane Française (V). Le genre *Ixodes*. Arch. Inst. Pasteur Guyane (364), 6 pp.

Heath, A.C.G. 2001. Exotic tick interceptions 1980–2000. Surveillance, 28 (4): 13–15.

Heath, A.C.G. & Hardwick, S. 2011. The role of humans in the importation of ticks to New Zealand: a threat to public health and biosecurity. N. Zeal. Med. J., 124: 67–82.

Jameson, L.J., Phipps, L.P. & Medlock, J.M. 2010. Surveillance for exotic ticks on companion animals in the UK. Vet. Rec., 166: 202–203.

Joyce, C. R. 1961. Notes and exhibitions. Proc. Hawaiian Entomol. Soc. 17: 330.

Khattak, R.M., Ali, S., Jahangir, M., Khan, M.N., Rasul, A. & Iqbal, F. 2012. Prevalence of ectoparasites in wild and domesticated grey (*Francolinus pondicerianus*) and black partridge (*Francolinus francolinus*) from Khyber Pakhtoonkhwa Province of Pakistan. Pakistan J. Zool., 44: 1239–1244.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Lane, R.S., Kucera, T.F., Barrett, R.H., Mun, J., Wu, C. & Smith, V.S. 2006. Wild turkey (*Meleagris gallopavo*) as a host of ixodid ticks, lice, and Lyme disease spirochetes (*Borrelia burgdorferi* sensu lato) in California state parks. J. Wildl. Dis., 42: 759–771.

Scott, J.D., Anderson, J.F. & Durden, L.A. 2012. Widespread dispersal of *Borrelia burgdorferi*- infected ticks collected from songbirds across Canada. J. Parasitol., 98: 49–59.

165 – *I. paranaensis* Barros-Battesti, Arzua, Pichorim & Keirans, 2003 (Mem. Inst. Oswaldo Cruz, 98: 93–102)

Type depositories: MHNCI (holotype, paratypes), IBU, ZMMO, USNTC (paratypes) (Barros-Battesti, D.M., Arzua, M., Pichorim, M. & Keirans, J.E. 2003. *Ixodes* (*Multidentatus*) *paranaensis* n. sp. (Acari: Ixodidae) a parasite of *Streptoprocne biscutata* (Sclater, 1865) (Apodiformes: Apodidae) birds in Brazil. Mem. Inst. Oswaldo Cruz, 98: 93–102)

Known stages: male, female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregions: mangroves and tropical grasslands; tropical and subtropical grasslands, savannas and shrublands

Hosts: Apodiformes: Apodidae (ANL)

Human infestation: no

References

Barros-Battesti, D.M., Arzua, M., Pichorim, M. & Keirans, J.E. 2003. *Ixodes* (*Multidentatus*) *paranaensis* n. sp. (Acari: Ixodidae) a parasite of *Streptoprocne biscutata* (Sclater, 1865) (Apodiformes: Apodidae) birds in Brazil. Mem. Inst. Oswaldo Cruz, 98: 93–102.

Dantas-Torres, F., Bernardi, L.F. de, Souza-Silva, M., Ferreira, R.L., Onofrio, V.C., Barros-Battesti, D.M. & Labruna, M.B. 2009. New records of *Ixodes paranaensis* (Acari: Ixodidae) from Minas Gerais, southeastern Brazil. Syst. Appl. Acarol., 14: 213–215.

166 – *I. pararicinus* Keirans & Clifford, 1985 (*In* Keirans et al. J. Med. Entomol., 22: 401–407)
See *I. aragaoi* and remarks below.

Type depositories: USNTC (holotype, paratypes), MCN, BMNH, INTA (paratypes) (Keirans, J.E., Clifford, C.M., Guglielmone, A.A. & Mangold, A.J. 1985. *Ixodes* (*Ixodes*) *pararicinus*, n. sp. (Acari: Ixodoidea: Ixodidae), a South American cattle tick long confused with *Ixodes ricinus*. J. Med. Entomol., 22: 401–407). However, the types of *I. pararicinus* are not listed for BMNH in Keirans and Hillyard (2001, *op. cit.* under *I. anatis*).

Known stages: male, female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical moist and dry broadleaf forests; subtropical grasslands and savannas

Hosts: Chiroptera are considered exceptional hosts for this tick.
Artiodactyla: Bovidae, Cervidae, Tayassuidae; Perissodactyla: Equidae; Chiroptera: Phyllostomidae (A)
Rodentia: Cricetidae; Passeriformes (several families) (NL)
Carnivora: Canidae (N)

Didelphimorphia: Didelphidae (L)

Human infestation: no

Remarks: Camicas et al. (1998) state that the larva and nymph of *I. parariciinus* are undescribed, but they were subsequently described by Venzal et al. (2005). Infestation of Chiroptera by this tick appears to be an infrequent event; the single record in Venzal et al. (2004) is not included in Kolonin (2009). Guglielmone et al. (2003) consider *I. parariciinus* tentatively valid because it exhibits some biological differences when compared with *I. aragaoi*, but these species are morphologically very close and further studies will be required to confirm their status. Such studies should include *I. ricinus rochensis* Calzada, 1936, which could be a senior synonym of *I. parariciinus*. Additionally, Barbieri et al. (2013) present relatively important differences of partial sequences of the 16S rDNA gene between *I. parariciinus* from Uruguay and Argentina, as well as between *Ixodes parariciinus* from Uruguay and *I. affinis* from Colombia and USA.

References

Barbieri, A.M., Venzal, J.M., Marcili, A., Almeida, A.P., González, E.M. & Marcelo, M.B. 2013. *Borrelia burgdorferi* sensu lato infecting ticks of the *Ixodes ricinus* complex in Uruguay: first report for the southern hemisphere. Vector-Borne Zoon. Dis., 13: 145–153.

Beldoménico, P.M., Baldi, J.C., Orcellet, V., Peralta, J.L., Venzal, J.M., Mangold, A.J. & Guglielmone, A.A. 2003. Ecological aspects of *Ixodes parariciinus* (Acari: Ixodidae) and other tick species parasitizing sigmodontin mice (Rodentia: Muridae) in the northwestern Argentina. Acarologia, 54: 15–21.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Guglielmone, A.A., Nava, S. & Díaz, M.M. 2011. Relationships of South American marsupials (Didelphimorphia, Microbiotheria and Paucituberculata) and hard ticks (Acari: Ixodidae) with distribution of four species of *Ixodes*. Zootaxa, 3086: 1–30.

Ivancovich, J.C. & Luciani, C.A. 1992. Las garrapatas de Argentina. Monografía de la Asociación Argentina de Parasitología Veterinaria, Buenos Aires, 95 pp.

Keirans, J.E., Clifford, C.M., Guglielmone, A.A. & Mangold, A.J. 1985. *Ixodes* (*Ixodes*) *parariciinus*, n. sp. (Acari: Ixodoidea: Ixodidae), a South American cattle tick long confused with *Ixodes ricinus*. J. Med. Entomol., 22: 401–407.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Mastropaolo, M., Orcellet, V. Guglielmone, A.A. & Mangold, A.J. 2008. *Ixodes parariciinus* Keirans & Clifford 1985 y *Amblyomma tigrinum* Koch, 1884 [sic] (Acari: Ixodidae): nuevos registros para Argentina y Chile. Rev. FAVE Cienc. Vet., 7: 67–70.

Venzal, J.M., Autino, A.G., Nava, S. & Guglielmone, A.A. 2004. Nuevos registros de garrapatas (Ixodida) para murciélagos de Argentina. 19ª Jorn. Arg. Mastozool., Puerto Madryn, Argentina, noviembre 2004, p. 106.
Venzal, J.M., Estrada-Peña, A., Barros-Battesti, D.M., Onofrio, V.C. & Beldoménico, P.M. 2005. *Ixodes* (*Ixodes*) *pararicinus* Keirans & Clifford, 1985 (Acari: Ixodidae): description of the immature stages, distribution, hosts and medical/veterinary importance. Syst. Parasitol., 60: 225–234.
Venzal, J.M., Félix, M.L., Olmos, A., Mangold, A.J. & Guglielmone, A.A. 2005. A collection of ticks (Ixodidae) from wild birds in Uruguay. Exp. Appl. Acarol., 36: 325–331.

167 – *I. pavlovskyi* Pomerantzev, 1946 (Opred. Fauna SSSR Zool. Inst. Akad. Nauk SSR (26), 28 pp. In Russian)
Filippova, N.A. & Panova, I.V. (1998. Geographic variation of all active stages of ontogenesis as a basis for estimate of intraspecific taxonomic structure of *Ixodes pavlovskyi* (Ixodidae). Parazitologiya, 32: 396–411. In Russian) found morphological differences between eastern and western populations of this tick and named the eastern population *I. pavlovskyi pavlovskyi* and the western population *I. pavlovskyi occidentalis*.

Type depository: ZIAC. (holotype) (Filippova 2008, *op. cit*. under *I. berlesei*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregion: boreal forests/taiga

Hosts: Aves (several orders); Lagomorpha: Leporidae; Rodentia: Cricetidae, Muridae, Sciuridae; Soricomorpha: Soricidae (ANL)
Carnivora: Canidae (AN)
Erinaceomorpha: Erinaceidae; Artiodactyla: Bovidae (A)
Carnivora: Procyonidae; Lagomorpha: Ochotonidae; Rodentia: Dipodidae, Muridae (NL)

Human infestation: yes (Filippova 1977)

Remarks: see above.

References

Bolotin, E.I., Kolonin, G.V., Kiselev, A.N. & Matiushina, O.A. 1977. Distribution and ecology of *Ixodes pavlovskyi* (Ixodidae) in Alin. Parazitologiya, 11: 225–229. In Russian.
Chigirik, E.D., Istratkina, S.V., Biryukova, M.P. & Nekrasova, A.V. 1972. The occurrence of *Ixodes pavlovskyi* Pom. (Ixodoidea, Ixodidae) in Kemerovo District. Parazitologiya, 6: 305–306. In Russian, NAMRU-3 translation 570.
Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.

Filippova, N.A. & Ushakova, G.V. 1967. On the species of the group *Ixodes persulcatus* (Ixodidae, Parasitiformes). Parazitologiya, 1: 269–278. In Russian.

Moskvitina, N.S., Romanenko, V.N., Ternovoi, V.A., Ivanova, N.V., Protopopova, E.V., Kravchenko, L.B., Kononova, Yu. V., Kuranova, V.N., Chausov, E.A. Moskvitin, S.S., Pershikova, N.L., Gashkov, S.I., Konovalova, S.N., Bolshakova, N.P. & Loktev, V.B. 2008. Detection of West Nile virus and its genetic typing in ixodid ticks (Parasitiformes: Ixodidae) in Tomsk City and its suburbs. Parazitologiya, 42: 210–225. In Russian.

Ushakova, G.V. & Filippova, N.A. 1968. On the species of the genus *Ixodes persulcatus* group (Parasitiformes, Ixodidae). II. On the ecology of *I. pavlovskyi* from east Kazakhstan. Parazitologiya, 2: 334–338. In Russian.

Voloshina, I.V. 2010. Ticks (Ixodidae) of the Lazovsky Reserve. Proc. Sci. Conf devoted 75 Anniv. Lazovsky Reserve, Vladivostok, pp. 59–65. In Russian.

Yamauchi, T., Agetsuma, N., Araki, A. & Fukushima, M. 2012. Ixodid ticks collected from the raccoon dog *Nyctereutes procyonoides albus* and the common raccoon *Procyon lotor* in southern Hokkaido, Japan. Int. J. Acarol., 38: 214–216.

168 – *I. percavatus* Neumann, 1906 (Arch. Parasitol., 10: 195–219)

Type depositories: BMNH (syntypes) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: female, nymph, larva

Zoogeographic Region: islands in the Atlantic and Indian Oceans

Ecoregions: several island ecoregions associated with tundra

Hosts: Procellariiformes: Diomedeidae (ANL)
Passeriformes: Turdidae (L)
Procellariiformes: Pelecanoididae; Pelecaniformes: Hydrobatidae; Sphenisciformes: Spheniscidae (stages unknown)

Human infestation: no

Remarks: Camicas et al. (1998) consider this species, classified as *Scaphixodes percavatus*, Afrotropical-Australasian, but Halliday (2000) shows that *I. percavatus* is not an Australasian tick, and the alleged Australian *I. percavatus* are in fact *I. eudyptidis* and *I. kohlsi*. All records of this species are from islands so distant from any continent that we were unable to assign them to major zoogeographic regions. Mihalca et al. (2011) regard this tick as an endangered species. See also *I. eudyptidis*, *I. kerguelenensis* and *I. kohlsi*.

References

Anastos, G. 1954. Description of a tick, *Ixodes percavatus* Neumann, 1906, from Tristan da Cunha. Results Norw. Sci. Exped. Tristan da Cunha 1937–1938 (27): 1–4.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Halliday, B. 2000. *Ixodes* Latreille, 1795. Australian biological resources study. Canberra. http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/index/html/. Accessed February 12, 2008.
Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.
Paulian, P. 1953. Pinnipèdes, cétacés, oiseaux des Iles Kerguelen et Amsterdam. Mission Kerguelen 1951. Mém. Inst. Sci. Madagascar, Ser. A, Biol. Anim., 8: 111–234.

169 – *I. peromysci* Augustson, 1940 (Bull. South. Calif. Acad. Sci., 38: 141–147)
Type depositories: LACM (holotype, paratypes), USNTC (paratypes) (Augustson, G.F. 1940. A new *Ixodes* (Acarina: Ixodidae). Bull. South. Calif. Acad. Sci., 38: 141–147; Keirans and Clifford 1984, *op. cit.* under *I. amersoni*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Nearctic

Ecoregion: mediterranean forests of the California southern coast

Hosts: hosts for larvae, nymphs and adults are Rodentia: Cricetidae, while Squamata are considered exceptional hosts for this tick.
Rodentia: Cricetidae (ANL)
Muridae (NL)
Squamata: Anguidae (N)

Human infestation: no

Remarks: Durden and Keirans (1996) regard *I. peromysci* as an endangered species.

References

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.
Furman, D.P. & Loomis, E.C. 1984. The ticks of California (Acari: Ixodida). Bull. Calif. Insect Surv., 25: 1–239.
Lane, R.S., Miller, S.E. & Collins, P.W. 1982. Ticks (Acari: Argasidae and Ixodidae) from the California Channel Islands. Pan-Pacific Entomol., 58: 96–104.

170 – *I. persulcatus* Schulze, 1930 (Zool. Anz., 90: 294–303)
See *I. maslovi* and *I. sachalinensis*.

Type depository: WUM (holotype but apparently lost) (Schulze, P. 1930. Über einige Verwandte von *Ixodes ricinus* L. aus Ostasien. Zool. Anz., 90: 294–303). One of us (TNP) notes that the types at WUM appear to be lost. See also *I. ovatus*.

Known stages: male, female, nymph, larva

Zoogeographic Regions: Palearctic, Oriental

Ecoregions: several ecoregions associated with broad-leaf and taiga forests

Hosts: Mammalia (several orders); Aves (several orders); Squamata: Lacertidae (ANL)
Anura: Ranidae (A)
Squamata: Viperidae (stage unknown)

Human infestation: yes (Heath and Hardwick 2011 among others)

Remarks: Camicas et al. (1998) state that *I. persulcatus* is found only in the Palearctic Region, but there are *bona fide* records for the Oriental Region in Robbins (2005) that are supported by Chen et al. (2010), who include additional Oriental localities (Taiwan) in the distribution of *I. persulcatus*. Heath and Hardwick (2011) record the introduction of ticks of the *I. persulcatus* group into the Australasian Region, but there is no evidence that this tick has become established there. Infestation of Anura and Squamata by *I. persulcatus* appears to be an infrequent event, and these hosts are not included in Kolonin (2009).

References

Ai, C., Qiu, G., Shi, Z., Wu, X., Liu, X. & Zhao, J. 1991. Host associations and seasonal abundance of immature *Ixodes persulcatus* (Acari: Ixodidae) in a Lyme-disease- endemic area in China. Exp. Appl. Acarol., 12: 251–257.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Fedorov, V.G. 1970. Bloodsucking ticks on amphibians and reptiles in western Siberia. Tezisy Dokl. 2. Akarol. Sovesch. (2): 185–186. In Russian, NAMRU-3 translation 1493.

Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.

Heath, A.C.G. & Hardwick, S. 2011. The role of humans in the importation of ticks to New Zealand: a threat to public health and biosecurity. N. Zeal. Med. J., 124: 67–82.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Robbins, R.G. 2005. The ticks (Acari: Ixodida: Argasidae, Ixodidae) of Taiwan: a synonymic checklist. Proc. Entomol. Soc. Wash., 107: 245–253.

Sapegina, V.F., Dorontzova, V.A., Telegin, B.I., Ivleva, N.G. & Dobrotvorsky, A.K. 1984. Distribution of *Ixodes persulcatus* in the forest-park zone in the city of Novosibirsk. Parazitologiya, 19: 370–373.

Shilova, S.A. & Clabovsky, V.I. 1960. The species composition of vertebrate animals hosts of *Ixodes persulcatus* P. Sch. within the distribution area of this species. Byul. Mosk. Obshch. Ispyt. Prirod. Otd. Biol. New Ser., 65: 40–51. In Russian, NAMRU-3 translation 250.

Voloshina, I.V. 2010. Ticks (Ixodidae) of the Lazovsky Reserve. Proc. Sci. Conf devoted 75 Anniv. Lazovsky Reserve, Vladivostok, pp. 59–65. In Russian.

Yamaguti, N., Tipton, V.J., Keegan, H.L. & Toshioka, S. 1971. Ticks of Japan, Korea, and the Ryukyu Islands. Brigham Young Univ. Sci. Bull. Biol. Ser., 15 (1), 226 pp.

Yamauchi, T., Fukui, Y., Watanabe, M., Nakagawa, H. & Kamimura, K. 2010. Forty cases of human infestations with hard ticks (Acari: Ixodidae) in Toyama Prefecture, Japan. Med. Entomol. Zool., 61: 133–143. In Japanese.

Yamauchi, T., Agetsuma, N., Araki, A. & Fukushima, M. 2012. Ixodid ticks collected from the raccoon dog *Nyctereutes procyonoides albus* and the common raccoon *Procyon lotor* in southern Hokkaido, Japan. Int. J. Acarol., 38: 214–216.

171 – *I. petauristae* Warburton, 1933 (Parasitology, 24: 558–568)

Type depository: BMNH (holotype) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregions: Indian and Sri-Lankan lowland rain forests

Hosts: usual hosts for adult ticks are Rodentia: Sciuridae; usual hosts for larvae and nymphs are Rodentia: Muridae and Soricomorpha: Soricidae.
Rodentia: Sciuridae, Muridae, Hystricidae (ANL)
Artiodactyla: Cervidae, Tragulidae; Carnivora: Canidae, Felidae; Soricomorpha: Soricidae (NL)
Primates (unknown families); Aves (unknown orders) (stages unknown)

Human infestation: no

Remarks: Dilrukshi (2006) records Herpestidae and Alaudidae as hosts of *I. ceylonensis* and *I. petauristae* without stating clearly whether these hosts are shared by the two species. According to Senadhira (1969), both host families are parasitized by *I. ceylonensis*; consequently, we have excluded them from our host list for *I. petauristae*. See also *I. ceylonensis*. In a general comment in Rajagopalan (1965), Primates and Aves are considered to be hosts of *I. petauristae*.

References

Dilrukshi, P.R.M.P. 2006. Taxonomic status of ticks in Sri Lanka. *In* C.N.B. Bambaradeniya (editor), The fauna of Sri Lanka: status of taxonomy, research and conservation. The World Conservation Union, Colombo, Sri Lanka, pp. 65–69.

Hoogstraal, H. & Rack, G. 1967. Ticks (Ixodidae) collected by Deutsche Indien-Expedition, 1955–1958. J. Med. Entomol., 3: 284–288.

Rajagopalan, P.K. 1965. Description of the nymph and larva of *Ixodes petauristae* Warburton, 1933. J. Bombay Nat. Hist. Soc., 62: 174–176.

Rajagopalan, P.K., Patil, A.P. & Boshell, J. 1968. Ixodid ticks on their mammalian hosts in the Kyasanur Forest disease area of Mysore State, India, 1961–1964. Ind. J. Med. Res., 56: 510–526.

Senadhira, M.A.P. 1969. The parasites of Ceylon. V. Arthropoda, a host check list. Ceylon Vet. J., 17: 3–25.

172 – *I. philipi* Keirans & Kohls, 1970 (J. Med. Entomol., 7: 725–726)

Type depository: USNTC (holotype, paratype) (Keirans and Clifford 1984, *op. cit.* under *I. amersoni*)

Known stages: male, female

Zoogeographic Region: Palearctic

Ecoregion: Nihonkai montane deciduous forests

Hosts: usual hosts for adult ticks are Procellariiformes: Procellariidae.

Procellariiformes: Hydrobatidae, Procellariidae (A)

Human infestation: no

Remarks: Camicas et al. (1998) list the male of *I. philipi* (under the name *Scaphixodes philipi*) as undescribed; it was subsequently described by Takahashi et al. (2005), but this description is not recognized by Kolonin (2009).

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Dietrich, M., Gómez-Díaz, E. & McCoy, K.D. 2011. Worldwide distribution and diversity of seabird ticks: implications for the ecology and epidemiology of tick-borne pathogens. Vector-Borne Zoon. Dis., 11: 453–470.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Takahashi, M., Misumi, H., Tsurumi, M. & Uchikawa, K. 2005. *Ixodes philipi*: redescription of female and first description of male, with records from streaked shearwater in Japan (Acarina: Ixodidae). J. Med. Entomol., 42: 213–217.

173 – *I. pilosus* Koch, 1844 (Arch. Naturgersch., 10: 217–239)
See remarks below.

Type depository: ZMB (holotype) (Moritz and Fischer 1981, *op. cit.* under *I. acutitarsus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: several ecoregions associated with montane grasslands and shrublands; xeric shrublands in South Africa

Hosts: usual hosts for larvae, nymphs and adults are Artiodactyla: Bovidae.
Mammalia (several orders) (ANL)

Human infestation: yes (Horak et al. 2002 as *I. pilosus* group, see below)

Remarks: McKay (1994) believes that there are three species in the *I. pilosus* complex. According to Theiler (1962) and Morel (2003), several records of *I. pilosus* from the southern part of Africa need to be re-assessed because they do not belong to *I. pilosus s.s.*, while Santos Dias (1993) maintains that the same applies for most records from Mozambique. Phan Trong (1977) lists *I. pilosus* from the Oriental Region, but we believe that this diagnosis is in error and this region is not included within the range of this tick. Keirans and Durden (2001) report that *I. pilosus* had been introduced into the Nearctic Region, but there is no evidence that it has become established there. Theiler (1962) uses the term "immatures" without specifying whether larvae, nymphs or both stages were found on hosts.

References

Arthur, D.R. 1965. Ticks of the genus *Ixodes* in Africa. The Athlone Press, University of London, London, 348 pp.

Horak, I.G., Fourie, L.J., Heyne, H., Walker, J.B. & Needham, G.R. 2002. Ixodid ticks feeding on humans in South Africa: with notes on preferred hosts, geographic distribution, seasonal occurrence and transmission of pathogens. Exp. Appl. Acarol., 27: 113–136.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

McKay, I.J. 1994. Two new species of ixodid ticks closely related to *Ixodes pilosus* (Acari: Ixodidae). J. S. Afr. Vet. Assoc., 65:158.

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Phan Trong, C. 1977. Ve bet va con trung ky sinh o Viet Nam. Tap 1. Ve (Ixodoidea), mo ta va phan loai. Ha Noi: Khoa hoc va ky thuat, 489 pp. In Vietnamese.

Santos Dias, J.A.T. 1993. Some data concerning the ticks (Acarina-Ixodoidea) presently known in Mozambique. García de Orta Ser. Zool., 18: 27–48.

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.

174 – *I. pomerantzevi* Serdjukova, 1941 (Dokl. Akad. Nauk SSR, 32: 519–522. In Russian)

The name of this tick is written *I. pomerantzevi* by several authors, while others, including Guglielmone et al. (2009, *op. cit.* under *I. anatis*), use *I. pomeranzevi*, the name in the original description. However, the correct spelling is *pomerantzevi*, after the emendation of Pomerantzev (1950, *op. cit.* under *I. kashmiricus*), as explained in Guglielmone et al. (2010, *op. cit.* under *I. abrocomae*). See "remarks on some invalid names" at the beginning of this chapter for the alleged synonymy of *I. angulatus* and *I. pomerantzevi*.

Type depository: ZIAC (holotype) (Filippova 2008, *op. cit.* under *I. berlesei*). Originally named *I. pomeranzevi*

Known stages: female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: temperate broadleaf and mixed forests

Hosts: usual hosts for larvae and nymphs are Rodentia: Cricetidae.
Rodentia: Muridae, Sciuridae (ANL)
Carnivora: Canidae (A)
Rodentia: Cricetidae (NL)
Soricomorpha: Soricidae; Erinaceomorpha: Erinaceidae (stages unknown)

Human infestation: no

Remarks: Yang et al. (1997) state that *I. pomerantzevi* is common on Artiodactyla: Bovidae, but we feel that these records require confirmation and they have been excluded from our host list above. Robbins and Keirans (1992) consider records of *I. pomerantzevi* from Sciuridae and Canidae doubtful, but these records are included in Teng and Jiang (1991) and we regard them as provisionally valid.

References

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.

Kim, H.C., Kim, J.H., Jo, Y.S., Chong, S.T., Sames, W.J., Klein, T.A. & Robbins, R.G. 2009. Records of *Ixodes pomeranzevi* [sic] Serdjukova, 1941 (Acari: Ixodidae) from small mammals in northern Gyeonggi and Gangwon Provinces, Republic of Korea. Syst. Appl. Acarol., 14: 129–135.

Robbins, R.G. & Keirans, J.E. 1992. Systematics and ecology of the subgenus *Ixodiopsis* (Acari: Ixodidae: *Ixodes*). Thomas Say Publ. Entomol. Monogr. (14), 159 pp.

Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.

Yang, J.-Y., Yin, G.-R. & Fan, L.-C. 1997. Investigation and analysis of parasitic arthropods in flocks of sheep in Shaanxi Province. Chin. J. Vector Biol. Contr., 8: 27–29. In Chinese.

175 – *I. pomerantzi* Kohls, 1956 (J. Parasitol., 42: 636–649)

Type depositories: CNHM (holotype, paratype), USNTC (paratypes) (Kohls 1956, *op. cit.* under *I. andinus*)

Known stages: male, female

Zoogeographic Region: Neotropical

Ecoregions: Talamancan and eastern Cordillera Real montane forests in Panama and Peru; few ticks in subtropical coniferous forests

Hosts: Lagomorpha: Leporidae (AN)

Human infestation: no

Remarks: Camicas et al. (1998) and Kolonin (2009) list the nymph of *I. pomerantzi* as described, but this is not the case, as stated in Guglielmone et al. (2003). Nevertheless, Fairchild et al. (1966) present records of nymphs of *I. pomerantzi* from Leporidae that we consider provisionally valid. Durden and Keirans (1996) regard *I. pomerantzi* as an endangered species.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.

Fairchild, G.B., Kohls, G.M. & Tipton, V.J. 1966. The ticks of Panama (Acarina: Ixodoidea). *In* W.R. Wenzel & V.J. Tipton (editors), Ectoparasites of Panama. Field Museum of Natural History, Chicago, pp. 167–219.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

176 – *I. priscicollaris* Schulze, 1932 (Sber. Abh. Naturf. Ges. Rostock 1930–1932, 3: 104–126)

Type depository: although Schulze (1932, *op. cit.* under *I. luxuriosus*) states that the specimens of *I. priscicollaris* belong to ZMB they are not listed in Moritz and Fischer (1981, *op. cit.* under *I. acutitarsus*).

Known stages: female

Zoogeographic Region: Australasian

Ecoregion: New Guinean lowland rain forests

Hosts: Dasyuromorpha: Dasyuridae (A)

Human infestation: no

References

Filippova, N.A. 2010. Uncommon zoogeographical connections in the subgenus *Exopalpiger* Schultze [sic] of the genus *Ixodes* Latreille (Acari, Ixodidae). Entomol. Rev., 90: 793–797.

Hoogstraal, H. 1982. Ticks (Acari: Ixodoidea): a preliminary study. Monogr. Biol., 42: 537–544.

177 – *I. procaviae* Arthur & Burrow, 1957 (Bull. Mus. Comp. Zool., 116: 493–537)

Type depository: USNTC (holotype, paratypes) (Keirans and Clifford 1984, *op. cit*. under *I. amersoni*)

Known stages: male, female, nymph

Zoogeographic Region: Afrotropical

Ecoregions: Victoria Basin forest-savanna mosaic; southern *Acacia-Commiphora* bushlands and thickets

Hosts: usual hosts for nymphs and adult ticks are Hyracoidea: Procaviidae.
Hyracoidea: Procaviidae (AN)
Artiodactyla: Suidae (A)

Human infestation: no

Remarks: Morel (1965) considered the female of *I. ugandanus djaronensis* collected from Hyracoidea in Nuttall and Warburton (1911) to be *I. brumpti*, but Keirans (1985) reclassified it as *I. procaviae*. This specimen needs to be re-examined to settle the question of its identity. See also *I. brumpti*.

References

Elbl, A. & Anastos, G. 1966. Ixodid ticks (Acarina, Ixodidae) of Central Africa. Vol. II. Genus *Ixodes* Latreille, 1795. Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (146), 205 pp.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Morel, P.-C. 1965. Description de *Ixodes brumpti* n. sp. (Acariens, Ixodoidea) des Damans du Harrar (Éthiopie). Ann. Parasitol. Hum. Comp., 40: 215–218.

Nuttall, G.H.F. & Warburton, C. 1911. Ticks, a monograph of the Ixodoidea. Part II The Ixodidae. Section II Genus I. *Ixodes* Latreille 1795. Cambridge University Press, London, pp. 133–293.

Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.

178 – *I. prokopjevi* (Emel'yanova, 1979) (*In* Zooparasitology of Lake Baikal Bassin, M.V. Efimov & N.M. Pronim (editors), Akademy Nauk SSR, Ulan-Ude, pp. 5–27. In Russian)

Kolonin (2009, *op. cit*. under *I. arabukiensis*) expresses doubts about the validity of this species, referring to it as "? *I. prokopjevi*" under the name *I. crenulatus* without further elaboration. We agree with Guglielmone et al. (2010, *op. cit*. under *I. abrocomae*), who believe that there is no reason to declare *I. prokopjevi* an invalid name.

Type depository: unknown (Keirans and Robbins 1999, *op. cit.* under *I. myospalacis*) as *Pholeoixodes prokopjevi*.

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregion: trans-Baikal Bald Mountain tundra

Hosts: Erinaceomorpha: Erinaceidae (ANL)

Human infestation: no

Reference

Emel'yanova, N.D. 1979. Taxonomic status of ixodid ticks of the genus *Pholeoixodes* within the subfamily Ixodinae and its division into subgenera. *In* Zooparasitology of Lake Baikal Bassin. M.V. Efimov & N.M Pronin (editors). Akad. Nauk. SSSR, Sib. Otd. Buryat. Filial, Otd. Biol., Ulan-Ude, pp. 5–27. In Russian, NAMRU-3 translation 1739.

179 – *I. radfordi* Kohls, 1948 (J. Parasitol., 33: 497–498)

Type depositories: USNTC (holotype, paratypes), BMNH (paratype) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: male, female

Zoogeographic Region: Oriental

Ecoregions: northern Indochina subtropical forests; lower Gangetic plains moist deciduous forests

Hosts: Rodentia: Muridae (A)

Human infestation: no

References

Kohls, G.M. 1948. *Ixodes radfordi*, a new species of tick from rats in Eastern India (Acarina: Ixodida: Ixodidae). J. Parasitol., 33: 497–498.

Petney, T.N. & Keirans, J.E. 1994. Ticks of the genus *Ixodes* in South-east Asia. Trop. Biomed., 11: 123–134.

180 – *I. rageaui* Arthur, 1957 (Parasitology, 47: 544–559)

Type depositories: OVI (holotype, paratypes), MRCB (paratypes) (Arthur 1965, *op. cit.* under *I. arabukiensis*)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregions: Guinean forest-savanna mosaic; few ticks in west Sudanian savanna

Hosts: Primates: Cercopithecidae (A)

Human infestation: yes (Morel and Mouchet 1965)

References

Elbl, A. & Anastos, G. 1966. Ixodid ticks (Acarina, Ixodidae) of Central Africa. Vol. II. Genus *Ixodes* Latreille, 1795. Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (146), 205 pp.

Morel, P.-C. & Mouchet, J. 1965. Les tiques du Cameroun (Ixodidae et Argasidae) (2e. note). Ann. Parasitol. Hum. Comp., 40: 477–496.

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

Uilenberg, G., Estrada-Peña, A. & Thal, J. 2013. Ticks of the Central African Republic. Exp. Appl. Acarol., 60: 1–40.

181 – *I. randrianasoloi* Uilenberg & Hoogstraal, 1969 (Ann. Parasitol. Hum. Comp., 44: 93–96)

Type depository: USNTC (holotype) (Keirans and Clifford 1984, *op. cit.* under *I. amersoni*)

Known stages: female

Zoogeographic Region: Afrotropical

Ecoregion: Madagascar subhumid forests

Hosts: Afrosoricida: Tenrecidae; Rodentia: Muridae (A)

Human infestation: no

Reference

Uilenberg, G., Hoogstraal, H. & Klein, J.-M. 1979. Les tiques (Ixodoidea) de Madagascar et leur rôle vecteur. Arch. Inst. Pasteur Madagascar Num. Spéc., 153 pp.

182 – *I. rasus* Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)

Type depositories: ENV, ZMB (syntypes) (Nuttall and Warburton 1911, *op. cit.* under *I. acuminatus*); however, Moritz and Fischer (1981, *op. cit.* under *I. acutitarsus*) do not record them in the collection of ZMB.

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical moist broadleaf forests in central Africa; few ticks in Miombo woodlands

Hosts: Artiodactyla: Bovidae; Carnivora: Canidae, Herpestidae (ANL)

Mammalia (several orders) (AN)
Rodentia: Muridae, Sciuridae; Galliformes: Numididae (NL)
Hyracoidea: Procaviidae; Galliformes: Phasianidae; Cuculiformes: Cuculidae (N)
Passeriformes: Turdidae (L)

Human infestation: yes (Ntiamoa-Baidu et al. 2004)

Remarks: Camicas et al. (1998) list the nymph and larva as described, and Clifford et al. (1973) identified these stages from collected material, but we have been unable to locate any formal description of either the nymph or larva of *I. rasus*. Kolonin (2009) ignores Aves as hosts of *I. rasus*, but we provisionally accept the records of immature stages of *I. rasus* from these hosts (and also from mammals) in Morel and Mouchet (1965), Konstantinov et al. (1990) and Morel (2003). The data on hosts of the "immature stages" presented by Theiler (1962) are unclear and these hosts have not been included in our list above. Recently, Pourrut et al. (2011) found adults of *I. rasus* on Testudines: Testudinidae, but we believe that this record requires confirmation and it too has not been included in our host list.

References

Arthur, D.R. 1965. Ticks of the genus *Ixodes* in Africa. The Athlone Press, University of London, London, 348 pp.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Clifford, C.M., Sonenshine, D.E., Keirans, J.E. & Kohls, G.M. 1973. Systematics of the subfamily Ixodinae (Acarina: Ixodidae). 1. The subgenera of *Ixodes*. Ann. Entomol. Soc. Am., 66: 489–500.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Konstantinov, O.K., Balde, M.C., Tchounina, L.M., Mourzin, S.V., Popov, N.V. & Tchebotarev, A.N. 1990. Les tiques de la famille Ixodidae comme réservoir d'arbovirus en République de Guinée. I. Faune et écologie des tiques. Rev. Élev. Méd. Vét. Pays Trop., 43: 85–92.

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Morel, P.-C. & Mouchet, J. 1965. Les tiques du Cameroun (Ixodidae et Argasidae) (2e. note). Ann. Parasitol. Hum. Comp., 40: 477–496.

Ntiamoa-Baidu, Y., Carr-Saunders, C., Matthews, B.E., Preston, P.M. & Walker, A.R. 2004. An updated list of the ticks of Ghana and an assessment of the distribution of the ticks of Ghanaian wild mammals in different vegetation zones. Bull. Entomol. Res., 94: 245–260.

Ntiamoa-Baidu, Y., Carr-Saunders, C., Matthews, B.E., Preston, P.M. & Walker, A.R. 2005. Ticks associated with wild mammals in Ghana. Bull. Entomol. Res., 95: 205–219.

Pourrut, X., Emane, K.A., Camicas, J.-L., Leroy, E. & González, J.-P. 2011. Contribution to the knowledge of ticks (Acarina: Ixodidae) in Gabon. Acarologia, 51: 465–471.

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

183 – *I. redikorzevi* Olenev, 1927 (Dokl. Akad. Nauk SSR, A (14): 219–224. In Russian)

Kolonin (2009, *op. cit.* under *I. arabukiensis*) treats *I. redikorzevi* as a synonym of *I. acuminatus*, based on a comparison of female specimens of *I. acuminatus* from Italy and France and *I. redikorzevi* from the former USSR, but the holotype female of *I. redikorzevi* was not examined. Morel, P.-C. & Pérez, C. (1977. Morphologie des stases préimaginales des Ixodidae *s. str.* d'Europe occidentale IV. Généralité sur le sous-genre *Ixodes* (*Ixodes*), Acarologia, 19: 201–208) accept this synonymy, as does Morel (2003, *op. cit.* under *I. berlesei*), who considers it probable that *I. redikorzevi* is in fact a synonym of *I. acuminatus*, but we feel that further research is necessary to substantiate these claims, and any of such investigation must include comparison of types. Chen, Z., Yang, X., Bu, F., Yang, X, Yang, X. & Liu, J. (2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404) apparently agree with Kolonin (2009, *op. cit.* under *I. arabukiensis*) because they treat *I. acuminatus*, but not *I. redikorzevi*, as a member of the Chinese tick fauna. Keirans and Hillyard (2001, *op. cit.* under *I. anatis*) also doubt the validity of *I. redikorzevi*, but this name is accepted as valid here.

Type depository: ZIAC (holotype) (Filippova 2008, *op. cit.* under *I. berlesei*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: many ecoregions within the Palearctic Region

Hosts: Squamata and Testudines are considered exceptional hosts for this tick.
Erinaceomorpha: Erinaceidae; Lagomorpha: Leporidae; Rodentia (several families); Passeriformes: Fringillidae, Turdidae (ANL)
Carnivora: Canidae, Mustelidae; Galliformes: Phasianidae (AN)
Carnivora: Canidae; Aves (several orders); Squamata: Lacertidae (A)
Passeriformes: Corvidae, Paridae; Testudines: Emydidae (NL)
Chiroptera: Vespertilionidae; Soricomorpha: Soricidae; Passeriformes: Muscicapidae; Squamata: Anguidae, Colubridae, Viperidae (L)
Carnivora: Herpestidae (stages unknown)

Human infestation: yes (Emchuk, 1967; Bursali et al. 2012 among others)

Remarks: Camicas et al. (1998) list the nymph and larva of this species as undescribed, but both stages were well depicted in Filippova (1977). See also *I. eldaricus*. The records in Mitchell (1979) of *I. redikorzevi* from Herpestidae (no tick stage specified) probably refer to specimens found by Clifford et al. (1975) on "carnivores" that were classified as *I.* near *redikorzevi*. We regard Mitchell's (1979) records as provisionally valid. See also *I. acuminatus*.

References

Arthur, D.R. 1965. Ticks of the genus *Ixodes* in Africa. The Athlone Press, University of London, London, 348 pp.

Bakhaeva, A.V. 1962. The fauna of ticks in Turkmenia. Izv. Akad. Nauk Turkmen. Ser. Biol. Nauk. (5): 72–79. In Russian.

Bursali, A., Keskin, A. & Tekin, S. 2012. A review of the ticks (Acari: Ixodida) of Turkey: species diversity, hosts and geographical distribution. Exp. Appl. Acarol., 57: 91–104.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chen, Z., Yang, X., Bu, F., Yang, X, Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Clifford, C.M., Hoogstraal, H. & Keirans, J.E. 1975. The *Ixodes* ticks (Acarina: Ixodidae) of Nepal. J. Med. Entomol., 12: 115–137.

Emchuk, E.M. 1967. Certain biological peculiarities of *Ixodes redikorzevi* Olen. Tezisy Dokl. Nauch. Konf. Ukrain. Respub. Nauch. Obshch. Parasitol., Kiev, pp. 354–355. In Russian, NAMRU-3 translation 267.

Feider, Z. 1964. Les connaissances actuelles sur les Acariens de Roumanie (Ixodides, Gamasides et Trombiculides). Acarologia (Fasc. Hors Sér.): 262–274.

Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.

Filippova, N.A., Neronov, V.M. & Farhang-Azad, A. 1976. Materials on the fauna of ixodids (Acarina, Ixodidae) of small mammals in Iran. Entomol. Obozr., 55: 467–478. In Russian.

Grebenyuk, R.V. 1957. Vertical distribution of ixodid ticks of farm and wild animals in southern Kirgizia. Trud. Inst. Zool. Parasitol. Akad. Nauk Kirgiz. SSR (6): 201–213. In Russian, NAMRU-3 translation 242.

Mihalca, A.D., Dumitrache, M.O., Magdaş, C., Gherman, C.M., Domşa, C., Mircean, V., Ghira, I.V., Pocora, V., Ionescu, D.T., Sikó Barabási, S., Cozma, V. & Sandor, A.D. 2012. Synopsis of the hard ticks (Acari: Ixodidae) of Romania with update on host associations and geographical distribution. Exp. Appl. Acarol., 58: 183–206.

Mitchell, R.M. 1979. A list of ectoparasites from Nepalese mammals, collected during the Nepal ectoparasite program. J. Med. Entomol., 16: 227–233.

Pomerantzev, B.I. 1950. Ixodid ticks (Ixodidae). Fauna of USSR, Zool. Inst. Acad. Sci. USSR New Ser. (41), 224 pp. In Russian.

Theodor, O. & Costa, M. 1967. A survey of the parasites of wild mammals and birds in Israel. Part one. Ectoparasites. The Israel Academy of Sciences and Humanities, Jerusalem, 119 pp.

184 – *I. rhabdomysae* Arthur, 1959 (Rev. Zool. Bot. Afr., 59: 137–157)

Type depository: OVI (holotype, paratype) (Arthur 1959, *op. cit.* under *I. bedfordi*). Walker, J.B. (1991. A review of the ixodid ticks (Acari, Ixodidae) occurring

in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105), however, states that the holotype is not present in the OVI museum and is also not listed in the Onderstepoort Tick Collection Catalogue.

Known stages: female

Zoogeographic Region: Afrotropical

Ecoregions: Zambezian and Mopane woodlands

Hosts: Rodentia: Muridae; Soricomorpha: Soricidae (AN)
Rodentia: Nesomyidae; Macroscelidea: Macroscelididae (A)

Human infestation: no

Remarks: Cumming (1998) lists Rodentia as the only hosts infested by this tick, but *bona fide* records from other types of hosts infested by *I. rhabdomysae* are included in the references cited below. Kolonin (2009) lists the larva as the only stage of *I. rhabdomysae* that has not been described. Colbo and MacLeod (1976) found males and what they believed to be nymphs of *I. rhabdomysae* in their study of the ticks of Zambia, but we have been unable to locate any formal description of the immature stages.

References

Arthur, D.R. 1965. Ticks of the genus *Ixodes* in Africa. The Athlone Press, University of London, London, 348 pp.

Colbo, M.H. & MacLeod, J. 1976. Ecological studies of ixodid ticks (Acari, Ixodidae) in Zambia. II. Ticks found on small mammals and birds. Bull. Entomol. Res., 66: 489–500.

Cumming, G.S. 1998. Host preference in African ticks (Acari: Ixodida): a quantitative data set. Bull. Entomol. Res., 88: 379–406.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.

185 – *I. ricinus* (Linnaeus, 1758) (*In Systema naturae per regna tria naturae*, *secundum classes*, *ordines*, *genera*, *species cum characteribus*, *differentiis*, *synonymis*, *locis*. Editio decima, reformata. Holmiae, 1, 823 pp).
See remarks below.

Type depositories: LC (lost), BMNH (“electotype” [sic]) (Arthur 1965, *op. cit.* under *I. arabukiensis*) as *Acarus ricinus*. See also *I. ovatus*.

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: several Palearctic ecoregions, commonly associated with broadleaf temperate forests

Hosts: Aves and Squamata are considered exceptional hosts for adults of this tick, while Testudines are considered exceptional hosts for all stages of this tick.
Mammalia (several orders); Galliformes: Phasianidae; Falconiformes: Accipitridae; Passeriformes (several families); Squamata: Lacertidae (ANL)
Testudines: Testudinidae (A)
Aves (several orders); Squamata: Viperidae (NL)
Gruiformes: Rallidae; Testudines: Emydidae (N)
Squamata: Colubridae (stage unknown)

Human infestation: yes (Estrada-Peña and Jongejan 1999; Heath and Hardwick 2011, among others)

Remarks: Noureddine et al. (2011) stress that the genetic structure of populations of *I. ricinus* suggests that allopatric speciation is developing. There are many references to *I. ricinus* from all zoogeographic regions. Some are the result of accidental introductions of ticks that failed to become established outside the Palearctic Region, but most are due to incorrect identification, especially in papers published before 1950, although misdeterminations of *I. ricinus* also appear later than 1950, as in Phan Trong (1977) for the Oriental Region, or in recently published papers (*e.g.*, Juvenal and Edward 2010 for the Afrotropical Region). Kolonin (2009) does not include hosts other than mammals for adults of *I. ricinus*, probably because non-mammalian records are rare.

References

Arthur, D.R. 1963. British ticks. Butterworths, London , 213 pp.
Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.
Estrada-Peña, A. & Jongejan, F. 1999. Ticks feeding on humans: a review of records on human-biting Ixodoidea with special reference to pathogen transmission. Exp. Appl. Acarol., 23: 685–715.
Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.
Heath, A.C.G. & Hardwick, S. 2011. The role of humans in the importation of ticks to New Zealand: a threat to public health and biosecurity. N. Zeal. Med. J., 124: 67–82.
Jaenson, T.G.T., Talleklint, L., Lundqvist, L., Olsen, B., Chirico, J. & Mejlon, H. 1994. Geographical distribution, host associations, and vector roles of ticks (Acari: Ixodidae, Argasidae) in Sweden. J. Med. Entomol., 31: 240–256.
Juvenal, N. & Edward, M. 2010. Seasonal dynamics and distribution of ticks in Rwanda: implications for tick control strategy in Rwanda. Int. J. Anim. Vet. Adv., 2: 21–25.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Krčmar, S. 2012. Hard ticks (Acari, Ixodidae) of Croatia. ZooKeys, 234: 19–57.
Mihalca, A.D., Dumitrache, M.O., Magdaş, C., Gherman, C.M., Domşa, C., Mircean, V., Ghira, I.V., Pocora, V., Ionescu, D.T., Sikó Barabási, S., Cozma, V. & Sandor, A.D. 2012. Synopsis of the hard ticks (Acari: Ixodidae) of Romania with update on host associations and geographical distribution. Exp. Appl. Acarol., 58: 183–206.

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.
Noureddine, R., Chauvin, A. & Plantard, O. 2011. Lack of genetic structure among Eurasian populations of the tick *Ixodes ricinus* contrasts with marked divergence from north- African populations. Int. J. Parasitol., 41: 183–192.
Phan Trong, C. 1977. Ve bet va con trung ky sinh o Viet Nam. Tap 1. Ve (Ixodoidea), mo ta va phan loai. Ha Noi: Khoa hoc va ky thuat, 489 pp. In Vietnamese.
Serdjukova, G.V. 1956. Ixodid ticks of the fauna of USSR. Opred. Faune SSSR. Zool. Inst. Akad. Nauk SSSR (64), 121 pp. In Russian.

186 – *I. rothschildi* Nuttall & Warburton, 1911 (*In* Ticks, a monograph of the Ixodoidea. Part II The Ixodidae. Section II Genus I. *Ixodes* Latreille, 1795. Cambridge University Press, London, pp. 133–348)

Type depository: BMNH (syntypes) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*) as *I. percavatus rothschildi*. The lectotype and paralectotypes for *I. rothschildi* were selected (Keirans, J.E. & Brewster, B.E. 1981. The Nuttall and British Museum (Natural History) tick collections: lectotype designations for ticks (Acarina: Ixodoidea) described by Nuttall, Warburton, Cooper & Robinson. Bull. Br. Mus. Nat. Hist. (Zool.), 41: 153–178), but ignored in Keirans and Hillyard (2001, *op. cit.* under *I. anatis*).

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregion: Celtic broadleaf forests

Hosts: Procellariiformes: Procellariidae; Charadriiformes: Alcidae (ANL)
Charadriiformes: Laridae (AN)
Pelecaniformes: Phalacrocoracidae (stage unknown)

Human infestation: no

Remarks: Nuttall and Warburton (1911) and Nuttall (1916) refer to this tick as *I. percavatus rothschildi*. There is a report of *I. rothschildi* from Tristan da Cunha Island in Zumpt (1952) that is repeated in Hänel and Heyne (2008), but the specimen that was found on this island is the type of *I. diomedeae*. See *I. diomedeae*.

References

Arthur, D.R. 1955. The larva of *Ixodes rothschildi* Nuttall & Warburton, 1911. Ann. Mag. Nat. Hist. Ser. 12, 8: 711–712.
Arthur, D.R. 1963. British ticks. Butterworths, London , 213 pp.
Arthur, D.R. 1958. A review of some ticks (Acarina: Ixodidae) of sea birds, including a consideration of other cognate material. I. Parasitology, 48: 124–130
Dietrich, M., Gómez-Díaz, E. & McCoy, K.D. 2011. Worldwide distribution and diversity of seabird ticks: implications for the ecology and epidemiology of tick-borne pathogens. Vector-Borne Zoon. Dis., 11: 453–470.
Hänel, C. & Heyne, H. 2008. Ticks of the Tristan da Cunha Archipelago (Acarina: Ixodidae: Argasidae). Beitr. Entomol., 58: 121–134.

Nuttall, G.H.F. 1916. Notes on ticks. IV. Relating to the genus *Ixodes* and including a description of three new species and two new varieties. Parasitology, 8: 294–337.
Nuttall, G.H.F. & Warburton, C. 1911. Ticks, a monograph of the Ixodoidea. Part II The Ixodidae. Section II Genus I. *Ixodes* Latreille 1795. Cambridge University Press, London, pp. 133–293.
Nuttall, P.A., Kelly, T.C., Carey, D., Moss, S.R. & Harrar, K.A. 1984. Mixed infections with tick- borne viruses in a sea bird colony in Eire. Arch. Virol., 79: 35–44.
Zumpt, F. 1952. Australian National Antarctic Research Expedition Reports, Series B, Volume 1, Zoology, pp. 12–20.

187 – *I. rotundatus* Arthur, 1958 (Parasitology, 48: 38–69)

Type depository: OVI (holotype, paratypes) (Arthur 1965, *op. cit.* under *I. arabukiensis*)

Known stages: female

Zoogeographic Region: Afrotropical

Ecoregions: Victoria Basin forest-savanna mosaic; few ticks in east African montane forests

Hosts: usual hosts for adult ticks are Rodentia: Spalacidae.
Rodentia: Spalacidae; Artiodactyla: Bovidae (A)

Human infestation: no

Remarks: Kolonin (2009) does not include Bovidae as hosts for this tick, probably because Matthysse and Colbo (1987) consider this record doubtful. We regard Bovidae as provisionally valid hosts of *I. rotundatus*.

References

Elbl, A. & Anastos, G. 1966. Ixodid ticks (Acarina, Ixodidae) of Central Africa. Vol. II. Genus *Ixodes* Latreille, 1795. Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (146), 205 pp.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Matthysse, J.G. & Colbo, M.H. 1987. The ixodid ticks of Uganda. Entomological Society of America, College Park, Maryland, 426 pp.

188 – *I. rubicundus* Neumann, 1904 (Arch. Parasitol., 8: 444–464)

Type depositories: ENV, OVI (syntypes) (Nuttall and Warburton 1911, *op. cit.* under *I. acuminatus*; Arthur 1965, *op. cit.* under *I. arabukiensis*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: several ecoregions associated with South African Karoo, grasslands and shrubs

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae and Carnivora: Felidae; usual hosts for nymphs and larvae are Lagomorpha: Leporidae, Macroscelidea: Macroscelididae, and Carnivora: Felidae. Aves are considered exceptional hosts for this tick.
Artiodactyla: Bovidae; Carnivora: Felidae; Lagomorpha: Leporidae (ANL)
Carnivora: Canidae, Hyaenidae (AN)
Passeriformes: Ploceidae (AL)
Macroscelidea: Macroscelididae; Rodentia: Muridae (NL)
Perissodactyla: Equidae; Rodentia: Nesomyidae; Passeriformes: Alaudidae (L)
Hyracoidea: Procaviidae (N and/or L)

Human infestation: yes (Horak et al. 2002)

Remarks: Theiler (1962) and Arthur (1965) use the term "immatures" without specifying whether larvae, nymphs or both parasitic stages were found on hosts. Kolonin (2009) ignores Aves as hosts of adults and larvae of *I. rubicundus*, but we accept the few avian records of this tick in Van Niekerk et al. (2006).

References

Arthur, D.R. 1965. Ticks of the genus *Ixodes* in Africa. The Athlone Press, University of London, London, 348 pp.
Fourie, L.J., Horak, I.G. & Woodall, P.F. 2005. Elephant shrews as hosts of immature ixodid ticks. Onderstepoort J. Vet. Res., 72: 293–301.
Horak, I.G., Moolman, L.C. & Fourie, L.J. 1987. Some wild hosts of the Karoo paralysis tick, *Ixodes rubicundus* Neumann, 1904 (Acari: Ixodidae). Onderstepoort J. Vet. Res., 54: 49–51.
Horak, I.G., Fourie, L.J., Heyne, H., Walker, J.B. & Needham, G.R. 2002. Ixodid ticks feeding on humans in South Africa: with notes on preferred hosts, geographic distribution, seasonal occurrence and transmission of pathogens. Exp. Appl. Acarol., 27: 113–136.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.
Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.
Van Niekerk, D.J., Fourie, L.J. & Horak, I.G. 2006. Birds as hosts of immature ixodid ticks in Free State Province, South Africa. Onderstepoort J. Vet. Res., 73: 123–130.

189 – *I. rubidus* Neumann, 1901 (Mém. Soc. Zool. Fr., 14: 249–372)
See remarks below.

Type depository: ENV (syntypes) (Nuttall and Warburton 1911, *op. cit.* under *I. acuminatus*)

Known stages: female, nymph

Zoogeographic Regions: Nearctic, Neotropical

Ecoregions: tropical and subtropical broadleaf and conifer forests

Hosts: Carnivora: Procyonidae (ANL)
Carnivora: Canidae, Mephitidae (AN)
Carnivora: Mustelidae; Didelphimorphia: Didelphidae; Rodentia: Myocastoridae (A)

Human infestation: no

Remarks: Clifford et al. (1973) state that *I. rubidus* is a Nearctic species (under the name *I. rubidis*), while Camicas et al. (1998), who classify this species as *Pholeoixodes rubidus*, assert that it occurs exclusively in the Neotropical Region. This tick is present in both the Nearctic and Neotropical Regions, as discussed in Guglielmone et al. (2003). The larva of *I. rubidus* remains undescribed, although Camicas et al. (1998) state the contrary, and there are larval records of this tick from Procyonidae in Fairchild et al. (1966) that we consider provisionally valid. The record of *I. rubidus* from Rodentia in Keirans (1985) is ignored by Kolonin (2009).

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Clifford, C.M., Sonenshine, D.E., Keirans, J.E. & Kohls, G.M. 1973. Systematics of the subfamily Ixodinae (Acarina: Ixodidae). 1. The subgenera of *Ixodes*. Ann. Entomol. Soc. Am., 66: 489–500.

Fairchild, G.B., Kohls, G.M. & Tipton, V.J. 1966. The ticks of Panama (Acarina: Ixodoidea). *In* W.R. Wenzel & V.J. Tipton (editors), Ectoparasites of Panama. Field Museum of Natural History, Chicago, pp. 167–219.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Guzmán-Cornejo, C., Robbins, R.G. & Pérez, T.M. 2007. The *Ixodes* (Acari: Ixodidae) of Mexico: parasite-host and host-parasite checklists. Zootaxa, 1553: 47–58.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

190 – *I. rugicollis* Schulze & Schlottke, 1929 (Sber. Abh. Naturf. Ges. Rostock 1927–1929, 2: 95–110)

The year of description of *I. rugicollis* is 1930 for some authors and 1929 for others. Guglielmone et al. (2010, *op. cit.* under *I. abrocomae*) consider 1930 correct. Recently, one of us (TNP) noted that the date of publication of the issue that contains the description of *I. rugicollis* is November 30, 1929. See *I. cornutus* at the beginning of this chapter. Clifford et al. (1973, *op. cit.* under *I. cooleyi*) doubt the

validity of *I. rugicollis*, but it is indeed a sound species, as described in Aubert, M.-F.-A. (1977. Description du mâle de *Pholeoixodes rugicollis* (Schulze et Schlottke, 1929) (Acariens, Ixodina). Ann. Parasitol. Hum. Comp., 52:481–490), among others. See also remarks below.

Type depository: USNTC (syntypes) (Keirans and Clifford 1984, *op. cit.* under *I. amersoni*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregion: western European broadleaf forests

Hosts: usual hosts for larvae, nymphs and adults are Carnivora: Canidae and Mustelidae.
Carnivora: Canidae, Mustelidae (ANL)
Carnivora: Felidae (AN)

Human infestation: no

Remarks: Toutoungi et al. (1991) classify *I. rugicollis* as *Pholeoixodes rugicollis*.

References

Aubert, M.F.A. 1981. Breeding of the tick *Ixodes* (*Pholeoixodes*) *rugicollis* (Acari: Ixodidae) under laboratory conditions. J. Med. Entomol., 4: 324–327.

Siuda, K., Nowak, M. & Gierczak, M. 2010. Confirmation of occurrence of *Ixodes* (*Pholeoixodes*) *rugicollis* Schulze et Schlottke, 1929 (Acari: Ixodidae) in Poland, including the morphological description and diagnostic features of this species. Wiad. Parazytol., 56: 77–80.

Toutoungi, L.N., Gern, L., Aeschlimann, A. & Debrot, S. 1991. À propos du genre *Pholeoixodes*, parasite des carnivores en Suisse. Acarologia, 32: 311–328.

191 – *I. rugosus* Bishopp, 1911 (Proc. Biol. Soc. Wash., 24: 197–208)

Type depository: USNTC (lectotype) (Keirans and Clifford 1984, *op. cit.* under *I. amersoni*), originally referred to as *I. cookei rugosus*.

Known stages: male, female, nymph, larva

Zoogeographic Region: Nearctic

Ecoregion: temperate conifer forests of coastal western USA

Hosts: usual hosts for larvae, nymphs and adults are Carnivora: Canidae, while Mephitidae, Didelphimorphia and Rodentia are considered exceptional hosts for this tick.
Carnivora: Canidae, Mephitidae (ANL)
Carnivora: Felidae, Mustelidae, Procyonidae (AN)
Didelphimorphia: Didelphidae; Rodentia: Sciuridae (A)

Human infestation: yes (Furman and Loomis 1984)

Remarks: Bishopp and Trembley (1945) refer to this species as *I. cookei rugosus*. Kolonin (2009) lists the larva of *I. rugosus* as undescribed, but this stage was earlier described by Bennett et al. (1989). Kolonin (2009) ignores the few records from Didelphimorphia and Rodentia in Bishopp and Trembley (1945) and Furman and Loomis (1984), respectively. Walters and Roth (1950) found *I. rugosus* in the nests of cricetid rodents (tick stages not stated), but this record is probably incidental and has not been included in our analyses.

References

Bennett, S.G., Webb, J.P. & Collins, P.W. 1989. *Ixodes rugosus* Bishopp (Acari: Ixodidae): description of larvae from Santa Rosa Island, California. Bull. Soc. Vector Ecol., 14: 262–265.

Bishopp, F.C. & Trembley, H.L. 1945. Distribution and hosts of certain North American ticks. J. Parasitol., 31: 1–54.

Cooley, R.A. & Kohls, G.M. 1945. The genus *Ixodes* in North America. Natl. Inst. Health Bull. (184), 246 pp.

Furman, D.P. & Loomis, E.C. 1984. The ticks of California (Acari: Ixodida). Bull. Calif. Insect Surv., 25: 1–239.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Walters, R.D. & Roth, V.D. 1950. Faunal nest study of the wood rat, *Neotoma fuscipes monochroura* Rhoads. J. Mammal., 31: 290–292.

192 – *I. sachalinensis* Filippova, 1971 (Entomol. Obozr., 50: 236–239. In Russian)
Kolonin (2009, *op. cit.* under *I. arabukiensis*) follows Camicas et al. (1998, *op. cit.* under *I. anatis*) and treats *I. sachalinensis* as a synonym of *I. persulcatus*. However, these authors provide no evidence to back their claim, as noted by Guglielmone et al. (2009, *op. cit.* under *I. anatis*). We consider *I. sachalinensis* a valid species.

Type depository: ZIAC (holotype) (Filippova 2008, *op. cit.* under *I. berlesei*)

Known stages: female

Zoogeographic Region: Palearctic

Ecoregion: Sakhalin Island taiga

Hosts: Lagomorpha: Leporidae (A)

Human infestation: no

References

Filippova, N.A. 1971. A new species of ixodid tick, *Ixodes sachalinensis*, sp. n. (Ixodoidea, Ixodidae), from Sakhalin. Entomol. Obozr., 50: 236–239. In Russian, translation in Entomol. Rev., 50: 136–138.

Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.

193 – *I. scapularis* Say, 1821 (J. Acad. Nat. Sci. Philadelphia, 2: 59–82)
The name *I. scapularis* on page 153 of Camicas et al. (1998, *op. cit.* under *I. anatis*) is unrelated to *I. scapularis* Say, 1821 because it is a *lapsus* for *I. scapulatus* Mégnin, 1880 which is a *nomen dubium*. See also below.

Type depository: USNTC (neotype) (Keirans and Clifford 1984, *op. cit.* under *I. amersoni*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Nearctic, Neotropical

Ecoregions: several Palearctic and Neotropical ecoregions

Hosts: Aves and Squamata are considered exceptional hosts for adults of this tick, while Testudines are exceptional hosts for nymphs.
Mammalia (several orders); Passeriformes: Corvidae (ANL)
Squamata (unknown family for a lizard) (A)
Passeriformes (several families); Galliformes: Odontophoridae; Squamata: Anguidae, Scincidae (NL)
Testudines: Emydidae (N)

Human infestation: yes (Reeves et al. 2007 among others)

Remarks: several authors prior to Oliver et al. (1993) used the name *I. dammini* Spielman, Clifford, Piesman and Corwin, 1979 for *I. scapularis*, and some, such as Niu et al. (2011), still do. Bishopp and Trembley (1945) refer to this species as *I. ricinus scapularis*. Guglielmone et al. (2003) state that this species is found only in the Nearctic Region, but Guzmán-Cornejo et al. (2007) present *bona fide* records for the Neotropical Region. Romero-Castañón et al. (2008) believe that their records of *I. scapularis* are the first for Mexico, but the first Mexican record is that of Chavarría (1941) (as *I. ricinus scapularis*), and other records also precede Romero-Castañón et al. (2008). Hoyle et al. (2001), among others, report the introduction of this species into the Palearctic Region, but there is no evidence that *I. scapularis* has become established there. Infestation of Aves and Squamata by adult *I. scapularis* appears to be an infrequent event; the same applies to infestation of Testudines by nymphs of this tick, and such occasional records are ignored in Kolonin (2009). Scott et al. (2012) determined that five questing nymphs of *I. scapularis* had ingested blood from wild turkey (*Meleagris gallopavo*) as larvae – data that we feel should be confirmed through additional studies. See also *I. sculptus*.

References

Bishopp, F.C. & Trembley, H.L. 1945. Distribution and hosts of certain North American ticks. J. Parasitol., 31: 1–54.

Chavarría, C. M. 1941. Garrapatas determinadas en México. Caracteres genéricos de las más comunes. Rev. Inst. Pecu., 1: 18–24.

Cooley, R.A. & Kohls, G.M. 1945. The genus *Ixodes* in North America. Natl. Inst. Health Bull. (184), 246 pp.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication

of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Guzmán-Cornejo, C., Robbins, R.G. & Pérez, T.M. 2007. The *Ixodes* (Acari: Ixodidae) of Mexico: parasite-host and host-parasite checklists. Zootaxa, 1553: 47–58.

Hamer, S.A., Goldberg, T.L., Kitron, U.D., Brawn, J.D., Anderson, T.K., Loss, S.R., Walker, E.D. & Hamer, G.L. 2012. Wild birds and urban ecology of ticks and tick-borne pathogens, Chicago, Illinois, USA, 2005–2010. Emerg. Inf. Dis., 18: 1589–1595.

Hoyle, D.V., Walker, A.R., Craig, P.S. & Woolhouse, M.E.J. 2001. Survey of parasite infections not endemic to the United Kingdom in quarantined animals. Vet. Rec., 149: 457–458.

Keirans, J.E., Hutcheson, H.J., Durden, L.A. & Klompen, J.S.H. 1996. *Ixodes* (*Ixodes*) *scapularis* (Acari: Ixodidae): redescription of all active stages, distribution, hosts, geographical variation, and medical and veterinary importance. J. Med. Entomol., 33: 297–318.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Niu, Q., Guan, G., Yang, J., Fu, Y., Xu, Z., Li, Y., Ma, M., Liu, Z., Liu, J., Ren, Q., Jorgensen, W., Luo, J. & Yin, H. 2011. Detection and differentiation of *Borrelia burgdorferi* sensu lato in ticks collected from sheep and cattle in China. BMC Vet. Res., 7 (17), 9 pp.

Oliver, J.H., Owsley, M.R., Hutcheson, H.J., James, A.M., Chen, C., Irby, W.S., Dotson, E.M. & Mclain, D. K. 1993. Conspecificity of the ticks *Ixodes scapularis* and *I. dammini* (Acari: Ixodidae). J. Med. Entomol., 30: 54–63.

Reeves, W.K., Durden, L.A., Ritzi, C.M., Beckham, K.R., Super, P.E., Connor, B.M. 2007. Ectoparasites and other ectosymbiotic arthropods of vertebrates in the Great Smoky Mountains National Park, USA. Zootaxa, 1392: 31–68.

Romero-Castañón, S., Ferguson, B.G., Güiris, D., González, D., López, S., Paredes, A. & Webber, M. 2008. Comparative parasitology of wild and domestic ungulates in the Selva Lacandona, Chiapas, México. Comp. Parasitol., 75: 115–126.

Scott, C.M., Harmon, J.R., Tsao, J.I., Jones, C.J. & Hickling, G.J. 2012. Reverse line blot probe design and polymerase chain reaction optimization for bloodmeal analysis of ticks from the eastern United States. J. Med. Entomol., 49: 697–709.

Scott, J.D., Anderson, J.F. & Durden, L.A. 2012. Widespread dispersal of *Borrelia burgdorferi*- infected ticks collected from songbirds across Canada. J. Parasitol., 98: 49–59.

Sylvester, T.L., Hoffman, J.D. & Lyons, E.K. 2012. Diet and ectoparasites of the southern short- tailed shrew (*Blarina carolinensis*) in Louisiana. West. N. Am. Nat., 72: 586–590.

Tugwell, P. & Lancaster, J.L. 1962. Results of a tick-host study in northwest Arkansas. J. Kansas Entomol. Soc., 35: 202–211.

194 – *I. schillingsi* Neumann, 1901 (Mém. Soc. Zool. Fr., 14: 249–372)

Type depositories: BMNH, ZMB (syntypes) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregion: East Sudanian savanna

Hosts: usual hosts for larvae, nymphs and adults are Primates: Cercopithecidae.
Primates: Cercopithecidae (ANL)
Rodentia: Cricetidae, Sciuridae (A)
Primates: Galagidae (NL)
Hyracoidea: Procaviidae (stage unknown)

Human infestation: yes (Burridge 2011)

Remarks: Keirans and Durden (2001) and Burridge (2011) record *I. schillingsi* as having been introduced into the Nearctic Region on Procaviidae (tick stage unknown), but there is no evidence that it has become established there. Records from Muridae are doubtful according to Arthur (1965), and we have excluded them from the list above. Burridge (2011) includes the record of *I. schillingsi* from Muridae, but ignores the record from Sciuridae in Norval et al. (1987), which we consider valid. Kolonin (2009) ignores records from hosts other than Primates. Mihalca et al. (2011) regard this tick as endangered.

References

Arthur, D.R. 1965. Ticks of the genus *Ixodes* in Africa. The Athlone Press, University of London, London, 348 pp.

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Hoogstraal, H. & Theiler, G. 1959. Ticks (Ixodoidea, Ixodidae) parasitizing lower primates in Africa, Zanzibar and Madagascar. J. Parasitol., 45: 217–222.

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

Norval, R.A.I., Spickett, A.M. & Clifford, C.M. 1987. The ticks of Zimbabwe. XVI. The genus *Ixodes*. Zimbabwe Vet. J., 18: 1–10.

195 – *I. schulzei* Aragão & Fonseca, 1951 (Mem. Inst. Oswaldo Cruz, 49: 567–574)
Clifford et al. (1973, *op. cit.* under *I. cooleyi*) doubt the validity of *I. schulzei*, but this is a valid species, as stated in Guglielmone et al. (2003, *op. cit.* under *I. cookei*), among others. See remarks below.

Type depository: IOC (holotype, paratypes) (Barros-Battesti and Knysak 1999, *op. cit.* under *I. affinis*)

Known stages: female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: Rodentia: Cricetidae (ANL)

Human infestation: no

Remarks: Camicas et al. (1998) list the larva and nymph of *I. schulzei* as undescribed. However, both stages were subsequently described by Barros-Batesti et al. (2007). These authors, as well as Kolonin (2009), state that the natural hosts for larvae and nymphs are cricetid rodents, but the larva and nymph of *I. schulzei* were known only from laboratory reared-specimens (Barros-Battesti et al. 2007) until 2013, when records of nymphs and larvae of *I. schulzei* from cricetid rodents in southern Brazil were published by Onofrio et al. (2013).

References

Barros-Battesti, D.M., Onofrio, V.C., Faccini, J.L.H., Labruna, M.B., Arruda-Santos, A.D. & Giacomin, F.G. 2007. Description of the immature stages and redescription of the female of *Ixodes schulzei* Aragão & Fonseca, 1951 (Acari: Ixodidae), an endemic tick species of Brazil. Syst. Parasitol., 68: 157–166.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Labruna, M.B., Silva, M.N.J. da, Oliveira, M.F. de, Barros-Battesti, D.M. & Keirans, J.E. 2003. New records and laboratory-rearing data for *Ixodes schulzei* (Acari: Ixodidae) in Brazil. J. Med. Entomol., 40: 116–118.

Onofrio, V.C., Barros-Battesti, D.M., Labruna, M.B. & Faccini, J.L.H. 2009. Diagnoses of and illustrated key to the species of *Ixodes* Latreille, 1795 (Acari: Ixodidae) from Brazil. Syst. Parasitol., 72: 143–157.

Onofrio, V.C., Nieri-Bastos, F.A., Sampaio, J.S., Soares, J.F., Silva, M.J.J. & Barros-Battesti, D.M. 2013. Noteworthy records of *Ixodes schulzei* (Acari: Ixodidae) on rodents from the State of Parana, southern Brazil. Rev. Bras. Parasitol. Vet., 22 (1): 159–161.

196 – *I. sculptus* Neumann, 1904 (Arch. Parasitol., 8: 444–464)

Type depository: USNTC (holotype) (Keirans and Clifford 1984, *op. cit.* under *I. amersoni*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Nearctic

Ecoregions: temperate conifer forests; few ticks in temperate grasslands, savannas and shrublands

Hosts: usual hosts for larvae, nymphs and adults are Rodentia: Sciuridae. Artiodactyla and Aves are considered exceptional hosts for this tick.

Carnivora: Mustelidae, Mephitidae, Procyonidae; Rodentia: Sciuridae, Geomyidae, Muridae; Lagomorpha: Leporidae (ANL)
Carnivora: Felidae (AN)
Carnivora: Canidae; Artiodactyla: Bovidae; Galliformes: Odontophoridae (A)
Rodentia: Cricetidae, Dipodidae, Ochotonidae (NL)
Rodentia: Heteromyidae (N)

Human infestation: yes (Salkeld et al. 2006)

Remarks: Chamberlin (1937) confused the hosts of *I. scapularis* in Hooker et al. (1912) with those of *I. sculptus*. Parasitism of Bovidae and Aves by *I. sculptus* is a rare event reported in Salkeld et al. (2009) and Furman and Loomis (1984), respectively, but these hosts are not included in Kolonin (2009).

References

Allred, D.M., Beck, D.E. & White, L.D. 1960. Ticks of the genus *Ixodes* in Utah. Brigham Young Univ. Sci. Bull. Biol. Ser., 1 (4), 42 pp.
Chamberlin, W.J. 1937. The ticks of Oregon. Agric. Exp. Stn. Bull. (349), 34 pp.
Furman, D.P. & Loomis, E.C. 1984. The ticks of California (Acari: Ixodida). Bull. Calif. Insect Surv., 25: 1–239.
Hooker, W.A., Bishopp, F.C. & Wood, H.P. 1912. The life history and bionomics of some North American ticks. Bull. Bur. Entomol. U. S. Dept. Agric. (106), 239 pp.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Salkeld, D.J., Eisen, R.J., Antolin, M.F., Stapp, P. & Eisen, L. 2006. Host usage and seasonal activity patterns of *Ixodes kingi* and *I. sculptus* (Acari: Ixodidae) nymphs in a Colorado prairie landscape, with a summary of published North American host records for all life stages. J. Vector Ecol., 31: 168–180.

197 – *I. semenovi* Olenev, 1929 (Dokl. Akad. Nauk SSSR, A (21): 489–494. In Russian)
See *I. berlesei* for support of the validity of *I. semenovi*.

Type depository: ZIAC (holotype) (Filippova 2008, *op. cit.* under *I. berlesei*)

Known stages: female, nymph

Zoogeographic Region: Palearctic

Ecoregions: montane grasslands and shrublands

Hosts: Passeriformes: Prunellidae (AN)
Passeriformes (several families); Falconiformes: Falconidae (A)

Human infestation: no

Remarks: Camicas et al. (1998), who classify this species as *Scaphixodes semenovi*, state that the only described stage of *I. semenovi* is the female, but Filippova (1977) provides a description of the nymph.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.

Grebenyuk, R.V. 1966. Ixodid ticks (Parasitiformes, Ixodidae) of Kirgizia. Akademii Nauk Kirgizkoy SSR, Instituta Biologii, Frunze, 328 pp. In Russian.

Serdjukova, G.V. 1956. Ixodid ticks of the fauna of USSR. Opred. Faune SSSR. Zool. Inst. Akad. Nauk SSSR (64), 121 pp. In Russian.

Teng, K.-F. 1986. Studies on the genus *Ixodes* in China (Acari: Ixodidae). Acta Zootax. Sin., 11: 46–53. In Chinese.

198 – *I. shahi* Clifford, Hoogstraal & Kohls, 1971 (J. Med. Entomol., 8: 430–438)

Type depository: USNTC (holotype, paratypes) (Keirans and Clifford 1984, *op. cit*. under *I. amersoni*)

Known stages: female, nymph, larva

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Lagomorpha: Ochotonidae.
Lagomorpha: Ochotonidae (ANL)
Rodentia: Cricetidae (N)
Rodentia: Muridae (L)

Human infestation: no

Remarks: Durden and Keirans (1996) regard *I. shahi* as an endangered species.

References

Clifford, C.M., Hoogstraal, H. & Kohls, G.M. 1971. *Ixodes hyatti*, n. sp., and *I. shahi*, n. sp. (Acarina: Ixodidae), parasites of pikas (Lagomorpha: Ochotonidae) in the Himalayas of Nepal and West Pakistan. J. Med. Entomol., 8: 430–438.

Clifford, C.M., Hoogstraal, H. & Keirans, J.E. 1975. The *Ixodes* ticks (Acarina: Ixodidae) of Nepal. J. Med. Entomol., 12: 115–137.

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.

199 – *I. siamensis* Kitaoka & Suzuki, 1983 (Trop. Med., 25: 205–219)
Kolonin (2009, *op. cit*. under *I. arabukiensis*) follows Camicas et al. (1998, *op. cit*. under *I. anatis*) in treating *I. siamensis* as a synonym of *I. ovatus*. However, these authors provide no evidence to support their position. Guglielmone et al. (2009, *op.*

cit. under *I. anatis*) stress the need for a revision of the *I. ovatus* species group and consider *I. siamensis* tentatively valid. We see no reason to alter this view. See also *I. ovatus*.

Type depositories: NSM (holotype), NIAH (paratypes) (Kitaoka, S. & Suzuki, H. 1983. Studies on the parasite fauna of Thailand 5. Parasitic ticks on mammals and description of *Ixodes siamensis* sp. n. and *Rhipicephalus tetracornus* sp. n. (Acarina: Ixodidae). Trop. Med., 25: 205–219)

Known stages: larva

Zoogeographic Region: Oriental

Ecoregions: northern Indochina subtropical forests; few ticks in Kayah-Karen montane rain forests

Hosts: Rodentia: Muridae; Soricomorpha: Soricidae (L)

Human infestation: no

Reference

Kitaoka, S. & Suzuki, H. 1983. Studies on the parasite fauna of Thailand 5. Parasitic ticks on mammals and description of *Ixodes siamensis* sp. n. and *Rhipicephalus tetracornus* sp. n. (Acarina: Ixodidae). Trop. Med., 25: 205–219.

200 – *I. sigelos* Keirans, Clifford & Corwin, 1976 (Acarologia, 18: 217–225)
Ixodes sigelos is treated as a probable synonym of *I. abrocomae* in Camicas et al. (1998, *op*. *cit*. under *I. anatis*), but Guglielmone et al. (2010, *op*. *cit*. under *I. abrocomae*) found evidence for the validity of both *I. sigelos* and *I. abrocomae*. See comments under *I. abrocomae* for additional evidence that this is a good species, differing from *I. sigelos*.

Type depositories: USNTC (holotype, paratypes), TTU (paratypes) (Keirans, J.E., Clifford, C.M. & Corwin, D. 1976. *Ixodes sigelos*, n. sp. (Acarina: Ixodidae), a parasite of rodents in Chile, with a method for preparing ticks for examination by scanning electron microscopy. Acarologia, 18: 217–225)

Known stages: female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregions: mediterranean-type forests of the Chilean matorral; Valdivian temperate forests; Patagonian Steppe; few ticks in Puna montane grasslands and shrublands in northwestern Argentina

Hosts: usual hosts for larvae, nymphs and adults are Rodentia: Cricetidae.
Rodentia: Cricetidae, Octodontidae (ANL)
Rodentia: Abrocomidae, Muridae (N)

Human infestation: no

Remarks: Sánchez et al. (2010) state that molecular taxonomic investigations indicate that more than one species may be included under the name *I. sigelos*. See also *I. abrocomae*.

References

González-Acuña, D., Venzal, J.M. & Guglielmone, A.A. 2004. Nuevos hospedadores y localidades de *Ixodes sigelos* e *Ixodes auritulus* (Acari: Ixodidae) en Chile. Gayana, 68: 113–116.

Guglielmone, A.A., González-Acuña, D., Autino, A.G., Venzal, J.M., Nava, S. & Mangold, A.J. 2005. *Ixodes sigelos* Keirans, Clifford & Corwin, 1976 (Acari: Ixodidae) in Argentina and southern Chile. Syst. Appl. Acarol., 10: 37–40.

Keirans, J.E., Clifford, C.M. & Corwin, D. 1976. *Ixodes sigelos*, n. sp. (Acarina: Ixodidae), a parasite of rodents in Chile, with a method for preparing ticks for examination by scanning electron microscopy. Acarologia, 18: 217–225.

Sánchez, J.P., Nava, S., Lareschi, M., Udrizar Sauthier, D.E., Mangold, A.J. & Guglielmone, A.A. 2010. Host range and geographical distribution of *Ixodes sigelos* (Acari: Ixodidae). Exp. Appl. Acarol., 52: 199–205.

201 – *I. signatus* Birula, 1895 (Izv. Imp. Akad. Nauk, Ser. 5, 2 (4): 353–364)

Type depositories: ZIAC (lectotype, paralectotypes), BMNH, ZSH (paralectotypes) (Filippova 2008, *op. cit.* under *I. berlesei*; Nuttall and Warburton 1911, *op. cit.* under *I. acuminatus*, Keirans and Hillyard 2001, *op. cit.* under *I. anatis*). Keirans, J.E. & Clifford, C.M. (1978. The genus *Ixodes* in the United States: a scanning electron microscope study and key to the adults. J. Med. Entomol. (Suppl. 2), 149 pp.) include MCZ as possibly containing a "type specimen" of *I. signatus*, but not identified as such on the corresponding label.

Known stages: male, female, nymph, larva

Zoogeographic Regions: Nearctic, Palearctic

Ecoregions: temperate conifer forests and Taiga forests

Hosts: usual hosts for larvae, nymphs and adults are Pelecaniformes: Phalacrocoracidae. Carnivora are considered exceptional hosts for this tick.
Charadriiformes: Alcidae, Laridae; Pelecaniformes: Phalacrocoracidae (ANL)
Passeriformes: Fringillidae (AN)
Carnivora: Otariidae (A)
Passeriformes: Turdidae (stage unknown)

Human infestation: no

Remarks: Neumann (1911) provides a record of *I. signatus* from Carnivora (a rare event) under the name *I. arcticus* Osburn, 1899. Kolonin (2009) does not include Carnivora as hosts for this tick. Gregson (1954) states that females, a nymph and larvae were found on Fringillidae, but thereafter larvae were not included in Gregson (1956), and this tick stage has been excluded for *I. signatus* in the host list above.

References

Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.
Gregson, J.D. 1954. The male of *Ixodes signatus* Birula (Acarina: Ixodidae). Can. Entomol., 86: 275–277.
Gregson, J.D. 1956. The Ixodoidea of Canada. Can. Dept. Agric. Sci. Serv. Entomol. Div. Publ. (930), 92 pp.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Kozlovskaya, O.L., Chernykh, P.A. & Koshkin, S.M. 1968. New and little known ectoparasite species in Khabarovsk region. Izv. Irkutsk. Gos. Nauch.-Issled. Protiv. Inst. Sibiri Dal'n. Vost. 27: 312–315. In Russian.
Neumann, L.G. 1911. Ixodidae. Das Tierreich (26), 169 pp.
Schwan, T.G. & Kelly, P.R. 1981. *Ixodes signatus* (Ixodoidea: Ixodidae) parasitizing pigeon guillemots on the Channel Islands, California. J. Med. Entomol., 18: 171–172.
Yamaguti, N., Tipton, V.J., Keegan, H.L. & Toshioka, S. 1971. Ticks of Japan, Korea, and the Ryukyu Islands. Brigham Young Univ. Sci. Bull. Biol. Ser., 15 (1), 226 pp.

202 – *I. simplex* Neumann, 1906 (Arch. Parasitol., 10: 195–219)

Type depository: BMNH (syntypes) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Afrotropical, Australasian, Oriental, Palearctic

Ecoregions: bat caves associated with many ecoregions in the four zoogeographic regions listed above

Hosts: usual hosts for larvae, nymphs and adults are Chiroptera: Vespertilionidae and Rhinolophidae.
Chiroptera: Vespertilionidae, Rhinolophidae (ANL)
Rodentia: Muridae (A)
Chiroptera: Pteropodidae (L)

Human infestation: yes (Okino et al. 2010)

Remarks: Kohls (1955) named this species *I. audyi* Kohls, 1955.

References

Bush, S.E. & Robbins, R.G. 2012. New host and locality records for *Ixodes simplex* Neumann and *Ixodes vespertilionis* Koch (Acari: Ixodidae) from bats (Chiroptera: Hipposideridae, Rhinolophidae and Vespertilionidae) in southern China. Int. J. Acarol., 38: 1–5.
Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Filippova, N.A. 1972. New data on ticks of the genus *Ixodes* Latr. (Ixodoidea, Ixodidae) which are specific bat parasites. Entomol. Obozr., 51: 463–475. In Russian, translation in Entomol. Rev., 72: 279–285.

Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.

Hoogstraal, H., Lim, B.L., Nadchatram, M. & Anastos, G. 1972. The Gunong Benom Expedition 1967. 8. Ticks (Ixodidae) of Gunong Benom and their altitudinal distribution, hosts and medical relationships. Bull. Br. Mus. (Nat. Hist) Zool., 23: 167–186.

Kim, H.C., Han, S.H., Chong, S.T., Robbins, R.G. & Klein, T.A. 2011. *Ixodes vespertilionis* Koch and first report of *Ixodes simplex* Neumann (Acari: Ixodidae) from bats in the Republic of Korea. Syst. Appl. Acarol., 16: 233–237.

Kohls, G.M. 1955. Two new species of ticks from North Borneo (Acarina: Ixodidae). J. Parasitol. 41: 312–315.

Norval, R.A.I., Spickett, A.M. & Clifford, C.M. 1987. The ticks of Zimbabwe. XVI. The genus *Ixodes*. Zimbabwe Vet. J., 18: 1–10.

Okino, T., Ushirogawa, H., Matoba, K. & Hatsushika, R. 2010. Bibliographical studies on human cases of hard tick (Acarina: Ixodidae) bites in Japan: (6) Cases of infestation with rare tick species. Kawasaki Med. J., 36: 121–126. In Japanese.

Wilson, N. 1970. New distributional records of ticks from Southeast Asia and the Pacific (Metastigmata: Argasidae, Ixodidae). Oriental Insects, 4: 37–46.

203 – *I. sinaloa* Kohls & Clifford, 1966 (J. Parasitol., 52: 810–820)

Type depository: USNTC (holotype, paratypes) (Keirans and Clifford 1984, *op. cit.* under *I. amersoni*)

Known stages: female, nymph, larva

Zoogeographic Regions: Nearctic, Neotropical

Ecoregions: tropical and subtropical dry broadleaf and conifer forests

Hosts: Rodentia: Cricetidae (ANL)
Rodentia: Heteromyidae (AN)
Didelphimorphia: Didelphidae (N)

Human infestation: no

Remarks: Camicas et al. (1998) list the male of *I. sinaloa* as described, but Guglielmone et al. (2003) do not include a description of the male, and we agree with the latter opinion. These authors also consider *I. sinaloa* to be a species exclusive to the Neotropical Region, but it is also established in the Nearctic Region (Keirans and Jones 1972).

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Guzmán-Cornejo, C., Robbins, R.G. & Pérez, T.M. 2007. The *Ixodes* (Acari: Ixodidae) of Mexico: parasite-host and host-parasite checklists. Zootaxa, 1553: 47–58.

Guzmán-Cornejo, C., García-Prieto, L., Acosta-Gutiérrez, R., Falcón-Ordaz, J. & León- Paniagua, L. 2012. Metazoarios parásitos de *Tlacuatzin canescens* y *Marmosa mexicana* (Mammalia: Didelphimorphia) de México. Rev. Mex. Biodiversidad, 83: 557–561.

Keirans, J.E. & Jones, E.K. 1972. Description of the immature stages of *Ixodes* (*I.*) *sinaloa* Kohls and Clifford (Acarina: Ixodidae) from rodents in Mexico and Nicaragua. Acarologia, 13: 471–475.

Kohls, G.M. & Clifford, C.M. 1966. Three new species of *Ixodes* from Mexico and description of the male of *I. auritulus auritulus* Neumann, *I. conepati* Cooley and Kohls, and *I. lasallei* Méndez and Ortiz (Acarina: Ixodidae). J. Parasitol., 52: 810–820.

McCain, C.M., Timm, R.M. & Weksler, M. 2007. Redescription of the enigmatic long-tailed rat *Sigmodontomys aphrastus* (Cricetidae: Sigmodontinae) with comments on taxonomy and natural history. Proc. Biol. Soc. Wash., 120: 117–136.

204 – *I. sinensis* Teng, 1977 (Acta Entomol. Sin., 20: 342–344. In Chinese)

Type depository: IZAS (holotype, paratype) (Teng, K.-F. 1977. A new species of *Ixodes* from China (Acarina: Ixodidae). Acta Entomol. Sin., 20: 342–344. In Chinese)

Known stages: male, female, larva

Zoogeographic Region: Oriental

Ecoregions: temperate broadleaf and mixed forests

Hosts: Artiodactyla: Bovidae, Cervidae; Carnivora: Canidae, Felidae; Lagomorpha: Leporidae; Galliformes: Phasianidae (A)
Rodentia: Muridae (stage unknown)

Human infestation: yes (Teng and Jiang 1991)

Remarks: Kolonin (2009) ignores hosts other than Artiodactyla: Bovidae for adults of *I. sinensis*, but the references below include what we consider *bona fide* records for Cervidae and other orders of vertebrates parasitized by adults of this tick. We have been unable to determine hosts for the larvae of *I. sinensis*.

References

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Sun, Y., Xu, R. & Cao, W. 2003. *Ixodes sinensis*: competence as a vector to transmit the Lyme disease spirochete *Borrelia garinii*. Vector-Borne Zoon. Dis., 3: 39–44.

Teng, K.-F. 1977. A new species of *Ixodes* from China (Acarina: Ixodidae). Acta Entomol. Sin., 20: 342–344. In Chinese.
Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.
Xu, R. & Li, K. 1997. A collection of ticks from Guizhou, China. Syst. Appl. Acarol., 2: 245–246.
Xu, R. & Luo, G. 1998. Ticks parasitic on *Muntiacus reevesi* and *Lepus sinensis* in Wuyi Mountains, Fujian, China. Syst. Appl. Acarol. 3: 197.
Ye, X.-D., Zheng, S.-G., Zheng, H.-O., Huang, L.-L. & Wang, Q. 2007. First investigation of tick borne Lyme disease in Junhua, Zhejiang Province. Acta Parasitol. Med Entomol. Sin., 14: 165–168.

205 – *I. soricis* Gregson, 1942 (Can. Entomol., 74: 137–139)

Type depository: CNC (holotype) (Robbins and Keirans 1992, *op. cit.* under *I. ochotonae*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Nearctic

Ecoregions: Willamette Valley-Puget trough-Georgia basin and Middle Rockies – Blue Mountains, temperate conifer forests

Hosts: usual hosts for larvae, nymphs and adults are Soricomorpha: Soricidae.
Soricomorpha: Soricidae; Rodentia: Cricetidae (ANL)
Soricomorpha: Talpidae (AN)
Rodentia: Geomyidae (A)

Human infestation: yes (Robbins and Keirans 1992)

Remarks: Kolonin (2009) ignores the hosts other than Soricidae that are recorded in Robbins and Keirans (1992).

References

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Robbins, R.G. & Keirans, J.E. 1992. Systematics and ecology of the subgenus *Ixodiopsis* (Acari: Ixodidae: *Ixodes*). Thomas Say Publ. Entomol. Monogr. (14), 159 pp.

206 – *I. spinae* Arthur, 1958 (Parasitology, 48: 38–69)

Type depository: OVI (holotype, paratypes) (Arthur, D.H. 1958. New species of *Ixodes* ticks from eastern Africa, with a description of the male and nymph of *Ixodes oldi* Nuttall, 1913. Parasitology, 48: 38–69). Walker, J.B. (1991, *op. cit.*, in *I. rhabdomysae*), however, states that the holotype is not present in the OVI museum and is also not listed in the Onderstepoort Tick Collection catalogue.

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregion: southern Africa bushveld

Hosts: Hyracoidea: Procaviidae; Rodentia (unknown family); Passeriformes: Fringillidae, Ploceidae (A)

Human infestation: no

Remarks: Theiler (1962) doubts a record of *I. spinae* from Passeriformes, while Hasle et al. (2009) regard their record from Ploceidae as uncertain. These hosts have provisionally been included in the list above. Kolonin (2009) does not include Aves as hosts for *I. spinae*, probably because of the aforementioned uncertainty of the diagnoses. The latter author also excludes the record of *I. spinae* from Rodentia in Elbl and Anastos (1966). Morel (2003) is of the opinion that records of larvae and nymphs close to *I. pilosus* from Procaviidae are in fact *I. spinae*, but these records have not been included in our host list.

References

Elbl, A. & Anastos, G. 1966. Ixodid ticks (Acarina, Ixodidae) of Central Africa. Vol. II. Genus *Ixodes* Latreille, 1795. Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (146), 205 pp.

Hasle, G., Horak, I.G., Grieve, G., Leinaas, H.P. & Clarke, F. 2009. Ticks collected from birds in the northern provinces of South Africa, 2004–2006. Onderstepoort J. Vet. Res., 76: 167–175.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

207 – *I. spinicoxalis* Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)

Type depository: BMNH (syntypes) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregion: Changjiang Plain evergreen forests

Hosts: Scandentia: Tupaiidae (ANL)
Passeriformes: Pittidae (A, N and/or L)
Rodentia: Muridae (AN)
Carnivora: Mephitidae, Mustelidae, Viverridae; Passeriformes: Muscicapidae (A)
Soricomorpha: Soricidae; Rodentia: Sciuridae (N)

Human infestation: yes (Wilson 1970)

Remarks: Yakimov and Kohl-Yakimova (1911) provide Palearctic records of *I. spinicoxalis*, but Anastos (1950) regards their diagnosis as erroneous and we concur

with this opinion. Tanskul et al. (1983) do not state whether nymphs, larvae or both immature stages of *I. spinicoxalis* were present on Pittidae. Kolonin (2009) ignores Aves as hosts for adult *I. spinicoxalis*, but there are records of this host-parasite relationship that we consider sound in Tanskul et al. (1983).

References

Anastos, G. 1950. The scutate ticks, or Ixodidae, of Indonesia. Entomol. Am., 30: 1–144.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Schulze, P. 1934. Über eine Zeckenausbeute von Kleinsäugern aus Java. Z. Parasitenkd., 7: 167–171.

Tanskul, P., Stark, H.E. & Inlao, I. 1983. A checklist of ticks of Thailand (Acari: Metastigmata: Ixodoidea). J. Med. Entomol., 20: 330–341.

Wilson, N. 1970. New distributional records of ticks from Southeast Asia and the Pacific (Metastigmata: Argasidae, Ixodidae). Oriental Insects, 4: 37–46.

Yakimov, V.L. & Kohl-Yakimova, N. 1911. Étude des ixodidés de Russie. Arch. Parasitol., 14: 426–425.

208 – *I. spinipalpis* Hadwen & Nuttall, 1916 (*In* Nuttall, Parasitology, 8: 294–337)
Ixodes neotomae Cooley, 1944, a junior synonym of *I. spinipalpis*, as discussed in Guglielmone et al. (2009, *op. cit.* under *I. anatis*), is regarded as a valid name in Camicas et al. (1998, *op. cit.* under *I. anatis*) and Barker and Murrell (2008, *op. cit.* under *I. anatis*).

Type depository: BMNH (lectotype, paralectotypes) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*) as *I. dentatus spinipalpis*

Known stages: male, female, nymph, larva

Zoogeographic Regions: Nearctic, Neotropical

Ecoregion: temperate conifer forests of western Nearctic

Hosts: usual hosts for adult ticks are Lagomorpha: Leporidae and Rodentia: Cricetidae; usual hosts for larvae and nymphs are Rodentia: Cricetidae.
Rodentia: Cricetidae, Sciuridae; Lagomorpha: Leporidae, Ochotonidae (ANL)
Carnivora: Canidae (A)
Rodentia: Heteromyidae; Passeriformes: Emberizidae, Troglodytidae (NL)
Passeriformes: Corvidae, Parulidae, Turdidae (N)
Soricomorpha: Soricidae (L)
Rodentia: Muridae (stage unknown)

Human infestation: yes (Merten and Durden 2000)

Remarks: Camicas et al. (1998) treat *I. spinipalpis* as a Nearctic species, but a recent finding in Veracruz (Mexico) by Guzmán-Cornejo et al. (2007) expands its distribution to include the Neotropical Region. Allan (2001) states that *I. spinipalpis*

was found feeding on Mustelidae, but we have been unable to confirm this from the references listed by the author; consequently, Mustelidae have been excluded as hosts of *I. spinipalpis*. The record from Canidae in Furman and Loomis (1984) is under the name *I. neotomae*. See also *I. diversifossus*.

References

Allan, S.A. 2001. Ticks (Class Arachnida: Order Acarina). *In* W.S. Samuel, M.J. Pybus & A.A. Kocan (editors), Parasitic Diseases of Wild Animals, 2nd edition. Iowa State University Press, Ames, pp. 72–106.

Allred, D.M., Beck, D.E. & White, L.D. 1960. Ticks of the genus *Ixodes* in Utah. Brigham Young Univ. Sci. Bull. Biol. Ser., 1 (4), 42 pp.

Burkot, T.R., Maupin, G.O., Schneider, B.S., Denatale, C., Happ, C.M., Rutherford, J.S. & Zeidner, N.S. 2001. Use of sentinel host system to study the questing behavior of *Ixodes spinipalpis* and its role in the transmission of *Borrelia bissettii*, human granulocytic ehrlichiosis, and *Babesia microti*. Am. J. Trop. Med. Hyg., 65: 293–299.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Cooley, R.A. & Kohls, G.M. 1945. The genus *Ixodes* in North America. Natl. Inst. Health Bull. (184), 246 pp.

Foley, J.E., Nieto, N.C., Adjemian, J., Dabritz, H. & Brown, R.N. 2008. *Anaplasma phagocytophilum* infection in small hosts of *Ixodes* ticks, western United States. Emerg. Inf. Dis., 14: 1147–1150. **Note**: the information on hosts is in an online "technical appendix."

Furman, D.P. & Loomis, E.C. 1984. The ticks of California (Acari: Ixodida). Bull. Calif. Insect Surv., 25: 1–239.

Gregson, J.D. 1956. The Ixodoidea of Canada. Can. Dept. Agric. Sci. Serv. Entomol. Div. Publ. (930), 92 pp.

Guzmán-Cornejo, C., Robbins, R.G. & Pérez, T.M. 2007. The *Ixodes* (Acari: Ixodidae) of Mexico: parasite-host and host-parasite checklists. Zootaxa, 1553: 47–58.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Keirans, J.E., Brown & Lane, R.S. (1996). *Ixodes* (*Ixodes*) *jellisoni* and *I.* (*I.*) *neotomae* (Acari: Ixodidae): descriptions of the immature stages from California. J. Med. Entomol., 33: 319–327.

Lane, R.S., Peavey, C.A., Padgett, K.A. & Hendson, M. 1999. Life history of *Ixodes* (*Ixodes*) *jellisoni* (Acari: Ixodidae) and its vector competence for *Borrelia burgdorferi* sensu lato. J. Med. Entomol., 36: 329–340.

Merten, H.A. & Durden, L.A. 2000. A state-by-state survey of ticks recorded from humans in the United States. J. Vector Ecol., 25: 102–113.

Mohr, C.O., Beck, D.E. & Brinton, E.P.1964. Observations on host-parasite relationships and seasonal history of ticks in San Mateo County, California. Great Basin Nat., 24: 1–6.

Norris, D.E., Klompen, J.S.H., Keirans, J.E., Lane, R.S., Piesman, J. & Black, W.C. 1997. Taxonomic status of *Ixodes neotomae* and *I. spinipalpis* (Acari: Ixodidae) based on mitochondrial DNA evidence. J. Med. Entomol., 34: 696–703.

Scott, J.D., Anderson, J.F. & Durden, L.A. 2012. Widespread dispersal of *Borrelia burgdorferi*- infected ticks collected from songbirds across Canada. J. Parasitol., 98: 49–59.

Webb, J.P., Bennett, S.G. & Challet, G.L. 1990. The larval ticks of the genus *Ixodes* Latreille (Acari: Ixodidae) of California. Bull. Soc. Vector Ecol., 15: 73–124.

209 – *I. steini* Schulze, 1935 (Z. Morphol. Ökol. Tiere, 30: 1–40)

Camicas et al. (1998, *op. cit.* under *I. anatis*) and Guglielmone et al. (2010, *op. cit.* under *I. abrocomae*), among others, state that *I. steini* was described in 1932. However, the description in Schulze, P. (1932, *op. cit.* under *I. luxuriosus*) is incomplete (*nomen nudum*); the valid description of *I. steini* is actually that in Schulze, P. (1935, *op. cit.* under *I. luxuriosus*).

Type depository: Schulze, P. (1935, *op. cit.* under *I. luxuriosus*) states that the type specimens of *I. steini* are deposited in the ZMB, but they are not listed in Moritz and Fischer (1981, *op. cit.* under *I. acutitarsus*)

Known stages: female, nymph

Zoogeographic Region: Australasian

Ecoregion: New Guinea lowland rain forests

Hosts: Dasyuromorphia: Dasyuridae (AN)
Rodentia (unknown family) (stage unknown)

Human infestation: no

Remarks: see *I. luxuriosus*.

References

Hoogstraal, H. 1982. Ticks (Acari: Ixodoidea): a preliminary study. Monogr. Biol., 42: 537–544.

Schulze, P. 1935. Zur vergleichenden Anatomie der Zecken. Z. Morphol. Ökol. Tiere, 30: 1–40.

Wilson, N. 1972. Ticks. Encyclopedia of Papua and New Guinea, 2: 1122–1124.

210 – *I. stilesi* Neumann, 1911 (Arch. Parasitol., 14: 415)

Clifford et al. (1973, *op. cit.* under *I. cooleyi*) doubt the validity of *I. stilesi*, but there are no reasons to consider it a doubtful taxon, as stated in Guglielmone et al. (2003, *op. cit.* under *I. cookei*), among others. See remarks below.

Type depository: MNHN (syntypes) (Nuttall and Warburton 1911, *op. cit.* under *I. acuminatus*); it was originally named *I. elegans* Neumann, 1910, a name preoccupied by *Ixodes elegans* Guérin-Méneville, 1844 and consequently renamed.

Known stages: male, female, nymph

Zoogeographic Region: Neotropical

Ecoregions: Valdivian temperate forests in Chile; few ticks in scrub and woodlands
Hosts: usual hosts for adult ticks are Artiodactyla: Cervidae.
Artiodactyla: Cervidae (AN)
Rodentia: Cricetidae (N)

Human infestation: no

Remarks: Camicas et al. (1998) list the female as the only stage of *I. stilesi* that has been described; the male and nymph were subsequently described by Guglielmone et al. (2006, 2007). Mihalca et al. (2011) regard this tick as an endangered species.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Guglielmone, A.A., Venzal, J.M., González-Acuña, D., Nava, S. & Mangold, A.J. 2006. The phylogenetic position of *Ixodes stilesi* Neumann, 1911 (Acari: Ixodidae): morphological and preliminary molecular evidences from 16S rDNA sequences. Syst. Parasitol., 65: 1–11.

Guglielmone, A.A., Nava, S., González-Acuña, D., Mangold, A.J., & Robbins, R.G. 2007. Additional observations on the morphology and hosts of *Ixodes stilesi* Neumann, 1911 (Acari: Ixodidae). Syst. Appl. Acarol., 12: 135–139.

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

211 – *I. stromi* Filippova, 1957 (Zool. Zh., 36: 864–869. In Russian)

Type depository: ZIAC (lectotype, paralectotypes) (Filippova 2008, *op. cit.* under *I. berlesei*)

Known stages: female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: several ecoregions associated with montane grasslands and shrublands

Hosts: Rodentia: Cricetidae (ANL)
Rodentia: Muridae (AL)
Soricomorpha: Soricidae; Lagomorpha: Ochotonidae; Carnivora: Mustelidae (stages unknown)

Human infestation: no

References

Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.
Robbins, R.G. & Keirans, J.E. 1992. Systematics and ecology of the subgenus *Ixodiopsis* (Acari: Ixodidae: *Ixodes*). Thomas Say Publ. Entomol. Monogr. (14), 159 pp.

212 – *I. subterraneus* Filippova, 1961 (Parazitol. Sborn. Zool. Inst. Akad. Nauk SSSR, 20: 226–247. In Russian)

Type depository: ZIAC (lectotype, paralectotypes) (Filippova 2008, *op. cit.* under *I. berlesei*) as *I. subterranus*, a name subsequently corrected to *subterraneus* in Filippova (1977, *op. cit.* under *I. eldaricus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: several Palearctic ecoregions associated with xeric shrublands

Hosts: Passeriformes: Passeridae (ANL)
Aves (several orders) (stages unknown)

Human infestation: no

References

Filippova, N.A. 1961. Contribution to the taxonomy of ticks of the *crenulatus* group (Ixodidae, *Ixodes*, *Pholeoixodes*). Parazitol. Sborn. Zool. Inst. Akad. Nauk SSSR, 20: 226–247. In Russian., translation by Knowles, Z.
Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.

213 – *I. succineus* Weidner, 1964 (Veröff. Überseemus. Bremen Ser. A, 3: 143–151)

Kolonin (2009, *op. cit.* under *I. arabukiensis*) ignores this species, but it is unclear whether he does so because he considers this tick invalid or because fossil species were not included in his list of ticks.

Type depository: OMB (holotype) (Weidner, H. 1964. Eine Zecke, *Ixodes succineus* sp. n., im baltischen Bernstein. Veröff. Überseemus. Bremen Ser. A, 3: 143–151)

Known stages: female

Zoogeographic Region: Palearctic

Ecoregion: unknown

Hosts: unknown (fossil)

Human infestation: no

Remarks: this fossil tick species is remarkably similar to the extant *I. ricinus* (Weidner 1964).

Reference

Weidner, H. 1964. Eine Zecke, *Ixodes succineus* sp. n., im baltischen Bernstein. Veröff. Überseemus. Bremen Ser. A, 3: 143–151.

214 – *I. taglei* Kohls, 1969 (J. Med. Entomol., 6: 280–283)

Type depositories: USNTC (holotype, paratypes), EMV (paratypes) (Keirans and Clifford 1984, *op. cit.* under *I. amersoni*)

Known stages: male, female

Zoogeographic Region: Neotropical

Ecoregion: Valdivian temperate forests

Hosts: Artiodactyla: Cervidae (A)

Human infestation: no

Remarks: Mihalca et al. (2011) regard *I. taglei* as an endangered species.

References

González-Acuña, D. & Guglielmone, A.A. 2005. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of Chile. Exp. Appl. Acarol., 35: 147–163.

Kohls, G.M. 1969. *Ixodes taglei* n. sp. (Acarina: Ixodidae) a parasite of the deer, *Pudu pudu* (Wol.), in Chile. J. Med. Entomol., 6: 280–283.

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

215 – *I. tamaulipas* Kohls & Clifford, 1966 (J. Parasitol., 52: 810–820)

Type depository: USNTC (holotype, paratypes) (Keirans and Clifford 1984, *op. cit.* under *I. amersoni*)

Known stages: female

Zoogeographic Region: Nearctic

Ecoregion: Sierra Madre Oriental pine-oak forests

Hosts: Rodentia: Sciuridae (A)

Human infestation: no

Remarks: Clifford et al. (1973) and Camicas et al. (1998) state that this species is present in the Neotropical Region, but the only record of *I. tamaulipas* is from a locality that lies within the Nearctic Zoogeographic Region, as noted in Guglielmone et al. (2003).

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Clifford, C.M., Sonenshine, D.E., Keirans, J.E. & Kohls, G.M. 1973. Systematics of the subfamily Ixodinae (Acarina: Ixodidae). 1. The subgenera of *Ixodes*. Ann. Entomol. Soc. Am., 66: 489–500.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Guzmán-Cornejo, C., Robbins, R.G. & Pérez, T.M. 2007. The *Ixodes* (Acari: Ixodidae) of Mexico: parasite-host and host-parasite checklists. Zootaxa, 1553: 47–58.

Kohls, G.M. & Clifford, C.M. 1966. Three new species of *Ixodes* from Mexico and description of the male of *I. auritulus auritulus* Neumann, *I. conepati* Cooley and Kohls, and *I. lasallei* Méndez and Ortiz (Acarina: Ixodidae). J. Parasitol., 52: 810–820.

216 – *I. tancitarius* Cooley & Kohls, 1942 (Rev. Soc. Mex. Hist. Nat., 3: 149–154)

Type depository: USNTC (holotype) (Keirans and Clifford 1984, *op. cit.* under *I. amersoni*)

Known stages: female

Zoogeographic Regions: Nearctic, Neotropical

Ecoregions: tropical and subtropical moist broadleaf and conifer forests

Hosts: Rodentia: Cricetidae (A)

Human infestation: yes (Hoffmann 1969, see below)

Remarks: Guglielmone et al. (2003) treat *I. tancitarius* as a Nearctic species, but Guzmán-Cornejo et al. (2007) present a *bona fide* record from the Neotropics. Hoffmann (1969) reports a record of *I. tancitarius* or a species close to it from a human. We consider this record provisionally valid.

References

Cooley, R.A. & Kohls, G.M. 1945. The genus *Ixodes* in North America. Natl. Inst. Health Bull. (184), 246 pp.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Guzmán-Cornejo, C., Robbins, R.G. & Pérez, T.M. 2007. The *Ixodes* (Acari: Ixodidae) of Mexico: parasite-host and host-parasite checklists. Zootaxa, 1553: 47–58.

Hoffmann, A. 1969. Un caso de parálisis por picadura de garrapata. Rev. Latinoam. Microbiol. Parasitol., 11: 75–77.

217 – *I. tanuki* Saito, 1964 (Acta Med. Biol., 12: 59–66)

Type depository: MZD (holotype, paratypes) (Saito, Y. 1964. Studies on ixodid ticks. VII. Notes on the ticks infesting badgers in Japan with a description of *Ixodes tanuki* n. sp. Acta Med. Biol., 12: 59–66)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: temperate broadleaf and mixed forests

Hosts: Carnivora: Canidae, Mustelidae (AN)
Carnivora: Felidae (A)
Rodentia: Cricetidae (NL)
Artiodactyla: Cervidae (N)
Rodentia: Muridae (L)
Carnivora: Procyonidae (stage unknown)

Human infestation: yes (Yoneda et al. 1992)

Remarks: Camicas et al. (1998) list the nymph of *I. tanuki* as undescribed, but it was subsequently described by Fujita and Takada (2007). Mitchell (1979) listed all hosts of Nepalese ticks, including *I. tanuki*, collected between 1966 and 1970 from Felidae, but no tick stage was identified. This record was not confirmed by Clifford et al. (1975) in their study of the *Ixodes* of Nepal, and it has not been included in our list of hosts for this species. Tsunoda et al. (2011) state that Takada and Fujita (1978) recorded *I. tanuki* from Ursidae, but we were unable to confirm this record with the information provided in Takada and Fujita (1978), and Ursidae are therefore not included in the host list above.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Clifford, C.M., Hoogstraal, H. & Keirans, J.E. 1975. The *Ixodes* ticks (Acarina: Ixodidae) of Nepal. J. Med. Entomol., 12: 115–137.

Fujita, H. & Takada, N. 2007. Identification of immature ticks in Japan. *In* Organization Committee of SADI (editor), Acari and Emerging/ Reemerging Diseases. Zenkoku Nosom Kyoiku Kyokai Publ. Co., Tokyo, pp. 53–68. In Japanese, Spanish translation of legends of figures by Kori, V.

Kawabuchi, T., Tsuji, M., Matoba, Y., Asakawa, M. & Ishihara, C. 2005. *Babesia microti*-like parasites detected in feral raccoons (*Procyon lotor*) captured in Hokkaido, Japan. J. Vet. Med. Sci. 67: 825–827.

Lee, W.-K., Lim, J.-W., Lee, S.-Y. & Lee, I.-Y. 1997. Redescription of *Haemaphysalis flava* and *Ixodes tanuki* collected from a racoon dog in Korea. Korean J. Parasitol., 35: 1–8. In Korean.

Masuzawa, T., Suzuki, H., Kawabata, H., Ishiguro, F., Takada, N. & Yanagihara, Y. 1996. Characterization of *Borrelia* spp. Isolated from the tick, *Ixodes tanuki* and small rodents in Japan. J. Wildl. Dis., 32: 565–571.

Mitchell, R.M. 1979. A list of ectoparasites from Nepalese mammals, collected during the Nepal ectoparasite program. J. Med. Entomol., 16: 227–233.
Petney, T.N. & Keirans, J.E. 1994. Ticks of the genus *Ixodes* in South-East Asia. Trop. Biomed., 11: 123–134.
Takada, N. & Fujita, H. 1978. Studies on ixodid fauna in the northern part of Honshu, Japan 4. An inclusive survey of the tick fauna during the past ten years. Annu. Rep. Ohara Gen. Hosp., 21: 19–34. In Japanese.
Tsunoda, T., Chinone, S. & Yamazaki, K. 2001. Ticks of the Asiatic black bear, *Ursus thibetanus*, in the Okutuma Mts., central Japan. Bull. Ibaraki Nat. Mus., (4): 101–102.
Yamauchi, T., Yano, S., Yamamoto, T., Yamamoto, E. & Miyamoto, T. 2013. Ticks (Acari: Ixodidae) from medium-sized to large mammals in Ehime Prefecture, Japan. Exp. Appl. Acarol., 60: 263–270.
Yamauchi, T., Satô, M., Ito, T., Fujita, H., Takada, N., Kawabata, H., Ando, S., Sakata, A. & Takano, A. 2012. Survey of tick fauna and tick-borne pathogenic bacteria on Rishiri Island, off north Hokkaido. Int. J. Acarol., 39: 3–6.
Yoneda, Y., Fukuma, T., Itoh, T., Odawara, S. & Yoshida, F. 1992. Eleven human cases infested with ixodid ticks. Jap. J. Sanit. Zool., 43: 263–266. In Japanese.

218 – *I. tapirus* Kohls, 1956 (J. Parasitol., 42: 636–649)

Type depository: CNHM (holotype) (Kohls 1956, *op. cit.* under *I. andinus*)

Known stages: female

Zoogeographic Region: Neotropical

Ecoregion: Eastern Cordillera Real montane forests

Hosts: Perissodactyla: Tapiridae (A)

Human infestation: no

Remarks: Mihalca et al. (2011) regard *I. tapirus* as an endangered species.

References

Fairchild, G.B., Kohls, G.M. & Tipton, V.J. 1966. The ticks of Panama (Acarina: Ixodoidea). *In* W.R. Wenzel & V.J. Tipton (editors), Ectoparasites of Panama. Field Museum of Natural History, Chicago, pp. 167–219.
Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

219 – *I. tasmani* Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)
See below

Type depositories: MNHN, ZMB (syntypes) (Nuttall and Warburton 1911, *op. cit.* under *I. acuminatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Australasian

Ecoregions: temperate broadleaf and mixed forests of eastern Australia; few ticks in tropical and subtropical grasslands, savannas and shrublands

Hosts: Diprotodontia: Macropodidae, Phalangeridae, Pseudocheiridae; Peramelemorphia: Peramelidae; Rodentia: Muridae (ANL)
Dasyuromorpha: Dasyuridae; Diprotodontia: Phascolarctidae, Vombatidae (AN)
Mammalia (several orders) (A)
Diprotodontia: Petauridae, Potoroidae (N)
Diprotodontia: Burramyidae (unknown stage)

Human infestation: yes (Murdoch and Spratt 2005)

Remarks: Roberts (1970) states that more than one taxon is probably included under the name *I. tasmani*. Baxter et al. (2009) present a tentative record of a nymph of *I. tasmani* found either on a dog or a cat, while Lindenmayer and Viggers (1994) state that *I. tasmani* from Petauridae were not sexed because the specimens were damaged; these records have not been included in our host list above.

References

Baxter, C.G., Vogelnest, L.J. & Doggett, S.L. 2009. Dermatoses caused by infestations of immature *Ixodes* spp. on dogs and cats in Sydney, Australia. Aust. Vet. J., 87: 182–187.

Lindenmayer, D.B. & Viggers, K.L. 1994. Fur inhabiting ectoparasites of Leadbeater's possum, *Gymnobelidae leadbeateri* (Marsupialia: Petauridae). Austr. Mammal., 17: 109–11.

Murdoch, F.A. & Spratt, D.M. 2005. Ecology of the common marsupial tick (*Ixodes tasmani* Neumann) (Acarina: Ixodidae), in eastern Australia. Aust. J. Zool. 53: 383–388.

Roberts, F.H.S. 1960. A systematic study of the Australian species of the genus *Ixodes* (Acarina: Ixodidae). Aust. J. Zool., 8: 392–485.

Roberts, F.H.S. 1964. The tick fauna of Tasmania. Rec. Queen Victoria Mus. Launceston New Ser. (17): 2–8.

Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.

Skerrat, L.F., Skerrat, J.H.L., Banks, S., Martin, R. & Handasyde, K. 2004. Aspects of the ecology of common wombats (*Vombatus ursinus*) at high density on pastoral land in Victoria. Aust. J. Zool., 52: 303–330.

Smales, L.R., Miller, A.K. & Obendorf, D.L. 1990. Parasites of the water rat, *Hydromys chrysogaster*, from Victoria and South Australia. Aust. J. Zool., 37: 657–663.

Vilcins, I.-M.E., Old, J.M. & Deane, E.M. 2008. Detection of a spotted fever group *Rickettsia* in the tick *Ixodes tasmani* collected from Koalas in Port Macquarie, Australia. J. Med. Entomol., 45: 745–750.

220 – *I. tecpanensis* Kohls, 1956 (J. Parasitol., 42: 636–649)

Type depositories: CNHM (holotype), USNTC (paratype) (Kohls 1956, *op. cit.* under *I. andinus*)

Known stages: female

Zoogeographic Region: Neotropical

Ecoregion: Central American pine-oak forests

Hosts: Rodentia: Geomyidae (A)

Human infestation: no

References

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Kohls, G.M. 1956. Eight new species of *Ixodes* from Central and South America (Acarina: Ixodidae). J. Parasitol., 42: 636–649.

221 – *I. texanus* Banks, 1909 (Proc. Entomol. Soc. Wash. 10: 170–173)
See remarks below

Type depository: USNTC (holotype, paratype) (Keirans and Clifford 1984, *op. cit.* under *I. amersoni*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Nearctic, Neotropical

Ecoregions: several Nearctic and Neotropical ecoregions

Hosts: usual hosts for larvae, nymphs and adults are Carnivora: Mustelidae and Procyonidae.
Carnivora (several families); Didelphimorphia: Didelphidae; Lagomorpha: Leporidae; Rodentia: Cricetidae, Sciuridae (ANL)

Human infestation: yes (Merten and Durden 2000)

Remarks: Guglielmone et al. (2003) and Kolonin (2009) treat *I. texanus* as a Nearctic species, but Guzmán-Cornejo et al. (2007) present *bona fide* records for the Neotropics. The host profile of *I. texanus* differs between the eastern and western portions of its range in the U.S.A. (Durden and Keirans 1996), implying some doubt about the conspecificity of both populations.

References

Darsie, R.F. & Anastos, G. 1957. Geographical distribution and hosts of *Ixodes texanus* Banks (Acarina, Ixodidae). Ann. Entomol. Soc. Am., 50: 295–301.

Durden, L.A. & Keirans, J.E. 1996. Nymphs of the genus *Ixodes* (Acari: Ixodidae) of the United States: taxonomy, identification key, distribution, hosts, and medical/veterinary importance. Thomas Say Publ. Entomol. Monogr. (9), 95 pp.

Goddard, J. & Norment, B.R. 1983. New record for *Ixodes texanus* (Acarina: Ixodidae) Banks in Mississippi, with a new host record. Entomol. News, 94: 139–140.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.
Guzmán-Cornejo, C., Robbins, R.G. & Pérez, T.M. 2007. The *Ixodes* (Acari: Ixodidae) of Mexico: parasite-host and host-parasite checklists. Zootaxa, 1553: 47–58.
Harlan, H.J. & Palmer, D.B. 1974. Ectoparasites of mammals and birds from Fort Bragg, North Carolina. J. Elisha Mitchell Sci. Soc., 90: 141–144.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Merten, H.A. & Durden, L.A. 2000. A state-by-state survey of ticks recorded from humans in the United States. J. Vector Ecol., 25: 102–113.

222 – *I. theilerae* Arthur, 1953 (Parasitology, 43: 239–245)

Type depository: OVI (paratype) (Arthur 1965, *op. cit.* under *I. arabukiensis*), originally named *I. theileri* and given its correct name in Arthur, D.R. (1958. New species of *Ixodes* ticks from eastern Africa, with a description of the male and nymph of *Ixodes oldi* Nuttall, 1913. Parasitology, 48: 38–69)

Known stages: female

Zoogeographic Region: Afrotropical

Ecoregions: succulent Karoo; few ticks in Nama Karoo

Hosts: Passeriformes (several families) (A)

Human infestation: no

References

Arthur, D.R. 1965. Ticks of the genus *Ixodes* in Africa. The Athlone Press, University of London, London, 348 pp.
Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.

223 – *I. thomasae* Arthur & Burrow, 1957 (Bull. Mus. Comp. Zool., 116: 493–537).

Type depository: USNTC (holotype, paratype) (Keirans and Clifford 1984, *op. cit.* under *I. amersoni*)

Known stages: male, female, larva

Zoogeographic Region: Afrotropical

Ecoregions: northern *Acacia-Commiphora* bushlands and thickets; few ticks in Victoria Basin forest-savanna mosaic

Hosts: Mammalia (several orders); Cuculiformes: Cuculidae; Passeriformes: Malaconotidae, Ploceidae (A)
Soricomorpha: Soricidae (L)

Human infestation: no

Remarks: Camicas et al. (1998) list the larva of *I. thomasae* as described, but there is no formal description of it. Morel (1976) states that larva B from Soricidae in Liwro (Kivu), described in Morel et al. (1969), should be regarded as the larva of *I. thomasae*. We consider this description provisionally valid, but Kolonin (2009) does not believe that the larva has been described. The latter author also ignores records of this tick from Aves in Keirans et al. (1972) and Mathysse and Colbo (1987). Punyua and Newson (1985) presumably found larvae of *I. thomasae* on several mammalian hosts, but they state that these records need confirmation and we have not included them in our host list. Morel (1976) claims that Keirans et al. (1972) found *I. thomasae* on *Guttera* (Galliformes: Numididae), but we have been unable to confirm this. Colbo (1973) allegedly found adult *I. thomasae* on Muridae, but this diagnosis was changed to *Ixodes* near *thomasae* in Colbo and MacLeod (1976).

References

Arthur, D.R. 1965. Ticks of the genus *Ixodes* in Africa. The Athlone Press, University of London, London, 348 pp.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Clifford, C.M. & Walker, J.B. 1966. Host and distribution records for several species of the genus *Ixodes* (Acarina: Ixodidae) that occur in East Africa. Rev. Zool. Bot. Afr., 74: 155–168.

Colbo, M.H. 1973. Ticks of Zambian wild animals: a preliminary checklist. Puku (7): 97–105.

Colbo, M.H. & MacLeod, J. 1976. Ecological studies of ixodid ticks (Acari, Ixodidae) in Zambia. II. Ticks found on small mammals and birds. Bull. Entomol. Res., 66: 489–500.

Keirans, J.E., Backhurst, G.C. & Clifford, C.M. 1972. Description of the male of *Ixodes walkerae* with notes on the female and description of the males of *Ixodes daveyi* and *Ixodes thomasae* (Acarina: Ixodidae). Rev. Zool. Bot. Afr., 85: 59–66.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Matthysse, J.G. & Colbo, M.H. 1987. The ixodid ticks of Uganda. Entomological Society of America, College Park, Maryland, 426 pp.

Morel, P.-C. 1976. Contribution à la connaissance de la distribution des tiques (Acariens, Ixodidae et Amblyommidae) en Afrique éthiopienne continentale. Annexe cartographique. Institut d'Élevage et de Médecine Vétérinaire des Pays Tropicaux, Paris, 326 pp.

Morel, P.-C., Sénevet, G. & Rodhain, F. 1969. Morphologie de quelques larves d'*Ixodes* d'Afrique centrale. Rev. Zool. Bot. Afr., 79: 132–141.

Punyua, D.K. & Newson, R.M. 1985. The brown ear tick *Rhipicephalus appendiculatus* Neumann (Acarina: Ixodidae) and associated tick species on wild and domestic hosts at Muguga, Kenya. J. Parasitol., 71: 248–252.

224 – *I. tiptoni* Kohls & Clifford, 1962 (J. Parasitol., 48: 182–184)

Type depository: USNTC (holotype, paratypes) (Keirans and Clifford 1984, *op. cit*. under *I. amersoni*)

Known stages: female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: Rodentia: Sciuridae (ANL)

Human infestation: no

References

Fairchild, G.B., Kohls, G.M. & Tipton, V.J. 1966. The ticks of Panama (Acarina: Ixodoidea). *In* W.R. Wenzel & V.J. Tipton (editors), Ectoparasites of Panama. Field Museum of Natural History, Chicago, pp. 167–219.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

225 – *I. tovari* Cooley, 1945 (Pan-Pacif. Entomol., 21: 144–148)

Type depository: USNTC (holotype, paratypes), MCZ, DEP, CT (paratypes) (Cooley, R.A. 1945. *Ixodes tovari*, a new species from Mexico (Ixodidae). Pan-Pacific. Entomol., 21: 144–148)

Known stages: male, female, nymph, larva

Zoogeographic Region: Nearctic

Ecoregion: xeric shrublands and subtropical dry broadleaf forests

Hosts: usual hosts for larvae, nymphs and adult ticks are Lagomorpha: Leporidae.
Lagomorpha: Leporidae (ANL)
Artiodactyla: Bovidae; Rodentia: Heteromyidae; Passeriformes: Emberizidae, Icteridae (N)

Human infestation: no

Remarks: Camicas et al. (1998) regard this species as Nearctic-Neotropical, but we have been unable to locate *bona fide* records from the Neotropics.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Eads, R.B., Menzies, G.C. & Hightower, B.G. 1956. The ticks of Texas, with notes on their medical significance. Texas J. Sci., 8: 7–24.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.
Guzmán-Cornejo, C., Robbins, R.G. & Pérez, T.M. 2007. The *Ixodes* (Acari: Ixodidae) of Mexico: parasite-host and host-parasite checklists. Zootaxa, 1553: 47–58.

226 – *I. transvaalensis* Clifford & Hoogstraal, 1966 (J. Med. Entomol., 2: 372–373)

Type depositories: SAIMR (holotype, paratype), USNTC (paratype) (Clifford, C.M. & Hoogstraal, H. 1966. *Ixodes transvaalensis* n. sp. from a rodent nest in the Republic of South Africa. J. Med. Entomol., 2: 372–373)

Known stages: female

Zoogeographic Region: Afrotropical

Ecoregion: montane Fynbos and renosterbosveld

Hosts: Rodentia: Muridae (N)

Human infestation: no

Remark: this species is known only from two female specimens collected in a nest of Muridae, indicating that the adults that were used for the description of *I. transvaalensis* had fed as nymphs on this type of host.

References

Clifford, C.M. & Hoogstraal, H. 1966. *Ixodes transvaalensis* n. sp. from a rodent nest in the Republic of South Africa. J. Med. Entomol., 2: 372–373.
Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.

227 – *I. trianguliceps* Birula, 1895 (Izv. Imp. Akad. Nauk, Ser. 5, 2 (4): 353–364)

Type depository: ZIAC (holotype) (Filippova 2008, *op. cit.* under *I. berlesei*)

Known stages: male, female, nymph, larva

Ecoregions: several Palearctic ecoregions

Zoogeographic Region: Palearctic

Hosts: usual hosts for larvae, nymphs and adults are Soricomorpha: Soricidae and Talpidae, and Rodentia: Cricetidae and Muridae. Squamata and Chiroptera are considered exceptional hosts for this tick.
Soricomorpha: Soricidae, Talpidae; Rodentia: Cricetidae, Muridae (ANL)
Rodentia: Myocastoridae (AN)
Galliformes: Phasianidae; Passeriformes: Fringillidae (A)
Rodentia: Sciuridae; Passeriformes: Turdidae (NL)
Squamata: Lacertidae (N)

Chiroptera: Vespertilionidae; Passeriformes: Motacillidae (L)
Mammalia (several orders); Passeriformes: Corvidae, Emberizidae; Piciformes: Picidae; Strigiformes: Strigidae (stages unknown)

Human infestation: yes (Hillyard 1996)

Remarks: Kolonin (2009) ignores Aves and Squamata as hosts of *I. trianguliceps*, but the references below support this host-parasite relationship. However, infestation of Squamata appears to be a rare event (Fedorov 1970), as is infestation of Chiroptera (Siuda et al. 2009).

References

Arthur, D.R. 1963. British ticks. Butterworths, London , 213 pp
Domínguez, G. 2004. North Spain (Burgos) wild mammals ectoparasites. Parasite, 11: 267–272.
Fedorov, V.G. 1970. Bloodsucking ticks on amphibians and reptiles in western Siberia. Tezisy Dokl. 2. Akarol. Sovesch. (2): 185–186. In Russian, NAMRU-3 translation 1493.
Fedorov, V.G. 1972. Ticks of the superfamily Ixodoidea of birds and their nests in western Siberia. *In* A. Cherepanov and L.A. Mater (editors), Transcontinental associations of migratory birds and their role in distribution of arboviruses. 5. Simp. Isuch. Roli Pereletn. Ptits Rasp. Arbovirus, Novosibirsk, Jul. 1969, pp. 384–388. In Russian, NAMRU-3 translation 1494.
Feider, Z. 1964. Les connaissances actuelles sur les Acariens de Roumanie (Ixodides, Gamasides et Trombiculides). Acarologia (Fasc. Hors Sér.): 262–274.
Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.
Filippova, N.A. 2010. Uncommon zoogeographical connections in the subgenus *Exopalpiger* Schultze [sic] of the genus *Ixodes* Latreille (Acari, Ixodidae). Entomol. Rev., 90: 793–797.
Graf, J.-F., Mermod, C. & Aeschlimann, A. 1979. Nouvelles donées concernant la distribution, l' écologie et la biologie d'*Ixodes* (*Exopalpiger*) *trianguliceps* (Birula, 1895) [sic] en Suisse (Ixodoidea, Ixodidae). Bull. Soc. Neuchâteloise Sci. Nat., 102: 55–67.
Hillyard, P.D. 1996. Ticks of North-West Europe. Keys and notes for identification of the species. Synopses of the British Fauna (New Series) (52), Field Studies Council, Shrewsbury, UK, 178 pp.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Korenberg, E.I. & Lebedeva, N.N. 1969. Distribution and some general features of the ecology of *Ixodes trianguliceps* Bir. in the Soviet Union. Folia Parasitol., 16: 143–152.
Krčmar, S. 2012. Hard ticks (Acari, Ixodidae) of Croatia. ZooKeys, 234: 19–57.
Martyn, K.P. 1988. Provisional atlas of the ticks (Ixodoidea) of the British Isles. Biological Records Centre, Natural Environment Research Council, UK, 62 pp.
Newson, R.M. & Holmes, R.G. 1968. Some ectoparasites of the coypu (*Myocastor coypus*) in eastern England. J. Anim. Ecol., 37: 471–481.

Nilsson, A. 1974, Host relations and population changes of *Ixodes trianguliceps* (Acari) in northern Scandinavia. Oikos, 25: 315–320.
Siuda, K. 1993. Ticks of Poland (Acari: Ixodidae) Part II. Taxonomy and distribution. Polskie Towarystwo Parazytologiczne, Warsaw, 381 pp.
Siuda, K., Stanko, M., Piksa, K. & Górz, A. 2009. Ticks (Acari: Ixodida) parasitizing bats in Poland and Slovakia. Wiad. Parazytol., 55: 39–45.
Tovornik, D. 1988. Geographic distribution and other population parameters of *Ixodes* (*Exopalpiger*) *trianguliceps* (Birula, 1895) [sic] in Yugoslavia. Biol. Vestn., 36: 33–54.

228 – *I. trichosuri* Roberts, 1960 (Aust. J. Zool., 8: 392–485)

Type depositories: AM (holotype, paratypes), ANIC, NM, QM (paratypes) (Roberts, 1960, *op. cit.* under *I. antechini*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Australasian

Ecoregions: southeast Australian temperate forests; Tasmanian temperate forests; few ticks in Tasmanian central highland forests

Hosts: Diprotodontia: Phalangeridae (AN)
Diprotodontia: Potoroidae (N)
Rodentia: Muridae (L)
Peramelemorphia: Peramelidae (N and/or L)
Diprotodontia: Macropodidae (stage unknown)

Human infestation: no

Remarks: Roberts (1964) lists Passeriformes as hosts of larvae and nymphs of *I. trichosuri*, but this statement was not confirmed in Roberts (1970). Poiani (1992) also mentions Aves as probable hosts for *I. trichosuri*, but, again, this statement has not been confirmed. We therefore have not included Aves in our host list for this tick. Aves are retained as hosts for *I. trichosuri* in Camicas et al. (1998). Baxter et al. (2009) provide tentative diagnoses of larvae and nymphs of *I. trichosuri* from dogs and cats, but we feel that these identifications require confirmation, and dogs and cats have not been included in the above host list. Roberts (1970) does not indicate whether larvae, nymphs or both immature stages were present on Peramelidae.

References

Baxter, C.G., Vogelnest, L.J. & Doggett, S.L. 2009. Dermatoses caused by infestations of immature *Ixodes* spp. on dogs and cats in Sydney, Australia. Aust. Vet. J., 87: 182–187.
Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Owen, I.L. 2011. Parasites of animals in Papua New Guinea recorded at the National Veterinary Laboratory: a catalogue, historical review and zoogeographical affiliations. Zootaxa, 3143: 1–163.
Poiani, A. 1992. Ectoparasitism as a possible cost of social life: a comparative analysis using Australian passerines (Passeriformes). Oecologia, 92: 429–441.
Roberts, F.H.S. 1964. The tick fauna of Tasmania. Rec. Queen Victoria Mus. Launceston New Ser. (17): 2–8.
Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.

229 – *I. tropicalis* Kohls, 1956 (J. Parasitol., 42: 636–649)

Type depositories: CNHM (holotype), USNTC (paratypes) (Kohls 1956, *op. cit.* under *I. andinus*)

Known stages: female

Zoogeographic Region: Neotropical

Ecoregion: Cauca Valley montane moist broadleaf forests

Hosts: Rodentia: Cricetidae (ANL)
Rodentia: Echimyidae (A)

Human infestation: no

Remarks: the larva and nymph of *I. tropicalis* have not been described. However, there are provisional records of these stages from Rodentia in Trapido and Sanmartín (1971).

References

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.
Kohls, G.M. 1956. Eight new species of *Ixodes* from Central and South America (Acarina: Ixodidae). J. Parasitol., 42: 636–649.
Trapido, H. & Sanmartín, C. 1971. Pichindé virus. A new virus of the Tacaribe group from Colombia. Am. J. Trop. Med. Hyg., 20: 631–641.

230 – *I. turdus* Nakatsudi, 1942 (J. Agric. Sci. (Tokyo), 1: 287–328. In Japanese)

Type depository: undetermined

Known stages: female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: Nihonkai montane deciduous forests; few ticks in Manchurian mixed forests

Hosts: Rodentia are considered exceptional host for this tick.

Galliformes: Phasianidae; Passeriformes (several families) (ANL)
Strigiformes: Strigidae (AL)
Rodentia: Muridae (L)

Human infestation: yes (Okino et al. 2010)

Remarks: there is a record of *I. turdus* in Noh (1972) from Erinaceidae that requires confirmation, and this record has not been included in our list of hosts of this tick. On the other hand, we accept as valid the record of this tick from Muridae in Asanuma and Kosaka (1955). This odd record is not included in Kolonin (2009). Heath (2013) lists ungulates as hosts of *I. turdus* as a result of a transcription error (Heath, A.C.G., personal communication to Guglielmone, A.A.).

References

Asanuma, K. & Kosaka, K. 1955. Notes on a tick, *Ixodes turdus* Nakatsuji, 1942, found on birds in Japan. Bull. Biogeogr. Soc. Jap. (16–19) (Recent conceptions of Japanese fauna), pp. 192–196. In Japanese, NAMRU-3 translation 50.

Heath, A.C.G. 2013. Implications for New Zealand of potentially invasive ticks sympatric with *Haemaphysalis longicornis* Neumann, 1901 (Acari: Ixodidae). Syst. Appl. Acarol., 18: 1–26.

Kang, J.-G., Kim, H.-C., Choi, C.-Y., Nam, H.-Y., Chae, H.-Y., Chong, S.-T., Klein, T.A., Ko, S. & Chae, J.-S. 2013. Molecular detection of *Anaplasma*, *Bartonella*, and *Borrelia* species in ticks collected from migratory birds from Hong-do Island, Republic of Korea. Vector- Borne Zoon. Dis., 13: 215–225.

Kim, H.C., Ko, S., Choi, C.-Y., Nam, H.-Y., Chae, H.Y., Chong, S.T., Klein, T.A., Sames, W.J., Robbins, R.G. & Chae, J.-S. 2009. Migratory bird tick surveillance, including a new record of *Haemaphysalis ornithophila* Hoogstraal and Kohls 1959 (Acari: Ixodidae) from

Hong-do (Hong Island), Republic of Korea. Syst. Appl. Acarol., 14: 3–10.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Miyamoto, K., Masuzawa, T. & Kudeken, M. 2000. Tick collection from wild birds and detection of Lyme disease spirochetes from a new avian reservoir in Japan. Med. Entomol. Zool., 51: 221–226.

Noh, Y.T. 1972. Faunal studies on the ticks in Korea. *In* Floral studies on some taxa of plants and faunal studies on some taxa of animals in Korea. Ministry of Science and Technology, pp. 141–160. In Korean.

Okino, T., Ushirogawa, H., Matoba, K., Hatsushika, R. 2010. Bibliographical studies on human cases of hard tick (Acarina: Ixodidae) bites in Japan (5) Cases of *Ixodes acutitarsus* and *I. turdus* infestation. Kawasaki Med. J., 36: 115–120.

Woo, I.C., Baba, S., Suzuki, H. & Kawabata, M. 1990. A case of tick bite with *Ixodes turdus* Nakatsuji. A report from Japan. J. Dermatol., 17: 56–58.

Yamaguti, N., Tipton, V.J., Keegan, H.L. & Toshioka, S. 1971. Ticks of Japan, Korea, and the Ryukyu Islands. Brigham Young Univ. Sci. Bull. Biol. Ser., 15 (1), 226 pp.

Yamauchi, T. 2001. A bibliographical survey of host-parasite relationships between birds and ticks from Japan. Bull. Hoshizaki Green Found., 5: 271–308. In Japanese.

231 – *I. ugandanus* Neumann, 1906 (Arch. Parasitol., 10: 195–219)

Type depository: BMNH (syntypes) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: several Afrotropical ecoregions

Hosts: usual hosts for nymphs and adults are Rodentia: Thryonomyidae. Aves are considered exceptional hosts for this tick.
Carnivora: Viverridae; Rodentia: Nesomyidae, Thryonomyidae (AN)
Carnivora: Herpestidae; Primates: Lorisidae (A)
Artiodactyla: Bovidae (N)
Primates: Cercopithecidae; Rodentia: Muridae; Cuculiformes: Cuculidae (stages unknown)

Human infestation: no

Remarks: Kolonin (2009) states that the larva of *I. ugandanus* had been found on Rodentia, but we have been unable to confirm this or any other host for the larva. This author does not include hosts other than Rodentia in his list of hosts of *I. ugandanus*, but we accept records from other hosts reported in the references below. Matthysse and Colbo (1987) mention differences in the morphological characters of the female specimens that they examined and those of *I. ugandanus* as defined by Arthur (1965).

References

Allen, G.M. & Lawrence, B. 1936. Scientific results of an expedition to rain forest regions in eastern Africa. III. Mammals. With field notes by Arthur Loveridge. Bull. Mus. Comp. Zool., 79: 29–126.

Arthur, D.R. 1965. Ticks of the genus *Ixodes* in Africa. The Athlone Press, University of London, London, 348 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Matthysse, J.G. & Colbo, M.H. 1987. The ixodid ticks of Uganda. Entomological Society of America, College Park, Maryland, 426 pp.

Norval, R.A.I., Spickett, A.M. & Clifford, C.M. 1987. The ticks of Zimbabwe. XVI. The genus *Ixodes*. Zimbabwe Vet. J., 18: 1–10.

Rousselot, R. 1951. *Ixodes* de l'Afrique noire. Bull. Soc. Pathol. Exot., 44: 307–309.

Santos Dias, J.A.T. 1960. Lista das carraças de Moçambique e respectivos hospedeiros. III. Anais Serv. Vet. Ind. Anim. Moçambique (1953–1954), 6: 213–287.

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

232 – *I. unicavatus* Neumann, 1908 (Arch. Parasitol., 12: 5–27)

Type depositories: EC (syntypes) (Nuttall and Warburton 1911, *op. cit.* under *I. acuminatus*).

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: Celtic broadleaf forests; English lowlands beech forests; few ticks in North Atlantic moist mixed forests

Hosts: usual hosts for larvae, nymphs and adults are Pelecaniformes: Phalacrocoracidae.
Pelecaniformes: Phalacrocoracidae (ANL)
Passeriformes: Motacillidae (L)
Charadriiformes: Alcidae; Falconiformes: Falconidae (stages unknown)

Human infestation: no

References

Arthur, D.R. 1963. British ticks. Butterworths, London , 213 pp.
Dietrich, M., Gómez-Díaz, E. & McCoy, K.D. 2011. Worldwide distribution and diversity of seabird ticks: implications for the ecology and epidemiology of tick-borne pathogens. Vector-Borne Zoon. Dis., 11: 453–470.
Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.
Guiguen, C., Monnat, J.Y., Launay, H. & Beaucournu, J.C. 1987. Ectoparasites des oiseaux en Bretagne. III. Ixodoidea. Cah. ORSTOM, Sér. Entomol. Méd. Parasitol. (spec. issue): 73–81.
Jaenson, T.G.T., Talleklint, L., Lundqvist, L., Olsen, B., Chirico, J. & Mejlon, H. 1994. Geographical distribution, host associations, and vector roles of ticks (Acari: Ixodidae, Argasidae) in Sweden. J. Med. Entomol., 31: 240–256.
Martyn, K.P. 1988. Provisional atlas of the ticks (Ixodoidea) of the British Isles. Biological Records Centre, Natural Environment Research Council, UK, 62 pp.

233 – *I. uriae* White, 1852 (*In* Journal of a voyage in Baffin's Bay and Barrow Straits in the years 1850–1851, volume 2 (appendix): 208–211)

Type depository: MNHN? [sic] (Arthur 1965, *op. cit.* under *I. arabukiensis*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: circumpolar (around the poles and adjacent regions of the Afrotropical, Australasian, Nearctic, Neotropical and Palearctic Regions and various islands)

Ecoregions: several circumpolar ecoregions or close to these. See remarks below.

Hosts: Mammalia are considered exceptional hosts for this tick.
Aves (several orders) (ANL)

Carnivora: Mustelidae (A)
Rodentia: Muridae (N)
Rodentia: Cricetidae (stages unknown)

Human infestation: yes (Jaenson and Jensen 2007)

Remarks: Camicas et al. (1998), who classify this species as *Ceratixodes uriae*, state that, with the exception of the Oriental Region, the distribution of *I. uriae* encompasses all zoogeographic regions. In fact, there are records from islands close to the north and south polar portion of these regions, as well as continental coastal records, sometimes quite distant from the poles. McCoy et al. (2005) consider that *I. uriae* probably comprises a species complex, but the situation is still undefined (McCoy et al. 2012; Dietrich et al. 2013). See Johnston (1937) for a discussion of several erroneous host and locality records for *I. uriae* (under the name *I. putus*), and Yamaguti et al. (1971) who doubt a record of *I. uriae* (named *I. putus*) from a bat in Kishida (1930). There are at least three *bona fide* records from Mammalia in Eley (1977), Jaenson and Jensen (2007) and Baggs et al. (2011). Kolonin (2009) does not include the odd records of Eley (1977) and Jaenson and Jensen (2007) in his list of hosts of this tick.

References

Baggs, E.M., Stack, S.H., Finney-Crawling, J.R. & Simon, N.P. 2011. *Peromyscus maniculatus*, a possible reservoir host of *Borrelia garinii* from the Gannet Islands off Newfoundland and Labrador. J. Parasitol., 97: 792–794.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Dietrich, M., Gómez-Díaz, E. & McCoy, K.D. 2011. Worldwide distribution and diversity of seabird ticks: implications for the ecology and epidemiology of tick-borne pathogens. Vector-Borne Zoon. Dis., 11: 453–470.

Dietrich, M., Beati, L., Elguero, E., Boulinier T. & McCoy, K.D. 2013. Body size and shape evolution in host races of the tick *Ixodes uriae*. Biol. J. Linnean Soc., 108: 323–334.

Eley, T.J. 1977. *Ixodes uriae* (Acari: Ixodidae) from a river otter. J. Med. Entomol., 13: 506.

Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.

Jaenson, T.G.T. & Jensen, J.-K. 2007. Records of ticks (Acari, Ixodidae) from the Faroe Islands. Norw. J. Entomol., 54: 11–15.

Jaenson, T.G.T., Talleklint, L., Lundqvist, L., Olsen, B., Chirico, J. & Mejlon, H. 1994. Geographical distribution, host associations, and vector roles of ticks (Acari: Ixodidae, Argasidae) in Sweden. J. Med. Entomol., 31: 240–256.

Johnston, T.H. 1937. Ticks (Ixodoidea). Australas. Antarc. Exp. Ser. C, 2 (part 3): 5–19.

Kishida, K. 1930. Notes on Japanese ticks of the genus *Ixodes* Latreille, 1795. Lansania, 2 (11): 1–5. In Japanese.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
McCoy, K.D., Chapuis, E., Tirard, C., Boulinier, T., Michalakis, Y., Le Bohec, C., Le Maho, Y. & Gauthier-Clerc, M. 2005. Recurrent evolution of host-specialized races in a globally distributed parasite. Proc. R. Soc. B, 272: 2389–2395.
McCoy, K.D., Beis, P., Barbosa, A., Cuervo, J.J., Fraser, W.R., González-Solís, J., Jourdain, E., Poisbleau, M., Quillfeldt, P., Léger, E. & Dietrich, M. 2012. Population genetic structure and colonization of the western Antarctic Peninsula by the sea bird tick *Ixodes uriae*. Mar. Ecol. Progr. Ser., 459: 109–120.
Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.
Yamaguti, N., Tipton, V.J., Keegan, H.L. & Toshioka, S. 1971. Ticks of Japan, Korea, and the Ryukyu Islands. Brigham Young Univ. Sci. Bull. Biol. Ser., 15 (1), 226 pp.

234 – *I. vanidicus* Schulze, 1943 (Zool. Anz., 142: 121–141)

Type depository: lost (Keirans et al. 1982, *op. cit.* under *I. catherinei*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: Cameroonian highlands forests; few ticks in Eastern Guinean forests and Central Congolian lowland forests

Hosts: Carnivora: Herpestidae (ANL)

Artiodactyla: Bovidae; Carnivora: Canidae, Felidae, Viverridae; Macroscelidea: Macroscelididae (A)

Human infestation: yes (Ntiamoa-Baidu et al. 2004)

Remarks: see *I. oldi*.

References

Keirans, J.E., Clifford, C.M. & Walker, J.B. 1982. The *Ixodes* (*Afrixodes*) *oldi* group (Acari: Ixodidae) from sub-Saharan Africa with descriptions of five new species. J. Med. Entomol., 19: 309–329.
Morel, P.-C. & Mouchet, J. 1965. Les tiques du Cameroun (Ixodidae et Argasidae) (2e. note). Ann. Parasitol. Hum. Comp., 40: 477–496.
Ntiamoa-Baidu, Y., Carr-Saunders, C., Matthews, B.E., Preston, P.M. & Walker, A.R. 2004. An updated list of the ticks of Ghana and an assessment of the distribution of the ticks of Ghanaian wild mammals in different vegetation zones. Bull. Entomol. Res., 94: 245–260.
Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

235 – *I. venezuelensis* Kohls, 1953 (J. Parasitol., 39: 300–303)

Type depositories: USNTC (holotype, paratypes), BMNH (paratypes) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: Didelphimorphia: Didelphidae; Rodentia: Cricetidae (ANL)
Rodentia: Heteromyidae (AN)
Rodentia: Muridae (A)
Rodentia: Echimyidae (NL)
Rodentia: Dasyproctidae, Sciuridae (N)

Human infestation: no

References

Durden, L.A. & Keirans, J.E. 1994. Description of the larva, diagnosis of the nymph and female based on scanning electron microscopy, hosts, and distribution of *Ixodes* (*Ixodes*) *venezuelensis*. Med. Vet. Entomol., 8: 310–316.

Guglielmone, A.A. & Nava, S. 2011. Rodents of the subfamily Sigmodontinae (Myomorpha: Cricetidae) as hosts for South American hard ticks (Acari: Ixodidae) with hypothesis of life history. Zootaxa, 2904: 45–65.

Guglielmone, A.A., Nava, S. & Díaz, M.M. 2011. Relationships of South American marsupials (Didelphimorphia, Microbiotheria and Paucituberculata) and hard ticks (Acari: Ixodidae) with distribution of four species of *Ixodes*. Zootaxa, 3086: 1–30.

236 – *I. ventalloi* Gil Collado, 1936 (Treballs Mus. Cienc. Nat. Barcelona, Ser. Entomol., 11 (2), 8 pp.)
See *I. bivari*.

Type depositories: MCNB (holotype) (Santos Dias, J.A.T. 1985. Um novo Ixodídeo (Acarina, Ixodoidea) para a fauna de Portugal. *Ixodes ventalloi* Gil Collado, 1936. Bol. Soc. Port. Entomol. 4 (Suppl. 1): 149–159)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: southwest Iberian mediterranean sclerophyllous and mixed forests; northwest Iberian montane forests; Iberian conifer forests

Hosts: Lagomorpha: Leporidae; Carnivora: Canidae, Mustelidae; Rodentia: Gliridae, Muridae (ANL)
Erinaceomorpha: Erinaceidae; Strigiformes: Strigidae, Tytonidae (AN)
Carnivora: Felidae, Herpestidae, Viverridae; Rodentia: Sciuridae; Galliformes: Phasianidae; Gruiformes: Rallidae; Passeriformes: Corvidae, Turdidae (A)
Soricomorpha: Soricidae (N)
Squamata: Agamidae, Lacertidae, Scincidae (NL)

Human infestation: yes (Gilot and Pérez 1978)

Remarks: see *I. festai*.

References

Bailly-Choumara, H., Morel, P.-C. & Rageau, J. 1974. Première contribution au catalogue des tiques du Maroc (Acari, Ixodoidea). Bull. Soc. Sci. Phil. Nat. Maroc, 54: 71–80.

Gilot, B. & Pérez, C. 1978. Individualisation et caractérisation de deux *Ixodes* actuellement confondus: *I. festai* Rondelli, 1926, *I. ventalloi* Gil Collado, 1936. (Acarina, Ixodidae). Rev. Suisse Zool., 85: 143–149.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Millán, J., Ruiz-Fons, F., Márquez, F.J., Viota, M., López-Bao, J.V. & Martín-Mateo, M.P. 2007. Ectoparasites of the endangered Iberian lynx *Lynx pardinus* and sympatric wild and domestic carnivores in Spain. Med. Vet. Entomol., 21: 248–254.

Rosalino, L.M., Rodrigues, M., Santos-Silva, M. & Santos-Reis, M. 2007. Unusual findings on host-tick interactions through carnivore scat analysis. Exp. Appl. Acarol., 43: 293–302.

Santos Dias, J.A.T. 1985. Um novo Ixodídeo (Acarina, Ixodoidea) para a fauna de Portugal. *Ixodes ventalloi* Gil Collado, 1936. Bol. Soc. Port. Entomol. 4 (Suppl. 1): 149–159.

Santos Dias, J.A.T. & Santos-Reis, M. 1989. A carraça *Ixodes ventalloi* Gil Collado, 1936 como principal ectoparasita de uma população de doninhas (*Mustela nivalis* Linnaeus, 1766) em Portugal. García de Orta Ser. Zool., 14: 35–50.

Santos-Silva, M.M., Beati, L., Santos, A.S., Sousa de, R., Núncio, M.S., Melo, P., Santos-Reis, M., Fonseca, C., Formosinho, P., Vilela, C. & Bacellar, F. 2011. The hard-tick fauna of mainland Portugal (Acari: Ixodidae): an update on geographical distribution and known associations with hosts and pathogens. Exp. Appl. Acarol., 55: 85–121.

Sobrino, R., Millán, J., Oleaga, A., Gortázar, C., de la Fuente, J. & Ruiz-Fons, F. 2012. Ecological preferences of exophilic and endophilic ticks (Acari: Ixodidae) parasitizing wild carnivores in the Iberian Peninsula. Vet. Parasitol., 184: 248–257.

Tomassone, L., Grego, E., Auricchio, D., Iori, A., Giannini, F. & Rambozzi, L. 2013. Lyme borreliosis spirochetes and spotted fever group rickettsiae in ixodid ticks from Pianosa Island, Tuscany Archipelago, Italy. Vector-Borne Zoon. Dis., 13: 84–91.

237 – *I. vespertilionis* Koch, 1844 (*In* Deutschlands Crustaceen, Myriapoden und Arachniden. Ein Beitrag zur deutschen Fauna. Herausgegeben von Herrich-Schaäffer, Regensburg, 40 parts)

Type depository: ZMB (holotype) (Moritz and Fischer 1981, *op. cit.* under *I.acutitarsus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical, Oriental, Palearctic

Ecoregion: several Afrotropical, Oriental and Palearctic ecoregions

Hosts: usual hosts for larvae, nymphs and adults are Chiroptera: Rhinolophidae.
Chiroptera: Rhinolophidae, Vespertilionidae (ANL)
Chiroptera: Hipposideridae (AL)
Chiroptera: Emballuronidae (A, N and/or L)

Human infestation: yes (Piksa et al. 2012)

Remarks: Camicas et al. (1998), who classify this species as *Eschatocephalus vespertilionis*, include the Australasian Region within the range of *I. vespertilionis*, but there are no *bona fide* records of this species from Australia according to Halliday (2000), or elsewhere within the region. The alleged record of *I. vespertilionis* from Australia in Nuttall and Warburton (1911), repeated in Neumann (1916), corresponds in fact to an African locality, as explained in Halliday (2000). Theiler (1962) records immature stages of *I. vespertilionis* without specifying whether larvae, nymphs or both stages were found on hosts. Yamaguti et al. (1971) doubt a record from Leporidae in Japan, and although Noh (1972) claims to have found females of this tick on dogs, we regard these records as doubtful and they have not been included in our list of hosts of *I. vespertilionis*.

References

Beaucournu, J.-C. 1961. Ectoparasites des chiroptères de l'ouest de la France. 1re partie: Ixodoidés, Cimicides et Nyctéribiidés. Bull. Soc. Sci. Bretagne, 36: 315–338.

Bush, S.E. & Robbins, R.G. 2012. New host and locality records for *Ixodes simplex* Neumann and *Ixodes vespertilionis* Koch (Acari: Ixodidae) from bats (Chiroptera: Hipposideridae, Rhinolophidae and Vespertilionidae) in southern China. Int. J. Acarol., 38: 1–5.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.

Halliday, B. 2000. *Ixodes* Latreille, 1795. Australian biological resources study. Canberra. http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/index/html/. Accessed February 12, 2008.

Neumann, L.G. 1916. Ixodidei (Acariens) Première série. Arch. Zool. Exp. Gén., 55: 515–527.

Noh, Y.T. 1972. Faunal studies on the ticks in Korea. *In* Floral studies on some taxa of plants and faunal studies on some taxa of animals in Korea. Ministry of Science and Technology, pp. 141–160. In Korean.

Nuttall, G.H.F. & Warburton, C. 1911. Ticks, a monograph of the Ixodoidea. Part II. Ixodidae. Section II. Genus I. *Ixodes* Latrielle, 1795. Cambridge at the University Press, London, pp. 133–293.

Piksa, K., Nowak-Chmura, M. & Siuda, K. 2012. First case of human infestation by the tick *Ixodes vespertilionis* (Acari: Ixodidae). Int. J. Acarol., 39: 1–2.
Sanyal, A.K. & De, S.K. 2005. Status of ticks (Acari: Metastigmata) of Rajasthan. Rec. Zool. Survey Ind., 104: 129–136.
Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.
Yamaguti, N., Tipton, V.J., Keegan, H.L. & Toshioka, S. 1971. Ticks of Japan, Korea, and the Ryukyu Islands. Brigham Young Univ. Sci. Bull. Biol. Ser., 15 (1), 226 pp.

238 – *I. vestitus* Neumann, 1908 (Arch. Parasitol., 12: 5–27)

Type depository: BMNH (holotype) (Nuttall and Warburton 1911, *op. cit.* under *I. acuminatus*), but not listed in the catalog for BMNH by Keirans and Hillyard (2001, *op. cit.* under *I. anatis*)

Known stages: female, nymph, larva

Zoogeographic Region: Australasian

Ecoregion: southwest Australia woodlands

Hosts: usual hosts for adult ticks are Dasyuromorphia: Myrmecobiidae.
Squamata: Elapidae (ANL)
Dasyuromorphia: Myrmecobiidae (A)

Human infestation: no

Remarks: Kolonin (2009) ignores records of *I. vestitus* from Squamata, but we provisionally accept the record from this type of host in Nuttall and Warburton (1911). Durden and Keirans (1996) list *I. vestitus* as an endangered species.

References

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Nuttall, G.H.F. & Warburton, C. 1911. Ticks, a monograph of the Ixodoidea. Part II The Ixodidae. Section II Genus I. *Ixodes* Latreille, 1795. Cambridge University Press, London, pp 133–293.
Roberts, F.H.S. 1969. The larvae of Australian Ixodidae (Acarina: Ixodoidea). J. Aust. Entomol. Soc., 8: 37–78.
Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.

239 – *I. victoriensis* Nuttall, 1916 (Parasitology, 8: 294–337)

Type depository: BMNH (lectotype) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: female

Zoogeographic Region: Australasian

Ecoregion: southeast Australia temperate forests

Hosts: Diprotodontia: Vombatidae (A)

Human infestation: no

Reference

Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.

240 – *I. walkerae* Clifford, Kohls & Hoogstraal, 1968 (J. Med. Entomol., 5: 513–514)

Type depository: USNTC (holotype) (Keirans and Clifford 1984, *op. cit.* under *I. amersoni*)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregion: Victoria Basin forest-savanna mosaic

Hosts: Carnivora: Herpestidae, Viverridae; Galliformes: Numididae; Passeriformes: Turdidae (A)

Human infestation: no

Remarks: Cumming (1998) does not recognize Galliformes as hosts of this species, but we accept the record from this type of host in Keirans et al. (2004). Agreeing with Camicas et al. (1998), Kolonin (2009) recognizes only Aves as hosts for *I. walkerae*. Nonetheless, Norval et al. (1987) found female ticks resembling *I. walkerae* on Carnivora in Zimbabwe. We feel that labeling *I. walkerae* as an exclusive parasite of Aves is premature, and we therefore provisionally accept hosts from Aves and Mammalia.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Cumming, G.S. 1998. Host preference in African ticks (Acari: Ixodida): a quantitative data set. Bull. Entomol. Res., 88: 379–406.

Keirans, J.E., Backhurst, G.C. & Clifford, C.M. 1972. Description of the male of *Ixodes walkerae* with notes on the female and description of the males of *Ixodes daveyi* and *Ixodes thomasae* (Acarina: Ixodidae). Rev. Zool. Bot. Afr., 85: 59–66.

Kolonin, G.V. 2008. Birds as hosts of ixodid ticks (Acarina, Ixodidae). Entomol. Rev., 88: 1012–1015.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Norval, R.A.I., Spickett, A.M. & Clifford, C.M. 1987. The ticks of Zimbabwe. XVI. The genus *Ixodes*. Zimbabwe Vet. J., 18: 1–10.

241 – *I. werneri* Kohls, 1950 (Natl. Inst. Health Bull. (192), 28 pp.)

Type depository: CNHM (holotype, paratype) (Kohls, G.M. 1950. Ticks (Ixodoidea) of the Philippines. Natl. Inst. Health Bull. (192), 28 pp.)

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregions: Peninsular Malaysian rain forests; Java rain forests; Palawan rain forests

Hosts: Rodentia: Muridae (ANL)

Scandentia: Tupaiidae (NL)

Human infestation: no

Remarks: Kolonin (2009) states that adult *I. werneri* also feed on Scandentia, but we have been unable to confirm this host-parasite relationship.

References

Keirans, J.E., Clifford, C.M. & Hoogstraal, H. 1970. Description of the male and immature stages of *Ixodes* (*I.*) *werneri* Kohls (Acarina: Ixodidae), a parasite of *Rattus* in mountains of Palawan, Malaya, and Java. J. Med. Entomol., 7: 605–608.

Kolonin, G.V. 2003. New data on ixodid tick fauna of Vietnam. Entomol. Rev., 83 (Suppl. 2): S190-S192.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

242 – *I. woodi* Bishopp, 1911 (Proc. Biol. Soc. Wash., 24: 197–208)

Type depository: USNTC (holotype) (Keirans and Clifford 1984, *op. cit.* under *I. amersoni*) as *I. angustus woodi*

Known stages: male, female, nymph, larva

Zoogeographic Region: Nearctic

Ecoregions: Upper East Gulf Coastal Plain; USA prairie-forest border

Hosts: usual hosts for larvae, nymphs and adults are Rodentia: Cricetidae.
Rodentia: Cricetidae; Soricomorpha: Soricidae (ANL)
Carnivora: Procyonidae; Rodentia: Sciuridae (A)
Rodentia: Heteromyidae (NL)
Carnivora: Mephitidae; Rodentia: Geomyidae (N)

Human infestation: yes (Merten and Durden 2000)

Remarks: Kolonin (2009) ignores host records other than Rodentia, but there are *bona fide* records from other orders of Mammalia in the references cited below.

References

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
McCay, T.S. & Durden, L.A. 1996. Ticks and fleas of shrews in Appalachian Georgia and North Carolina. J. Parasitol., 82: 666–667.
Merten, H.A. & Durden, L.A. 2000. A state-by-state survey of ticks recorded from humans in the United States. J. Vector Ecol., 25: 102–113.
Rejmanek, D., Nieto, N.C., Barash, N. & Foley, J.E. 2011. Temporal patterns of tick-borne granulocytic anaplasmosis in California. Ticks Tick-borne Dis., 2: 81–87.
Robbins, R.G. & Keirans, J.E. 1992. Systematics and ecology of the subgenus *Ixodiopsis* (Acari: Ixodidae: *Ixodes*). Thomas Say Publ. Entomol. Monogr. (14), 159 pp.

243 – *I. zaglossi* Kohls, 1960 (Acarologia, 2: 447–452)

Type depositories: AM (holotype, paratypes), USNTC (paratypes) (Kohls, G.M. 1960. *Ixodes* (*Endopalpiger*) *zaglossi*, n. sp. from the long-beaked echidna of New Guinea (Acarina: Ixodidae). Acarologia, 2: 447–452)

Known stages: male, female

Zoogeographic Region: Australasian

Ecoregion: New Guinea montane rain forests

Hosts: Monotremata: Tachyglossidae (A)

Human infestation: no

Remarks: Durden and Keirans (1996) regard *I. zaglossi* as an endangered species.

References

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.
Kohls, G.M. 1960. *Ixodes* (*Endopalpiger*) *zaglossi*, n. sp. from the long-beaked echidna of New Guinea (Acarina: Ixodidae). Acarologia, 2: 447–452.

244 – *I. zairensis* Keirans, Clifford & Walker, 1982 (J. Med. Entomol., 19: 309–329)

Type depositories: USNTC (holotype, paratypes), BMNH, OVI (paratypes) (Keirans and Hillyard 2001, *op. cit.* under *I. anatis*)

Known stages: female, nymph

Zoogeographic Region: Afrotropical

Ecoregion: Central Congolian lowland forests

Hosts: Soricomorpha: Soricidae (AN)

Human infestation: no

Remarks: see *I. oldi*.

Reference

Keirans, J.E., Clifford, C.M. & Walker, J.B. 1982. The *Ixodes* (*Afrixodes*) *oldi* group (Acari: Ixodidae) from sub-Saharan Africa with descriptions of five new species. J. Med. Entomol., 19: 309–329.

Synopsis of the Genus *Ixodes*

A synopsis of the genus *Ixodes* is presented in Tables 1 and 2. This genus is more speciose in the Afrotropical Region (63 species, 26 % of the total) than in other regions and is least represented in the Oriental Region (10 taxa, 4.1 % of the total) (Table 1). Seven species have broad distributions and are present in three or more zoogeographic regions or remote oceanic islands. Thus, *I. auritulus* is present in parts of the Afrotopical, Australasian, Nearctic and Neotropical Regions; *I. kopsteini* is found in the Afrotropical, Australasian and Oriental Regions; *I. simplex* occurs in the Afrotropical, Australasian, Oriental and Palearctic Regions; *I. vespertilionis* is an Afrotropical, Oriental and Palearctic species; *I. granulatus* is present in the Australasian, Oriental and Palearctic Regions; *I. kerguelenensis* is found in the Australasian Region and remote islands in the Atlantic, Indian and Pacific oceans; and *I. uriae* is a circumpolar species, with records from the adjacent continental territories of all the zoogeographic regions except the Oriental Region. With the exception of *I. granulatus*, these species are all predominantly either bird or bat ticks.

The distribution of species of the genus *Ixodes* embraces all zoogeographic regions, remote islands and territories close to the poles and spans 20 categories of land usage. No other genus of Ixodidae has as vast a distribution as *Ixodes* or its unique relationship with the world's islands and poles.

Our overall analyses indicate that more than 57 % of *Ixodes* species (138) are established exclusively in regions that constituted the ancient continent Gondwana, while 30 % of species (74) are established only in regions that formed Laurasia. The remaining species are currently present in regions related to both ancient continents, several islands around the world, the poles and adjacent lands.

A total of 63 species (26 %) have been recorded as feeding on humans.

The larva, nymph and at least one adult stage are known for 134 (55 %) of the 244 species of *Ixodes*. In order to better understand the phylogenetic relationships of this group, an effort should be made to further our knowledge of the sub-adult stages in the Afrotropical and Neotropical Regions because in these regions all parasitic stages are known for less than 50 % of the species.

Host utilization by the 132 species of *Ixodes* whose adult (female and/or male) and sub-adult stages are known, together with their natural hosts, is presented in Table 2, first with the inclusion of exceptional hosts, and second with the exclusion of these hosts. All parasitic stages of *I. banksi* and *I. kashmiricusi* have been described, but one or both subadult stages of these ticks are known only from laboratory-reared specimens. Similarly, all stages of *I. downsi* have been described

Table 1 Number and percentages of all species of *Ixodes* by zoogeographic region(s), islands in various oceans and around the poles, number known to feed on humans (% of the total number of species in a particular region), and number of species for which all stages (larva, nymph, male and/or female) are known (% of the total number of species in a particular region)

Regions	No. of species	%	No. of species on humans	No. of species of which all stages are known
Afrotropical	63	25.8	8 (12.7)	15 (23.8)
Palearctic	44	18.0	17 (38.6)	34 (77.3)
Neotropical	38	15.6	1 (2.6)	17 (44.7)
Nearctic	28	11.5	11 (39.3)	21 (75.0)
Australasian	24	9.8	6 (25.0)	13 (54.2)
Oriental-Palearctic	11	4.5	6 (54.5)	10 (90.9)
Oriental	10	4.1	2 (20.0)	5 (50.0)
Nearctic-Neotropical	10	4.1	6 (60.0)	8 (80.0)
Australasian-Oriental	2	0.8	1 (50.0)	1 (50.0)
Nearctic-Palearctic	2	0.8	1 (50.0)	2 (100)
Islands in Central Pacific ocean	2	0.8	0	1 (50.0)
Afrotropical-Australasian-Nearctic-Neotropical	1	0.4	0	1 (100)
Afrotropical-Australasian-Oriental	1	0.4	0	1 (100)
Afrotropical-Australasian-Oriental-Palearctic	1	0.4	1 (100)	1 (100)
Afrotropical-Oriental-Palearctic	1	0.4	1 (100)	1 (100)
Australasian-islands in Atlantic & Indian oceans	1	0.4	0	1 (100)
Australasian- islands in Atlantic, Pacific &, Indian oceans	1	0.4	0	1 (100)
Australasian-Oriental-Palearctic	1	0.4	1 (100)	1 (100)
Circumpolar	1	0.4	1 (100)	1 (100)
Islands in the Atlantic ocean	1	0.4	0	0
Unknown	1	0.4	0	0
Total	**244**		**63 (25.8)**	**135 (55.3)**

Table 2 Numbers and percentages of the 132 species of *Ixodes* whose adult (female and/or male), larval and nymphal stages as well as natural hosts are known, including or excluding exceptional hosts

Hosts	No. of species	%	No. of species	%
	Including exceptional hosts		Excluding exceptional hosts	
Mammalia	61	46.2	76	57.6
Aves + Mammalia	38	28.8	24	18.2
Aves	19	14.4	25	18.9
Aves + Mammalia + Squamata	6	4.5	5	3.8
Mammalia + Squamata	4	3.0	1	0.8
Aves + Mammalia + Squamata + Testudines	3	2.3	0	0
Anura + Aves + Mammalia + Squamata + Testudines	1	0.8	0	0
Squamata	0	0	1	0.8
Total	**132**		**132**	

but hosts for the nymph of this tick are unknown. These three species of *Ixodes* have been excluded from our analysis of hosts.

When exceptional hosts are included, *Ixodes* ticks show a surprisingly restricted range of host usage (seven categories) for the 132 species analyzed. Only Mammalia and Aves are exclusive hosts for *Ixodes*, with 61 (46 %) and 19 species (14 %), respectively. The usage of Aves as exclusive hosts for a large number of species is uniquely characteristic of this genus.

The most common combination of hosts for ticks of this genus is Aves + Mammalia (38 species, 29 %), but Mammalia are also exclusive or non-exclusive hosts, for a total of 113 species (86 %), and Aves for 67 species (51 %). The contribution of Squamata as hosts is relatively minor, with 13 taxa (10 % of the total) as non-exclusive hosts of *Ixodes*. Testudines are of little relevance for *Ixodes* ticks because only three species are non-exclusive hosts, namely the Palearctic ticks *I. redikorzevi* and *I. ricinus* and the Nearctic-Neotropical species *I. scapularis*. Anura are of almost no importance as hosts of *Ixodes* because they are only rarely parasitized by the Oriental-Palearctic species *I. persulcatus*. Finally, Crocodilia play no role as hosts for any species of *Ixodes*.

Important changes in the descriptive picture of host utilization are evident when exceptional hosts are excluded from the analysis – the categories of host usage decrease from seven to six. Anura and Testudines no longer appear as hosts for any species, thus demonstrating their irrelevance for the survival of *Ixodes*, while Squamata become exclusive hosts for one species, the Palearctic *I. asanumai*. Mammalia and Aves increase their representation as exclusive hosts, with 76 (58 %) and 25 (19 %) species, respectively.

The most common combination of hosts is Aves + Mammalia comprising 24 species (18 %), followed by the combination Aves + Mammalia + Squamata with 5 species (4 %), and Mammalia + Squamata with one species, the poorly known Australasian *I. vestitus*.

Part II
The Genus *Haemaphysalis*

Remarks on Some Invalid Names

Haemaphysalis aksarensis Özkan, 1977, a forgotten name, is considered provisionally valid in Bursali et al. (2012), who state that this tick was described in 1978. However, two of us (DAA and AEP) feel that *H. aksarensis* is a junior synonym of *Haemaphysalis pospelovashtromae* and we have accepted that view here.

Haemaphysalis cholodkovskyi Olenev, 1928 is treated as a valid species by Geevarghese et al. (1997) and more recently by Ghosh et al. (2007), along with *H. sulcata*. However, *H. cholodkovskyi* was not regarded as a controversial name in Guglielmone et al. (2009) because it has long been recognized as a junior synonym of *H. sulcata*, as stated in Filippova (1997) and Camicas et al. (1998). Still, Moshaverinia et al. (2012) consider this name valid but spell it *H. choldokovsky.*

Haemaphysalis cretica Sénevet & Caminopetros, 1936 (originally named *Haemaphysalis punctata cretica*) is treated as a valid name in Feldman-Muhsam (1951), Yeruham et al. (1996), Chen et al. (2012) and others, but it is a synonym of *Haemaphysalis sulcata*, as stated in Filippova (1997) and Camicas et al. (1998). There is a sequence of 16S rDNA mitochondrial gene in GenBank (L34308) deposited by Black and Piesman (1994) under the name *Haemaphysalis cretica*, and this name is repeated each time that this sequence is used.

Haemaphysalis ibrikliensis Özkan, 1978 is another forgotten name that is considered provisionally valid in Bursali et al. (2012), but two of us (DAA and AEP) argue that *H. ibrikliensis* is a junior synonym of *Haemaphysalis inermis*, a view that is accepted here.

Haemaphysalis kochi Aragão, 1908 is a name that is preoccupied by *H. concinna kochi* Neumann, 1905; as a result, Aragão and Fonseca (1951) changed the name *kochi* to *kohlsi*. However, as explained in Kohls (1960), the name *H. juxtakochi* Cooley, 1946 takes precedence over the latter name, although Rawlins et al. (1993) treat this name as valid along with that of *H. juxtakochi* (spelled *H. juxtakichi*).

Haemaphysalis xinjiangensis Teng, 1980 is treated as valid by Camicas et al. (1998), Horak et al. (2002) and Barker and Murrell (2008), but Kolonin (2009) regards *H. xinjiangensis* as an invalid name. This taxon was not considered controversial in Guglielmone et al. (2009). However, Teng and Jiang (1991)

DOI 10.1007/978-94-007-7497-1_4,

regard this name as a synonym of *H. danieli*, and we accept their decision, particularly since the senior author also described *H. xinjiangensis*. This situation was recognized in Guglielmone et al. (2010).

Haemaphysalis yalvaci Özkan, 1978 is a third forgotten name considered provisionally valid in Bursali et al. (2012), but two of us (DAA and AEP) feel that it is a synonym of *Haemaphysalis erinacei.*

References

Aragão, H.B. 1908. Algunas novas especies de carrapatos brazileiros. Bras. Med., 22: 111–115.

Aragão, H.B. & Fonseca, F. da 1951. Notas de ixódologia. I. Duas novas espécies do género *Ixodes* e um novo nome para *Haemaphysalis kochi* Aragão, 1908. Mem. Inst. Oswaldo Cruz, 49: 567–574.

Barker, S.C. & Murrell, A. 2008. Systematics and evolution of ticks with a list of valid genus and species names. *In* A.S. Bowman & P.A. Nuttall (editors), Ticks: biology, disease and control. Cambridge University Press, Cambridge, pp. 1–39.

Black, W.C. & Piesman, J. 1994. Phylogeny of hard- and soft-tick taxa (Acari: Ixodida) based on mitochondrial 16S rDNA sequences. Proc. Natl. Acad. Sci. U.S.A., 91: 10034–10038.

Bursali, A., Keskin, A. & Tekin, S. 2012. A review of the ticks (Acari: Ixodida) of Turkey: species diversity, hosts and geographical distribution. Exp. Appl. Acarol., 57: 91–104.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chen, X., Yu, Z., Guo, L., Li, L., Meng, H., Wang, D., Liu, R. & Liu, J. 2012. Life cycle of *Haemaphysalis doenitzi* (Acari: Ixodidae) under laboratory conditions and its phylogeny based on mitochondrial 16S rDNA. Exp. Appl. Acarol., 56: 143–150.

Feldman-Muhsam, B. 1951. A note on east Mediterranean species of the genus *Haemaphysalis*. Bull. Res. Counc. Israel, 1: 96–107.

Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian.

Geevarghese, G., Fernandes, S. & Kulkarni, S.M. 1997. A checklist of Indian ticks (Acari: Ixodoidea). Ind. J. Anim. Sci., 67: 566–574.

Ghosh, S., Bansal, G.C., Gupta, S.C., Ray, D., Khan, M.Q., Irshad, H., Shahiduzzaman, Md., Seitzer, U. & Ahmed, J.S. 2007. Status of tick distribution in Bangladesh, India and Pakistan. Parasitol. Res., 101 (Suppl. 2): 207–216.

Guglielmone, A.A., Robbins, R.G., Apanaskevich, D.A., Petney, T.N., Estrada-Peña, A. & Horak, I.G. 2009. Comments on controversial tick (Acari: Ixodida) species names and species described or resurrected from 2003 to 2008. Exp. Appl. Acarol., 48: 311–327.

Guglielmone, A.A., Robbins, R.G., Apanaskevich, D.A., Petney, T.N., Estrada-Peña, A., Horak, I.G., Shao, R. & Barker, S.C. 2010. The Argasidae, Ixodidae and Nuttalliellidae (Acari: Ixodida) of the world: a list of valid species names. Zootaxa, 2528: 1–28.

Horak, I.G., Camicas, J.-L. & Keirans, J.E. 2002. The Argasidae, Ixodidae and Nuttalliellidae (Acari: Ixodida): a world list of valid tick names. Exp. Appl. Acarol., 28: 27–54.

Kohls, G.M. 1960. Records and new synonymy of New World *Haemaphysalis* ticks, with descriptions of the nymph and larva of *H. juxtakochi* Cooley. J. Parasitol., 46: 355–361.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Moshaverinia, A., Dini, M. & Azizzadeh, M. 2012. Prevalence of ixodid tick infestation of sheep in the Arasbaran region of Iran. J. Paras. Dis., 36: 230–233.

Olenev, N.A. 1928. On the taxonomy and geographical distribution of ticks (Ixodoidea). II. Dokl. Akad. Nauk SSSR, Ser. A (2): 29–34. In Russian.

Özkan, M. 1977. *Allophysalis* alt cinsi ve *Haemaphysalis* (*A.*) *aksarensis* sp. n. Doğa, 1: 106–110. In Turkish.

Özkan, M. 1978. Erzurum ve çevre illeri kenelerinin sistematik yönden incelenmesi. Ataturk Üniversitesi fen Fakultesi Yayinlari, 116 pp. In Turkish.

Rawlins, S.C., Mahadeo, S. & Martínez, R. 1993. A list of the ticks affecting man and animals in the Caribbean. CARAPHIN News, (6): 8–9.

Sénevet, G. & Caminopetros, J. 1936. Une nouvelle variété de l'*Haemaphysalis punctata.* Arch**.** Inst. Pasteur Algérie, 14: 24–29.

Teng, K.-F. 1980. On the Chinese *Haemaphysalis* subgenus *Allophysalis* with description of a new species. Acta Entomol. Sin., 23: 86–89. In Chinese.

Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.

Yeruham, I., Hadani, A., Galker, F. & Rosen, S. 1996. The seasonal occurrence of ticks (Acari: Ixodidae) on sheep and in the field in the Judean area of Israel. Exp. Appl. Acarol., 20: 47–56.

Individual Species Accounts

1 – *H. aborensis* Warburton, 1913 (Parasitology, 6: 121–130)

Type depository: IM (holotype) (Hoogstraal, H., Dhanda, V. & El Kammah, K.M. 1971. *Aborphysalis*, a new subgenus of Asian *Haemaphysalis* ticks; and identity, distribution and hosts of *H. aborensis* Warburton (resurrected) (Ixodoidea: Ixodidae). J. Parasitol., 57: 748–760)

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregion: northern Indochina subtropical forest

Hosts: Artiodactyla: Bovidae, Suidae, Moschidae; Carnivora: Mustelidae; Rodentia: Hystricidae (AN)
Artiodactyla: Cervidae; Carnivora: Felidae (A)
Galliformes: Phasianidae (NL)
Scandentia: Tupaiidae; Passeriformes: Paridae (N)

Human infestation: no

Remarks: Mitchell (1979) listed Muridae among the alleged hosts of Nepalese ticks collected between 1966 and 1970, including *H. aborensis* (stage not stated). However, in Hoogstraal's (1971) resurrection of *H. aborensis*, murids are not mentioned as hosts, and for that reason they do not appear in our host list.

References

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Hoogstraal, H., Dhanda, V. & El Kammah, K.M. 1971. *Aborphysalis*, a new subgenus of Asian *Haemaphysalis* ticks; and identity, distribution and hosts of *H. aborensis* Warburton (resurrected) (Ixodoidea: Ixodidae). J. Parasitol., 57: 748–760.

Mitchell, R.M. 1979. A list of ectoparasites from Nepalese mammals, collected during the Nepal ectoparasite program. J. Med. Entomol., 16: 227–233.

DOI 10.1007/978-94-007-7497-1_5,

Phan Trong, C. 1977. Ve bet va con trung ky sinh o Viet Nam. Tap 1. Ve (Ixodoidea), mo ta va phan loai. Ha Noi: Khoa hoc va ky thuat, 489 pp. In Vietnamese.
Xu, R. & Li, K. 1997. A collection of ticks from Guizhou, China. Syst. Appl. Acarol., 2: 245–246.

2 – *H. aciculifer* Warburton, 1913 (Parasitology, 6: 121–130)

Type depository: BMNH (lectotype, paralectotypes) (Keirans, J.E. & Hillyard, P.D. 2001. A catalogue of the type specimens of Ixodida (Acari: Argasidae, Ixodidae) deposited in The Natural History Museum, London. Occ. Pap. Syst. Entomol. (13), 74 pp.)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands; tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Artiodactyla: Bovidae; Carnivora: Viverridae; Lagomorpha: Leporidae (ANL)
Carnivora: Canidae, Herpestidae (AL)
Artiodactyla: Suidae; Carnivora: Felidae (A)
Rodentia: Muridae; Galliformes: Phasianidae (NL)
Erinaceomorpha: Erinaceidae; Passeriformes: Corvidae (N)
Carnivora: Hyaenidae; Rodentia: Cricetidae (L)

Human infestation: no

Remarks: data concerning *H. aciculifer* prior to Hoogstraal and El Kammah (1972) are ignored here because of confusion with related tick species that made earlier diagnoses uncertain. See also *H. rugosa.*

References

Hoogstraal, H. & El Kammah, K.M. 1972. Notes on African *Haemaphysalis* ticks. X. *H.* (*Kaiseriana*) *aciculifer* Warburton and *H.* (*K.*) *rugosa* Santos Dias, the African representatives of the *spinigera* subgroup (Ixodoidea: Ixodidae). J. Parasitol., 58: 960–978.
Horak, I.G. & Boomker, J. 1998. Parasites of domestic and wild animals in South Africa. XXXV. Ixodid ticks and bot fly larvae in the Bontebok National Park. Onderstepoort J. Vet. Res., 65: 205–211.
Horak, I.G., Fourie, L.J. & Boomker, J. 1997. A ten-year study of ixodid tick infestations of bontebok and grey rhebok in the Western Cape Province, South Africa. S. Afr. J. Wildl. Res., 27: 5–10.
Norval, R.A.I. 1985. The ticks of Zimbabwe. XIV. The lesser known *Haemaphysalis* species. Zimbabwe Vet. J., 16: 54–59.
Walker, J.B. 1974. The ixodid ticks of Kenya. A review of present knowledge of their hosts and distribution. Commonwealth Institute of Entomology, London, 220 pp.

3 – *H. aculeata* Lavarra, 1904 (Bol. Soc. Zool. Ital. Ser. 2, 5: 255–258)

Type depository: BMNH (lectotype) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregions: tropical and subtropical dry broadleaf forests; desert and xeric shrublands

Hosts: usual hosts for larvae, nymphs and adults are Artiodactyla: Tragulidae.
Artiodactyla: Tragulidae (ANL)
Artiodactyla: Bovidae (AN)
Artiodactyla: Cervidae; Carnivora: Felidae, Herpestidae; Primates (unknown family); Aves (unknown order) (A)
Primates: Cercopithecidae; Galliformes: Phasianidae (NL)
Rodentia: Hystricidae; Cuculiformes: Cuculidae; Passeriformes: Pycnonotidae, Sturnidae, Timaliidae (N)
Rodentia: Muridae; Passeriformes: Muscicapidae (L)

Human infestation: yes (Keirans 1985)

Remarks: all parasitic stages of *H. aculeata* were redescribed by Geevarghese et al. (2009). Without further explanation, Geevarghese et al. (1997) reduced the host range of this tick to "man, monkey and birds." We consider records from other types of hosts in the references below to be provisionally valid.

References

Bhat, H.R. & Sreenivasan, M.A. 1981. Further records of the ticks of some reptilian and mammalian hosts in the Kyasanur Forest disease area, Karnataka, India. Ind. J. Parasitol., 5: 207–210.

Geevarghese, G., Mandke, O.A. & Mishra, A.C. 2009. *Haemaphysalis* (*Kaiseriana*) *aculeata* Lavarra, 1904 (Ixodoidea: Ixodidae) re-description of adult and immature stages. Acarologia, 49: 5–11.

Geevarghese, G., Fernandes, S. & Kulkarni, S.M. 1997. A checklist of Indian ticks (Acari: Ixodoidea). Ind. J. Anim. Sci., 67: 566–574.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Rajagopalan, P.K. 1972. Ixodid ticks (Acarina: Ixodidae) parasitizing wild birds in the Kyasanur Forest disease area of Shimoga District, Mysore State, India. J. Bombay Nat. Hist. Soc., 69: 55–78.

Rajagopalan, P.K. & Sreenivasan, M.A. 1981. Ixodid ticks on cattle and buffaloes in the Kyasanur Forest disease area of Karnataka State. Ind. J. Med. Res., 73: 880–889.

Rajagopalan, P.K., Patil, A.P. & Boshell, J. 1968. Ixodid ticks on their mammalian hosts in the Kyasanur Forest disease area of Mysore State, India, 1961–1964. Ind. J. Med. Res., 56:510–526.

Seneviratna, P. 1965. The Ixodoidea (ticks) of Ceylon. Parts II and III. Ceylon Vet. J., 13: 28–54.
Trapido, H., Goverdhan, M.K., Rajagopalan, P.K. & Rebello, M.J. 1964. Ticks ectoparasitic on monkeys in the Kyasanur Forest disease area of Shimoga District, Mysore State, India. Am. J. Trop. Med. Hyg., 13: 763–772.

4 – *H. adleri* Feldman-Musham, 1951 (Bull. Res. Counc. Israel Ser. C, 1: 96–107)

Type depository: not stated (Feldman-Muhsam, B. 1951. A note on east Mediterranean species of the genus *Haemaphysalis*. Bull. Res. Counc. Israel Ser. C, 1: 96–107)

Known stages: male, female

Zoogeographic Region: Palearctic

Ecoregions: desert and xeric shrublands

Hosts: Carnivora: Mustelidae (AN)
Artiodactyla: Suidae; Carnivora: Canidae, Felidae (A)

Human infestation: no

Remarks: Kolonin (2009) does not include hosts for nymphs of *H. adleri*, probably because this stage has not been described. We provisionally accept the record of Theodor and Costa (1967) of nymphs of this tick on Mustelidae.

References

Keysary, A., Eremeeva, M.E., Leitner, M., Din, A.B., Wikswo, M.E., Mumcuoglu, K.Y., Inbar, M., Wallach, A.D., Shanas, U., King, R. & Waner, T. 2011. Spotted fever group rickettsiae collected from wild animals in Israel. Am. J. Trop. Med. Hyg., 85: 919–923.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.
Theodor, O. & Costa, M. 1967. A survey of the parasites of wild mammals and birds in Israel. Part one. Ectoparasites. The Israel Academy of Science and Humanities, Jerusalem, 119 pp.

5 – *H. anomala* Warburton, 1913 (Parasitology, 6: 121–130)

Type depository: IM (holotype) (Hoogstraal, H., Kohls, G.M. & Trapido, H. 1967. Studies on Southeast Asian *Haemaphysalis* ticks (Ixodoidea, Ixodidae). *H.* (*Kaiseriana*) *anomala* Warburton: redescription, hosts, and distribution. J. Parasitol., 53: 196–201) as *Haemaphysalis cornigera anomala*

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Artiodactyla: Bovidae, Cervidae; Carnivora: Canidae, Felidae (A)
Rodentia: Muridae; Cuculiformes: Cuculidae (NL)
Galliformes: Phasianidae; Passeriformes: Turdidae (stages unknown)

Human infestation: yes (Tanskul et al. 1983)

References

Hoogstraal, H., Dhanda, V. & Bhat, H.R. 1972. *Haemaphysalis* (*Kaiseriana*) *anomala* Warburton (Ixodoidea: Ixodidae) from India: description of immature stages and biological observations. J. Parasitol., 58: 605–610.

Mitchell, R.M. & Dick, J.A. 1978. Ectoparasites from Nepal birds. J. Bombay Nat. Hist. Soc., 74: 264–274.

Tanskul, P., Stark, H.E. & Inlao, I. 1983. A checklist of ticks of Thailand (Acari: Metastigmata: Ixodoidea). J. Med. Entomol., 20: 330–341.

6 – *H. anomaloceraea* Teng, 1984 (*In* Teng and Cui, 1984, Acta Zootax. Sin., 9: 37–40. In Chinese)
Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. (1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.) regard this species as a synonym of *H. shimoga* without justifying their decision. Kolonin, G.V. (2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/) considers *H. anomaloceraea* and also *H. shimoga* to be synonyms of *H. taiwana* but does not elaborate. We follow Guglielmone, A.A., Robbins, R.G., Apanaskevich, D.A., Petney, T.N., Estrada-Peña, A., Horak, I.G., Shao, R. & Barker, S.C. (2010. The Argasidae, Ixodidae and Nuttalliellidae (Acari: Ixodida) of the world: a list of valid species names. Zootaxa, 2528: 1–28), who regard *H. anomaloceraea* as a valid species, pending a robust justification of the positions taken by the authors cited above.

Type depository: IZAS (holotype) (Teng, K.-F. & Cui, Y.-Q. 1984. Descriptions of a new species of *Haemaphysalis* and male of *H. primitiva* Teng, 1982 from Yunnan. Acta Zootax. Sin., 9: 37–40. In Chinese)

Known stages: male

Zoogeographic Region: Oriental

Ecoregions: Nujiang Langcang Gorge alpine conifer and mixed forests

Hosts: unknown

Human infestation: no

Remarks: see above.

References

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Teng, K.-F. & Cui, Y.-Q. 1984. Descriptions of a new species of *Haemaphysalis* and male of *H. primitiva* Teng, 1982. Acta Zootax. Sin., 9: 37–40.

7 – *H. anoplos* Hoogstraal, Uilenberg & Klein, 1967 (J. Parasitol., 53: 1103–1105)

Type depositories: USNTC (holotype), HH (paratype) (Hoogstraal, H., Uilenberg, G. & Klein, J.-L. 1967. *Haemaphysalis* (*Rhipistoma*) *anoplos* sp. n., a spurless tick of the *elongata* group (Ixodoidea, Ixodidae) parasitizing *Nesomys rufus* Peters (Rodentia) in Madagascar. J. Parasitol., 53: 1103–1105)

Known stages: female

Zoogeographic Region: Afrotropical

Ecoregion: Madagascar subhumid forests

Hosts: Rodentia: Nesomyidae (A)

Human infestation: no

Reference

Uilenberg, G., Hoogstraal, H. & Klein, J.-M. 1979. Les tiques (Ixodoidea) de Madagascar et leur rôle vecteur. Arch. Inst. Pasteur Madagascar Num. Spéc., 153 pp.

8 – *H. aponommoides* Warburton, 1913 (Parasitology, 6: 121–130)

Type depository: BMNH (lectotype, paralectotypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*) originally named *Haemaphysalis inermis aponommoides*

Known stages: male, female, nymph, larva

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: tropical and subtropical grasslands, savannas and shrublands; temperate conifer forests

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Artiodactyla: Bovidae, Cervidae; Perissodactyla: Equidae; Carnivora: Canidae, Felidae, Ursidae; Rodentia: Sciuridae (A)
Rodentia: Muridae; Soricomorpha: Soricidae; Galliformes: Phasianidae (NL)

Human infestation: yes (Hoogstraal and Mitchell 1971)

Remarks: Mitchell (1979) listed all hosts of Nepalese ticks collected between 1966 and 1970, including *H. aponommoides* (no developmental stage stated), which was allegedly found on Cricetidae. However, cricetids are not included by Hoogstraal and Mitchell (1971) in their study of this tick, and consequently this host record does not appear in our list of hosts of *H. aponommoides*.

References

Chen, Z., Yang, X., Bu, F., Yang, X. & Liu, J. 2010. The ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Hoogstraal, H. & Mitchell, R.M. 1971. *Haemaphysalis* (*Alloceraea*) *aponommoides* Warburton (Ixodoidea: Ixodidae), description of immature stages, hosts, distribution, and ecology in India, Nepal, Sikkim, and China. J. Parasitol., 57: 635–645.

Mitchell, R.M. 1979. A list of ectoparasites from Nepalese mammals, collected during the Nepal ectoparasite program. J. Med. Entomol., 16: 227–233.

Phan Trong, C. 1977. Ve bet va con trung ky sinh o Viet Nam. Tap 1. Ve (Ixodoidea), mo ta va phan loai. Ha Noi: Khoa hoc va ky thuat, 489 pp. In Vietnamese.

9 – *H. asiatica* (Supino, 1897) (Atti Soc. Veneto-Trentina Sci. Nat. Residente Padova, Ser. 2, 3: 230–238)

Type depository: GM (holotype) (Hoogstraal, H. & Trapido H. 1966. Studies on Southeast Asian *Haemaphysalis* ticks (Ixodoidea, Ixodidae). Species described by Supino in 1897 from Burma, with special reference to *H.* (*Rhipistoma*) *asiaticus* (= *H. dentipalpis* Warburton and Nuttall). J. Parasitol., 52: 1172–1187) as *Opisthodon asiaticus.* See also below.

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregions: tropical and subtropical forests

Hosts: usual hosts for adult ticks are Carnivora: Viverridae.
Scandentia: Tupaiidae (ANL)
Carnivora: Canidae, Felidae (AN)
Artiodactyla: Suidae; Carnivora: Viverridae (A)
Rodentia: Muridae (NL)
Rodentia: Sciuridae (N)

Human infestation: no

Remarks: this tick has been treated as a synonym of *H. leachi* by several authors, but *H. asiatica* is a legitimate species, as stated in Hoogstraal and Trapido (1966), who refer to this tick as *Haemaphysalis asiaticus.* Phan Trong (1977) found adults of *H. asiatica* on Aves (Cuculiformes and Passeriformes), but we feel that these records need confirmation and they are not included in our host list. Kolonin (2009) does not recognize Scandentia as hosts of adults, but we consider this relationship, cited by Tanskul et al. (1983), to be valid.

References

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Grassman, L.I., Sarataphan, N., Tewes, M.E., Silvy, N.J. & Nakanakrat, T. 2004. Ticks (Acari: Ixodidae) parasitizing wild carnivores in Phu Khieo wildlife sanctuary. J. Parasitol., 90: 657–659.

Hoogstraal, H. & Trapido, H. 1966. Studies on Southeast Asian *Haemaphysalis* ticks (Ixodoidea: Ixodidae). Species described by Supino in 1897 from Burma, with special reference to *H.* (*R.*) *asiaticus* (= *H. dentipalpis* Warburton and Nuttall). J. Parasitol., 52: 1172–1187.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Parola, P., Cornet, J.-P., Sanogo, Y.O., Miller, R.S., Thien, H.V., González, J.-P., Raoult, D., Telford, S.R. & Wongsrichanalai, C. 2003. Detection of *Ehrlichia* spp., *Anaplasma* spp. *Rickettsia* spp., and other eubacteria in ticks from the Thai-Myanmar border and Vietnam. J. Clin. Microbiol., 41: 1600–1608.

Phan Trong, C. 1977. Ve bet va con trung ky sinh o Viet Nam. Tap 1. Ve (Ixodoidea), mo ta va phan loai. Ha Noi: Khoa hoc va ky thuat, 489 pp. In Vietnamese.

Saito, Y., Hoogstraal, H. & Vasuvat, C. 1971. Studies on Southeast Asian *Haemaphysalis* ticks (Ixodoidea: Ixodidae). Identity and hosts of immature stages of *H.* (*Rhipistoma*) *asiatica* (Supino) from Thailand. J. Parasitol., 57: 1099–1103.

Tanskul, P., Stark, H.E. & Inlao, I. 1983. A checklist of ticks of Thailand (Acari: Metastigmata: Ixodoidea). J. Med. Entomol., 20: 330–341.

Xu, R. & Li, K. 1997. A collection of ticks from Guizhou, China. Syst. Appl. Acarol., 2: 245–246.

10 – *H. atheruri* Hoogstraal, Trapido & Kohls, 1965 (J. Parasitol., 51: 114–125)

Type depositories: USNTC (holotype, paratypes), BMNH, IMRKL (paratypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*) as *Haemaphysalis atherurus*

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregions: tropical and subtropical forests

Hosts: usual hosts for larvae, nymphs and adults are Rodentia: Hystricidae.
Rodentia: Hystricidae (ANL)
Scandentia: Tupaiidae; Carnivora: Canidae (A)

Human infestation: no

Remarks: see *H. traguli*, which has been confused with *H. atheruri.*

References

Hoogstraal, H., Trapido, H. & Kohls, G.M. 1965. Studies on Southeast Asian *Haemaphysalis* ticks (Ixodoidea, Ixodidae). *H. atherurus* sp. n. and redescription of type material of *H. birmaniae* Supino, 1897. J. Parasitol., 51: 114–125.

Tanskul, P., Stark, H.E. & Inlao, I. 1983. A checklist of ticks of Thailand (Acari: Metastigmata: Ixodoidea). J. Med. Entomol., 20: 330–341.

11 – *H. bancrofti* Nuttall & Warburton, 1915 (Ticks. A monograph of the Ixodoidea. Part III. The genus *Haemaphysalis*. Cambridge University Press, London, pp. 349–550)
See below and also *H. novaeguineae.*

Type depository: BMNH (lectotype, paralectotypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Australasian, Oriental

Ecoregions: tropical and subtropical moist broadleaf forests; tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for larvae, nymphs and adults are Diprotodontia: Macropodidae. Aves are considered exceptional hosts for this tick.
Diprotodontia: Macropodidae, Phascolarctidae (ANL)
Artiodactyla: Bovidae; Carnivora: Canidae; Peramelemorphia: Peramelidae (AN)
Dasyuromorphia: Dasyuridae (AL)
Artiodactyla: Suidae; Perissodactyla: Equidae (A)
Diprotodontia: Phalangeridae, Potoroidae; Cuculiformes: Cuculidae (N)
Chiroptera: Vespertilionidae (L)
Artiodactyla: Cervidae; Carnivora: Felidae; Diprotodontia: Macropodidae, Petauridae, Vombatidae; Peramelemorphia: Thylacomyidae; Rodentia: Muridae; Passeriformes: Corvidae, Cracticidae (stages unknown)

Human infestation: yes (Laan et al. 2011)

Remarks: Camicas et al. (1998) state that *H. bancrofti* is found exclusively in the Australasian Region, but there is a record for the Oriental Region in Hoogstraal and Kim (1985). Kolonin (2009) does not include Aves as hosts of *H. bancrofti*, but we accept the records in Roberts (1963), Laan et al. (2011) and Owen (2011) from birds. It should be noted, however, that Roberts (1963) states that a female specimen had been found on Cuculidae when, in fact, it was a nymph of *H. bancrofti* that subsequently molted to the female stage in the laboratory, as clarified by Wilkinson and Utech (1962).

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Heath, A.C.G. 1986. Aspects of the biology, seasonality and host associations of *Haemaphysalis bancrofti*, *H. humerosa*, *H. bremneri* and *Ixodes tasmani* (Acari: Ixodidae). *In* C. Cremin, C. Dobson & D.E. Moorhouse (editors), Parasite lives. University of Queensland Press, St Lucia, Australia, pp. 179–188.

Hoogstraal, H. & Kim, K.C. 1985. Tick and mammal coevolution, with emphasis on *Haemaphysalis. In* K.C. Kim (editor), Coevolution of parasitic arthropods and mammals. John Wiley & Sons, New York, pp. 505–568.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Laan, B., Handasyde, K. & Beveridge, I. 2011. Occurrence of the tick *Haemaphysalis bancrofti* Nuttall & Warburton, 1915 in Victoria with additional data on its distribution and with scanning electron micrographs of life cycle stages. Proc. R. Soc. Victoria, 123: 187–197.
Oakwood, M. & Spratt, D.M. 2000. Parasites of the northern quoll, *Dasyurus hallucatus* (Marsupialia: Dasyuridae) in tropical savanna, Northern Territory. Aust. J. Zool., 48: 79–90.
Owen, I.L. 2011. Parasites of animals in Papua New Guinea recorded at the National Veterinary Laboratory: a catalogue, historical review and zoogeographical affiliations. Zootaxa, 3143: 1–163.
Roberts, F.H.S. 1963. A systematic study of the Australian species of the genus *Haemaphysalis* Koch (Acarina: Ixodidae). Aust. J. Zool., 11: 35–80.
Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.
Wilkinson, P.R. & Utech, K.B.W. 1962. Bird hosts of *Haemaphysalis* ticks in Australia. Aust. J. Sci., 25: 169–170.

12 – *H. bandicota* Hoogstraal & Kohls, 1965 (J. Parasitol., 51: 460–466)

Type depositories: USNTC (holotype, paratypes), HH, SEATO (paratypes) (Hoogstraal, H. & Kohls, G.M. 1965. Southeast Asian *Haemaphysalis* ticks (Ixodoidea, Ixodidae). *H. bandicota* sp. n. from bandicoot rats in Taiwan, Thailand and Burma. J. Parasitol., 51: 460–466)

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: usual hosts for larvae, nymphs and adult ticks are Rodentia: Muridae. Artiodactyla are considered exceptional hosts for this tick.
Rodentia: Muridae (ANL)
Scandentia: Tupaiidae; Carnivora: Herpestidae (A, N and/or L)
Artiodactyla: Bovidae (A)

Human infestation: no

Remarks: Tanskul et al. (1983) use the term “immatures” without specifying which of the sub-adult stages of *H. bandicota* were found on hosts.

References

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Hoogstraal, H. & Kohls, G.M. 1965. Southeast Asian *Haemaphysalis* ticks (Ixodoidea, Ixodidae). *H. bandicota* sp. n. from bandicoot rats in Taiwan, Thailand, and Burma. J. Parasitol., 51: 460–466.

Tanskul, P., Stark, H.E. & Inlao, I. 1983. A checklist of ticks of Thailand (Acari: Metastigmata: Ixodoidea). J. Med. Entomol., 20: 330–341.

13 – *H. bartelsi* Schulze, 1938 (Z. Morphol. Ökol. Tiere, 34: 135–149)
This species was originally classified as *H. koningsbergeri* (Wilson, N., Hoogstraal, H. & Kohls, G.M. 1968. Studies on Southeast Asian *Haemaphysalis* ticks (Ixodoidea, Ixodidae). Redescription of *H.* (*Rhipistoma*) *bartelsi* Schulze (resurrected), the Indonesia flying squirrel haemaphysalid. J. Parasitol., 54: 1223–1227).

Type depository: USNTC (lectotype, paralectotype) (Keirans, J.E. & Clifford, C.M. 1984. A checklist of types of Ixodoidea (Acari) in the collection of the Rocky Mountain Laboratories. J. Med. Entomol., 21: 310–320)

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregion: Java rain forests

Hosts: Rodentia: Sciuridae (ANL)

Human infestation: no

Reference

Hoogstraal, H., Gaber, S., Van Peenen, P.F.D., Duncan, F. J. & Kadarsan, S. 1972. *Haemaphysalis* (*Rhipistoma*) *bartelsi* Schulze (Ixodoidea: Ixodidae): immature stages from a treehole nest of the Indonesian red giant flying squirrel. J. Parasitol., 58: 989–992.

14 – *H. bequaerti* Hoogstraal, 1956 (J. Parasitol., 42: 156–172)

Type depositories: USNTC (holotype, paratype), BMNH, HH, OVI (paratypes) (Keirans and Hillyard, 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: Hyracoidea: Procaviidae (ANL)

Human infestation: no

Reference

Hoogstraal, H. 1956. Notes on African *Haemaphysalis* ticks. III. The hyrax parasites, *H. bequaerti* sp. nov., *H. orientalis* N. and W., 1915 (new combination), and *H. cooleyi* Bedford, 1929 (Ixodoidea, Ixodidae). J. Parasitol., 42: 156–172.

15 – *H. birmaniae* Supino, 1897 (Atti Soc. Veneto-Trentina Sci. Nat. Residente Padova, Ser. 2, 3: 230–238)

Type depositories: GM, BMNH (syntypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*). See *H. darjeeling*.

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregions: temperate broadleaf deciduous forests

Hosts: usual hosts for larvae, nymphs and adults are Artiodactyla: Bovidae and Cervidae.
Artiodactyla: Bovidae, Cervidae (ANL)
Artiodactyla: Suidae; Carnivora: Canidae, Mustelidae; Rodentia: Hystricidae (A)

Human infestation: yes (Hoogstraal 1970)

Remarks: collection data published prior to the work of Hoogstraal (1970) have been ignored because there is considerable uncertainty concerning the identification of *H. birmaniae.*

References

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Hoogstraal, H. 1970. *Haemaphysalis* (*H.*) *birmaniae* Supino and *H.* (*H.*) *goral* sp. n. (Ixodoidea: Ixodidae), Asian parasites of artiodactyl mammals. J. Parasitol., 56: 1227–1238.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Phan Trong, C. 1977. Ve bet va con trung ky sinh o Viet Nam. Tap 1. Ve (Ixodoidea), mo ta va phan loai. Ha Noi: Khoa hoc va ky thuat, 489 pp. In Vietnamese.

16 – *H. bispinosa* Neumann, 1897 (Mém. Soc. Zool. Fr., 10: 324–420)
See remarks below.

Type depository: BMNH (neotype) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: usual hosts for larvae, nymphs and adults are Artiodactyla: Bovidae and Carnivora: Canidae.
Mammalia (several orders); Galliformes: Phasianidae; Passeriformes: Sturnidae (ANL)
Psittaciformes: Psittacidae (A)

Cuculiformes: Cuculidae; Coraciiformes: Coraciidae; Passeriformes (several families) (NL)
Falconiformes: Accipitridae (L)
Charadriiformes: Charadriidae; Strigiformes: Strigidae (stages unknown)

Human infestation: no

Remarks: many specimens formerly identified as *H. bispinosa* are in fact *H. longicornis*, as discussed in Hoogstraal et al. (1968), or several other species of *Haemaphysalis* (Keirans 1985). Camicas et al. (1998) state that this species is found in the Australasian and Oriental Zoogeographic Regions, and Keirans (1985) presents Afrotropical records for *H. bispinosa.* We, however, have not found *bona fide* records for the Australasian Region, and we believe that African records are the result of mislabeling or the introduction of this tick to new environments in which it failed to become established. Guo et al. (2002) state that *H. bispinosa* has been found in Gansu Province (Palearctic) but this record was not validated in Chen et al. (2010). The latter authors describe the distribution of *H. bispinosa* as including Hubei Province, whose boundaries overlap the Palearctic and Oriental Regions. Nevertheless, we provisionally regard this species as Oriental. There is a record of *H. bispinosa* crawling on a human in Audy et al. (1960), but as the tick was not attached, we do not consider humans to be hosts of this species. Other records of *H. bispinosa* on humans are doubtful or refer to *H. longicornis* in the Australasian Region. Kolonin (2009) excludes Aves as hosts for adults of *H. bispinosa*, but the records of Rajagopalan (1972) of males and females on Aves are regarded as valid by us. Dilrukshi (2006) considers it probable that *H. bispinosa* constitutes a complex of species in Sri Lanka. See also *H. longicornis.*

References

Arunachalam, K. & Harikrishnan, T.J. 2009. Occurrence of *Haemaphysalis bispinosa* in a child. Ind. Vet. J., 86: 93.

Audy, J.R., Nadchatram, M. & Lim, B.-L. 1960. Malaysian parasites. XLIX. Host distribution of Malayan ticks (Ixodoidea). Stud. Inst. Med. Res. Malaya, 29: 225–246.

Bhat, H.R. & Sreenivasan, M.A. 1981. Further records of the ticks of some reptilian and mammalian hosts in the Kyasanur Forest disease area, Karnataka, India. Ind. J. Parasitol., 5: 207–210.

Boshell, J. & Rajagopalan, P.K. 1968. Observations on the experimental exposure of monkeys, rodents and shrews to infestation of ticks in forest in Kyasanur Forest disease area. Ind. J. Med. Res., 56 (4) (Suppl.): 573–588.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Dilrukshi, P.R.M.P. 2006. Taxonomic status of ticks in Sri Lanka. *In* C.N.B. Bambaradeniya (editor), The fauna of Sri Lanka: status of taxonomy, research

and conservation. The World Conservation Union, Colombo, Sri Lanka, pp. 65–69.
Guo, S., Yuan, Z., Wu, G., Wang, W, Ma, D. & Du, H. 2002. Epidemiology of ovine theileriosis in Ganan Region, Gansu Province, China. Parasitol. Res. (Suppl.), 88: S36-S37.
Hoogstraal, H., Roberts, F.H.S., Kohls, G.M. & Tipton, V.J. 1968. Review of *Haemaphysalis* (*Kaiseriana*) *longicornis* Neumann (resurrected) of Australia, New Zealand, New Caledonia, Fiji, Japan, Korea, and northeastern China and USSR, and its parthenogenetic and bisexual populations (Ixodoidea, Ixodidae). J. Parasitol., 54: 1197–1213.
Hoogstraal, H., Lim, B.-L. & Anastos, G. 1969. *Haemaphysalis* (*Kaiseriana*) *bispinosa* Neumann (Ixodoidea: Ixodidae): evidence for consideration as an introduced species in the Malay Peninsula and Borneo. J. Parasitol., 55: 1075–1077.
Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Mitchell, R.M. & Dick, J.A. 1978. Ectoparasites from Nepal birds. J. Bombay Nat. Hist. Soc., 74: 264–274.
Rahman, M.H. & Mondal, M.M.H. 1985. Tick fauna of Bangladesh. Ind. J. Parasitol., 9: 145–149.
Rajagopalan, P.K. 1972. Ixodid ticks (Acarina: Ixodidae) parasitizing wild birds in the Kyasanur Forest disease area of Shimoga District, Mysore State, India. J. Bombay Nat. Hist. Soc., 69: 55–78.
Rajagopalan, P.K., Patil, A.P. & Boshell, J. 1968. Ixodid ticks on their mammalian hosts in the Kyasanur Forest disease area of Mysore State, India, 1961–1964. Ind. J. Med. Res., 56: 510–526.
Rebello, M.J. & Reuben, R. 1967. A report on ticks collected from birds and small mammals in North Arcot and Chittoor Districts, South India. J. Bombay Nat. Hist. Soc., 68: 283–289.
Seneviratna, P. 1965. The Ixodoidea (ticks) of Ceylon. Parts II and III. Ceylon Vet. J., 13: 28–54.
Sreenivasan, M.A., Rajagopalan, P.K. & Bhat, H.R. 1972. Isolation of Kyasanur Forest disease virus from ixodid ticks collected between 1965 and 1972. *In* G.P. Channabasavanna & C.A. Viraktamath (editors), Progress in acarology, volume I. Oxford & IBH Publishing Company, New Delhi, pp. 37–44.

17 – *H. borneata* Hoogstraal, 1971 (J. Parasitol., 57: 1096–1098)

Type depository: BMNH (holotype) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male

Zoogeographic Region: Oriental

Ecoregions: tropical and subtropical moist and dry broadleaf forests

Hosts: Artiodactyla: Cervidae (A)

Human infestation: no

Remarks: Mihalca et al. (2011) regard *H. borneata* as an endangered species.

References

Hoogstraal, H. 1971. *Haemaphysalis* (*Kaiseriana*) *borneata* sp. n. (Ixodoidea: Ixodidae), a tick of the *H.* (*K.*) *aculeata* group parasitizing the sambar deer in Borneo. J. Parasitol., 57: 1096–1098.

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

18 – *H. bremneri* Roberts, 1963 (Aust. J. Zool., 11: 35–80)

Type depositories: QM (holotype, paratypes), ANIC (paratypes), USNTC (paratypes?). (Roberts, F.H.S. 1963. A systematic study of the Australian species of the genus *Haemaphysalis* Koch (Acarina: Ixodidae). Aust. J. Zool., 11: 35–80). Keirans and Clifford (1984, *op. cit.* under *H. bartelsi*) state that the USNTC "probably" contains paratypes of this species.

Known stages: male, female, larva

Zoogeographic Region: Australasian

Ecoregion: eastern Australia temperate forests

Hosts: Diprotodontia: Phalangeridae (ANL)
Artiodactyla: Bovidae; Perissodactyla: Equidae; Aegotheliformes: Aegothelidae (A)
Aves (unknown orders) (stages unknown)

Human infestation: no

Remarks: Kolonin (2009) states that the immature stages of *H. bremneri* have not been described, but there is a description of the larva in Roberts (1969). The nymph is undescribed, but the holotype of *H. bremneri* is from a nymph collected from Phalangeridae that molted into a male (Roberts 1963). Hoogstraal and Wassef (1973) and Hoogstraal and Kim (1985) state, without elaboration, that this tick may feed on various birds.

References

Heath, A.C.G. 1986. Aspects of the biology, seasonality and host associations of *Haemaphysalis bancrofti*, *H. humerosa*, *H. bremneri* and *Ixodes tasmani* (Acari: Ixodidae). *In* C. Cremin, C. Dobson & D.E. Moorhouse (editors), Parasite lives. University of Queensland Press, St Lucia, Australia, pp. 179–188.

Hoogstraal, H. & Kim, K.C. 1985. Tick and mammal coevolution, with emphasis on *Haemaphysalis. In* K.C. Kim (editor), Coevolution of parasitic arthropods and mammals. John Wiley & Sons, New York, pp. 505–568.

Hoogstraal, H. & Wassef, H.Y. 1973. The *Haemaphysalis* ticks (Ixodoidea: Ixodidae) of birds. 3.*H.* (*Ornithophysalis*) subgen. n.: definition, species, hosts and distribution in the Oriental, Palearctic, Malagasy, and Ethiopian Faunal Regions. J. Parasitol., 59: 1099–1117.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Roberts, F.H.S. 1963. A systematic study of the Australian species of the genus *Haemaphysalis* Koch (Acarina: Ixodidae). Aust. J. Zool., 11: 35–80.
Roberts, F.H.S. 1969, The larvae of Australian Ixodidae (Acarina: Ixodoidea). J. Aust. Entomol. Soc., 8: 37–78.

19 – *H. calcarata* Neumann, 1902 (Arch. Parasitol., 6: 109–128)

Type depository: BMNH (syntypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for adult ticks are Rodentia: Sciuridae.
Rodentia: Sciuridae (AN)
Carnivora: Felidae, Herpestidae (A)
Lagomorpha: Leporidae (N)
Rodentia: Muridae (stage unknown)

Human infestation: no

Remarks: Kolonin (2009) recognizes only Felidae as hosts for adult *H. calcarata* – not Sciuridae or Herpestidae. However, we consider records of adults of this tick on Herpestidae in Iori et al. (1996) to be valid.

References

Hoogstraal, H. 1955. Notes on African *Haemaphysalis* ticks. II. The ground-squirrel parasites, *H. calcarata* Neumann, 1902, and *H. houyi* Nuttall and Warburton, 1915 (Ixodoidea, Ixodidae). J. Parasitol., 41: 361–373.
Iori, A., Lanfrachi, P. & Manilla, G. 1996. Contribution to the knowledge of Ixodidae ticks of wild mammals of Somalia. Parassitologia, 38: 571–573.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Santos Dias, J.A.T. 1955. Contribuição para o conhecimento de fauna ixodológica do sudoeste africano. An. Inst. Med. Trop., 12: 75–100.
Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

20 – *H. calva* Nuttall & Warburton, 1915 (Ticks. A monograph of the Ixodoidea. Part III. The genus *Haemaphysalis*. Cambridge University Press, London, pp. 349–550)

Type depository: BMNH (lectotype, paralectotypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*) as *Haemaphysalis calvus*

Known stages: male, female, nymph

Zoogeographic Region: Oriental

Ecoregions: Sumatra peat swamp forests; Borneo rain forests

Hosts: usual hosts for adult ticks are Artiodactyla: Cervidae.
Artiodactyla: Bovidae, Cervidae, Suidae; Carnivora: Viverridae, Ursidae (A)

Human infestation: no

Remarks: the nymph of *H. calva* is only known from a nymphal pelt (Hoogstraal and Wassef 1981).

Reference

Hoogstraal, H. & Wassef, H.Y. 1981. *Haemaphysalis* (*Garnhamphysalis*) subgen. nov. (Acarina: Ixodidae): candidate tick vectors of hematozoa in the Oriental Region. Parasitol. Topics Spec. Publ., pp. 117–124.

21 – *H. campanulata* Warburton, 1908 (Proc. Cambr. Phil. Soc., 14: 508–519)

Type depository: BMNH (lectotype, paralectotypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: temperate broadleaf and mixed forests

Hosts: usual hosts for larvae, nymphs and adult ticks are Carnivora: Canidae.
Carnivora: Canidae (ANL)
Mammalia (several orders) (A)
Rodentia: Muridae (NL)

Human infestation: yes (Yamaguti et al. 1971)

Remarks: Camicas et al. (1998) list the nymph of *H. campanulata* as undescribed, but it was described by Yamaguti et al. (1971). There is a record of this species' introduction into the Australasian Region, but it failed to become established there (Roberts 1963). Noh (1972) records males, females and nymphs of *H. campanulata* on Galliformes: Phasianidae, while Phan Trong (1977) reports adults of this tick from Cuculiformes and Passeriformes, and Tsai et al. (2012) record one adult of *H. campanulata* from an undetermined bird, but we feel that these records require confirmation and they have not been included in our list of hosts for this species.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Hoogstraal, H. & Kim, K.C. 1985. Tick and mammal coevolution, with emphasis on *Haemaphysalis. In* K.C. Kim (editor), Coevolution of parasitic arthropods and mammals. John Wiley & Sons, New York, pp. 505–568.
Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.
Kitaoka, S. 1985. Keys to the species in immature stages of the Japanese *Haemaphysalis* ticks (Ixodidae). Bull. Natl. Inst. Anim. Health Q. (88): 49–63. In Japanese.
Noh, Y.T. 1972. Faunal studies on the ticks in Korea. *In* Floral studies on some taxa of plants and faunal studies on some taxa of animals in Korea. Ministry of Science and Technology, pp. 141–160. In Korean.
Nuttall, G.H.F. & Warburton, C. 1915. Ticks. A monograph of the Ixodoidea. Part III. The genus *Haemaphysalis*. Cambridge University Press, London, pp. 349–550.
Phan Trong, C. 1977. Ve bet va con trung ky sinh o Viet Nam. Tap 1. Ve (Ixodoidea), mo ta va phan loai. Ha Noi: Khoa hoc va ky thuat, 489 pp. In Vietnamese.
Roberts, F.H.S. 1963. A systematic study of the Australian species of the genus *Haemaphysalis* Koch (Acarina: Ixodidae). Aust. J. Zool., 11: 35–80.
Tsai, Y.-L., Shyu, C.-L., Yao, C.-T. & Lin, J.A. 2012. The ixodid ticks collected from dogs and other animals in Taiwan and Kinmen Island. Int. J. Acarol., 38: 110–115.
Yamaguti, N., Tipton, V.J., Keegan, H.L. & Toshioka, S. 1971. Ticks of Japan, Korea, and the Ryukyu Islands. Brigham Young Univ. Sci. Bull. Biol. Ser., 15 (1), 226 pp.

22 – *H. canestrinii* (Supino, 1897) (Atti Soc. Veneto-Trentina Sci. Nat. Residente Padova, Ser. 2, 3: 230–238)

Type depository: GM (lectotype, paralectotypes) (Hoogstraal and Trapido 1966, *op. cit.* under *H. asiatica*) as *Opisthodon canestrinii*

Known stages: male, female, nymph

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: tropical and subtropical forests

Hosts: usual hosts for adult ticks are Carnivora: Canidae, Felidae and Viverridae. Aves are considered exceptional hosts for adults of this tick.
Carnivora: Viverridae (AN)
Carnivora (several families); Lagomorpha: Leporidae; Galliformes: Phasianidae (A)
Rodentia: Sciuridae, Muridae; Scandentia: Tupaiidae (N)

Human infestation: no

Remarks: data published prior to Hoogstraal (1971) have been ignored because of uncertainties concerning the identification of *H. canestrinii*. Camicas et al. (1998) treat *H. canestrinii* as an exclusively Oriental species, but several records in Teng and Jiang (1991) are from the Palearctic Region. Hoogstraal (1971) records this species

on humans, but the specimens were not actually feeding, and we have therefore not included humans as hosts of *H. canestrinii*. Kolonin (2009) ignores Aves as hosts of this species, but we regard the odd record from Aves in Hoogstraal (1971) as sound. Kolonin (2009) appears to believe that the larvae of *H. canestrinii* feed on various host species, but we have been unable to confirm this.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Hoogstraal, H. 1971. Identity, hosts, and distribution of *Haemaphysalis* (*Rhipistoma*) *canestrinii* (Supino) (resurrected), the postulated Asian progenitor of the African *leachi* complex (Ixodoidea: Ixodidae). J. Parasitol., 57: 161–172.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Tanskul, P., Stark, H.E. & Inlao, I. 1983. A checklist of ticks of Thailand (Acari: Metastigmata: Ixodoidea). J. Med. Entomol., 20: 330–341.

Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.

23 – *H. capricornis* Hoogstraal, 1966 (J. Parasitol., 52: 783–786)

Type depositories: BMNH (holotype, paratypes), USNTC (paratypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*), originally identified as *H. hystricis*, as stated in Hoogstraal, H. (1966. Studies on Southeast Asian *Haemaphysalis* ticks (Ixodoidea: Ixodidae). *H.* (*H.*) *capricornis* sp. n., the large Malayan serow haemaphysalid from southwestern Thailand. J. Parasitol., 52: 783–786)

Known stages: male

Zoogeographic Region: Oriental

Ecoregion: Tenasserim-South Thailand semi-evergreen rain forests

Hosts: Artiodactyla: Bovidae (A)

Human infestation: no

Remarks: Tanskul et al. (1983) list Muridae as hosts for the adults of *H. capricornis*, but this record is not included in Tanskul and Inlao (1989) (both papers refer to ticks in Thailand), and we have therefore omitted murids from our host list for this tick. Mihalca et al. (2011) regard *H. capricornis* as endangered.

References

Hoogstraal, H. 1966. Studies on Southeast Asian *Haemaphysalis* ticks (Ixodoidea: Ixodidae). *H.* (*H.*) *capricornis* sp. n., the large Malayan serow haemaphysalid from southwestern Thailand. J. Parasitol., 52: 783–786.

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

Tanskul, P. & Inlao, I. 1989. Keys to the adult ticks of *Haemaphysalis* Koch, 1844, in Thailand with notes on changes in taxonomy (Acari: Ixodoidea: Ixodidae). J. Med. Entomol., 26: 573–601.
Tanskul, P., Stark, H.E. & Inlao, I. 1983. A checklist of ticks of Thailand (Acari: Metastigmata: Ixodoidea). J. Med. Entomol., 20: 330–341.

24 – *H. caucasica* Olenev, 1928 (Dokl. Akad. Nauk USSR, Ser. A (2): 29–34. In Russian)

Type depository: ZIAC (lectotype, paralectotype) (Filippova, N.A. 2008. Type specimens of argasid and ixodid ticks (Ixodoidea: Argasidae, Ixodidae) in the collection of the Zoological Institute, Russian Academy of Sciences (St. Petersburg). Entomol. Rev., 88: 1002–1011)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: desert and xeric shrublands

Hosts: usual hosts for larvae, nymphs and adults are Lagomorpha: Leporidae.
Lagomorpha: Leporidae (ANL)
Artiodactyla: Bovidae; Carnivora: Canidae, Mustelidae, Ursidae (A)
Erinaceomorpha: Erinaceidae; Rodentia: Muridae; Passeriformes (several families); Coraciiformes: Upupidae; Galliformes: Phasianidae; Squamata: Lacertidae, Scincidae (NL)

Human infestation: yes (Filippova 1997)

Remarks: Camicas et al. (1998) consider pholeophilic (burrowing) mammals to be the sole hosts of this tick species, but we believe that Aves are important hosts for the larvae and nymphs of *H. caucasica*, as stated in Filippova (1997). Durden and Keirans (1996) list *H. caucasica* as an endangered species.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.
Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.
Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp.

25 – *H. celebensis* Hoogstraal, Trapido & Kohls, 1965 (J. Parasitol., 51: 1001–1003)

Type depository: BMNH (holotype) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*). Originally named *H. hystricis* in Nuttall, G.H.F. & Warburton, C. (1915. Ticks. A monograph of the Ixodoidea. Part III. The genus *Haemaphysalis*. Cambridge Univ. Press, London, pp. 349–550), as stated in Hoogstraal, H.,

Trapido, H. & Kohls, G.M. (1965. Studies on Southeast Asian *Haemaphysalis* ticks (Ixodoidea, Ixodidae). *H.* (*Kaiseriana*) *celebensis* sp. n., from a wild boar in Celebes. J. Parasitol., 51, 1001–1003)

Known stages: male, female

Zoogeographic Region: Australasian

Ecoregion: Sulawesi montane rain forests

Hosts: usual hosts for adult ticks are Artiodactyla: Suidae.
Artiodactyla: Bovidae, Cervidae, Suidae; Perissodactyla: Equidae (A)
Rodentia: Muridae (NL)

Human infestation: yes (Durden et al. 2008)

Remarks: the larva and nymph of *H. celebensis* have not been described, but we consider records of the immature stages of this tick in Durden et al. (2008) to be provisionally valid. Kolonin (2009) ignores Equidae as hosts for *H. celebensis*, but we accept the record from this type of host in Durden et al. (2008).

References

Durden, L.A., Merker, S. & Beati, L. 2008. The tick fauna of Sulawesi, Indonesia (Acari: Ixodoidea: Argasidae and Ixodidae). Exp. App. Acarol., 45: 85–110.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

26 – *H. chordeilis* (Packard, 1869) (First Annual Report of the Trustees of the Peabody Academy of Sciences, Appendix, pp. 52–69)

Type depository: MCZ (holotype). Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. (2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.) state that the types were housed in MPAS as *Ixodes chordeilis* but have apparently been lost. However, Cooley, R.A. (1946. The genera *Boophilus*, *Rhipicephalus*, and *Haemaphysalis* (Ixodoidea) of the New World. Natl. Inst. Health Bull. (187), 54 pp.) states that "types" are in MCZ, as *Ixodes chordeilis*. The MCZ online zoological collections database (http://mczbase.mcz.harvard.edu/ accessed April 4, 2013) indicates that the holotype of *H. chordeilis* is held there.

Known stages: male, female, nymph, larva

Zoogeographic Region: Nearctic

Ecoregions: several different Nearctic ecoregions

Hosts: Mammalia are considered exceptional hosts for this tick.
Galliformes: Phasianidae; Passeriformes: Icteridae (ANL)
Anseriformes: Anatidae; Caprimulgiformes: Caprimulgidae; Artiodactyla: Bovidae; Perissodactyla: Equidae; Rodentia: Sciuridae (A)

Passeriformes: Emberizidae (NL)
Falconiformes: Accipitridae; Passeriformes: Mimidae (N)
Passeriformes: Corvidae, Troglodytidae (L)
Rodentia: Geomyidae (stage unknown)

Human infestation: yes (Keirans 1985)

Remarks: Camicas et al. (1998) state that *H. chordeilis* is present in the Nearctic and Neotropical Regions, but there are no *bona fide* Neotropical records of this species, as discussed in Guglielmone et al. (2003). Cooley (1946) cites Hewitt (1915, who uses the name *H. cinnabarina*) concerning Leporidae as hosts of *H. chordeilis*, while Allan (2001) lists the domestic cat as a host without supplying details for this record. Becklund (1964) presents a table with the caption "parasites of dog and cats" in which *H. chordeilis* is included, but without specifying whether the tick was a parasite of Canidae, Felidae or both. None of the latter four authors mention the developmental stage of ticks found on hosts. These doubtful records have been excluded from our list of hosts of *H. chordeilis.* Infestation of mammals with *H. chordeilis* does not appear to be a common event. See also *H. cinnabarina.*

References

Allan, S.A. 2001. Ticks (Class Arachnida: Order Acarina). *In* W.S. Samuel, M.J. Pybus & A.A. Kocan (editors), Parasitic Diseases of Wild Animals, 2nd edition. Iowa State University Press, Ames, pp. 72–106.

Becklund, W.W. 1964. Revised check list of internal and external parasites of domestic animals in the United States and possessions and in Canada. Am. J. Vet. Res., 25: 1380–1416.

Bequaert, J.C. 1945. The ticks, or Ixodoidea, of the northeastern United States and eastern Canada. Entomol. Am., 25: 73–232.

Bishopp, F.C. & Trembley, H.L. 1945. Distribution and hosts of certain North American ticks. J. Parasitol., 31: 1–54.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Cooley, R.A. 1946. The genera *Boophilus*, *Rhipicephalus*, and *Haemaphysalis* (Ixodidae) of the New World. Natl. Inst. Health Bull. (187), 54 pp.

Gregson, J.D. 1956. The Ixodoidea of Canada. Can. Dept. Agric. Sci. Serv. Entomol. Div. Publ. (930), 92 pp.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Hewitt, C.G. 1915. A contribution to a knowledge of Canadian ticks. Trans. R. Soc. Can. Ser. 3, 9: 225–239.

Keirans, J.E. 1967. Some avian ectoparasites in New England. Entomol. News, 78: 40–42.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.
Wilson, N. & Kale, H.W. 1972. Ticks collected from Indian River County, Florida (Acari: Metastigmata: Ixodidae). Florida Entomol., 55: 53–57.

27 – *H. cinnabarina* Koch, 1844 (Arch. Naturgesch., 10: 217–239)
This species is not included in Kolonin (2009, *op. cit*. under *H. anomaloceraea*). See also remarks below.

Type depository: ZMB (holotype) (Moritz, M. & Fischer, S.C. 1981. Die Typen der Arachniden-Sammlung des Zoologischen Museums Berlin. Mitt. Zool. Mus. Berlin, 57: 341–364)

Known stages: female

Zoogeographic Region: Neotropical

Ecoregion: the only known records mention Brazil as locality, without further geographical information

Hosts: unknown

Human infestation: no

Remarks: this tick is known from two specimens collected almost 170 years ago as *H. cinnabarina* and its synonym *H. sanguinolenta* Koch, 1844. Although Hoogstraal (1973) defended the Brazilian origin of *H. cinnabarina*, Guglielmone et al. (2003) did not include it as a Neotropical taxon. Their opinion was based on the statement by Keirans and Restifo (1993) that most investigators consider this name identical to *H. punctata*, and Kolonin (2009) also maintains this view. Cooley (1946) had previously believed that *H. cinnabarina* was partly a synonym of *H. chordeilis.* Recently, Barros-Battesti et al. (2008) examined the type and concurred with the opinion of Hoogstraal (1973). Consequently, we now regard *H. cinnabarina* as a tick exclusive to the Neotropical Zoogeographic Region. Camicas et al. (1998) list ungulates as hosts of this tick species, but we have found no information to support this statement. There is a record from Rodentia in Suriname (Neotropical Region) by Reyne (1923), but it requires confirmation and we have excluded it from our list of *bona fide* hosts of *H. cinnabarina.*

References

Barros-Battesti, D.M., Onofrio, V.C., Arzua, M. & Labruna, M.B. 2008. Comments on the validity of *Haempahysalis cinnabarina* Koch, 1844 (Acari: Ixodidae), a taxon known solely by the type specimens from northern Brazil. Rev. Bras. Parasitol. Vet., 17 (1): 53–55.
Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Cooley, R.A. 1946. The genera *Boophilus*, *Rhipicephalus*, and *Haemaphysalis* (Ixodidae) of the New World. Natl. Inst. Health Bull. (187), 54 pp.
Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.
Hoogstraal, H. 1973. Redescription of the type material of *Haemaphysalis* (*Aboimisalis*) *cinnabarina* (revalidated) and its junior synonym *H.* (*A.*) *sanguinolenta* described by Koch in 1844 from Brazil (Ixodoidea: Ixodidae). J. Parasitol., 59: 379–383.
Keirans, J.E. & Restifo, R.A. 1993. *Haemaphysalis juxtakochi* Cooley (Acari: Ixodidae), a Neotropical tick species, found in Ohio. J. Med. Entomol., 30: 1074–1075.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Reyne, A. 1923. Verslag van den entomoloog. Versl. Dep. Landbouw. Nijver. Handel Suriname (1922), pp. 32–39.

28 – *H. colasbelcouri* (Santos Dias, 1958) (Mem. Estud. Mus. Zool. Univ. Coimbra (249), 9 pp.)
Barker, S.C. & Murrell, A. (2008. Systematics and evolution of ticks with a list of valid genus and species names. *In* A.S. Bowman & P.A. Nuttall (editors), Ticks: biology, disease and control. Cambridge University Press, Cambridge, pp. 1–39) include as valid *Haemaphysalis vietnamensis* Hoogstraal & Wilson, 1966 and *H. colasbelcouri*, but the former species has since been treated as a synonym of the latter (Guglielmone, A.A., Robbins, R.G., Apaneskevich, D.A., Petney, T.N., Estrada-Peña, A. & Horak, I.G., 2009. Comments on controversial tick (Acari: Ixodida) species names and species described or resurrected from 2003 to 2008. Exp. Appl. Acarol., 48: 311–327). Kolonin (2009, *op. cit*. under *H. anomaloceraea*) includes this name as? *H. colasbelcouri* under the name *I. vietnamensis* without further explanation. Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. (2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.) listed *H. vietnamensis* but not *H. colasbelcouri* for China, probably because they accepted Kolonin's view (*op. cit.* above).

Type depository: IPP (holotype, paratypes) (Santos Dias, J.A.T. 1958. Notas ixodológicas. III. Sobre duas espécies do género *Aponomma* Neumann, 1899 da Região Oriental. Mem. Estud. Mus. Zool. Univ. Coimbra (249): 1–9) as *Aponomma colasbelcouri*

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregions: tropical and subtropical dry broadleaf forests

Hosts: Artiodactyla: Bovidae, Cervidae (A)

Human infestation: yes (Kolonin 1995 as *H. vietnamensis*, see above)

Remarks: Camicas et al. (1998) list the nymph and larva of this species as undescribed, but Ding and Ying (1996) described them under the name *H. vietnamensis*. The latter authors appear to have described these immature stages from laboratory-reared specimens, although we have only seen the abstract of their paper. Mihalca et al. (2011) regard this species as endangered under the name *H. vietnamensis.*

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Ding, X.-C. & Ying, P.-Y. 1996. Scanning electron microscopic observations of *Haemaphysalis vietnamensis*. Chin. J. Vet. Sci., 16: 486–490. In Chinese.

Kolonin, G.V. 1995. Review of the ixodid tick fauna (Acari: Ixodidae) of Vietnam. J. Med. Entomol., 32: 276–282.

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

29 – *H. colesbergensis* Apanaskevich & Horak, 2008 (J. Parasitol., 94: 594–607)
Kolonin (2009, *op. cit*. under *H. anomaloceraea*) does not include this species in his list of Ixodidae of the world.

Type depositories: USNTC (holotype, paratypes), OVI, ZIAC (paratypes) (Apanaskevich, D.A. & Horak, I.G. 2008. Two new species of African *Haemaphysalis* ticks (Acari: Ixodidae), carnivore parasites of the *H.* (*Rhipistoma*) *leachi* group. J. Parasitol., 94: 594–607). This tick was originally identified as *H. leachi.*

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: mediterranean woodlands and scrub; deserts and xeric shrublands

Hosts: Erinaceomorpha: Erinaceidae (AN)
Carnivora: Canidae, Felidae (A)

Human infestation: no

Remarks: the natural hosts for the larva of *H. colesbergensis* are unknown, and the larva and nymph were described from laboratory-reared material.

References

Apanaskevich, D.A. & Horak, I.G. 2008. Two new species of African *Haemaphysalis* ticks (Acari: Ixodidae), carnivore parasites of the *H.* (*Rhipistoma*) *leachi* group. J. Parasitol., 94: 594–607.

Horak, I.G., Welman, S., Hallam, S.L., Lutermann, H. & Mzilikazi, N. 2011. Ticks of four-toed elephant shrews and Southern African hedgehogs. Onderstepoort J. Vet. Res. 78, doi:10.4102/ojvr.v78i1.243

30 – *H. concinna* Koch, 1844 (Arch. Naturgesch., 10: 217–239)

Type depository: ZMB (syntypes) (Nuttall and Warburton 1915, *op. cit.* under *H. celebensis*), but not included in ZMB (Moritz and Fischer 1981, *op. cit*. under *H. cinnabarina*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: several different ecoregions within the Palearctic and Oriental Zoogeographic Regions

Hosts: Squamata are considered exceptional hosts for this tick.
Mammalia (several orders); Galliformes: Phasianidae; Passeriformes (several families) (ANL)
Aves (several orders); Squamata: Colubridae, Lacertidae (NL)

Human infestation: yes (Hillyard 1996; Bursali et al. 2012 among others)

Remarks: recent records of *H. concinna* from China indicate that its distribution includes the Oriental Region (Chu et al. 2008; Bian et al. 2009). These records are not included in Chen et al. (2010), but we treat them as valid. Camicas et al. (1998) do not list Aves as significant hosts for larvae and nymphs of *H. concinna*, but Kislenko and Koneva (1965), Nosek (1971) and others found Aves to be important hosts of this species. Kolonin (2009) excludes Aves as hosts for adult *H. concinna*, and Squamata are also ignored as hosts of this tick. We accept the records of *H. concinna* adults on Aves in Kislenko and Koneva (1965), as well as the unusual records on Squamata in Nosek (1971) and Krčmar (2012).

References

Bian, Y., Yang, G., Wang, T., Yan, H., Wang, S., Sun, J. & Li, K. 2009. *Haemaphysalis concinna* (Acari: Ixodida): Persistent efficacy of doramectin in rabbits under laboratory conditions. Entomol. Res., 39: 119–122.

Bursali, A., Keskin, A. & Tekin, S. 2012. A review of the ticks (Acari: Ixodida) of Turkey: species diversity, hosts and geographical distribution. Exp. Appl. Acarol., 57: 91–104

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Chu, C.-Y., Jiang, B.-G., Liu, W., Zhao, Q.-M., Wu, X.-M., Zhang, P.-H., Zhan, L., Yang, H. & Cao, W.-C. 2008. Presence of pathogenic *Borrelia burgdorferi sensu lato* in ticks and rodents in Zhejiang, south-east China. J. Med. Microbiol., 57: 980–985.

Emel'yanova, N.D. & Gordeeva, V.P. 1969. Data on the study of birds acting as hosts of ixodid ticks in East Manchurian mountain area spurs and in the

Pre-Khanka Plain. *In* A. O. Cherepanov (editor), Migratory birds and their role in arboviral distribution. Sibirisk. Otd. Akad. Nauk SSSR, Biol. Inst., Akad. Nauk SSSR, Inst. Polio. Virus Entsef., Min. Zdravookhr. RSFSR, Omsk Inst. Prirod.-Ochag. Infekts., Novosibirsk, pp. 160–169. In Russian, NAMRU-3 translation 621.

Feider, Z. 1964. Les connaissances actuelles sur les Acariens de Roumanie (Ixodides, Gamasides et Trombiculides). Acarologia (Fasc. Hors Sér.): 262–274.

Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian.

Hillyard, P.D. 1996. Ticks of North-West Europe. Keys and notes for identification of the species. Synopses of the British Fauna (New Series) (52), Field Studies Council, Shrewsbury, UK, 178 pp.

Kislenko, G.S. & Koneva, I.V. 1965. Infestations of birds by ixodid ticks in secondary forests in lower reaches of the Ussuri River. Mater. 4. Vses. Orinthol. Konf., Alma-Ata, Sep. 1965, pp. 160–163. In Russian, NAMRU-3 translation 408.

Krčmar, S. 2012. Hard ticks (Acari, Ixodidae) of Croatia. ZooKeys, 234: 19–57.

Lebedeva, N.N. & Korenberg, E.I. 1981. Distribution of *Haemaphysalis concinna* Koch in the Soviet Union and some general features of its ecology. Folia Parasitol., 28: 249–261.

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Nosek, J. 1971. The ecology, bionomics and behaviour of *Haemaphysalis* (*Haemaphysalis*) *concinna* tick. Z. Parasitenkd., 36: 223–241.

Serdjukova, G.V. 1956. Ixodid ticks of the fauna of USSR. Opred. Faune SSSR. Zool. Inst. Akad. Nauk SSSR (64), 121 pp. In Russian.

Voloshina, I.V. 2010. Ticks (Ixodidae) of the Lazovsky Reserve. Proc. Sci. Conf devoted 75 Anniv. Lazovsky Reserve, Vladivostok, pp. 59–65. In Russian.

31 – *H. cooleyi* Bedford, 1929 (15th Annual Report of the Director of Veterinary Services, Department of Agriculture, Union of South Africa, pp. 493–499)
See remarks below.

Type depository: OVI (lectotype, paralectotypes) (Hoogstraal, H. & Wassef, H.Y. 1981. Notes on African *Haemaphysalis* ticks. XIII. Identity of *H.* (*Rhipistoma*) *cooleyi*, a parasite of the rock hyrax in South Africa (Acarina: Ixodidae). Onderstepoort J. Vet. Res., 48: 135–140)

Known stages: male, female, nymph

Zoogeographic Region: Afrotropical

Ecoregions: rocky outcrops and mountains in subtropical savannas and shrublands

Hosts: Hyracoidea: Procaviidae (AN)

Human infestation: no

Remarks: Bedford (1929) includes nymphs of *H. cooleyi* from Rodentia: Pedetidae in his description of this species. However, as reported in Hoogstraal (1956), these nymphs were in fact a male and a female that had at first been classified as *H. numidiana* Neumann, 1905 (= *H. erinacei*). Subsequently, Hoogstraal (1972) decided that these specimens belonged to a new species (*H. pedetes*). Descriptions and illustrations of the male, female and nymph of *H. cooleyi* are included in Hoogstraal and Wassef (1981).

References

Bedford, G.A.H. 1929. Notes on some South African ticks, with descriptions of three new species. 15th Annual Report of the Director of Veterinary Services, Department of Agriculture, Union of South Africa, pp. 493–499.

Hoogstraal, H. 1956. Notes on African *Haemaphysalis* ticks. III. The hyrax parasites, *H. bequaerti* sp. nov., *H. orientalis* N. and W., 1915 (new combination), and *H. cooleyi* Bedford, 1929 (Ixodoidea, Ixodidae). J. Parasitol., 42: 156–172.

Hoogstraal, H. 1972. Notes on African *Haemaphysalis* ticks. IX. *H.* (*Rhipistoma*) *pedetes* sp. n., a relict parasite of the springhare (Rodentia: Pedetidae) in Transvaal (Ixodoidea: Ixodidae). J. Parasitol., 58: 979–983.

Hoogstraal, H. & Wassef, H.Y. 1981. Notes on African *Haemaphysalis* ticks. XIII. Identity of *H.* (*Rhipistoma*) *cooleyi*, a parasite of the rock hyrax in South Africa (Acarina: Ixodidae). Onderstepoort J. Vet. Res., 48: 135–140.

Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.

32 – *H. cornigera* Neumann, 1897 (Mém. Soc. Zool. Fr., 10: 324–420)
See *H. taiwana* and remarks below.

Type depositories: MNHN (lectotype), BMNH (paralectotype) (Keirans and Hillyard, 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Australasian, Oriental, Palearctic

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: Aves are considered exceptional hosts for adults of this tick.
Carnivora: Viverridae (ANL)
Artiodactyla: Bovidae, Cervidae; Rodentia: Muridae (AN)
Artiodactyla: Suidae; Carnivora: Canidae, Felidae, Mustelidae; Rodentia: Hystricidae; Passeriformes: Timaliidae, Turdidae; Galliformes: Phasianidae (A)
Scandentia: Tupaiidae (N)
Rodentia: Sciuridae; Soricomorpha: Soricidae (N?)

Human infestation: yes (Durden et al. 2008)

Remarks: there is considerable confusion concerning *H. cornigera* and *H. ias* (see *H. ias* for further details) and contradictory information about *H. cornigera* itself. The larva and nymph of *H. cornigera* are listed as undescribed in Camicas et al. (1998), while Anastos (1950) initially expressed doubts about the Oudemans' (1927)

descriptions of the larva and nymph based on specimens from Ambon Island (Australasian), only to later accept this locality. Durden et al. (2008) also found *H. cornigera* in Sulawesi (Australasian). The descriptions of the sub-adult stages of *H. cornigera* by Oudemans (1927) are sufficiently detailed and we have found no direct criticism of his work. Consequently, we regard his descriptions as provisionally valid. Camicas et al. (1998) state that *H. cornigera* occurs in the Oriental and Palearctic Zoogeographic Regions. However, we were unable to find *bona fide* Palearctic localities for this species prior to Yamauchi et al. (2009), who recorded its presence in Honshu (Japan). Because Ambon Island and Sulawesi lie within the Australasian Zoogeographic Region, the distribution of *H. cornigera* includes this region in addition to the Oriental and Palearctic Regions listed by Camicas et al. (1998). Tanskul et al. (1983) present information on the hosts of *H. cornigera* in Thailand, but Tanskul and Inlao (1989) later state that the ticks identified as *H. cornigera* in Thailand were in fact *H. shimoga.* Sreenivasan et al. (1972) generalized that Soricomorpha and Rodentia: Muridae and Sciuridae were hosts for nymphs of *H. cornigera*, but it is unclear from their publication whether all these hosts were infested. Kolonin (2009) lists Muridae as hosts for the immature stages of *H. cornigera*, probably following Hoogstraal et al. (1972), who refer to this tick as *H. cornigera cornigera*, and state that nymphs and larvae feed on rodents, but present information for three nymphs from vegetation. We treat the record of Oudemans (1927) of larvae and nymphs on Viverridae, the record of Warburton (1926) of nymphs on Tupaiidae, and the record of Munaf (1978) of a nymph on Muridae as provisionally valid. Kolonin (2009) does not include Aves as hosts for adult *H. cornigera*, but we consider the few records from Aves in Anastos (1950) to be provisionally valid. Clearly, the literature on *H. cornigera* contains a number of conflicting statements.

References

Anastos, G. 1950. The scutate ticks, or Ixodidae, of Indonesia. Entomol. Am., 30: 1–144.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Durden, L.A., Merker, S. & Beati, L. 2008. The tick fauna of Sulawesi, Indonesia (Acari: Ixodoidea: Argasidae and Ixodidae). Exp. App. Acarol., 45: 85–110.

Hoogstraal, H., Lim, B.L., Nadchatram, M. & Anastos, G. 1972. The Gunong Benom Expedition 1967. 8. Ticks (Ixodidae) of Gunong Benom and their altitudinal distribution, hosts and medical relationships. Bull. Br. Mus. (Nat. Hist.) Zool., 23: 167–186.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Munaf, H.B. 1978. Tick fauna of Baluran Wildlife Reserve, Indonesia. Hemera Zoa, 70: 37–44.

Oudemans, A.C. 1927. X. Acari uit Ambon. Zool. Meded. Rijks Mus. Nat. Hist., 10: 185–237.

Phan Trong, C. 1977. Ve bet va con trung ky sinh o Viet Nam. Tap 1. Ve (Ixodoidea), mo ta va phan loai. Ha Noi: Khoa hoc va ky thuat, 489 pp. In Vietnamese.
Sreenivasan, M.A., Rajagopalan, P.K. & Bhat, H.R. 1972. Isolation of Kyasanur Forest disease virus from ixodid ticks collected between 1965 and 1972. *In* G.P. Channabasavanna & C.A. Viraktamath (editors), Progress in acarology, volume I. Oxford & IBH Publishing Company, New Dehli, pp. 37–44.
Tanskul, P. & Inlao, I. 1989. Keys to the adult ticks of *Haemaphysalis* Koch, 1844, in Thailand with notes on changes in taxonomy (Acari: Ixodoidea: Ixodidae). J. Med. Entomol., 26: 573–601.
Tanskul, P., Stark, H.E. & Inlao, I. 1983. A checklist of ticks of Thailand (Acari: Metastigmata: Ixodoidea). J. Med. Entomol., 20: 330–341.
Warburton, C. 1926. Ixodidae from Sumatra. Treubia, 8: 280.
Yamauchi, T., Tabara, K., Kanamori, H., Kawabata, H., Arai, S., Katayama, T., Fujita, H., Yano, Y., Takada, N. & Itagaki, A. 2009. Tick fauna associated with sika deer density in the Shimane Peninsula, Honshu. Japan. Med. Entomol Zool., 60: 297–304.

33 – *H. cornupunctata* Hoogstraal & Varma, 1962 (J. Parasitol., 48: 185–194)

Type depositories: USNTC (holotype, paratypes), BMNH, HH, VRC, ZSI (paratypes) (Keirans and Hillyard, 2001, *op. cit.* under *H. aciculifer*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: montane grasslands and shrublands

Hosts: usual hosts for larvae, nymphs and adults are Artiodactyla: Bovidae.
Artiodactyla: Bovidae; Perissodactyla: Equidae (ANL)
Rodentia: Muridae (N)
Lagomorpha: Ochotonidae (stage unknown)

Human infestation: no

Remarks: Camicas et al. (1998) consider this species to be exclusively Oriental, but Hoogstraal and Kim (1985) include Afghanistan (Palearctic) within its range. We were unable to confirm the record of *H. cornupunctata* on Cervidae in Ghosh et al. (2007). Rao et al. (1973) state that "mouse hare" is a host of *H. cornupunctata* but do not identify the tick stage(s) collected. Kolonin (2009) does not recognize hosts of *H. cornupunctata* other than "livestock."

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.
Dhanda, V. & Kulkarni, S.M. 1969. Immature stages of *Haemaphysalis cornupunctata* Hoogstraal & Varma, 1962 (Acarina: Ixodidae) with new host and locality records, and notes on its ecology. Oriental Insects, 3: 15–21.

Ghosh, S., Bansal, G.C., Gupta, S.C., Ray, D., Khan, M.Q., Irshad, H., Shahiduzzaman, Md., Seitzer, U. & Ahmed, J.S. 2007. Status of tick distribution in Bangladesh, India and Pakistan. Parasitol. Res., 101 (Suppl. 2): 207–216.
Hoogstraal, H. & Kim, K.C. 1985. Tick and mammal coevolution, with emphasis on *Haemaphysalis. In* K.C. Kim (editor), Coevolution of parasitic arthropods and mammals. John Wiley & Sons, New York, pp. 505–568.
Hoogstraal, H. & Varma, M.G.R. 1962. *Haemaphysalis cornupunctata* sp. n. and *H. kashmirensis* sp. n. from Kashmir, with notes on *H. sundrai* Sharif and *H. sewelli* Sharif of India and Pakistan (Ixodoidea: Ixodidae). J. Parasitol., 48: 185–194.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Rao, T.R., Dhanda, V., Bhat, H.R. & Kulkarni, S.M. 1973. A survey of haematophagous arthropods in western Himalayas, Sikkim and Hill Districts of West Bengal. A general account. Ind. J. Med. Res., 61: 1421–1461.
Sharma, B.D. 1993. Medical & veterinary arthropod-disease ecology. Ashish Publishing House, New Delhi, 335 pp.

34 – *H. cuspidata* Warburton, 1910 (Parasitology, 3: 395–407)

Type depositories: BMNH (lectotype, paralectotypes), ZMB (paratype) [sic] (Keirans and Hillyard, 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregions: Sri Lanka and southwestern Ghats montane rain forests

Hosts: Artiodactyla: Tragulidae; Carnivora: Viverridae; Cuculiformes: Cuculidae (ANL)
Carnivora: Felidae, Herpestidae; Lagomorpha: Leporidae (A)
Artiodactyla: Bovidae; Primates: Cercopithecidae (NL)
Rodentia: Hystricidae; Coraciiformes: Bucerotidae; Galliformes: Phasianidae (N)
Rodentia: Muridae, Sciuridae; Soricomorpha: Soricidae; Passeriformes: Sylviidae (L)
Carnivora: Canidae (stage unknown)

Human infestation: no

Remarks: Kolonin (2009) does not include Aves as hosts of adults of *H. cuspidata*, but we regard the records from Cuculidae in Rajagopalan (1972) as sound. Kolonin (2009) also lists Cervidae as hosts for all parasitic stages of *H. cuspidata*, but we were unable to confirm this from the reference provided by this author and have therefore excluded Cervidae from our host list above.

References

Bhat, H.R. & Sreenivasan, M.A. 1981. Further records of the ticks of some reptilian and mammalian hosts in the Kyasanur Forest disease area, Karnataka, India. Ind. J. Parasitol., 5: 207–210.
Boshell, J. & Rajagopalan, P.K. 1968. Observations on the experimental exposure of monkeys, rodents and shrews to infestation of ticks in forest in Kyasanur Forest disease area. Ind. J. Med. Res., 56 (4) (Suppl.): 573–588.

Grokhovskaya, I.M. & Nguen, H.H. 1968. Contribution to the study of ixodid ticks (Ixodidae) in Vietnam. Med. Parazit., 37: 710–715. In Russian, NAMRU-3 translation 401.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Nuttall, G.H.F. & Warburton, C. 1915. Ticks. A monograph of the Ixodoidea. Part III. The genus *Haemaphysalis*. Cambridge University Press, London, pp. 349–550.
Rajagopalan, P.K. 1972. Ixodid ticks (Acarina: Ixodidae) parasitizing wild birds in the Kyasanur Forest disease area of Shimoga District, Mysore State, India. J. Bombay Nat. Hist. Soc., 69: 55–78.
Rajagopalan, P.K. & Sreenivasan, M.A. 1981. Ixodid ticks on cattle and buffaloes in the Kyasanur Forest disease area of Karnataka State. Ind. J. Med. Res., 73: 880–889.
Rajagopalan, P.K., Patil, A.P. & Boshell, J. 1968. Ixodid ticks on their mammalian hosts in the Kyasanur Forest disease area of Mysore State, India, 1961–1964. Ind. J. Med. Res., 56: 510–526.
Warburton, C. 1910. On two collections of Indian ticks. Parasitology, 3: 395–407.

35 – *H. dangi* Phan Trong, 1977 (Ve bet va con trung ky sinh o Viet Nam. Tap 1. Ve (Ixodoidea), mo ta va phan loai. Ha Noi: Khoa hoc va ky thuat, 489 pp. In Vietnamese)

Type depository: AI (holotype, paratypes) (Kolonin, G.V. personal communication to Guglielmone, A.A.)

Known stages: male, female

Zoogeographic Region: Oriental

Ecoregion: south China-Vietnam subtropical evergreen forests

Hosts: Artiodactyla (several families); Carnivora: Mustelidae; Rodentia: Hystricidae (A)

Human infestation: no

References

Kolonin, G.V. 1995. Review of the ixodid tick fauna (Acari: Ixodidae) of Vietnam. J. Med. Entomol., 32: 276–282.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

36 – *H. danieli* Černý & Hoogstraal, 1977 (J. Parasitol., 63: 567–574)
Specimens of *H. danieli* from China are considered identical to *H. pospelovashtromae* by Kolonin (2009, *op. cit*. under *H. anomaloceraea*), but no conclusive evidence is presented. See also "Remarks on some invalid names" at the beginning of this chapter for justification of the status of *H. xinjiangensis* as a junior synonym of *H. danieli*, as well as the remarks below.

Type depository: IPCAS (holotype) (Černý, V. & Hoogstraal, H. 1977. *Haemaphysalis* (*Allophysalis*) *danieli*, sp. n., (Ixodoidea: Ixodidae), female and tentatively associated immature stages from high mountains of northern Pakistan and Afghanistan. J. Parasitol., 63: 567–574)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: montane grasslands and shrublands in the Oriental and Palearctic Zoogeographic Regions

Hosts: Artiodactyla: Bovidae (A)
Lagomorpha: Ochotonidae; Rodentia: Cricetidae, Muridae, Sciuridae (NL)

Human infestation: no

Remarks: Camicas et al. (1998) state that this species is found only in the Oriental Region, but there are localities included in the original description of *H. danieli* and in Teng and Jiang (1991), Yu et al. (1997) and Chen et al. (2010) that fall within the Palearctic Region. Camicas et al. (1998) list the male of *H. danieli* as undescribed. This statement is probably a consequence of regarding *H. xinjiangensis* as a species separate from *H. danieli* when in fact the converse is true (see the first paragraph of this chapter). The male of *H. danieli* was described by Teng (1980), but under the name *H. xinjiangensis.*

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Černý, V. & Hoogstraal, H. 1977. *Haemaphysalis* (*Allophysalis*) *danieli*, sp. n., (Ixodoidea: Ixodidae), female and tentatively associated immature stages from high mountains of northern Pakistan and Afghanistan. J. Parasitol., 63: 567–574.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Teng, K. 1980. On the Chinese *Haemaphysalis* subgenus *Allophysalis* with description of a new species. Acta Entomol. Sin., 23: 86–89. In Chinese.

Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.

Yu, X., Ye, R.-E. & Gong, Z.-D. 1997. The tick fauna of Xinjiang. Technological and Medical Publishing House, Urumqi, China, 168 pp. In Chinese.

37 – *H. darjeeling* Hoogstraal & Dhanda, 1970 (J. Parasitol., 56: 169–174)

Type depositories: BMNH (holotype, paratypes), USNTC, HH, IM (paratypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*). The specimens used in the description of *H. darjeeling* were part of the syntype series of *H. birmaniae.*

Known stages: male, female

Zoogeographic Region: Oriental

Ecoregions: montane grasslands and shrublands

Hosts: Artiodactyla: Bovidae, Cervidae, Suidae; Carnivora: Mustelidae (A)

Human infestation: yes (Tanskul and Inlao 1989, see below)

Remarks: Kolonin (2009) does not include Carnivora as hosts of *H. darjeeling*, probably because he regards the ticks found on these hosts in Tanskul and Inlao (1989) as closer to *H. quadriaculeata* than to *H. darjeeling*, as discussed in Kolonin (2003). We consider the records of this tick on Carnivora in Tanskul et al. (1983) and Tanskul and Inlao (1989) to be provisionally valid. See also *H. quadriaculeata.*

References

Hoogstraal, H. & Dhanda, V, 1970. *Haemaphysalis* (*H.*) *darjeeling* sp. n., a member of the *H.* (*H.*) *birmaniae* group (Ixodoidea, Ixodidae) parasitizing artiodactyl mammals in Himalayan forests of India, and in Burma and Thailand. J. Parasitol., 56: 169–174.

Kolonin, G.V. 2003. New data on ixodid tick fauna of Vietnam. Entomol. Rev., 83 (Suppl. 2): S190-S192.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Tanskul, P. & Inlao, I. 1989. Keys to the adult ticks of *Haemaphysalis* Koch, 1844, in Thailand with notes on changes in taxonomy (Acari: Ixodoidea: Ixodidae). J. Med. Entomol., 26: 573–601.

Tanskul, P., Stark, H.E. & Inlao, I. 1983. A checklist of ticks of Thailand (Acari: Metastigmata: Ixodoidea). J. Med. Entomol., 20: 330–341.

38 – *H. davisi* Hoogstraal, Dhanda & Bhat, 1970 (J. Parasitol., 56: 588–595)
See remarks below.

Type depositories: USNTC (holotype, paratypes), BMNH, VRC, HH, IM (paratypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph

Zoogeographic Region: Oriental

Ecoregion: temperate coniferous forests

Hosts: Artiodactyla: Bovidae, Cervidae; Perissodactyla: Equidae (AN)
Carnivora: Felidae, Mustelidae (A)

Human infestation: no

Remarks: specimens of *H. neumanni* Dönitz, 1905 (a synonym of *Haemaphysalis longicornis*) in Dhanda and Rao (1964) are in fact *H. davisi* (Hoogstraal et al. 1970). Camicas et al. (1998) list Aves and pholeophilic (burrowing) mammals as hosts for larvae and nymphs of this species, but we have found no references to support this statement.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Dhanda, V. & Rao, T.R. 1964. A report on a collection of ixodid ticks made in the North East Frontier Agency, India. Ind. J. Med. Res., 52: 1139–1153.
Hoogstraal, H., Dhanda, V. & Bhat, H.R. 1970. *Haemaphysalis* (*Kaiseriana*) *davisi* sp. n. (Ixodoidea: Ixodidae), a parasite of domestic and wild mammals in north-eastern India, Sikkim, and Burma. J. Parasitol., 56: 588–595.

39 – *H. demidovae* Emel'yanova, 1978 (*In* Natural conditions and resources of Prikhusbsugul (Mongolian People's Republic), O.M. Kozhova (editor). Trudy Sov. Mongol. Kompleks. Khubsugul. Eksp. Irkutsk. Gos. Univ. imeni A.A. Zhdanova, Minist. Vyssh. Spets. Obraz. RSFSR (6): 162–171. In Russian).

Type depository: not stated in the description of this species (Keirans, J.E. & Robbins, R.G. 1999. A world checklist of genera, subgenera, and species of ticks (Acari: Ixodida) published from 1973 to 1997. J. Vector Ecol., 24: 115–129).

Known stages: nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: deserts and xeric shrublands

Hosts: Rodentia: Cricetidae, Ochotonidae, Sciuridae (NL)

Human infestation: no

Reference

Emel'yanova, N.D. 1978. Two ixodid species of the subgenus *Allophysalis* (*Haemaphysalis*, Ixodidae) from Mongolian People's Republic. *In* O.M. Kozhova (editor), Natural conditions and resources of Prikhusbsugul (Mongolian People's Republic). Trudy Sov. Mongol. Kompleks. Khubsugul. Eksp. Irkutsk. Gos. Univ. Imeni A.A. Zhdanova, Minist. Vyssh. Spets. Obraz. RSFSR (6): 162–171. In Russian, NAMRU-3 translation 1738.

40 – *H. doenitzi* Warburton & Nuttall, 1909 (Parasitology, 2: 57–76)
See *H. phasiana* and *H. pavlovskyi* and remarks below.

Type depository: BMNH (lectotype, paralectotypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Australasian, Oriental, Palearctic

Ecoregions: tropical and subtropical rain forests

Hosts: usual hosts for larvae, nymphs and adult ticks are Cuculiformes: Cuculidae, Galliformes: Phasianidae. Mammalia and Testudines are considered exceptional hosts for this tick.
Cuculiformes: Cuculidae; Galliformes: Phasianidae; Passeriformes: Sturnidae; Rodentia: Muridae (ANL)

Falconiformes: Accipitridae, Falconidae; Passeriformes: Sylviidae; Strigiformes: Strigidae; Lagomorpha: Leporidae; Testudines: Geoemydidae (AN)
Passeriformes: Alaudidae (AL)
Coraciiformes: Coraciidae, Upupidae; Gruiformes: Rallidae; Passeriformes: Pycnonotidae (A)
Passeriformes: Pittidae, Timaliidae, Turdidae (NL)
Passeriformes: Hirundinidae, Muscicapidae; Piciformes: Capitonidae (N)

Human infestation: yes (Tanskul et al. 1983)

Remarks: although Aves are the preferred hosts of *H. doenitzi*, Kolonin (2008) believes that Mammalia are equally important as hosts. Kolonin (2009) claims that *H. phasiana* and *H. pavlovskyi* are synonyms of *H. doenitzi*, and perhaps these synonymies, which we consider invalid, are the source of Kolonin's unexplained statement concerning the host preferences of *H. doenitzi*. On the other hand, Sames et al. (2008) believe that a complex of species may be represented under the name *H. doenitzi*. Until this problem is solved, all the above names should be treated as valid. It is not clear whether or not Liu et al. (2002) found specimens of *H. doenitzi* on Soricidae, and we have therefore excluded this host group from our list above.

References

Hoogstraal, H. & Wassef, H.Y. 1973. The *Haemaphysalis* ticks (Ixodoidea: Ixodidae) of birds. 3.*H.* (*Ornithophysalis*) subgen. n.: definition, species, hosts and distribution in the Oriental, Palearctic, Malagasy, and Ethiopian Faunal Regions. J. Parasitol., 59: 1099–1117.

Kolonin, G.V. 2008. Birds as hosts of ixodid ticks (Acarina: Ixodidae). Entomol. Rev., 88: 1012–1015.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Liu, M.Z., Chen, W,.S. & Gu, W.Z. et al. [sic] 2002. Investigation on rats and insects on their body surface in Shenzhen. Chin. J. Vector Biol. Contr., 13: 13–15. In Chinese.

Sames, W.J., Kim, H.C., Chong, S.T., Lee, I.Y., Apanaskevich, D.A., Robbins, R.G., Bast. J., Moore, R. & Klein, T.A. 2008. *Haemaphysalis* (*Ornithophysalis*) *phasiana* (Acari: Ixodidae) in the Republic of Korea: two province records and habitat descriptions. Syst. Appl. Acarol., 13: 43–50.

Tanskul, P., Stark, H.E. & Inlao, I. 1983. A checklist of ticks of Thailand (Acari: Metastigmata: Ixodoidea). J. Med. Entomol., 20: 330–341.

41 – *H. elliptica* (Koch, 1844) (Arch. Naturgesch., 10: 217–239)
See remarks below.

Type depository: ZMB (holotype) (Moritz and Fischer 1981, *op. cit*. under *H. cinnabarina*) as *Rhipistoma ellipticum*

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: several Afrotropical ecoregions

Hosts: usual hosts for adult ticks are Carnivora: Canidae and Felidae. Aves are considered exceptional hosts for this tick.
Carnivora: Canidae, Felidae (ANL)
Mammalia (several orders) (A)
Macroscelidea: Macroscelididae (N)
Rodentia: Muridae (NL)
Passeriformes: Cisticolidae, Ploceidae (N and/or L)

Human infestation: yes (Apanaskevich et al. 2007)

Remarks: this species has frequently been confused with *H. leachi* (Apanaskevich et al. 2007). Camicas et al. (1998) listed the male and larva as the only stages of *H. elliptica* that had been described at the time of their publication; however, the female and nymph were subsequently described by Apanaskevich et al. (2007). The latter authors also indicated that subadults of *H. elliptica* feed on rodents, without identifying the families, whereas Matthee et al. (2010) collected the immature stages from Muridae. Hasle et al. (2009) do not state whether larvae, nymphs or both immature stages of *H. elliptica* were found on Passeriformes.

References

Apanaskevich, D.A., Horak, I.G. & Camicas, J.-L. 2007. Redescription of *Haemaphysalis* (*Rhipistoma*) *elliptica* (Koch, 1844), an old taxon of the *Haemaphysalis* (*Rhipistoma*) *leachi* group from East and southern Africa, and of *Haemaphysalis* (*Rhipistoma*) *leachi* (Audouin, 1826) (Ixodida: Ixodidae). Onderstepoort J. Vet. Res., 74: 181–208.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

De Matos, C., Sitoe, C., Neves, L., Bryson, N.R. & Horak, I.G. 2008. Ixodid ticks on dogs belonging to people in rural communities and villages in Maputo Province, Mozambique. Onderstepoort J. Vet. Res., 75: 103–108.

Hasle, G., Horak, I.G., Grieve, G., Leinaas, H.P. & Clarke, F. 2009. Ticks collected from birds in the northern provinces of South Africa, 2004–2006. Onderstepoort J. Vet. Res., 76: 167–175.

Horak, I.G., Heyne, H. & Donkin, E.F. 2010. Parasites of domestic and wild animals in South Africa. XLVIII. Ticks (Acari: Ixodidae) infesting domestic cats and wild felids in southern Africa. Onderstepoort J. Vet. Res., 77, doi:10.4102/ojvr.v77i1.3

Horak, I.G., Welman, S., Hallam, S.L., Lutermann, H. & Mzilikazi, N. 2011. Ticks of four-toed elephant shrews and Southern African hedgehogs. Onderstepoort J. Vet. Res., 78, doi:10.4102/ojvr.v78i1.243

Matthee, S., Horak, I.G., Van der Mescht, L., Ueckermann, E.A. & Radloff. F.G.T. 2010. Ectoparasite diversity on rodents at De Hoop Nature Reserve, Western Cape Province. Afr. Zool., 45: 213–224.
Nyangiwe, N., Goni, S., Hervé-Claude L.P., Ruddat, I. & Horak, I.G. 2012. Ticks on pasture and on two breeds of cattle in the Eastern Cape Province, South Africa. Onderstepoort J. Vet. Res., 78, doi:10.4102/ojvr.v78i1.320

42 – *H. elongata* Neumann, 1897 (Mém. Soc. Zool. Fr., 10: 324–420)

Type depository: BMNH (syntypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregion: Madagascar subhumid forests

Hosts: usual hosts for adult ticks are Afrosoricida: Tenricidae.
Afrosoricida: Tenrecidae (ANL)
Rodentia: Muridae (A)
Carnivora: Eupleridae; Erinaceomorpha: Erinaceidae (N)

Human infestation: yes (Burridge 2011)

Remarks: Uilenberg et al. (1979) regard a record of this tick from Chiroptera as doubtful and we have therefore excluded this record from our list for *H. elongata*. Keirans and Durden (2001) cite an introduction of this species into the Nearctic Region, but *H. elongata* has not become established there. Kolonin (2009) and Burridge (2011) ignore Erinaceidae as hosts of this tick, but we consider the record of Keirans (1985) on this host valid.

References

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.
Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.
Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Uilenberg, G., Hoogstraal, H. & Klein, J.-M. 1979. Les tiques (Ixodoidea) de Madagascar et leur rôle vecteur. Arch. Inst. Pasteur Madagascar Num. Spéc., 153 pp.

43 – *H. erinacei* Pavesi, 1884 (Ann. Mus. Civ. Stor. Nat. Genova, 20: 446–486)
The species *H. erinacei* described in Feldman-Muhsam, B. (1951. A note on east Mediterranean species of the genus *Haemaphysalis*. Bull. Res. Council Israel, 1: 96–107) is a synonym of *H. erinacei* Pavesi, 1884, as stated in Hoogstraal, H. (1955.

Notes on African *Haemaphysalis* ticks. I. The Mediterranean-littoral hedgehog parasite. *H. erinacei* Pavesi, 1884 (Ixodoidea, Ixodidae). J. Parasitol., 41: 221–233)

Many workers believe that this species comprises several subspecies, indicating that more than one taxon is probably included under the name *H. erinacei.* Filippova, N.A., Panova, I.V. & Musatov, S.A. (1993. Taxonomic structure of the polytypic species *Haemaphysalis erinacei* (Ixodidae). Parazitologiya, 27: 193–215. In Russian) provide a good description of the subspecies within *H. erinacei*. See "remarks on some invalid names" for an additional synonym of *H. erinacei.* See also remarks below.

Type depository: GM (syntypes) (Hoogstraal 1955, *op. cit*. above)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: mediterranean forests, woodlands and scrub

Hosts: Testudines are considered exceptional hosts for this tick.
Carnivora: Canidae; Erinaceomorpha: Erinaceidae (ANL)
Carnivora: Felidae, Hyaenidae, Mustelidae; Lagomorpha: Leporidae, Ochotonidae; Coraciiformes: Meropodidae; Testudines: Testudinidae (A)
Rodentia: Muridae (NL)
Rodentia: Gliridae; Apodiformes: Apodidae; Passeriformes: Motacillidae (N)
Rodentia: Dipodidae (L)
Chiroptera: Vespertilionidae; Rodentia: Calomyscidae, Cricetidae (N and/or L)
Artiodactyla: Bovidae; Carnivora: Ursidae; Rodentia: Sciuridae; Falconiformes: Falconidae; Passeriformes: Emberizidae, Muscicapidae (stages unknown)

Human infestation: yes (Bursali et al. 2012)

Remarks: Serdjukova (1956), Ushakova (1958), Gusev et al. (1961), Bakhaeva (1962), Grebenyuk (1966), and Filippova et al. (1976) call this species *H. numidiana.* We were unable to determine which immature stages were found by Filippova et al. (1976) on Chiroptera and Rodentia (Calomyscidae and Cricetidae). Tovornik and Černý (1974) doubt whether adult ticks of *H. erinacei* were found on Coraciiformes (Meropodidae) or Gruiformes (Gruidae), but Tovornik (1990) clearly states that a male was found on Meropodidae. Kolonin (2009) reduces the hosts of *H. erinacei* to "hedgehogs, small carnivores and rodents" but does not comment on this limited host range.

References

Bakhaeva, A.V. 1962. The fauna of ticks in Turkmenia. Izv. Akad. Nauk Turkmen. Ser. Biol. Nauk. (5): 72–79. In Russian.

Bursali, A., Keskin, A. & Tekin, S. 2012. A review of the ticks (Acari: Ixodida) of Turkey: species diversity, hosts and geographical distribution. Exp. Appl. Acarol., 57: 91–104.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Filippova, N.A., Neronov, V.M. & Farhang-Azad, A. 1976. Materials on the fauna of ixodids (Acarina, Ixodidae) of small mammals in Iran. Entomol. Obozr., 55: 467–478. In Russian.

Grebenyuk, R.V. 1966. Ixodid ticks (Parasitiformes, Ixodidae) of Kirgizia. Akademii Nauk Kirgizkoy SSR, Instituta Biologii, Frunze, 328 pp. In Russian.

Gusev, V.M., Bednyy, S.N., Guseva, A.A., Labunets, N.F. & Bakeyev, N.N. 1961. The ecological groups of birds on the Caucasus and their role in the life cycle of ticks and fleas. Trudy Nauch.-Issled. Protiv. Inst. Kavk. Zakav. (5): 217–267. In Russian.

Hoogstraal, H. 1955. Notes on African *Haemaphysalis* ticks. I. The Mediterranean-littoral hedgehog parasite *H. erinacei* Pavesi, 1884 (Ixodoidea, Ixodidae). J. Parasitol., 41: 221–233.

Hoogstraal, H. 1959. Biological observations on certain Turkish *Haemaphysalis* ticks (Ixodoidea, Ixodidae). J. Parasitol., 45: 227–232.

Hoogstraal, H., Wassef, H.Y. & Büttiker, W. 1981. Ticks (Acarina) of Saudi Arabia Fam. Argasidae, Ixodidae. Fauna Saudi Arabia, 3: 25–110.

Kolonin, G.V. 1995. Review of the ixodid tick fauna (Acari: Ixodidae) of Vietnam. J. Med. Entomol., 32: 276–282.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Serdjukova, G.V. 1956. Ixodid ticks of the fauna of USSR. Opred. Faune SSSR. Zool. Inst. Akad. Nauk SSSR (64), 121 pp. In Russian.

Široký, P., Petrželková, K.J., Kamler, D., Mihalca, A.D. & Modrý, D. 2006. *Hyalomma aegyptium* as dominant tick in tortoises of the genus *Testudo* in Balkan countries, with notes on its host preferences. Exp. Appl. Acarol., 40: 279–290.

Theodor, O. & Costa, M. 1967. A survey of the parasites of wild mammals and birds in Israel. Part one. Ectoparasites. The Israel Academy of Science and Humanities, Jerusalem, 119 pp.

Tovornik, D. 1990. The significance of the birds (Aves) as the hosts and disseminators of ixodid ticks (Yugoslavia). Biol. Vestn., 38: 77–108.

Tovornik, D. & Černý, V. 1974. Finding of *Haemaphysalis erinacei erinacei* Pavesi, 1884 on birds in Yugoslavia. Folia Parasitol., 21: 282.

Ushakova, G.V. 1958. Ixodoidea parasitic on birds of the lower Ili River. Trudy Inst. Zool. Akad. Nauk Kazakh. SSR, 9: 135–145. In Russian.

Ushakova, G.V. & Busalaeva, N.N. 1962. Data on ixodid ticks in the semideserts of the Karaganda Region. Parazit. Sel.-Khoz. Zhivot. Kazakh., 1: 216–224. In Russian.

Wassef, H.I., Büttiker, W. & Gallagher, M.D. 1997. Further records of ticks (Acari: Argasidae and Ixodidae) from the Arab Peninsula. Fauna Saudi Arabia, 16: 63–88.

44 – *H. eupleres* Hoogstraal, Kohls & Trapido, 1965 (J. Parasitol., 51: 997–1000)

Type depository: AMNH (holotype) (Hoogstraal, H. & Camicas, J.-L. 1977. *Haemaphysalis* (*Rhipistoma*) *eupleres* (Ixodoidea: Ixodidae), a parasite of the

Madagascar falanouc (mongoose): new data and male identity. J. Parasitol., 63: 1099–1102). **Note**: the Madagascar falanouc belongs to the family Eupleridae while mongoose are classified in the family Herpestidae.

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregion: Madagascar lowland forests

Hosts: Carnivora: Eupleridae (A)

Human infestation: no

Reference

Uilenberg, G., Hoogstraal, H. & Klein, J.-M. 1979. Les tiques (Ixodoidea) de Madagascar et leur rôle vecteur. Arch. Inst. Pasteur Madagascar Num. Spéc., 153 pp.

45 – *H. filippovae* Bolotin, 1979 (Zool. Zh., 58: 267–269. In Russian)
Camicas et. al. (1998, *op. cit.* under *H. anomaloceraea*) and Kolonin (2009, *op. cit*. under *H. anomaloceraea*) treat this species as an abnormal form of *H. concinna* without further comment. Guglielmone et al. (2009, *op. cit*. under *H. colasbelcouri*) consider *H. filippovae* a valid species and we agree.

Type depository: ZIAC (holotype) (Filippova 2008, *op. cit*. under *H. caucasica*)

Known stages: female

Zoogeographic Region: Palearctic

Ecoregions: Ussuri broadleaf and mixed forests

Hosts: unknown

Human infestation: no

References

Bolotin, E.I. 1979. A new *Haemaphysalis* species (Parasitiformes, Ixodidae) from southern Far East. Zool. Zh., 58: 267–269. In Russian, NAMRU-3 translation 1438.
Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

46 – *H. flava* Neumann, 1897 (Mém. Soc. Zool. Fr., 10: 324–420)

Type depository: MNHN (syntypes) (Neumann, L.G. 1897. Révision de la famille des ixodidés (2e mémoire). Mém. Soc. Zool. Fr., 10: 324–420)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: temperate broadleaf and mixed forests

Hosts: Aves are considered exceptional hosts for adults of *H. flava.*
Mammalia (several orders); Galliformes: Phasianidae (ANL)
Falconiformes: Accipitridae (A)
Aves (several orders) (NL)

Human infestation: yes (Yamauchi et al. 2010)

Remarks: Camicas et al. (1998) exclude Aves as hosts for the larva and nymph of *H. flava*, but Miyamoto et al. (2000) subsequently reported the importance of Aves as hosts of the sub-adults of this tick. On the other hand, Kolonin (2009) does not recognize Aves as hosts for adult *H. flava*, but we accept the record of adults of this species on Galliformes, as reported by Teng and Jiang (1991). See also *H. montgomeryi.*

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Fujimoto, K., Yamaguti, N. & Takahashi, M. 1986. Ecological studies on ixodid ticks. 1. Ixodid ticks on vegetations and wild animals at the low mountain zone lying south-western part of Saitama Prefecture. Jap. J. Sanit. Zool., 37: 325–331. In Japanese.

Kang, J.-G., Kim, H.-C., Choi, C.-Y., Nam, H.-Y., Chae, H.-Y., Chong, S.-T., Klein, T.A., Ko, S. & Chae, J.-S. 2013. Molecular detection of *Anaplasma*, *Bartonella*, and *Borrelia* species in ticks collected from migratory birds from Hong-do Island, Republic of Korea. Vector- Borne Zoon. Dis., 13: 215–225.

Kobayashi, S., Nakamoto, A., Shimizu, K., Takada, A. & Moriwaki, M. 2012. The first capture with ectoparasitic ticks and the first photograph in life of wild raccon, *Procyon lotor* (Linnaeus 1758), in Okayama Prefecture. Naturalistae, 16: 83–90. In Japanese.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Kolonin, G.V. & Bolotin, E.I. 1975. New findings of *Haemaphysalis flava* tick (Parasitioformes, Ixodidae) in the Soviet Primor'e region. Zool. Zh. 54: 616–617. In Russian, NAMRU-3 translation 1274.

Miyamoto, K., Masuzawa, T. & Kudeken, M. 2000. Tick collection from wild birds and detection of Lyme disease spirochetes from a new avian reservoir in Japan. Med. Entomol. Zool., 51: 221–226.

Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.

Yamauchi, T. 2001. A bibliographical survey of host-parasite relationships between birds and ticks from Japan. Bull. Hoshizaki Green Found., 5: 271–308. In Japanese.

Yamauchi, T. & Mori, S. 2004. Preliminary study on the tick (Acari: Ixodidae) infestation of wild birds in the eastern part of Shimane Prefecture, Japan. Med. Entomol. Zool., 55: 329–332.

Yamauchi, T., Fukui, Y., Watanabe, M., Nakagawa, H. & Kamimura, K. 2010. Forty cases of human infestations with hard ticks (Acari: Ixodidae) in Toyama Prefecture, Japan. Med. Entomol. Zool., 61: 133–143. In Japanese.
Yamauchi, T., Agetsuma, N., Araki, A. & Fukushima, M. 2012. Ixodid ticks collected from the raccoon dog *Nyctereutes procyonoides albus* and the common raccoon *Procyon lotor* in southern Hokkaido, Japan. Int. J. Acarol., 38: 214–216.
Yamauchi, T., Yano, S., Yamamoto, T., Yamamoto, E. & Miyamoto, T. 2013. Ticks (Acari: Ixodidae) from medium-sized to large mammals in Ehime Prefecture, Japan. Exp. Appl. Acarol., 60: 263–270.

47 – *H. formosensis* Neumann, 1913 (Entomol. Mitt., Suppl. Entomol., 2: 134–137)

Type depositories: BMNH, ZMB (syntypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*), but its presence in ZMB is not mentionated in Moritz and Fischer (1981, *op. cit*. under *H. cinnabarina*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: tropical and subtropical coniferous forests

Hosts: Carnivora: Canidae; Lagomorpha: Leporidae (ANL)
Artiodactyla: Cervidae, Suidae; Galliformes: Phasianidae (AN)
Artiodactyla: Bovidae, Moschidae; Carnivora: Ursidae; Rodentia: Hystricidae, Muridae (A)
Carnivora: Herpestidae; Charadriiformes: Scolopacidae (NL)
Carnivora: Mustelidae; Chiroptera: Vespertilionidae; Scandentia: Tupaiidae (N)
Passeriformes: Corvidae (L)

Human infestation: no

Remarks: Camicas et al. (1998) list the larva and nymph of *H. formosensis* as undescribed, but Teng and Jiang (1991) had previously provided descriptions of both stages. Kolonin (2009) limits the hosts of *H. formosensis* to pigs, dogs and muntjacs but provides no explanation for this reduced host range.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.
Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.
Dhanda, V. & Rao, T.R. 1964. A report on a collection of ixodid ticks made in the North East Frontier Agency, India. Ind. J. Med. Res., 52: 1139–1153.
Ishibashi, O., Niizuma, J., Miura, A., Iizuka, S., Fujita, H., Ogura, G., Sakashita, M., Ganeko, H., Sunagawa, K. & Nakada, T. 2009. Survey of parasitic ixodid ticks

on small Asian mongoose on Okinawajima Island, Japan. Jap. J. Zoo Wild. Med., 14: 51–57.
Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.
Kitaoka, S. & Suzuki, H. 1974. Reports of medico-zoology investigations in the Nansei Islands. Part 2. Ticks and their seasonal prevalences in southern Amami-oshima. Jap. J. Sanit. Zool., 26: 21–26. In Japanese.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Pang, D., Chen, C. & Xiang, R. 1982. Notes on ixodid ticks from southwestern Yunnan with description of a new species of *Haemaphysalis* (Acarina: Ixodidae). Zool. Res., 3 (Suppl.): 45–51. In Chinese.
Phan Trong, C. 1977. Ve bet va con trung ky sinh o Viet Nam. Tap 1. Ve (Ixodoidea), mo ta va phan loai. Ha Noi: Khoa hoc va ky thuat, 489 pp. In Vietnamese.
Sugimoto, M. 1937. Notes on the ticks in the Formosa Mountain Reservation for the aborigines. J. Centr. Soc. Vet. Med. Tokyo, 50: 303–340. In Japanese, NAMRU-3 translation 11.
Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.
Xu, R. & Luo, G. 1998. Ticks parasitic on *Muntiacus reevesi* and *Lepus sinensis* in Wuyi Mountains, Fujian, China. Syst. Appl. Acarol. 3: 197.
Yamauchi, T. & Funakoshi, K. 2000. Ticks (Acari: Ixodoidea) from Chiroptera (Mammalia) of the Kyushu mainland, Japan. J. Acarol. Soc. Jap., 9: 51–54.
Yamauchi, T., Yano, S., Yamamoto, T., Yamamoto, E. & Miyamoto, T. 2013. Ticks (Acari: Ixodidae) from medium-sized to large mammals in Ehime Prefecture, Japan. Exp. Appl. Acarol., 60: 263–270.

48 – *H. fossae* Hoogstraal, 1953 (Bull. Mus. Comp. Zool., 111: 37–113)

Type depositories: USNTC (holotype, paratypes), BMNH, HH, ISM, FMNH, MCZ, OVI, MNHN (paratypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female.

Zoogeographic Region: Afrotropical

Ecoregions: Madagascar dry deciduous forests and succulent woodlands

Hosts: usual hosts for adult ticks are Carnivora: Eupleridae.
Carnivora: Eupleridae, Viverridae (A)

Human infestation: no.

Reference

Uilenberg, G., Hoogstraal, H. & Klein, J.-M. 1979. Les tiques (Ixodoidea) de Madagascar et leur rôle vecteur. Arch. Inst. Pasteur Madagascar Num. Spéc., 153 pp.

49 – *H. fujisana* Kitaoka, 1970 (Natl. Inst. Anim. Health Q., 10: 73–81)

Type depositories: NIAH (holotype, paratypes), HH, USNTC (paratypes) (Kitaoka, S. 1970. *Haemaphysalis* (*Haemaphysalis*) *fujisana* sp. n. (Ixodoidea, Ixodidae), a cattle parasite in Japan. Natl. Inst. Anim. Health Q., 10: 73–81; Keirans and Clifford 1984, *op. cit.* under *H. bartelsi*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: temperate broadleaf and mixed forests

Hosts: Artiodactyla: Bovidae (ANL)

Human infestation: no

Remarks: the male, nymph and larva of *H. fujisana* are known only from laboratory-reared specimens. Camicas et al. (1998) list pholeophilic (burrowing) mammals as hosts for the larva and nymph, but we have found no records to substantiate this.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Kitaoka, S. 1970. *Haemaphysalis* (*Haemaphysalis*) *fujisana* sp. n. (Ixodoidea, Ixodidae), a cattle parasite in Japan. Natl. Inst. Anim. Health Q., 10: 73–81.

50 – *H. garhwalensis* Dhanda & Bhat, 1968 (J. Parasitol., 54: 674–678)

Type depositories: VRC (holotype, paratypes), BMNH, IM, HH, USNTC (paratypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: western Himalayan broadleaf forests; Upper Gangetic Plains moist deciduous forests; western Himalayan alpine shrub and meadows

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae. Rodentia: Cricetidae are considered exceptional hosts for adults of this tick.
Rodentia: Cricetidae (ANL)
Artiodactyla: Bovidae; Perissodactyla: Equidae (A)
Rodentia: Muridae (NL)

Human infestation: no

Remarks: Camicas et al. (1998) list Aves as hosts for larvae and nymphs of this species, but we have been unable to confirm this. Kolonin (2009) ignores Rodentia and Equidae as hosts for adult *H. garhwalensis*. Although infestation of Muridae by

adult *H. garhwalensis* appears to be an infrequent event, there are sound records for this host-parasite relationship in Dhanda et al. (1977).

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Dhanda, V., Bhat, H.R. & Kulkarni, S.M. 1977. *Haemaphysalis* (*Allophysalis*) *garhwalensis* Dhanda and Bhat (Acarina: Ixodidae), description of immature stages, hosts, distribution and ecology. Ind. J. Parasitol., 1: 9–14.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.

51 – *H. goral* Hoogstraal, 1970 (J. Parasitol., 56: 1227–1238)

Type depository: BMNH (holotype) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*). This tick was originally classified as *H. neumanni* Dönitz, 1905 (Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Publ. (1438), 1785 pp), which is a synonym of *H. longicornis.*

Known stages: female

Zoogeographic Region: Oriental

Ecoregion: Jian Nan subtropical evergreen forests

Hosts: Artiodactyla: Bovidae (A)

Human infestation: no

Remarks: Mihalca et al. (2011) regard *H. goral* as an endangered species.

References

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Hoogstraal, H. 1970. *Haemaphysalis* (*H.*) *birmaniae* Supino and *H.* (*H.*) *goral* sp. n. (Ixodoidea: Ixodidae), Asian parasites of artiodactyl mammals. J. Parasitol., 56: 1227–1238.

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

52 – *H. grochovskajae* Kolonin, 1992 (*In* Sokolov, V.E. (editor), Zoological Researches in Vietnam. Nauka, Moscow, pp. 242–277. In Russian)

Type depositories: ZIAC (holotype), KC (paratype) (Filippova 2008, *op. cit*. under *H. caucasica*)

Known stages: female

Zoogeographic Region: Oriental

Ecoregion: northern Indochina subtropical forests

Hosts: Artiodactyla: Bovidae (A)

Human infestation: no

Reference

Kolonin, G.V. 1995. Review of the ixodid tick fauna (Acari: Ixodidae) of Vietnam. J. Med. Entomol., 32: 276–282.

53 – *H. heinrichi* Schulze, 1939 (Z. Parasitenkd., 10: 722–728)
See remarks below.

Type depository: USNTC (lectotype, paralectotypes) (Keirans and Clifford 1984, *op. cit.* under *H. bartelsi*)

Known stages: male, female, nymph

Zoogeographic Region: Oriental

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: Carnivora: Canidae, Mustelidae (A, N and/or L)
Rodentia: Muridae (AN)
Artiodactyla: Bovidae; Carnivora: Viverridae; Rodentia: Sciuridae (A)
Carnivora: Herpestidae; Soricomorpha: Soricidae (N and/or L)

Human infestation: yes (Hoogstraal and Kohls 1968)

Remarks: Hoogstraal and Kim (1985) state that *H. heinrichi* is a polytypic species, and therefore it is possible that two or more species are represented under the name *H. heinrichi.* The host-parasite relationships above will probably change if this statement is confirmed. Tanskul et al. (1983) and Hoogstraal and Kim (1985) use the term "immatures" without stating whether larvae, nymphs or both stages were found on hosts. Tanskul et al. (1983) present records of *H. heinrichi* adults on Bovidae that we consider provisionally valid. However, this type of host is not mentioned in Kolonin (2009).

References

Hoogstraal, H. & Kim, K.C. 1985. Tick and mammal coevolution, with emphasis on *Haemaphysalis. In* K.C. Kim (editor), Coevolution of parasitic arthropods and mammals. John Wiley & Sons, New York, pp. 505–568.

Hoogstraal, H. & Kohls, G.M. 1968. Studies on Southeast Asian *Haemaphysalis* ticks (Ixodoidea, Ixodidae). Redescription of type material of *H.* (*Rhipistoma*) *heinrichi* Schulze, a parasite of the ferret-badger in Burma and Vietnam. J. Parasitol., 54: 1057–1062.

Kolonin, G.V. 2003. New data on ixodid tick fauna of Vietnam. Entomol. Rev., 83 (Suppl. 2): S190-S192.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Phan Trong, C. 1977. Ve bet va con trung ky sinh o Viet Nam. Tap 1. Ve (Ixodoidea), mo ta va phan loai. Ha Noi: Khoa hoc va ky thuat, 489 pp. In Vietnamese.
Tanskul, P., Stark, H.E. & Inlao, I. 1983. A checklist of ticks of Thailand (Acari: Metastigmata: Ixodoidea). J. Med. Entomol., 20: 330–341.

54 – *H. hirsuta* Hoogstraal, Trapido & Kohls, 1966 (J. Parasitol., 52: 169–191)

Type depository: MCZ (holotype, paratype) (Hoogstraal, H., Trapido, H. & Kohls, G.M. 1966. Studies on Southeast Asian *Haemaphysalis* ticks (Ixodoidea, Ixodidae). Speciation in the *H.* (*Kaiseriana*) *obesa* group: *H. semermis* Neumann, *H. obesa* Larrousse, *H. roubaudi* Toumanoff, *H. montgomeryi* Nuttall, and *H. hirsuta* sp. n. J. Parasitol., 52: 169–191), originally classified as *Haemaphysalis papuana*.

Known stages: male, female

Zoogeographic Region: Oriental

Ecoregions: Sumatran and Java rain forests

Hosts: Artiodactyla: Bovidae, Suidae; Carnivora: Canidae, Mustelidae; Rodentia: Hystricidae (A)
Artiodactyla: Cervidae; Carnivora: Viverridae (N and/or L)

Human infestation: yes (Hoogstraal and Kim 1985)

Remarks: Hoogstraal and Kim (1985) use the term “immatures” without specifying whether larvae, nymphs or both stages of *H. hirsuta* were found on hosts. Neither of these stages has formally been described, but we provisionally accept their diagnosis by these authors.

References

Hoogstraal, H. & Kim, K.C. 1985. Tick and mammal coevolution, with emphasis on *Haemaphysalis. In* K.C. Kim (editor), Coevolution of parasitic arthropods and mammals. John Wiley & Sons, New York, pp. 505–568.
Hoogstraal, H., Trapido, H. & Kohls, G.M. 1966. Studies on Southeast Asian *Haemaphysalis* ticks (Ixodoidea, Ixodidae). Speciation in the *H.* (*Kaiseriana*) group: *H. semermis* Neumann, *H. obesa* Larrousse, *H. roubaudi* Toumanoff, *H. montgomeryi* Nuttall, and *H. hirsuta* sp. n. J. Parasitol., 52: 169–191.
Phan Trong, C. 1977. Ve bet va con trung ky sinh o Viet Nam. Tap 1. Ve (Ixodoidea), mo ta va phan loai. Ha Noi: Khoa hoc va ky thuat, 489 pp. In Vietnamese.

55 – *H. hispanica* Gil Collado, J. 1938 (Brotéria Cienc. Nat., 7: 99–109)

Type depository: CGC-FF (holotype, paratypes) (Hoogstraal, H. & Morel, P.-C. 1970. *Haemaphysalis* (*Rhipistoma*) *hispanica* Gil Collado, a parasite of the European rabbit, redescription of adults, and description of immature stages (Ixodoidea: Ixodidae). J. Parasitol., 56: 813–822) as *Haemaphysalis campanulata hispanica*. These authors state that the type specimens were in the possession of

Professor Gil Collado, but one of us (AEP) located the CGC collection within the FF collection.

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: Iberian sclerophyllous and semi-deciduous forests

Hosts: usual hosts for adult ticks are Lagomorpha: Leporidae. Aves are considered exceptional hosts for this tick.
Lagomorpha: Leporidae (ANL)
Strigiformes: Strigidae (A)
Falconiformes: Accipitridae (L)

Human infestation: no

Remarks: González Montana et al. (1998) reported heavy infestations of dogs with *H. hispanica*, but we consider this doubtful. Santos Dias (1994) states that Gil Collado found this species on several orders of mammals, but we have been unable to confirm this. These vertebrates are not included in our host list for *H. hispanica*. Kolonin (2009) ignores the record of this tick on Aves, but we accept the exceptional record on birds in Estrada-Peña et al. (1985).

References

Estrada-Peña, A., Lucientes Curdi, J., Sánchez Acedo, C., Gutiérrez Galindo, J., Ocabo Meléndez, B., Galmes Femenias, M. & Castillo Hernández, J. 1985. Parasitismo accidental de *Haemaphysalis* (*Rhipistoma*) *hispanica* Gill Collado (Acari: Ixodoidea) sobre *Aquila chrysaetos*. Rev. Ibér. Parasitol., 45: 379–380.

González Montana, J.R., Rejas López, J., Alonso Diez, A.J., Alonso Alonso, M.P. & Prieto Montana, F. 1998. Utilización de citioato para controlar infestaciones por garrapatas en perros. Med. Vet. (Barcelona), 15: 143–146.

Hoogstraal, H. & Morel, P.-C. 1970. *Haemaphysalis* (*Rhipistoma*) *hispanica* Gil Collado, a parasite of the European rabbit, redescription of adults, and description of immature stages (Ixodoidea: Ixodidae). J. Parasitol., 56: 813–822.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Santos Dias, J.A.T. 1994. As carraças (Acarina: Ixodoidea) da península ibérica. Algumas considerações sobre a sua biogeografía e relacionamento com a ixodofauna afropaleártica e afrotropical. Estud. Ens. Doc. (158), 163 pp.

56 – *H. hoodi* Warburton & Nuttall, 1909 (Parasitology, 2: 57–76)

Type depository: BMNH (lectotype, paralectotypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: Mammalia are considered exceptional hosts for this tick.
Aves (several orders) (ANL)
Primates: Indriidae (AN)
Artiodactyla: Bovidae; Rodentia: Sciuridae (A, N and/or L)
Carnivora: Canidae; Lagomorpha: Leporidae; Rodentia: Hystricidae (A)
Carnivora: Viverridae (N and/or L)

Human infestation: no

Remarks: Keirans and Durden (2001) record an introduction of *H. hoodi* into the Nearctic Region, but there is no evidence that it has become established there. Theiler (1962) uses the term "immatures" without specifying whether larvae, nymphs or both stages of *H. hoodi* were found on hosts. Infestation of Mammalia by this tick is not a common event, but there are some examples of this host-parasite relationship in the references below. Kolonin (2009) ignores mammals as hosts for *H. hoodi* but provides no reason doing so.

References

Aeschlimann, A. 1967. Biologie et écologie des tiques (Ixodoidea) de Côte d'Ivoire. Acta Trop., 24: 281–405.

Cornet, J.-P. 1995. Contribution à l'étude des tiques (Acarina: Ixodina) de la République Centrafricaine 4. Inventaire et répartition. Acarologia, 36: 203–212.

Elbl, A. & Anastos, G. 1966. Ixodid ticks (Acarina, Ixodidae) of Central Africa. Vol. IV. Genera *Aponomma* Neumann, 1899, *Boophilus* Curtice, 1891, *Dermacentor* Koch, 1844, *Haemaphysalis* Koch, 1844, *Hyalomma* Koch, 1844 and *Rhipicentor* Nuttall and Warburton, 1908. Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (148), 412 pp.

Horak, I.G., Spickett, A.M., Braack, L.E.O., Penzhorn, B.L., Bagnall, R.J. & Uys, A.C. 1995. Parasites of domestic and wild animals in South Africa. XXXIII. Ixodid ticks on scrub hares in the north-eastern regions of Northern Transvaal and of KwaZulu-Natal. Onderstepoort J. Vet. Res., 62: 123–131.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Matthysse, J.G. & Colbo, M.H. 1987. The ixodid ticks of Uganda. Entomological Society of America, College Park, Maryland, 426 pp.

Santos Dias, J.A.T. 1958. Notes on various ticks (Acarina-Ixodoidea) in collection at some entomological Institutes in Paris and London. An. Inst. Med. Trop., 15: 459–563.

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

57 – *H. hoogstraali* Kohls, 1950 (Natl. Inst. Health Bull. (192), 28 pp)

Type depositories: CNHM (holotype, paratypes), USNTC (paratypes) (Kohls, G.M. 1950. Ticks (Ixodoidea) of the Philippines. Natl. Inst. Health Bull. (192), 28 pp.)

Known stages: male, female

Zoogeographic Region: Oriental

Ecoregion: Palawan rain forests

Hosts: Carnivora: Mephitidae (A)

Human infestation: no

Reference

Kohls, G.M. 1950. Ticks (Ixodoidea) of the Philippines. Natl. Inst. Health Bull. (192), 28 pp.

58 – *H. houyi* Nuttall & Warburton, 1915 (Ticks. A monograph of the Ixodoidea. Part III. The genus *Haemaphysalis*. Cambridge University Press, London, pp. 349–550)

Type depositories: BMNH (lectotype, paralectotypes), ZMB (paralectotypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*), originally named *Haemaphysalis calcarata houyi.*

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for larvae, nymphs and adults are Rodentia: Sciuridae.
Rodentia: Sciuridae (ANL)
Rodentia: Muridae; Soricomorpha: Soricidae (AN)
Erinaceomorpha: Erinaceidae; Carnivora: Mustelidae, Viverridae (A)
Hyracoidea: Procaviidae (stage unknown)

Human infestation: no

Remarks: Kolonin (2009) excludes records of *H. houyi* on hosts other than Sciuridae, but we accept several of the records from other hosts in the references below.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Cornet, J.-P., Zeller, H., Bâ, K., Camicas, J.-L., González, J.-P. & Wilson, M.L. 1995. Contribution a l'étude des tiques (Acarina: Ixodina) vectrices du virus de la fièvre hémorragique Crimée-Congo (CCHF) au Sénégal. I. Analyse du parasitisme chez les petits rongeurs. Acarologia, 36: 287–292.

Hoogstraal, H. 1955. Notes on African *Haemaphysalis* ticks. II. The ground-squirrel parasites, *H. calcarata* Neumann, 1902, and *H. houyi* Nuttall and Warburton, 1915 (Ixodoidea, Ixodidae). J. Parasitol., 41: 361–373.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Matthysse, J.G. & Colbo, M.H. 1987. The ixodid ticks of Uganda. Entomological Society of America, College Park, Maryland, 426 pp.
Morel, P.-C. 1978. Tiques d'animaux sauvages en Haute-Volta. Rev. Élev. Méd. Vét. Pays Trop., 31: 69–78.
Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.
Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

59 – *H. howletti* Warburton, 1913 (Parasitology, 6: 121–130)

Type depository: BMNH (lectotype, paralectotype) (Keirans and Hillyard, 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregion: southern Vietnam lowland dry forests

Hosts: Rodentia: Muridae (ANL)
Lagomorpha: Leporidae; Persissodactyla: Equidae (A)
Cuculiformes: Cuculidae (N)
Rodentia: Sciuridae (L)
Carnivora: Felidae, Herpestidae; Galliformes: Phasianidae (stages unknown)

Human infestation: no

Remarks: infestation of Rodentia by a male of *H. howletti*, as reported in Dhanda (1964), is ignored by Kolonin (2009). Rao et al. (1973) list "mongoose" as a host for *H. howletti* without further discussion, which is probably why Mitchell (1979) also lists Herpestidae as hosts of *H. howletti.* As a consequence, we have tentatively included this host in our list.

References

Dhanda, V. 1964. Description of immature stages of *Haemaphysalis howletti* (Ixodoidea: Ixodidae), and redescription of adults. J. Parasitol., 50: 459–465.
Kolonin, G.V. 1995. Review of the ixodid tick fauna (Acari: Ixodidae) of Vietnam. J. Med. Entomol., 32: 276–282.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Mitchell, R.M. 1979. A list of ectoparasites from Nepalese mammals, collected during the Nepal ectoparasite program. J. Med. Entomol., 16: 227–233.

Mitchell, R.M. & Dick, J.A. 1978. Ectoparasites from Nepal birds. J. Bombay Nat. Hist. Soc., 74: 264–274.
Rao, T.R., Dhanda, V., Bhat, H.R. & Kulkarni, S.M. 1973. A survey of haematophagous arthropods in western Himalayas, Sikkim and Hill Districts of West Bengal. A general account. Ind. J. Med. Res., 61: 1421–1461.

60 – *H. humerosa* Warburton & Nuttall, 1909 (Parasitology, 2: 57–76)

Type depository: BMNH (lectotype, paralectotypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Australasian

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for larvae, nymphs and adult ticks are Peramelemorphia: Peramelidae.
Peramelemorphia: Peramelidae; Rodentia: Muridae (ANL)
Monotremata: Tachyglossidae (A)
Cuculiformes: Cuculidae (NL)
Dasyuromorphia: Dasyuridae (L)
Artiodactyla: Bovidae; Perissodactyla: Equidae; Diprotodontia: Phalangeridae; Coraciiformes: Coraciidae (stages unknown)

Human infestation: yes (Stewart and De Vos 1984)

Remarks: Kolonin (2009) ignores Muridae as hosts for *H. humerosa*, but there are *bona fide* records of this host-parasite relationship in Roberts (1963, 1970), and more recently in Weaver and Smales (2012).

References

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Roberts, F.H.S. 1963. A systematic study of the Australian species of the genus *Haemaphysalis* Koch (Acarina: Ixodidae). Aust. J. Zool., 11: 35–80.
Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.
Stewart, N.P. & De Vos, A.J. 1984. Ticks and the diseases they carry. Queensland Agric. J., 110: 295–299.
Weaver, H.J. & Smales, L.R. 2012. Parasite assemblage of Australian species of *Pseudomys* (Rodentia: Muridae: Murinae). J. Parasitol., 98: 30–35.

61 – *H. hylobatis* Schulze, 1933 (Arch. Hydrobiol. Suppl. 12, 4: 490–502)

Type depositories: ZMB (holotype), USNTC (paratype) (Anastos, G. 1950. The scutate ticks, or Ixodidae, of Indonesia. Entomol. Am., 30: 1–144; Keirans and Clifford 1984, *op. cit.* under *H. bartelsi*). Moritz and Fischer (1981, *op. cit*. under *H. cinnabarina*) do not confirm the presence of the holotype of *H. hylobatis* in ZMB.

Known stages: male, female

Zoogeographic Region: Oriental

Ecoregion: Sumatran lowland rain forests

Hosts: Aves are considered exceptional hosts for adults of this tick.
Mammalia (several orders); Cuculiformes: Cuculidae (A)
Rodentia: Muridae (N)

Human infestation: yes (Hoogstraal and Kim 1985)

Remarks: Audy et al. (1960) state that the determination of a nymph of *H. hylobatis* from Tragulidae is tentative, and this family has therefore been excluded from our host list for this species. However, the record of a nymph from Muridae in Audy et al. (1960) is certain because the nymph molted into a female of *H. hylobatis.*

References

Anastos, G. 1950. The scutate ticks, or Ixodidae, of Indonesia. Entomol. Am., 30: 1–144.

Audy, J.R., Nadchatram, M. & Lim, B.-L. 1960. Malaysian parasites. XLIX. Host distribution of Malayan ticks (Ixodoidea). Stud. Inst. Med. Res. Malaya, 29: 225–246.

Hoogstraal, H. & Kim, K.C. 1985. Tick and mammal coevolution, with emphasis on *Haemaphysalis. In* K.C. Kim (editor), Coevolution of parasitic arthropods and mammals. John Wiley & Sons, New York, pp. 505–568.

Hoogstraal, H., Lim, B.L., Nadchatram, M. & Anastos, G. 1972. The Gunong Benom Expedition 1967. 8. Ticks (Ixodidae) of Gunong Benom and their altitudinal distribution, hosts and medical relationships. Bull. Br. Mus. (Nat. Hist.) Zool., 23: 167–186.

62 – *H. hyracophila* Hoogstraal, Walker & Neitz, 1971 (J. Parasitol., 57: 417–425)

Type depositories: USNTC (holotype, paratypes), BMNH, OVI, SAIMR, HH (paratypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: rocky outcrops and mountains in tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for larvae, nymphs and adults are Hyracoidea: Procaviidae, while Macroscelidea are considered exceptional hosts for this tick.
Hyracoidea: Procaviidae (ANL)
Macroscelidea: Macroscelididae (NL)

Human infestation: no

Remarks: the nymphs and larvae of *H. hyracophila* collected from Procaviidae by Horak and Fourie (1986) were tentatively thought to belong to this species, a host-parasite relationship that was later confirmed by Fourie et al. (2005). Kolonin (2009) ignores the *bona fide* records of larvae and nymphs of *H. hyracophila* on Macroscelidea reported by Fourie et al. (2005), probably because the latter authors regarded the few ticks found on these hosts as "stragglers."

References

Fourie, L.J., Horak, I.G. & Woodall, P.F. 2005. Elephant shrews as hosts of immature ixodid ticks. Onderstepoort J. Vet. Res., 72: 293–301.

Horak, I.G. & Fourie, L.J. 1986. Parasites of domestic and wild animals in South Africa. XIX. Ixodid ticks and fleas on rock dassies (*Procavia capensis*) in the Mountain Zebra National Park. Onderstepoort J. Vet. Res., 53: 123–126.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

63 – *H. hystricis* Supino, 1897 (Atti Soc. Veneto-Trentina Sci. Nat. Residente Padova, Ser. 2, 3: 230–238)

Type depositories: BMNH (lectotype, paralectotype), GM (paralectotype) (Keirans and Hillyard, 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph, larva

Zoogeoegraphic Regions: Australasian, Oriental, Palearctic

Ecoregions: tropical and subtropical forests

Hosts: Aves are considered exceptional hosts for this tick.
Mammalia (several orders) (ANL)
Cuculiformes: Cuculidae (L)
Passeriformes (several families) (stages unknown)

Human infestation: yes (Durden et al. 2008)

Remarks: with the exception of the type data, records of this species published prior to Hoogstraal et al. (1965) have been ignored because of diagnostic uncertainties. Camicas et al. (1998) state that this species is found in the Oriental and Palearctic Zoogeographic Regions, but Durden et al. (2008) confirmed its presence in the Australasian Region as well. Camicas et al. (1998) include Testudines as hosts for this species because there are records from *Geoemyda spinosa* (= *Heosemys spinosa*) prior to 1965, but we regard these as doubtful and they have not been included in our host list for *H. hystricis*. These questionable records are repeated in Barnard and Durden (2000). Aves are ignored as hosts of *H. hystricis*, but without elaboration, in Kolonin (2009). We treat records of *H. hystricis* on Aves in Jiang (1983) and Yamauchi (2001) as valid.

References

Barnard, S.M. & Durden, L.A. 2000. A Veterinary guide to the parasites of reptiles. Volume 2: Arthropods (Excluding Mites). Malabar, Florida: Krieger Publishing Co. 288 pp.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Dilrukshi, P.R.M.P. 2006. Taxonomic status of ticks in Sri Lanka. *In* C.N.B. Bambaradeniya (editor), The fauna of Sri Lanka: status of taxonomy, research and conservation. The World Conservation Union, Colombo, Sri Lanka, pp. 65–69.

Durden, L.A., Merker, S. & Beati, L. 2008. The tick fauna of Sulawesi, Indonesia (Acari: Ixodoidea: Argasidae and Ixodidae). Exp. App. Acarol., 45: 85–110.

Grassman, L.I., Sarataphan, N., Tewes, M.E., Silvy, N.J. & Nakanakrat, T. 2004. Ticks (Acari: Ixodidae) parasitizing wild carnivores in Phu Khieo wildlife sanctuary. J. Parasitol., 90: 657–659.

Hoogstraal, H., Trapido, H. & Kohls, G.M. 1965. Studies on Southeast Asian *Haemaphysalis* ticks (Ixodoidea, Ixodidae). The identity, distribution, and hosts of *H.* (*Kaiseriana*) *hystricis* Supino. J. Parasitol., 51: 467–480.

Hoogstraal, H., Santana, F.J. & Van Peenen, P.F.D. 1968. Ticks (Ixodoidea) of Mt. Sontra, Danang, Republic of Vietnam. Ann. Entomol. Soc. Am., 61: 722–729.

Jiang, Z.-J. 1983. Biology of *Haemaphysalis hystricis* Supino. Acta Entomol. Sin., 11: 413–418. In Chinese.

Kitaoka, S. & Suzuki, H. 1974. Reports of medico-zoology investigations in the Nansei Islands. Part 2. Ticks and their seasonal prevalences in southern Amami-oshima. Jap. J. Sanit. Zool., 26: 21–26. In Japanese.

Senadhira, M.A.P. 1969. The parasites of Ceylon. V. Arthropoda, a host check list. Ceylon Vet. J., 17: 3–25.

Shimada, Y., Inokuma, H., Beppu, T., Okuda, M. & Onishi, T. 2003. Survey of ixodid tick species on domestic cats in Japan. Vet. Parasitol., 111: 231–239.

Supino, F. 1897. Nuovi *Ixodes* della Birmaina (nota preventiva). Atti Soc. Veneto-Trentina Sci. Nat. Residente Padova, Ser. 2, 3: 230–238.

Tanskul, P. & Inlao, I. 1989. Keys to the adult ticks of *Haemaphysalis* Koch, 1844, in Thailand with notes on changes in taxonomy (Acari: Ixodoidea: Ixodidae). J. Med. Entomol., 26: 573–601.

Yamaguti, N., Tipton, V.J., Keegan, H.L. & Toshioka, S. 1971. Ticks of Japan, Korea, and the Ryukyu Islands. Brigham Young Univ. Sci. Bull. Biol. Ser., 15 (1), 226 pp.

Yamauchi, T. 2001. A bibliographical survey of host-parasite relationships between birds and ticks from Japan. Bull. Hoshizaki Green Found., 5: 271–308. In Japanese.

64 – *H. ias* Nakamura & Yajima, 1937 (Rep. Gov. Exp. Stn. Anim. Hyg. Tokyo (17): 133–184. In Japanese)
See remarks below

Type depository: CK (holotype) (Yamaguti, N., Tipton, V.J., Keegan, H.L. & Toshioka, S. (1971. Ticks of Japan, Korea, and the Ryukyu Islands. Brigham Young Univ. Sci. Bull. Biol. Ser., 15 (1), 226 pp.)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: temperate broadleaf and mixed forests

Hosts: Artiodactyla: Cervidae (AN)
Artiodactyla: Bovidae (A)
Aves (unknown orders) (NL)
Carnivora: Canidae (N)

Human infestation: no

Remarks: Yamaguti et al. (1971) referred to this species as *H. cornigera* group, *H. cornigera*, or *H. ias*. We regard all such records in Yamaguti et al. (1971) as *H. ias.* Mori et al. (1995) refer to this tick as *H. cornigera ias*, while Shimada et al. (2003) refer to it as *H. ias.* Takada (1990) and Fujita and Takada (2007) excluded the name *ias* but retained *cornigera* as a Japanese tick. Further studies or better translations of the Japanese literature are needed in order to assess the validity of these taxa. Heath (2013) lists humans as hosts of *H. ias* as a result of a transcription error (Heath, A.C.G., personal communication to Guglielmone, A.A.). See also *H. cornigera.*

References

Fujita, H. & Takada, N. 2007. Identification of immatures ticks in Japan. *In* Organization Committee of SADI (editor), Acari and Emerging/Reemerging Diseases. Zenkoku Nosom Kyoiku Kyokai Publishing Co, Tokyo, pp. 53–68. In Japanese.

Heath, A.C.G. 2013. Implications for New Zealand of potentially invasive ticks sympatric with *Haemaphysalis longicornis* Neumann, 1901 (Acari: Ixodidae). Syst. Appl. Acarol., 18: 1–26.

Mori, K., Tsunoda, T. & Fujimagari, M. 1995. Ixodid ticks on Sika deer *Cervus nippon* Temminck in Chiba Prefecture. Jap. J. Sanit. Zool., 46: 313–316.

Shimada, Y., Beppu, T., Inokuma, H., Okuda, M. & Onishi, T. 2003. Ixodid tick species recovered from domestic dogs in Japan. Med. Vet. Entomol., 17: 38–45.

Takada, N. 1990. A pictorial review of medical acarology in Japan. Kinpodo Press, Kyoto, Japan, 222 pp. In Japanese, translation of the legends of figures by Kore, V.

Yamaguti, N., Tipton, V.J., Keegan, H.L. & Toshioka, S. 1971. Ticks of Japan, Korea, and the Ryukyu Islands. Brigham Young Univ. Sci. Bull. Biol. Ser., 15 (1), 226 pp.

65 – *H. indica* Warburton, 1910 (Parasitology, 3: 395–407)
See remarks below.

Type depositories: BMNH, IM (syntypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*) as *H. leachi indica*

Known stages: male, female, nymph, larva

Zoogeographic Regions: Afrotropical, Oriental, Palearctic

Ecoregions: tropical and subtropical dry broadleaf forests

Hosts: usual hosts for adult ticks are Carnivora: Herpestidae. Aves are considered exceptional hosts for this tick.
Carnivora: Canidae, Felidae, Herpestidae (ANL)
Carnivora: Viverridae; Lagomorpha: Leporidae; Galliformes: Phasianidae (AN)
Carnivora: Mustelidae (AL)
Artiodactyla: Cervidae; Carnivora: Hyaenidae (A)
Soricomorpha: Soricidae (N)
Passeriformes: Muscicapidae, Timaliidae (NL)
Passeriformes: Laniidae (L)
Artiodactyla: Suidae; Erinaceomorpha: Erinaceidae; Rodentia: Muridae (N and/or L)
Cuculiformes: Cuculidae; Passeriformes: Turdidae (stage unknown)

Human infestation: no

Remarks: records published prior to Hoogstraal (1970) have not been included because of diagnostic uncertainties. Camicas et al. (1998) state that this species is found only in the Oriental Region, but there are also records from the Afrotropical and Palearctic Regions. However, the distribution of *H. indica* should be considered cautiously because Hoogstraal and Kim (1985) state that more than one taxon may be included under this name. These authors assert that *H. indica* is found in the Oriental and Palearctic Zoogeographic Regions, but mention its presence also in Oman, which we regard as part of the Afrotropical Region. Kaul et al. (1978), Hoogstraal (1980) and Geevarghese and Dhanda (1995) do not specify whether they found larvae, nymphs or both immature stages of *I. indica* on hosts. Dilrukshi (2006) provides records from Bovidae, Sciuridae and Aves that he classifies as *H. leachi indica*, but these have not been included in our host list because we believe that they need confirmation. Kolonin (2009) excludes Aves as hosts of *H. indica*, but we consider the records for this group of hosts in Kaul et al. (1978) to be valid.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Dilrukshi, P.R.M.P. 2006. Taxonomic status of ticks in Sri Lanka. *In* C.N.B. Bambaradeniya (editor), The fauna of Sri Lanka: status of taxonomy, research and conservation. The World Conservation Union, Colombo, Sri Lanka, pp. 65–69.

Geevarghese, G. & Dhanda, V. 1995. Ixodid ticks of Maharashtra State, India. Acarologia, 36: 309–313.

Hoogstraal, H. 1970. Identity, distribution, and hosts of *Haemaphysalis* (*Rhipistoma*) *indica* Warburton (resurrected) (Ixodoidea: Ixodidae), a carnivore parasite of the Indian subregion. J. Parasitol., 56: 1013–1022.
Hoogstraal, H. 1980. Ticks (Ixodoidea) from Oman. J. Oman Stud. Spec. Rep. (2): 265–272.
Hoogstraal, H. & Kim, K.C. 1985. Tick and mammal coevolution, with emphasis on *Haemaphysalis. In* K.C. Kim (editor), Coevolution of parasitic arthropods and mammals. John Wiley & Sons, New York, pp. 505–568.
Kaul, H.N., Mishra, A.C., Dhanda, V., Kulkarni, S.M. & Guttikar, S.N. 1978. Ectoparasitic arthropods of birds and mammals from Rajasthan State, India. Ind. J. Parasitol., 2: 19–25.
Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Mitchell, R.M. & Dick, J.A. 1978. Ectoparasites from Nepal birds. J. Bombay Nat. Hist. Soc., 74: 264–274.

66 – *H. indoflava* Dhanda & Bhat, 1968 (J. Parasitol., 54: 1063–1067)

Type depositories: VRC (holotype, paratypes), BMNH, HH, IM, USNTC (paratypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*). The specimens used to describe this species were originally classified as *H. flava* by Sharif, M. (1928. A revision of the Indian Ixodidae with special reference to the collection in the Indian Museum. Rec. Ind. Mus., 30: 217–344).

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregions: desert and xeric shrublands

Hosts: Artiodactyla: Bovidae, Suidae; Carnivora: Canidae (A)

Human infestation: yes (Dhanda and Bhat 1968)

Remarks: Camicas et al. (1998) list the larva and nymph of *H. indoflava* as undescribed, but both stages were earlier described by Dhanda and Bhat (1970), although their hosts remain unknown.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.
Dhanda, V. & Bhat, H.R. 1968. *Haemaphysalis* (*Haemaphysalis*) *indoflava* sp. n. (Acarina: Ixodidae) from the Himalayan region of Uttar Pradesh, and Madras, India. J. Parasitol., 54: 1063–1067.
Dhanda, V. & Bhat, H.R. 1970. Immature stages of *Haemaphysalis indoflava* Dhanda and Bhat, 1968 (Acarina: Ixodidae), and notes on its ecology. Oriental Insects, 4: 253–258.

67 – *H. inermis* Birula, 1895 (Izv. Imp. Akad. Nauk, Ser. 5, 2 (4): 353–364)

Type depository: ZIAC (holotype) (Filippova 2008, *op. cit.* under *H. caucasica*). Keirans and Hillyard (2001, *op. cit.* under *H. aciculifer*) found that a female of *H. inermis* sent by Birula to BMNH is possibly the holotype, but the information in Filippova (2008, *op. cit.* under *H. caucasica*) contradicts this opinion. See "remarks on some invalid names" for a new synonym of *H. inermis.*

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: temperate broadleaf and mixed forests

Hosts: Aves, Squamata and Testudines are considered exceptional hosts for this tick.
Artiodactyla: Suidae (ANL)
Mammalia (several orders) (AN)
Rodentia: Cricetidae, Muridae; Squamata: Lacertidae, Viperidae; Testudines: Testudinidae (NL)
Passeriformes: Sylviidae, Muscicapidae (L)
Charadriiformes: Scolopacidae; Galliformes: Phasianidae; Passeriformes: Corvidae (stages unknown)

Human infestation: yes (Černý 1972; Bursali et al. 2012 among others)

Remarks: there are several records of *H. inermis* for Taiwan (Oriental Region); however, Robbins (2005) considers them unsound and we concur. Kolonin (2009) excludes Aves, Squamata and Testudinidae as hosts of *H. inermis*, but they are listed as hosts of this species in Hoogstraal et al. (1964), Nosek et al. (1967), Filippova (1997) and Široký et al. (2006). Nevertheless, records from these hosts appear to be exceptional.

References

Bursali, A., Keskin, A. & Tekin, S. 2012. A review of the ticks (Acari: Ixodida) of Turkey: species diversity, hosts and geographical distribution. Exp. Appl. Acarol., 57: 91–104.

Černý, V. 1972. The tick fauna of Czechoslovakia. Folia Parasitol., 19: 87–92.

Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian.

Gusev, V.M., Bednyy, S.N., Guseva, A.A., Labunets, N.F. & Bakeyev, N.N. 1961. The Ecological groups of birds on the Caucasus and their role in the life cycle of ticks and fleas. Trudy Nauch.-Issled. Protiv. Inst. Kavk. Zakav. (5): 217–267. In Russian.

Hoogstraal, H., Traylor, M.A., Gaber, S., Malakatis, G., Guindy, E. & Helmy, I. 1964. Ticks (Ixodidae) on migrating birds in Egypt, spring and fall 1962. Bull. World Health Org., 30: 355–367.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Nosek, J., Lichard, M. & Sztankay, M. 1967. The ecology of ticks in the Tribeč and Hronský Inovec Mountains. Bull. World Health Org., 36 (Suppl. 1): 49–59.
Robbins, R.G. 2005. The ticks (Acari: Ixodida: Argasidae, Ixodidae) of Taiwan: a synonymic checklist. Proc. Entomol. Soc. Wash., 107: 245–253.
Široký, P., Petrželková, K.J., Kamler, D., Mihalca, A.D. & Modrý, D. 2006. *Hyalomma aegyptium* as dominant tick in tortoises of the genus *Testudo* in Balkan countries, with notes on its host preferences. Exp. Appl. Acarol., 40: 279–290.

68 – *H. intermedia* Nuttall & Warburton, 1909 (Parasitology, 2: 57–76)
See *H. parva.*

Type depository: BMNH (lectotype) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*) originally named *Haemaphysalis bispinosa intermedia*

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregions: tropical and subtropical dry broadleaf forests; few ticks in desert and xeric shrublands

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Mammalia (several orders); Cuculiformes: Cuculidae; Galliformes: Phasianidae (ANL)
Passeriformes: Muscicapidae (AN)
Passeriformes (several families) (NL)
Piciformes: Picidae; Columbiformes: Columbidae (L)

Human infestation: no

References

Bhat, H.R. & Sreenivasan, M.A. 1981. Further records of the ticks of some reptilian and mammalian hosts in the Kyasanur Forest disease area, Karnataka, India. Ind. J. Parasitol., 5: 207–210.
Bhat, H.R., Sreenivasan, M.A. & Jacob, P.G. 1986. Ixodid ticks infesting goats in the Kyasanur Forest disease area, Shimoga District, Karnataka. Ind. J. Parasitol., 10: 39–45.
Geevarghese, G. & Dhanda, V. 1995. Ixodid ticks of Maharashtra State, India. Acarologia, 36: 309–313.
Rajagopalan, P.K. 1972. Ixodid ticks (Acarina: Ixodidae) parasitizing wild birds in the Kyasanur Forest disease area of Shimoga District, Mysore State, India. J. Bombay Nat. Hist. Soc., 69: 55–78.
Rebello, M.J. & Reuben, R. 1967. A report on ticks collected from birds and small mammals in North Arcot and Chittoor Districts, South India. J. Bombay Nat. Hist. Soc., 68: 283–289.
Seneviratna, P. 1965. The Ixodoidea (ticks) of Ceylon. Parts II and III. Ceylon Vet. J., 13: 28–54.

69 – *H. japonica* Warburton, 1908 (Proc. Cambr. Phil. Soc., 14: 508–519)
It is generally held that this taxon comprises two subspecies: *H. japonica japonica* Warburton, 1908, and *H. japonica douglasi* Nuttall & Warburton, 1915. However, Japanese workers such as Kitaoka, S. (1985. Keys to the species immature stages of the Japanese *Haemaphysalis* ticks (Ixodidae). Bull. Natl. Inst. Anim. Health Q., 88: 49–63. In Japanese) and Fujita, H. & Takada, N. (2007. Identification of immature ticks in Japan. *In* Organization Committee of SADI (editor), Acari and Emerging/Reemerging Diseases. Zenkoku Nosom Kyoiku Kyokai Publishing Company, Tokyo, pp. 53–68. In Japanese, Spanish translation of legends of figures by Kori, V.), among others, treat *H. douglasi* and *H. japonica* as distinct species. Filippova, N.A. (1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian) considers *H. douglasi* a subspecies of *H. japonica*, while Yamaguti et al. (1971, *op. cit.* under *H. ias*) list only *H. japonica* as valid, but stress that additional studies are needed to elucidate the relationship between *H. japonica* and *H. japonica douglasi*.

Type depository: BMNH (lectotype, paralectotypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*) as *Haemaphysalis japonnica* (*lapsus*).

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: temperate broadleaf and mixed forests

Hosts: Artiodactyla: Cervidae; Carnivora: Canidae, Mustelidae; Galliformes: Phasianidae; Passeriformes (several families) (ANL)
Artiodactyla: Bovidae; Carnivora: Felidae, Ursidae; Lagomorpha: Leporidae (AN)
Artiodactyla: Suidae; Erinaceomorpha: Erinaceidae; Perissodactyla: Equidae (A)
Rodentia: Cricetidae, Muridae, Sciuridae; Strigiformes: Strigidae (NL)
Charadriiformes: Scolopacidae (N)

Human infestation: yes (Yamauchi et al. 2010)

Remarks: Camicas et al. (1998) do not regard Aves as important hosts for this tick species, but the studies of Emel'yanova and Goordeeva (1969) and others indicate that the opposite is true, especially for larvae and nymphs of *H. japonica*. Kitaoka (1985) provides a record of *H. japonica* (named *H. douglasi*) from Ursidae, but we were unable to determine whether his specimen is a nymph or a larva. See above.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Emel'yanova, N.D. & Gordeeva, V.P. 1969. Data on the study of birds acting as hosts of ixodid ticks in East Manchurian mountain area spurs and in the Pre-Khanka Plain. *In* A.O. Cherepanov (editor), Migratory birds and their role in arboviral distribution. Sibirisk. Otd. Akad. Nauk SSSR, Biol. Inst., Akad. Nauk SSSR, Inst. Polio. Virus Entsef., Min. Zdravookhr. RSFSR, Omsk Inst. Prirod.-Ochag. Infekts., Novosibirsk, pp. 160–169. In Russian, NAMRU-3 translation 621.

Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian.

Kislenko, G.S. & Koneva, I.V. 1965. Infestations of birds by ixodid ticks in secondary forests in lower reaches of the Ussuri River. Mater. 4. Vses. Orinthol. Konf., Alma-Ata, Sep. 1965, pp. 160–163. In Russian, NAMRU-3 translation 408.

Kitaoka, S. 1985. Keys to the species in immature stages of the Japanese *Haemaphysalis* ticks (Ixodidae). Bull. Natl. Inst. Anim. Health Q. (88): 49–63. In Japanese.

Shimada, Y., Inokuma, H., Beppu, T., Okuda, M. & Onishi, T. 2003. Survey of ixodid tick species on domestic cats in Japan. Vet. Parasitol., 111: 231–239.

Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.

Voloshina, I.V. 2010. Ticks (Ixodidae) of the Lazovsky Reserve. Proc. Sci. Conf. devoted 75 Anniv. Lazovsky Reserve, Vladivostok, pp. 59–65. In Russian.

Yamaguti, N., Tipton, V.J., Keegan, H.L. & Toshioka, S. 1971. Ticks of Japan, Korea and the Ryukyu Islands. Brigham Young Univ. Sci. Bull. Biol. Ser., 15 (1), 226 pp.

Yamauchi, T., Fukui, Y., Watanabe, M., Nakagawa, H. & Kamimura, K. 2010. Forty cases of human infestations with hard ticks (Acari: Ixodidae) in Toyama Prefecture, Japan. Med. Entomol. Zool., 61: 133–143. In Japanese.

70 – *H. juxtakochi* Cooley, 1946 (Natl. Inst. Health Bull. (187), 54 pp)

Rawlins, S.C., Mahadeo, S. & Martínez, R. (1993. A list of the ticks affecting man and animals in the Caribbean. CARAPHIN News, (6): 8–9) refer to this species as *H. juxtakichi* and treat its synonym *H. kochi* Aragão, 1908 as a valid species. See remarks on invalid names at the beginning of this chapter for the synonym of *H. kochi* Aragão, 1908 and *H. juxtakochi*.

Type depositories: USNTC (holotype, paratypes), MCZ, DEEZ (paratypes) (Cooley, 1946, *op. cit*. under *H. chordeilis*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Nearctic, Neotropical

Ecoregions: several different Nearctic and Neotropical ecoregions

Hosts: usual hosts for adult ticks are Artiodactyla: Cervidae.
Mammalia (several orders) (ANL)
Passeriformes: Thraupidae (A)
Passeriformes: Corvidae, Thamnophilidae, Turdidae (NL)
Falconiformes: Accipitridae (N)
Galliformes: Cracidae; Passeriformes: Emberizidae (L)

Human infestation: yes (Bermúdez et al. 2012)

Remarks: Camicas et al. (1998) state that this species is found only in the Neotropical Region, but field records from Tamaulipas (Mexico) and Ohio (USA) in Kohls (1960) and Keirans and Restifo (1993) belong to the Nearctic Region. Hoogstraal and Kim (1985) assert that immature stages of *H. juxtakochi* are primarily parasites of Cervidae and Rodentia: Dasyproctidae; however, the literature does not yield data confirming this argument.

References

Arzua, M., Onofrio, V.C. & Barros-Battesti, D.M. 2005. Catalogue of the tick collection (Acari, Ixodida) of the Museu de História Natural Capão da Imbuia, Curitiba, Paraná, Brazil. Rev. Bras. Zool., 22: 623–632.

Beldoménico, P.M., Baldi, J.C., Antoniazzi, L.R., Orduna, G.M., Mastropaolo, M., Macedo, A.C., Ruiz, M.F., Orcellet, V., Peralta, J.L., Venzal, J.M., Mangold, A.J. & Guglielmone, A.A. 2003. Ixodid ticks (Acari: Ixodidae) present at Parque Nacional El Rey, Argentina. Neotr. Entomol., 32: 273–277.

Bermúdez, S.E., Castro, A., Esser, H., Liefting, Y., García, G. & Miranda, R.J. 2012. Ticks (Ixodida) on humans from central Panama, Panama (2010–2011). Exp. Appl. Acarol., 58: 81–88.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Debárbora, V.N., Nava, S., Cirignoli, S., Guglielmone, A.A. & Poi, A.S.G. 2012. Ticks (Acari: Ixodidae) parasitizing endemic and exotic wild mammals in the Esteros del Iberá wetlands, Argentina. Syst. Appl. Acarol., 17: 243–250.

Fairchild, G.B., Kohls, G.M. & Tipton, V.J. 1966. The ticks of Panama (Acarina: Ixodoidea). *In* W.R. Wenzel & V.J. Tipton (editors), Ectoparasites of Panama. Field Museum of Natural History, Chicago, pp. 167–219.

Guglielmone, A.A., Mangold, A.J. & Aufranc, C.R. 1992. *Haemaphysalis juxtakochi*, *Ixodes pararicinus* (Ixodidae) and *Otobius megnini* (Argasidae) in relation to the phytogeography of Argentina. Ann. Parasitol. Hum. Comp., 67: 91–93.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Guglielmone, A.A., Romero, J., Venzal, J.M., Nava, S., Mangold, A.J. & Villavicencio, J. 2005. First record of *Haemaphysalis juxtakochi* Cooley, 1946 (Acari: Ixodidae) from Peru. Syst. Appl. Acarol., 10: 33–35.

Hoogstraal, H. & Kim, K.C. 1985. Tick and mammal coevolution, with emphasis on *Haemaphysalis. In* K.C. Kim (editor), Coevolution of parasitic arthropods and mammals. John Wiley & Sons, New York, pp. 505–568.

Ivancovich, J.C. & Luciani, C.A. 1992. Las garrapatas de Argentina. Monografía de la Asociación Argentina de Parasitología Veterinaria, Buenos Aires, 95 pp.

Jones, E.K., Clifford, C.M., Keirans, J.E. & Kohls, G.M. 1972. The ticks of Venezuela (Acarina: Ixodoidea) with a key to the species of *Amblyomma* in the Western Hemisphere. Brigham Young Univ. Sci. Bull. Biol. Ser., 17 (4), 40 pp.

Keirans, J.E. & Restifo, R.A. 1993. *Haemaphysalis juxtakochi* Cooley (Acari: Ixodidae), a Neotropical tick species, found in Ohio. J. Med. Entomol., 30: 1074–1075.

Kohls, G.M. 1960. Records and new synonymy of New World *Haemaphysalis* ticks, with descriptions of the nymph and larva of *H. juxtakochi* Cooley. J. Parasitol., 46: 355–361.

Labruna, M.B., Barbieri, F.S., Martins, T.F., Brito, L.G. & Ribeiro, F.D.S. 2010. New tick records in Rondônia, western Brazilian Amazon. Rev. Bras. Parasitol. Vet., 19 (3): 192–194.

Nava, S., Lareschi,M., Rebollo, C., Benítez Usher, C., Beati, L., Robbins, R.G., Durden, L.A., Mangold, A.J. & Guglielmone, A.A. 2007. The ticks (Acari: Ixodida: Argasidae, Ixodidae) of Paraguay. Ann. Trop. Med. Parasitol., 101: 255–270.

Ogrzewalska, M., Uezu, A. & Labruna, M.B. 2010. Ticks (Acari: Ixodidae) infesting wild birds in the eastern Amazon, northern Brazil, with notes on rickettsial infection in ticks. Parasitol. Res., 106: 809–816.

Ortiz, F., Nava, S. & Guglielmone, A.A. 2011. Análisis de una colección de garrapatas (Acari: Argasidae, Ixodidae) del norte argentino. Rev. FAVE Cienc. Vet., 10: 49–55.

Venzal, J.M., Félix, M.L., Olmos, A., Mangold, A.J. & Guglielmone, A.A. 2003. A collection of ticks (Ixodidae) from wild birds in Uruguay. Exp. Appl. Acarol., 36: 325–331.

71 – *H. kadarsani* Hoogstraal & Wassef, 1977 (J. Parasitol., 63: 1103–1109)

Type depositories: MZB (holotype, paratypes) USNTC (paratypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*) state that there are no paratypes of *H. kadarsani* in BMNH, despite the assertion by the authors of this species.

Known stages: male, female, nymph

Zoogeographic Region: Australasian

Ecoregion: Sulawesi montane rain forests

Hosts: Rodentia: Muridae (AN)

Human infestation: no

Remarks: Camicas et al. (1998) state that *H. kadarsani* is found in the Oriental Zoogeographic Region, but this tick is found exclusively on Sulawesi Island, which lies within the Australasian Zoogeographic Region. Durden and Keirans (1996) regard *H. kadarsani* as an endangered species.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.

Durden, L.A., Merker, S. & Beati, L. 2008. The tick fauna of Sulawesi, Indonesia (Acari: Ixodoidea: Argasidae and Ixodidae). Exp. App. Acarol., 45: 85–110.

Hoogstraal, H. & Wassef, H.Y. 1977. *Haemaphysalis* (*Ornithophysalis*) *kadarsani* sp. n. (Ixodoidea: Ixodidae), a rodent parasite of virgin lowland forests in Sulawesi (Celebes). J. Parasitol., 63: 1103–1109.

72 – *H. kashmirensis* Hoogstraal & Varma, 1962 (J. Parasitol., 48: 185–194)

Type depositories: USNTC (holotype, paratypes), VRC, HH, ZSI (paratypes) (Hoogstraal, H. & Varma, M.G.R. 1962. *Haemaphysalis cornupunctata* sp. n. and *H. kashmirensis* sp. n. from Kashmir, with notes on *H. sundrai* Sharif and *H. sewelli* Sharif of India and Pakistan (Ixodoidea: Ixodidae). J. Parasitol., 48: 185–194)

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregion: northwestern thorn scrub forests

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae; usual hosts for larvae and nymphs are Squamata: Agamidae. Squamata are considered exceptional hosts for adults of this tick.
Squamata: Agamidae (ANL)
Artiodactyla: Bovidae (A)
Rodentia: Muridae, Sciuridae (N)

Human infestation: no

Remarks: a record of adult *H. kashmirensis* from Agamidae in Hoogstraal and Kim (1985) is ignored in Kolonin (2009).

References

Hoogstraal, H. & Kim, K.C. 1985. Tick and mammal coevolution, with emphasis on *Haemaphysalis. In* K.C. Kim (editor), Coevolution of parasitic arthropods and mammals. John Wiley & Sons, New York, pp. 505–568.

Hoogstraal, H. & McCarthy, V.C. 1965. Hosts and distribution of *Haemaphysalis kashmirensis* with descriptions of immature stages and definition of the subgenus *Herpetobia* Canestrini (resurrected). J. Parasitol., 51: 674–679.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

73 – *H. kinneari* Warburton, 1913 (Parasitology, 6: 121–130)
See *H. toxopei.*

Type depository: BMNH (holotype) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregion: Deccan thorn scrub forests

Hosts: Carnivora: Canidae; Lagomorpha: Leporidae (ANL)
Carnivora: Herpestidae (AN)
Carnivora: Felidae, Ursidae (AL)
Artiodactyla: Suidae (A)
Mammalia (several orders); Galliformes: Phasianidae; Cuculiformes: Cuculidae; Passeriformes: Timaliidae, Sylviidae (NL)
Rodentia: Hystricidae; Coraciiformes: Bucerotidae; Passeriformes (several families); Piciformes: Capitonidae (L)

Human infestation: no

Remarks: Camicas et al. (1998) list the larva of *H. kinneari* as undescribed, but it had earlier been described by Trapido et al. (1964). With the exception of Bhat and Sreenivasan (1981), Rahman and Mondal (1985) and Geevarghese et al. (1997), all authors refer to this species as *H. papuana kinneari.* Geevarghese et al. (1997) limit the host range of *H. kinneari* to "tiger, wild boar, monkey and rodent" without elaboration.

References

Bhat, H.R. & Sreenivasan, M.A. 1981. Further records of the ticks of some reptilian and mammalian hosts in the Kyasanur Forest disease area, Karnataka, India. Ind. J. Parasitol., 5: 207–210.

Bhat, H.R., Sreenivasan, M.A. & Jacob, P.G. 1986. Ixodid ticks infesting goats in the Kyasanur Forest disease area, Shimoga District, Karnataka. Ind. J. Parasitol., 10: 39–45.

Boshell, J. & Rajagopalan, P.K. 1968. Observations on the experimental exposure of monkeys, rodents and shrews to infestation of ticks in forest in Kyasanur Forest disease area. Ind. J. Med. Res., 56 (4) (Suppl.): 573–588.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Geevarghese, G., Fernandes, S. & Kulkarni, S.M. 1997. A checklist of Indian ticks (Acari: Ixodoidea). Ind. J. Anim. Sci., 67: 566–574.

Rahman, M.H. & Mondal, M.M.H. 1985. Tick fauna of Bangladesh. Ind. J. Parasitol., 9: 145–149.

Rajagopalan, P.K. 1972. Ixodid ticks (Acarina: Ixodidae) parasitizing wild birds in the Kyasanur Forest disease area of Shimoga District, Mysore State, India. J. Bombay Nat. Hist. Soc., 69: 55–78.
Rajagopalan, P.K. & Sreenivasan, M.A. 1981. Ixodid ticks on cattle and buffaloes in the Kyasanur Forest disease area of Karnataka State. Ind. J. Med. Res., 73: 880–889.
Rajagopalan, P.K., Patil, A.P. & Boshell, J. 1968. Ixodid ticks on their mammalian hosts in the Kyasanur Forest disease area of Mysore State, India, 1961–1964. Ind. J. Med. Res., 56: 510–526.
Trapido, H., Hoogstraal, H. & Varma, M.G.R. 1964. Status and descriptions of *Haemaphysalis p. papuana* Thorell (n. comb.) and of *H. papuana kinneari* Warburton (n. comb.) (Ixodoidea, Ixodidae) of southern Asia and New Guinea. J. Parasitol., 50: 172–188.

74 – *H. kitaokai* Hoogstraal, 1969 (J. Parasitol., 55: 211–221)

Type depositories: USNTC (holotype, paratypes), NIAH (paratypes) (Hoogstraal, H. 1969. *Haemaphysalis* (*Alloceraea*) *kitaokai* sp. n. of Japan, and keys to species in the structurally primitive subgenus *Alloceraea* Schulze of Eurasia (Ixodoidea, Ixodidae). J. Parasitol., 55: 211–221)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: temperate conifer and broadleaf forests

Hosts: Aves are considered exceptional hosts for this tick.
Artiodactyla: Bovidae, Cervidae (AN)
Perissodactyla: Equidae; Galliformes: Phasianidae (A)

Human infestation: yes (Mahara 1997)

Remarks: the larva of *H. kitaokai* is known only from laboratory-reared specimens (Hoogstraal 1969). Camicas et al. (1998) state that this species is exclusively Palearctic, but Teng and Jiang (1991) show that the distribution of *H. kitaokai* encompasses localities in the Oriental and Palearctic Zoogeographic Regions. Xu and Li (1997) found a female of *H. kitaokai* on Phasianidae, but Kolonin (2009) ignores Aves as hosts for adult ticks.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.
Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.
Hoogstraal, H. 1969. *Haemaphysalis* (*Alloceraea*) *kitaokai* sp. n. of Japan, and keys to species in the structurally primitive subgenus *Alloceraea* Schulze of Eurasia (Ixodoidea, Ixodidae). J. Parasitol., 55: 211–221.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Mahara, F. 1997. Japanese spotted fever: report of 31 cases and review of the literature. Emerg. Inf. Dis., 3: 105–111.
Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.
Xu, R. & Li, K. 1997. A collection of ticks from Guizhou, China. Syst. Appl. Acarol., 2: 245–246.
Xu, R. & Luo, G. 1998. Ticks parasitic on *Muntiacus reevesi* and *Lepus sinensis* in Wuyi Mountains, Fujian, China. Syst. Appl. Acarol. 3: 197.
Yamaguti, N., Tipton, V.J., Keegan, H.L. & Toshioka, S. 1971. Ticks of Japan, Korea and the Ryukyu Islands. Brigham Young Univ. Sci. Bull. Biol. Ser., 15 (1), 226 pp.
Yamauchi, T. 2005. A bibliographical survey on ixodid fauna of Shimane Prefecture, Japan (Acari: Ixodidae). Bull. Hoshizaki Green Found., 8: 289–301. In Japanese.

75 – *H. knobigera* Prakasan & Ramani, 2007 (Int. J. Zool. Res., 3: 169–177)

This species is not included in Kolonin (2009, *op. cit*. under *H. anomaloceraea*). Guglielmone et al. (2009, *op. cit*. under *H. colasbelcouri*) doubt the validity of this species, whose description is very poor, but have included it in their list of valid names because it is uncertain whether it is a synonym of another species of *Haemaphysalis* found on Bovidae in India (Oriental Region).

Type depository: DA (holotype, paratypes) (Prakasan, K. & Ramani, M. 2007. Two new species of ixodid ticks (Acarina: Ixodida) from Kerala, India. Int. J. Zool. Res., 3: 169–177)

Known stages: male

Zoogeographic Region: Oriental

Ecoregion: southwestern Ghats moist deciduous forests

Hosts: Artiodactyla: Bovidae (A)

Human infestation: no

Reference

Prakasan, K. & Ramani, M. 2007. Two new species of ixodid ticks (Acarina: Ixodida) from Kerala, India. Int. J. Zool. Res., 3: 169–177.

76 – *H. koningsbergeri* Warburton & Nuttall, 1909 (Parasitology, 2: 57–76)

Type depository: BMNH (lectotype, paralectotypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, larva

Zoogeographic Region: Oriental

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Carnivora (several families).
Carnivora: Mustelidae; Rodentia: Muridae (A, N and/or L)
Mammalia (several orders) (A)

Human infestation: yes (Keirans 1985)

Remarks: Camicas et al. (1998) state that the larva of *H. koningsbergeri* is undescribed, but this stage was described by Kadarsan (1971). Tanskul et al. (1983) use the term "immatures" without stating whether larvae, nymphs or both stages were found on hosts, but we consider their records provisionally valid. There is a valid record of *H. koningsbergeri* from a human in Audy et al. (1960), but the specimen was merely crawling on the body and we therefore exclude humans as hosts of this tick. It is uncertain whether the nymph found in a nest of Pilocercidae by Kohls (1957) actually fed on this type of host, and Hoogstraal et al. (1972) treat the determination of a nymph of *H. koningsbergeri* on Sciuridae as tentative, while regarding a collection from Phasianidae (tick stage unknown) as probably erroneous. These records have not been included in our host list for this species.

References

Audy, J.R., Nadchatram, M. & Lim, B.-L. 1960. Malaysian parasites. XLIX. Host distribution of Malayan ticks (Ixodoidea). Stud. Inst. Med. Res. Malaya, 29: 225–246.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Hoogstraal, H., Lim, B.L., Nadchatram, M. & Anastos, G. 1972. The Gunong Benom Expedition 1967. 8. Ticks (Ixodidae) of Gunong Benom and their altitudinal distribution, hosts and medical relationships. Bull. Br. Mus. (Nat. Hist.) Zool., 23: 167–186.

Kadarsan, S. 1971. Larval ixodid ticks of Indonesia (Acarina: Ixodidae). Ph.D. Dissertation, University of Maryland, 182 pp.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Kohls, G.M. 1957. Malaysian parasites XVIII. Ticks (Ixodoidea) of Borneo and Malaya. Malaya (28): 65–94.

Tanskul, P., Stark, H.E. & Inlao, I. 1983. A checklist of ticks of Thailand (Acari: Metastigmata: Ixodoidea). J. Med. Entomol., 20: 330–341.

77 – *H. kopetdaghica* Kerbabaev, 1962 (Akad. Nauk. Turkmenistan SSR Ser. Biol. Nauk (1): 77–80. In Russian)

Type depository: ZIAC (neotype) (Filippova 2008, *op. cit*. under *H. caucasica*), originally named *H. warburtoni kopetdaghicus*.

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregion: Kopet Dag semi-desert

Hosts: usual hosts for larvae, nymphs and adult ticks are Artiodactyla: Bovidae.
Artiodactyla: Bovidae (ANL)
Perissodactyla: Equidae (AN)
Carnivora: Felidae (A)

Human infestation: no

Remarks: Mihalca et al. (2011) regard this species as endangered.

References

Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian.

Hoogstraal, H. & Wassef, H.Y. 1979. *Haemaphysalis* (*Allophysalis*) *kopetdaghica*: identity and discovery of each feeding stage on the wild goat in northern Iran (Ixodoidea: Ixodidae). J. Parasitol., 65: 783–790.

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

78 – *H. kumaonensis* Geevarghese & Mishra, 2011 (*In* Geevarghese, G. & Mishra, A.C. 2011. *Haemaphysalis* ticks of India. Elsevier, London, 260 pp.)

Type depositories: not stated in Geevarghese, G. & Mishra, A.C. (2011. *Haemaphysalis* ticks of India. Elsevier, London, 260 pp.)

Known stages: male, female, nymph, larva

Zoogeographic Region: undetermined

Ecoregions: undetermined

Hosts: unknown

Human infestation: no

Remarks: no locality or host data are provided for this species, and its relationship to other taxa is uncertain from the description in Geevarghese and Mishra (2011). We therefore consider this species provisionally valid.

Reference

Geevarghese, G. & Mishra, A.C. 2011. *Haemaphysalis* ticks of India. Elsevier, Amsterdam and several other cities, 260 pp.

79 – *H. kutchensis* Hoogstraal & Trapido, 1963 (J. Parasitol., 49: 489–497)

Type depositories: USNTC (holotype, paratypes), BMNH, ZIAC, FMNH, HH, VRC (paratypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*). This species was originally identified as *H. bispinosa intermedia* Warburton and Nuttall, 1909, a synonym of *H. intermedia*, by Nuttall and Warburton (1915, *op. cit.* under *H. celebensis*),

as discussed in Hoogstraal, H. & Trapido, H. (1963. *Haemaphysalis kutchensis* sp. n., a common larval and nymphal parasite of birds in northwestern India (Ixodoidea, Ixodidae). J. Parasitol., 49: 489–497).

Known stages: male, female, nymph, larva

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: desert and xeric shrublands

Hosts: Passeriformes: Sylviidae (ANL)
Carnivora: Canidae (A, N and/or L)
Rodentia: Muridae (A and/or N and/or L)
Artiodactyla: Bovidae; Carnivora: Felidae, Hyaenidae; Lagomorpha: Leporidae; Galliformes: Phasianidae; Cuculiformes: Cuculidae; Strigiformes: Strigidae (A)
Passeriformes (several families) (N)

Human infestation: no

Remarks: Camicas et al. (1998) state that this tick is found only in the Oriental Region, but following Filippova (1997), we consider it to also be present in the Palearctic Region. There is an Afrotropical record in Hoogstraal and Wassef (1985) from a migrant bird, but there is no evidence that *H. kutchensis* has become established in that region. Kaul et al. (1978) generalized that adults, nymphs and larvae of *H. kutchensis* are found on Muridae and Canidae without specifying which stages are found on each type of host. Rao et al. (1973) report parasitism of "mongoose" by *H. kutchensis* without further data, and this record has not been included in our host list for this species.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian.

Hoogstraal, H. & Trapido, H. 1963. *Haemaphysalis kutchensis* sp. n., a common larval and nymphal parasite of birds in northwestern India (Ixodoidea, Ixodidae). J. Parasitol., 49: 489–497.

Hoogstraal, H. & Wassef, H.Y. 1985. *Haemaphysalis kutchensis*, an Indian-Pakistani bird and mammal tick, parasitizing a migrant whitethroat in the Sultanate of Oman. J. Parasitol., 71: 129–130.

Kaul, H.N., Mishra, A.C., Dhanda, V., Kulkarni, S.M. & Guttikar, S.N. 1978. Ectoparasitic arthropods of birds and mammals from Rajasthan State, India. Ind. J. Parasitol., 2: 19–25.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Rao, T.R., Dhanda, V., Bhat, H.R. & Kulkarni, S.M. 1973. A survey of haematophagous arthropods in western Himalayas, Sikkim and Hill Districts of West Bengal. A general account. Ind. J. Med. Res., 61: 1421–1461.

80 – ***H. kyasanurensis*** Trapido, Hoogstraal & Rajagopalan, 1964 (J. Parasitol., 50: 295–302)

Type depositories: USNTC (holotype, paratypes), BMNH, VRC, ZIAC, HH (paratypes). (Trapido, H., Hoogstraal, H. & Rajagopalan, P.K. 1964. *Haemaphysalis kyasanurensis* sp. n., a member of the *formosensis* group in southern India and Ceylon (Ixodoidea, Ixodidae). J. Parasitol., 50: 295–302). However, Keirans and Hillyard (2001, *op. cit.*, under *H. aciculifer*) state that no paratypes of *H. kyasanurensis* are present in BMNH.

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregion: south Deccan plateau dry deciduous forests

Hosts: usual hosts for larvae, nymphs and adults are Rodentia: Hystricidae.
Rodentia: Hystricidae; Artiodactyla: Bovidae (ANL)
Carnivora: Canidae; Rodentia: Sciuridae (AN)
Artiodactyla: Suidae; Carnivora: Felidae (A)
Primates: Cercopithecidae; Aves (several orders) (NL)
Mammalia (several orders) (L)

Human infestation: no

References

Bhat, H.R. & Sreenivasan, M.A. 1981. Further records of the ticks of some reptilian and mammalian hosts in the Kyasanur Forest disease area, Karnataka, India. Ind. J. Parasitol., 5: 207–210.

Bhat, H.R., Sreenivasan, M.A. & Jacob, P.G. 1986. Ixodid ticks infesting goats in the Kyasanur Forest disease area, Shimoga District, Karnataka. Ind. J. Parasitol., 10: 39–45.

Boshell, J. & Rajagopalan, P.K. 1968. Observations on the experimental exposure of monkeys, rodents and shrews to infestation of ticks in forest in Kyasanur Forest disease area. Ind. J. Med. Res., 56 (4) (Suppl.): 573–588.

Hoogstraal, H. & Rack, G. 1967. Ticks (Ixodidae) collected by Deutsche Indien-Expedition, 1955–1958. J. Med. Entomol., 3: 284–288.

Rajagopalan, P.K. 1972. Ixodid ticks (Acarina: Ixodidae) parasitizing wild birds in the Kyasanur Forest disease area of Shimoga District, Mysore State, India. J. Bombay Nat. Hist. Soc., 69: 55–78.

Rajagopalan, P.K., Patil, A.P. & Boshell, J. 1968. Ixodid ticks on their mammalian hosts in the Kyasanur Forest disease area of Mysore State, India, 1961–1964. Ind. J. Med. Res., 56: 510–526.

81 – *H. lagostrophi* Roberts, 1963 (Aust. J. Zool., 11: 35–80)

Type depositories: WAM (holotype, paratypes), ANIC (paratypes) (Roberts 1963, *op. cit.* under *H. bremneri*; Halliday, B. personal communication to Guglielmone, A.A.)

Known stages: male, female, nymph

Zoogeographic Region: Australasian

Ecoregion: Kimberly tropical savanna

Hosts: usual hosts for adult ticks are Diprotodontia: Macropodidae.
Diprotodontia: Macropodidae (AN)
Peramelemorphia: Peramelidae (A)

Human infestation: no

References

Roberts, F.H.S. 1963. A systematic study of the Australian species of the genus *Haemaphysalis* Koch (Acarina: Ixodidae). Aust. J. Zool., 11: 35–80.
Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.

82 – *H. lagrangei* Larrousse, 1925 (Ann. Parasitol. Hum. Comp., 3: 301–305)

Type depositories: IP (lectotype), CM, BMNH, USNTC (paralectotypes) (Trapido, H. 1965. Notes on critical Asian *Haemaphysalis* specimens in European museum collections, with designations of lectotypes and a neotype. Proc. Entomol. Soc. Wash., 67: 152–165; Keirans and Clifford 1984, *op. cit.* under *H. bartelsi*; Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*).

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Artiodactyla: Cervidae and Carnivora: Mustelidae and Viverridae; usual hosts for larvae and nymphs are Carnivora: Mustelidae and Viverridae. Aves and Squamata are considered exceptional hosts for this tick.
Mammalia (several orders) (ANL)
Galliformes: Phasianidae (AN)
Falconiformes: Falconidae; Passeriformes: Laniidae, Muscicapidae; Squamata: Varanidae (A)

Human infestation: yes (Tanskul et al. 1983)

Remarks: Phan Trong (1977), who refers to this tick as *H. hystricis indochinensis* Phan Trong, 1977, found this species on Squamata and Aves apart from mammals. Two records of Aves as hosts for *H. lagrangei* are also included in Hoogstraal et al. (1973). All these records have been ignored in Kolonin (2009), probably because of their infrequency.

References

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Hoogstraal, H., El Kammah, K.M., Santana, F.J. & Van Peenen, P.F.D. 1973. Studies on Southeast Asian *Haemaphysalis* ticks (Ixodoidea: Ixodidae). *H.* (*Kaiseriana*) *lagrangei* Larrouse: identity, distribution, and hosts. J. Parasitol., 59: 1118–1129.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Phan Trong, C. 1977. Ve bet va con trung ky sinh o Viet Nam. Tap 1. Ve (Ixodoidea), mo ta va phan loai. Ha Noi: Khoa hoc va ky thuat, 489 pp. In Vietnamese.

Tanskul, P., Stark, H.E. & Inlao, I. 1983. A checklist of ticks of Thailand (Acari: Metastigmata: Ixodoidea). J. Med. Entomol., 20: 330–341.

83 – *H. laocayensis* Phan Trong, 1977 (Ve bet va con trung ky sinh o Viet Nam. Tap 1. Ve (Ixodoidea), mo ta va phan loai. Ha Noi: Khoa hoc va ky thuat, 489 pp.) In Vietnamese.

Type depository: AI (holotype, paratypes) (Kolonin, G.V. personal communication to Guglielmone, A.A.)

Known stages: male, female

Zoogeographic Region: Oriental

Ecoregion: south China-Vietnam subtropical evergreen forests

Hosts: Artiodactyla: Cervidae; Carnivora: Mustelidae (A)

Human infestation: no

Reference

Kolonin, G.V. 1995. Review of the ixodid tick fauna (Acari: Ixodidae) of Vietnam. J. Med. Entomol., 32: 276–282.

84 – *H. leachi* (Audouin, 1826) (Explication sommaire des planches d'arachnides de l'Égypte et de la Syrie. *In* Savigny, J. 1826. Description de l'Égypte ou Recueil des Observations et des Recherches qui ont été Faites en Égypte pendant l'Expédition de l'Armée Française. Histoire Naturelle, 1 (4): 99–186. C.L.F. Panckoucke: Paris). **Note**: major discrepancies exist among citations of this reference.

Type depository: USNTC (neotype) (Keirans and Clifford 1984, *op. cit.* under *H. bartelsi*). Originally named *Ixodes leachii.*

Known stages: male, female, nymph, larva

Zoogeographic Regions: Afrotropical, Palearctic

Ecoregions: several Afrotropical and Palearctic ecoregions

Hosts: usual hosts for adult ticks are Carnivora (several families).
Carnivora (several families); Artiodactyla: Bovidae, Suidae; Primates: Cercopithecidae; Rodentia: Muridae (A)

Human infestation: yes (Apanaskevich et al. 2007)

Remarks: all stages of *H. leachi* have been misdetermined in the literature, where different species are alleged to constitute the *H. leachi* group. We have therefore ignored records of this species published prior to Apanaskevich et al. (2007), including Oriental records in Phan Trong (1977). Kolonin (2009) states that the immature stages of this tick feed "on rodents and other small mammals," supporting the assertion in Apanaskevich et al. (2007). However, the latter authors also state that a taxonomic revision of the *H. leachi* group will be necessary in order to delimit the host range of the immature stages. For this reason we have not included hosts for larvae and nymphs of this tick. Keirans and Durden (2001) record introductions of *H. leachi* or ticks from the *H. leachi* group into the Nearctic Region, but no evidence exists that any member of this group has become established there. See also *H. leachi* and *H. zumpti.*

References

Apanaskevich, D.A., Horak, I.G. & Camicas, J.-L. 2007. Redescription of *Haemaphysalis* (*Rhipistoma*) *elliptica* (Koch, 1844), an old taxon of the *Haemaphysalis* (*Rhipistoma*) *leachi* group from East and southern Africa, and of *Haemaphysalis* (*Rhipistoma*) *leachi* (Audouin, 1826) (Ixodida: Ixodidae). Onderstepoort J. Vet. Res., 74: 181–208.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Phan Trong, C. 1977. Ve bet va con trung ky sinh o Viet Nam. Tap 1. Ve (Ixodoidea), mo ta va phan loai. Ha Noi: Khoa hoc va ky thuat, 489 pp. In Vietnamese.

85 – *H. lemuris* Hoogstraal, 1953 (Bull. Mus. Comp. Zool., 111: 37–113)

Type depositories: USNTC (holotype, paratypes), HH, MCZ, OVI (paratypes) (Hoogstraal, H. 1953. Ticks (Ixodoidea) of the Malagasy Faunal Region (excepting the Seychelles). Their origins and host-relationships; with descriptions of five new *Haemaphysalis* species. Bull. Mus. Comp. Zool., 111: 37–113)

Known stages: male, female, nymph

Zoogeographic Region: Afrotropical

Ecoregion: Madagascar succulent woodlands

Hosts: Primates: Indriidae, Lemuridae (AN)
Primates: Cheirogaleidae, Epilemuridae (N)

Human infestation: no

Remarks: Uilenberg et al. (1979) considered a record of two nymphs of *H. lemuris* from Passeriformes: Vangidae as uncertain, and this family has been excluded from our host list. Barrett et al. (2012) state that humans, domestic animals and rodents are hosts of *H. lemuris*, but we were unable to confirm this assertion with the references provided by the authors, and these hosts are not included in the list above. Durden and Keirans (1996) regard *H. lemuris* as an endangered species.

References

Barrett, M.A., Brown, J.L., Junge, R.E. & Yoder, A.D. 2012. Climate change, predictive modeling and lemur health: assessing impacts of changing climate on health conservation in Madagascar. Biol. Conserv., 157: 409–422.

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.

Durden, L.A., Zohdy, S. & Laakkonen, J. 2010. Lice and ticks of the Eastern rufous mouse lemur, *Microcebus rufus*, with descriptions of the male and third instar nymph of *Lemurpediculus verruculosus* (Phthiraptera: Anoplura). J. Parasitol., 96: 874–878.

Uilenberg, G., Hoogstraal, H. & Klein, J.-M. 1979. Les tiques (Ixodoidea) de Madagascar et leur rôle vecteur. Arch. Inst. Pasteur Madagascar Num. Spéc., 153 pp.

86 – *H. leporispalustris* (Packard, 1869) (First Annual Report of the Trustees of the Peabody Academy of Sciences, Appendix, pp. 56–69)

Type depository: MCZ (type?) (Cooley 1946, *op. cit.* under *H. chordeilis*) as *Ixodes leporispalustris.* Cooley (1946) states that the type of this species is in the MCZ, but on the museum web page for zoological collections (http://mczbase.mcz.harvard.edu/ accessed April 4, 2013), the specimen of *Ixodes leporispalustris* (as *Ixodes leporis-palustris*) bears the label "type?"

Known stages: male, female, nymph, larva

Zoogeographic Regions: Nearctic, Neotropical

Ecoregions: several different Nearctic and Neotropical ecoregions

Hosts: usual hosts for larvae, nymphs and adult ticks are Lagomorpha: Leporidae.
Mammalia (several orders); Galliformes: Phasianidae, Odontophoridae; Passeriformes (several families); Strigiformes: Strigidae (ANL)
Cuculiformes: Cuculidae (NL)
Caprimulgiformes: Caprimulgidae; Charadriiformes: Scolopacidae; Columbiformes: Columbidae (N)
Charadriiformes: Laridae, Sternidae; Piciformes: Picidae (L)
Falconiformes: Falconidae; Galliformes: Cracidae (stages unknown)

Human infestation: yes (Furman and Loomis 1984; Guglielmone et al. 2003)

Remarks: Neumann (1897, 1911) states that *H. leporispalustris* (cited as *H. leporis*) has been found in the Oriental Region, but we consider this determination erroneous. We also maintain that recent records of *H. leporispalustris* on Galliformes in Pakistan (Khattak et al. 2012) are in error. More recently, Han et al. (2009) state that *H. leporispalustris* is found on several wild and domestic animals in South Korea (Palearctic Region); this statement is treated as valid by Sutor et al. (2013), but we consider it to be erroneous. Kolonin (2009) excludes Aves as hosts of adult *H. leporispalustris*, but we feel that records of this stage from avian hosts listed in Bequaert (1945), Bishopp and Trembley (1945) and Hamer et al. (2012) are valid. Keirans (1985) considers his diagnoses of adults and larvae of *H. leporispalustris* on Dasyproctidae to be tentative. This mammal has therefore been provisionally excluded from our host list of *H. leporispalustris*.

References

Bequaert, J.C. 1945. The ticks or Ixodoidea, of the northeastern United States and eastern Canada. Entomol. Am., 25: 73–232.

Bishopp, F.C. & Trembley, H.L. 1945. Distribution and hosts of certain North American ticks. J. Parasitol., 31: 1–54.

Cooley, R.A. 1946. The genera *Boophilus*, *Rhipicephalus*, and *Haemaphysalis* (Ixodidae) of the New World. Natl. Inst. Health Bull. (187), 54 pp.

Furman, D.P. & Loomis, E.C. 1984. The ticks of California (Acari: Ixodida). Bull. Calif. Insect Surv., 25: 1–239.

Galloway, T.D. 2006. Ectoparasites (Phthiraptera: Philopteridae; Acari: Ixodidae) of common nighthawk, *Chordeilis minor*, and whip-poor-will, *Caprimulgus vociferous* (Caprimulgiformes: Caprimulgidae), in Manitoba. J. Entomol. Soc. Ontario, 137: 5–11.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Hamer, S.A., Goldberg, T.L., Kitron, U.D., Brawn, J.D., Anderson, T.K., Loss, S.R., Walker, E.D. & Hamer, G.L. 2012. Wild birds and urban ecology of ticks and tick-borne pathogens, Chicago, Illinois, USA, 2005–2010. Emerg. Inf. Dis., 18: 1589–1595.

Han, J.-I., Jang, H.-J. & Na, K.-J. 2009. Molecular detection of *Theileria* sp. in wild Chinese water deer (*Hydropotes inermis argyropus*). J. Wildl. Dis., 45: 1213–1216.

Hyland, K.E., Bernier, J., Markowski, D., MacLachlan, A., Amr, Z., Pitocchelli, J., Myers, J. & Hu, R. 2000. Records of ticks (Acari: Ixodidae) parasitizing birds (Aves) in Rhode Island, USA. Int. J. Acarol., 26: 183–192.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Khattak, R.M., Ali, S., Jahangir, M., Khan, M.N., Rasul, A. & Iqbal, F. 2012. Prevalence of ectoparasites in wild and domesticated grey (*Francolinus pondicerianus*) and black partridge (*Francolinus francolinus*) from Khyber Pakhtoonkhwa Province of Pakistan. Pakistan J. Zool., 44: 1239–1244.

Kohls, G.M. 1960. Records and new synonymy of New World *Haemaphysalis* ticks, with descriptions of the nymph and larva of *H. juxtakochi* Cooley. J. Parasitol., 46: 355–361.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Neumann, L.G. 1897. Révision de la famille des ixodidés (2e mémoire). Mém. Soc. Zool. Fr., 10: 324–420.

Neumann, L.G. 1911. Ixodidae. Das Tierreich (26), 169 pp.

Samuel, W.M. & Low, W.A. 1970. Parasites of the collared peccary from Texas. J. Wildl. Dis., 6: 16–23.

Scott, J.D., Anderson, J.F. & Durden, L.A. 2012. Widespread dispersal of *Borrelia burgdorferi*- infected ticks collected from songbirds across Canada. J. Parasitol., 98: 49–59.

Sutor, A., Schwarz, S., & Conraths, F.J. 2013. The biological potential of the raccoon dog (*Nyctereutes procyonoides*, Gray, 1834) as an invasive species in Europe – new risks for disease spread ? Acta Theriol., doi:10.1007/s13364-013-0138-9

Tugwell, P. & Lancaster, J.L. 1962. Results of a tick-host study in northwest Arkansas. J. Kansas Entomol. Soc., 35: 202–211.

87 – *H. lobachovi* Kolonin, 1995 (Folia Parasitol., 42: 239)

Type depositories: ZMMO, KC. (Kolonin, G.V. 1995. *Haemaphysalis lobachovi* sp. n. (Acarina: Ixodidae) from porcupine (*Hystrix cristata*) from Ethiopia. Folia Parasitol., 42: 239)

Known stages: male

Zoogeographic Region: Afrotropical

Ecoregion: Ethiopian montane moorlands

Hosts: Rodentia: Hystricidae (A)

Human infestation: no

Reference

Kolonin, G.V. 1995. *Haemaphysalis lobachovi* sp. n. (Acarina: Ixodidae) from porcupine (*Hystrix cristata*) from Ethiopia. Folia Parasitol., 42: 239.

88 – *H. longicornis* Neumann, 1901 (Mém. Soc. Zool. Fr., 14: 249–372)
See *H. goral* and remarks below.

Type depository: ENV (lectotype, paralectotype) (Hoogstraal, H., Roberts, F.H.S., Kohls, G.M. & Tipton, V.J. 1968. Review of *Haemaphysalis* (*Kaiseriana*) *longicornis* Neumann (resurrected) of Australia, New Zealand, New Caledonia, Fiji, Japan, Korea,

and northeastern China and USSR, and its parthenogenetic and bisexual populations (Ixodoidea, Ixodidae). J. Parasitol., 54: 1197–1213). See also *H. goral.*

Known stages: male, female, nymph, larva

Zoogeographic Regions: Australasian, Oriental, Palearctic

Ecoregions: temperate broadleaf and mixed forests

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae and Cervidae, and Perissodactyla: Equidae. Aves are considered exceptional hosts for this tick.
Mammalia (several orders); Galliformes: Phasianidae (ANL)
Anseriformes. Anatidae (A)
Apterygiformes: Apterygidae; Gruiformes: Rallidae; Passeriformes (several families) (NL)
Psittaciformes: Psittacidae (N)
Charadriiformes: Laridae (L)

Human infestation: yes (Yamauchi et al. 2010)

Remarks: records prior to Hoogstraal et al. (1968) have been ignored here because of their diagnostic uncertainties. A recent study of bisexual and parthenogenetic populations of *H. longicornis* in China showed that these populations are conspecific (Chen et al. 2012). Hoogstraal et al. (1981) reported the introduction of *H. longicornis* into the northern sector of the Afrotropical Zoogeographic Region, while Keirans and Durden (2001) reported its introduction into the Nearctic and Hoogstraal et al. (1968) reported its introduction into central Pacific islands, but *H. longicornis* has apparently failed to become established at any of these localities. According to Heath et al. (1988), infestation of Aves by *H. longicornis* appears to be an infrequent event, although Hoogstraal et al. (1968) state that Somov and Shestakov (1963), who refer to this tick as *H. neumanni*, found many birds that were infested with larvae. However, the English translation of the latter study by Russian researchers does not indicate parasitism of Aves by *H. longicornis*; we therefore accept the view of Heath et al. (1998). See also *H. bispinosa* and *H. davisi.*

References

Chen, Z., Yang, X., Bu, F., Ynag, X. & Liu, J. (2012) Morphological and molecular characteristics of bisexual and parthenogenetic *Haemaphysalis longicornis.* Vet. Parasitol., 189: 344–352.

Clark, J.M., Heath, D.D. & Stankiewicz, M.1997. The ectoparasites of brushtail possum *Trichosurus vulpecula* in New Zealand. N. Zeal. J. Zool., 24: 199–204.

Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian.

Heath, A.C.G. 2013. Implications for New Zealand of potentially invasive ticks sympatric with *Haemaphysalis longicornis* Neumann, 1901 (Acari: Ixodidae). Syst. Appl. Acarol., 18: 1–26.

Heath, A.C.G., Tenquist, J.D. & Bishop, D.M. 1988. Bird hosts of the New Zealand cattle tick, *Haemaphysalis longicornis*. N. Zeal. J. Zool., 15: 585–586.

Hoogstraal, H., Roberts, F.H.S., Kohls, G.M. & Tipton, V.J. 1968. Review of *Haemaphysalis* (*Kaiseriana*) *longicornis* Neumann (resurrected) of Australia, New Zealand, New Caledonia, Fiji, Japan, Korea, and northeastern China and USSR, and its parthenogenetic and bisexual populations (Ixodoidea, Ixodidae). J. Parasitol., 54: 1197–1123.

Hoogstraal, H., Wassef, H.Y. & Büttiker, W. 1981. Ticks (Acarina) of Saudi Arabia Fam. Argasidae, Ixodidae. Fauna Saudi Arabia, 3: 25–110.

Kang, J.-G., Kim, H.-C., Choi, C.-Y., Nam, H.-Y., Chae, H.-Y., Chong, S.-T., Klein, T.A., Ko, S. & Chae, J.-S. 2013. Molecular detection of *Anaplasma*, *Bartonella*, and *Borrelia* species in ticks collected from migratory birds from Hong-do Island, Republic of Korea. Vector- Borne Zoon. Dis., 13: 215–225.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.

Somov, G.P. & Shestakov, V.I. 1963. On spontaneous infection of *Haemaphysalis japonica douglasi* Nutt. and Warb. ticks with *D. sibiricus* rickettsiae in the Primorsk Region. J. Microbiol. (Moscow), 40: 51–56. In Russian, NAMRU-3 translation 205.

Xu, R. & Li, K. 1997. A collection of ticks from Guizhou, China. Syst. Appl. Acarol., 2: 245–246.

Yamauchi, T. 2001. A bibliographical survey of host-parasite relationships between birds and ticks from Japan. Bull. Hoshizaki Green Found., 5: 271–308. In Japanese.

Yamauchi, T., Fukui, Y., Watanabe, M., Nakagawa, H. & Kamimura, K. 2010. Forty cases of human infestations with hard ticks (Acari: Ixodidae) in Toyama Prefecture, Japan. Med. Entomol. Zool., 61: 133–143. In Japanese.

89 – *H. luzonensis* Hoogstraal & Parrish, 1968 (J. Parasitol., 54: 402–410)

Type depositories: USNTC (holotype, paratypes), BMNH, HH, FMNH, PNM (paratypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregion: Luzon tropical pine forests

Hosts: usual hosts for larvae, nymphs and adult ticks are Artiodactyla: Cervidae. Artiodactyla: Cervidae, Suidae (ANL)

Human infestation: no

Reference

Hoogstraal, H. & Parrish, D.W. 1968. Studies on Southeast Asian *Haemaphysalis* ticks (Ixodoidea: Ixodidae). *H.* (*Kaiseriana.*) *luzonensis* sp. n. from Philippine deer and boars. J. Parasitol., 54: 402–410.

90 – *H. madagascariensis* Colas-Belcour & Millot, 1948 (Bull. Soc. Pathol. Exot., 41: 384–388)

Type depository: IPP (holotype, paratype) (Hoogstraal, H. 1966. The *Haemaphysalis* ticks (Ixodoidea, Ixodidae) of birds. 2. Redescription of the type material of *H.* (*Rhipistoma*) *madagascariensis* Colas-Belcour and Millot. J. Parasitol., 52: 801–804), originally named *H. hoodi madagascariensis.*

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregion: Madagascar subhumid forests

Hosts: Cuculiformes: Cuculidae (ANL)
Passeriformes: Vangidae (L)

Human infestation: no

Remarks: Uilenberg et al. (1979) were unable to determine the undescribed larva and nymph of this species with certainty, and we therefore consider their records provisionally valid.

Reference

Uilenberg, G., Hoogstraal, H. & Klein, J.-M. 1979. Les tiques (Ixodoidea) de Madagascar et leur rôle vecteur. Arch. Inst. Pasteur Madagascar Num. Spéc., 153 pp.

91 – *H. mageshimaensis* Saito & Hoogstraal, 1973 (J. Parasitol., 59: 569–578)

Type depositories: MZD (holotype, paratype), USNTC (paratypes) (Saito, Y. & Hoogstraal, H. 1973. *Haemaphysalis* (*Kaiseriana*) *mageshimaensis* sp. n. (Ixodoidea: Ixodidae), a Japanese deer parasite with bisexual and parthenogenetic reproduction. J. Parasitol., 59: 569–578)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: Artiodactyla: Bovidae; Carnivora: Canidae, Felidae, Viverridae (ANL)
Artiodactyla: Cervidae (AN)
Artiodactyla: Suidae (A)
Rodentia: Muridae; Passeriformes: Pycnonotidae, Zosteropidae (L)

Human infestation: yes (Hoogstraal and Santana 1974)

References

Hoogstraal, H. & Santana, F.J. 1974. *Haemaphysalis* (*Kaiseriana*) *mageshimaensis* (Ixodoidea: Ixodidae): human and wild and domestic mammal hosts, and distribution in Japan, Taiwan, and China. J. Parasitol., 60: 866–869.

Kolonin, G.V. 1995. Review of the ixodid tick fauna (Acari: Ixodidae) of Vietnam. J. Med. Entomol., 32: 276–282.

92 – *H. megalaimae* Rajagopalan, 1963 (J. Parasitol., 49: 340–345)

Type depositories: USNTC (holotype, paratype), BMNH, HH, VRC, ZSI (paratypes) (Rajagopalan, P.K. 1963. *Haemaphysalis megalaimae* sp. n., a new tick from the small green barbet (*Megalaima viridis*) in India. J. Parasitol., 49: 340–345). However, Keirans and Hillyard (2001, *op. cit*. under *H. aciculifer*) do not include paratypes of this species in their list of types in the BMNH.

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregion: northern Indochina subtropical forests

Hosts: Piciformes: Capitonidae (ANL)

Human infestation: no

Remarks: Miranpuri and Naithani (1978) state that *Haemaphysalis megalaimae* has been found on birds other than Capitonidae, however without specifying the species of birds. Sun et al. (2012) determined *H. megalaimae* from *Chrysolophus pictus* (Galliformes) but we feel that this record requires confirmation. Hosts listed above are according to Rajagopalan (1972).

References

Miranpuri, G.S. & Naithani, R.C. 1978. A check-list of Indian ticks (Ixodoidea: Acarina). Indian Veterinary Research Institute, Izatnagar, 50 pp.

Rajagopalan, P.K. 1963. *Haemaphysalis megalaimae* sp. n., a new tick from the small green barbet (*Megalaima viridis*) in India. J. Parasitol., 49: 340–345.

Sun, Y., Wei, C.-C., Xu, R.-M. & Liu, X. 2012. *Haemaphysalis* ticks (Ixodoidea: Ixodidae) in China: subgenus *Ornithophysalis*, with a new record species. Acta Parasitol. Med. Entomol. Sin., 19: 50–57. In Chinese. **Note**: the information contained in this article has been obtained with the help of Yun, S., and we appreciate this collaboration.

93 – *H. megaspinosa* Saito, 1969 (Acta Med. Biol., 17: 87–96)

Type depositories: MZD (holotype, paratype), CS (paratype). (Saito, Y. 1969. Studies on ixodid ticks. X. *Haemaphysalis megaspinosa* n. sp. (Ixodoidea, Ixodidae) from Kanagawa Prefecture, Japan. Acta Med. Biol., 17: 87–96)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: temperate broadleaf and mixed forests

Hosts: usual hosts for adult ticks are Artiodactyla: Cervidae.
Artiodactyla: Cervidae; Perissodactyla: Equidae (AN)
Artiodactyla: Bovidae, Suidae; Carnivora: Canidae, Felidae, Ursidae (A)

Human infestation: yes (Sishima et al. 2000)

Remarks: Camicas et al. (1998) state that *H. megaspinosa* is found in the Oriental and Palearctic Regions, but we found no *bona fide* records for Oriental localities. The larva of *H. megaspinosa* is known only from laboratory-reared specimens in Yamaguti et al. (1971). Camicas et al. (1998) list pholeophilic (burrowing) mammals as hosts for the larva and nymph of *H. megaspinosa*, but we have found no records that support this host-parasite association. Heath (2013) lists rodents and mustelids as hosts of *H. megaspinosa* as a result of a transcription error (Heath, A.C.G., personal communication to Guglielmone, A.A.).

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Heath, A.C.G. 2013. Implications for New Zealand of potentially invasive ticks sympatric with *Haemaphysalis longicornis* Neumann, 1901 (Acari: Ixodidae). Syst. Appl. Acarol., 18: 1–26.

Kakuda, H., Shiraishi, S. & Uchida, T.A. 1989. Ticks from wild mammals in the Kyushu District including Okinawa Prefecture, Japan. J. Fac. Agr. Kyushu Univ., 33: 267–273.

Seishima, M., Izumi, T., Oyama, Z. & Kadoska, T. 2000. Tick bite by *Haemaphysalis megaspinosa* – First case. Eur. J. Dermatol., 10: 389–391.

Shimada, Y., Inokuma, H., Beppu, T., Okuda, M. & Onishi, T. 2003. Survey of ixodid tick species on domestic cats in Japan. Vet. Parasitol., 111: 231–239.

Takada, N., Ishiguro, F., Fujita, H., Wang, H.-P. & Masuzawa, T. 1998. Lyme disease spirochetes in ticks from northeastern China. J. Parasitol., 84: 499–504.

Yamaguti, N., Tipton, V.J., Keegan, H.L. & Toshioka, S. 1971. Ticks of Japan, Korea, and the Ryukyu Islands. Brigham Young Univ. Sci. Bull. Biol. Ser., 15 (1), 226 pp.

Yamauchi, T., Yano, S., Yamamoto, T., Yamamoto, E. & Miyamoto, T. 2013. Ticks (Acari: Ixodidae) from medium-sized to large mammals in Ehime Prefecture, Japan. Exp. Appl. Acarol., 60: 263–270.

Ybañez, A.P., Sato, F., Nambo, Y., Fukui, T., Masuzawa, T., Ohashi, N., Matsumoto, K., Kishimoto, T. & Inokuma, H. 2013. Survey on tick-borne pathogens in thoroughbred horses in the Hidaka District, Hokkaido, Japan. J. Vet. Med. Sci.,75: 11–15.

Yokohata, Y., Fujita, O., Kamiya, M., Fujita, T., Kaneko, K. & Ohbayashi, M. 1990. Parasites from the Asiatic black bear (*Ursus tibetanus*) on Kyushu island. J. Wildl. Dis., 26: 137–138.

94 – *H. menglaensis* Pang, Chen & Xiang, 1982 (Zool. Res., 3 (Suppl.): 45–51. In Chinese)
This species is not included in Camicas et al. (1998, *op. cit.* under *H. anomaloceraea*), but no reasons are given for its omission.

Type depository: IME (holotype, paratypes) (Pang, D., Chen, C. & Xiang, R. 1982. Notes on ixodid ticks from southwestern Yunnan with description of a new species of *Haemaphysalis* (Acarina: Ixodidae). Zool. Res., 3 (Suppl.): 45–51. In Chinese)

Known stages: male, female

Zoogeographic Region: Oriental

Ecoregion: Huang He plain mixed forests

Hosts: Artiodactyla: Cervidae (A)

Human infestation: no

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Horak, I.G., Camicas, J.-L. & Keirans, J.E. 2002. The Argasidae, Ixodoidea and Nuttalliellidae (Acari: Ixodida): a world list of valid tick names. Exp. Appl. Acarol., 27–54.

Pang, D., Chen, C. & Xiang, R. 1982. Notes on ixodid ticks from southwestern Yunnan with description of a new species of *Haemaphysalis* (Acarina: Ixodidae). Zool. Res., 3 (Suppl.): 45–51. In Chinese.

95 – ***H. minuta*** Kohls, 1950 (J. Parasitol., 36: 319–321)
Type depositories: USNTC (holotype, paratypes), BMNH (paratypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregions: tropical and subtropical dry broadleaf forests, desert and xeric shrublands

Hosts: usual hosts for larvae, nymphs and adults are Galliformes: Phasianidae. Mammalia are considered exceptional hosts for this tick.
Galliformes: Phasianidae (ANL)
Carnivora: Viverridae (A)
Passeriformes: Timaliidae (NL)
Artiodactyla: Bovidae; Primates: Cercopithecidae; Rodentia: Hystricidae; Cuculiformes: Cuculidae; Passeriformes (several families) (N)
Rodentia: Muridae (L)

Human infestation: no

Remarks: Camicas et al. (1998) list the female as undescribed, but it had earlier been described by Santos Dias (1956). Trapido et al. (1964b) reported some variation among their female specimens but did not reject the description of Santos Dias (1956) and we therefore regard his description as conditionally valid. Kolonin (2009) limits the hosts of *H. minuta* to Aves and Rodentia: Hystricidae, while Hoogstraal and Kim (1985) and Camicas et al. (1998) record only Aves as hosts of this tick. We have found no evidence that might lead us to conclude that the few records of this species from Mammalia are erroneous; consequently, we regard these records as provisionally valid but believe that *H. minuta* is primarily a parasite of Aves. Rao et al. (1973) list "mongoose" as hosts for *H. minuta* but provide no further details, and we have therefore not included such hosts in our list.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Hoogstraal, H. & Kim, K.C. 1985. Tick and mammal coevolution, with emphasis on *Haemaphysalis. In* K.C. Kim (editor), Coevolution of parasitic arthropods and mammals. John Wiley & Sons, New York, pp. 505–568.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Rajagopalan, P.K. 1972. Ixodid ticks (Acarina: Ixodidae) parasitizing wild birds in the Kyasanur Forest disease area of Shimoga District, Mysore State, India. J. Bombay Nat. Hist. Soc., 69: 55–78.

Rajagopalan, P.K. & Sreenivasan, M.A. 1981. Ixodid ticks on cattle and buffaloes in the Kyasanur Forest disease area of Karnataka State. Ind. J. Med. Res., 73: 880–889.

Rajagopalan, P.K., Patil, A.P. & Boshell, J. 1968. Ixodid ticks on their mammalian hosts in the Kyasanur Forest disease area of Mysore State, India, 1961–1964. Ind. J. Med. Res., 56: 510–526.

Rao, T.R., Dhanda, V., Bhat, H.R. & Kulkarni, S.M. 1973. A survey of haematophagous arthropods in western Himalayas, Sikkim and Hill Districts of West Bengal. A general account. Ind. J. Med. Res., 61: 1421–1461.

Santos Dias, J.A.T. 1956. Sobre duas entidades do género *Haemaphysalis* C.L. Koch, 1844. Mem. Estud. Mus. Zool. Univ. Coimbra (242), 9 pp.

Seneviratna, P. 1965. The Ixodoidea (ticks) of Ceylon. Parts II and III. Ceylon Vet. J., 13: 28–54.

Trapido, H., Goverdhan, M.K., Rajagopalan, P.K. & Rebello, M.J. 1964a. Ticks ectoparasitic on monkeys in the Kyasanur Forest disease area of Shimoga District, Mysore State, India. Am. J. Trop. Med. Hyg., 13: 763–772.

Trapido, H., Varma, M.G.R., Rajagopalan, P.K., Singh, K.R.P. & Rebello, M.J. 1964b. A guide to the identification of all stages of the *Haemaphysalis* ticks of South India. Bull. Entomol. Res., 55: 249–270.

96 – *H. mjoebergi* Warburton, 1926 (Parasitology, 18: 55–58)

Type depository: BMNH (lectotype) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female

Zoogeographic Region: Oriental

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Artiodactyla: Cervidae.
Artiodactyla: Cervidae, Bovidae (A)

Human infestation: yes

References

Hoogstraal, H. & Wassef, H.Y. 1982. *Haemaphysalis* (*Garnhamphysalis*) *mjoebergi*: identity, structural variation and biosystematic implications, deer hosts, and distribution in Borneo and Sumatra (Ixodoidea: Ixodidae). J. Parasitol., 68: 138–144.

97 – *H. montgomeryi* Nuttall, 1912 (Parasitology, 5: 50–60)

Type depositories: BMNH (lectotype, paralectotypes), ZMB (paralectotype, see below) (Keirans and Hillyard, 2001, *op. cit*. under *H. aciculifer*). Moritz and Fischer, (1981, *op. cit*. under *H. cinnabarina*) refer to the specimen in ZMB as Paratypus, "cotype" [sic].

Known stages: male, female, nymph, larva

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: montane grasslands and shrublands

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Artiodactyla: Bovidae; Rodentia: Muridae (AN)
Artiodactyla: Camelidae, Cervidae; Carnivora: Canidae, Felidae; Perissodactyla: Equidae; Rodentia: Sciuridae; Passeriformes: Corvidae (A)
Carnívora: Herpestidae; Soricomorpha: Soricidae (N)
Carnivora (unknown families); Erinaceomorpha: Erinaceidae; Aves (unknown orders) (N and/or L)
Carnivora: Herpestidae; Galliformes: Phasianidae (tick stages unknown)

Human infestation: yes (Hoogstraal et al. 1966)

Remarks: Camicas et al. (1998) list this species as exclusively Oriental, but Hoogstraal and Kim (1985) and Chen et al. (2010) present data for Palearctic localities. Hoogstraal and Kim (1985) use the term "immatures" without specifying whether larvae, nymphs or both stages were present on hosts. We have found no *bona fide* records for hosts of larval *H. montgomeryi.*

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Gupta, S.K. & Kumar, R. 1994. Ixodid ticks of camel in India and their control measures. Int. J. Anim. Sci., 9: 55–56.

Hoogstraal, H. & Kim, K.C. 1985. Tick and mammal coevolution, with emphasis on *Haemaphysalis*. *In* K.C. Kim (editor), Coevolution of parasitic arthropods and mammals. John Wiley & Sons, New York, pp. 505–568.

Hoogstraal, H., Trapido, H. & Kohls, G.M. 1966. Studies on Southeast Asian *Haemaphysalis* ticks (Ixodoidea, Ixodidae). Speciation in the *H.* (*Kaiseriana*) *obesa* group: *H. semermis* Neumann, *H. obesa* Larrousse, *H. roubaudi* Toumanoff, *H. montgomeryi* Nuttall, and *H. hirsuta* sp. n. J. Parasitol., 52: 169–191.

Kaul, H.N., Shetty, P.S., Ghalsasi, G.R. & Dhanda, V. 1990. Survey of ticks (Acarina: Ixodidae) for Crimean haemorrhagic fever virus activity in Jammu & Kashmir State, India. Ind. J. Med. Res. (A), 91: 5–8.

Mitchell, R.M. & Dick, J.A. 1978. Ectoparasites from Nepal birds. J. Bombay Nat. Hist. Soc., 74: 264–274.

Sharma, B.D. 1993. Medical & veterinary arthropod-disease ecology. Ashish Publishing House, New Delhi, 335 pp.

98 – ***H. moreli*** Camicas, Hoogstraal & El Kammah, 1972 (J. Parasitol., 58: 1185–1196)

Type depositories: USNTC (holotype, paratypes), ORSTOM (paratypes) (Camicas, J.-L., Hoogstraal, H. & El Kammah, K.M. 1972. Notes on African *Haemaphysalis* ticks. VIII. *H.* (*Rhipistoma*) *moreli* sp. n., a carnivore parasite of the *H.* (*R.*) *leachi* group (Ixodoidea: Ixodidae). J. Parasitol., 58: 1185–1196; Keirans & Clifford, 1984, *op. cit.* under *H. bartelsi*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for adult ticks are Carnivora: Viverridae.
Carnivora: Viverridae (ANL)
Mammalia (several orders) (A)
Rodentia: Muridae (N)

Human infestation: no

Remarks: the above host list excludes adults, larvae and nymphs of *H. moreli* found in the nests of Primates: Galagidae by Camicas et al. (1972).

References

Camicas, J.-L., Hoogstraal, H. & El Kammah, K.M. 1972. Notes on African *Haemaphysalis* ticks. VIII. *H.* (*Rhipistoma*) *moreli* sp. n., a carnivore parasite of the *H.* (*R.*) *leachi* group (Ixodoidea: Ixodidae). J. Parasitol., 58: 1185–1196.

Cumming, G.S. 1998. Host preference in African ticks (Acari: Ixodida): a quantitative data set. Bull. Entomol. Res., 88: 379–406.

Morel, P.-C. 1976. Contribution à la connaissance de la distribution des tiques (Acariens, Ixodidae et Amblyommidae) en Afrique éthiopienne continentale. Annexe cartographique. Institut d'Élevage et de Médecine Vétérinaire des Pays Tropicaux, Paris, 326 pp.

99 – *H. moschisuga* Teng 1980 (Acta Zootax. Sin., 5: 144–149. In Chinese)

Type depository: IZAS (holotype, paratypes) (Teng, K.-F. 1980. Two new species of *Haemaphysalis* from China (Acarina: Ixodidae). Acta Zootax. Sin., 5: 144–149. In Chinese, NAMRU-3 translation 1777)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: deserts and xeric shrublands, montane grasslands and shrublands

Hosts: usual hosts for larvae, nymphs and adult ticks are Artiodactyla: Moschidae.
Artiodactyla: Moschidae (ANL)
Artiodactyla: Bovidae; Lagomorpha: Leporidae (A)
Galliformes: Phasianidae (NL)

Human infestation: no

Remarks: Camicas et al. (1998) list this species as exclusively Palearctic, but records from Yunnan Province by Teng and Jiang (1991) and Chen et al. (2010) indicate that *H. moschisuga* is also present in the Oriental Zoogeographic Region. The list of hosts above follows that of Teng (1984), but Teng and Jiang (1991) limit hosts to Artiodactyla: Bovidae and Moschidae. Kolonin (2009) retains the host profile of *H. moschisuga* according to Teng (1984), which we provisionally accept. Mihalca et al. (2011) regard this species as endangered.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

Teng, K.-F. 1984. On the distribution, hosts and immature stages of *Haemaphysalis moschisuga* Teng (Acarina: Ixodidae). Acta Zootax. Sin., 9: 219–221. In Chinese, NAMRU-3 translation 1777.

Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.

100 – *H. muhsamae* Santos Dias, 1954 (Mem. Estad. Mus. Zool. Univ. Coimbra (225), 9 pp). Considerable difficulties attend the morphological identification of this species. Santos Dias, J.A.T. (1954. Mais uma nova espécie de carraça do género *Haemaphysalis* C.L. Koch, 1884, para a fauna de Moçambique. Mem. Estud. Mus. Zool. Univ. Coimbra (225), 9 pp.) described the male, female and nymph of *H. muhsamae* (as *H. muhsami*), but Santos Dias, J.A.T. (1955. Sobre uma pequena colecçao de carraças provenientes de Tete (Moçambique). Moçambique (81): 117–132) corrected himself concerning the female and nymph used in the original description, which were in fact *H. leachi indica* (a synonym of *H. indica*). He then redescribed the female and nymph of *H. muhsamae* from new material collected in Moçambique. Kolonin (2009, *op. cit*. under *H. anomaloceraea*) omits *H. muhsamae* from his list of ixodid ticks of the world but gives no reason for this omission. *Haemaphysalis muhsamae* is treated as provisionally valid here. See remarks below.

Type depository: VLM (holotype, paratype) (Santos Dias, J.A.T. 1962. Tipos entomológicos em colecçao no laboratorio central de patología veterinária de Lourenço Marques. An. Serv. Vet. Moçambique (8): 63–67) as *Haemaphysalis muhsami*

Known stages: male, female, (nymph?)

Zoogeographic Region: Afrotropical

Ecoregions: several Afrotropical ecoregions

Hosts: Aves are considered exceptional hosts for this tick.
Mammalia (several orders); Strigiformes: Strigidae; Passeriformes: Muscicapidae (A)

Human infestation: no

Remarks: the nymph is described in Santos Dias (1955) but not included in Camicas et al. (1998), probably because of the difficulties involved in correctly identifying this stage. Records of *H. muhsamae* adults from Aves are rare. Because it can be quite difficult to determine this species, we have not included the few records of sub-adult ticks. Walker (1991) considers the records of Theiler (1962) of *H. leachii* [sic] *mühsami* [sic] as in fact referring to *H. spinulosa*, and Theiler's records have therefore not been included in the above host list. Keirans and Durden (2001) record the introduction of *H. muhsamae* into the Nearctic Region, but there is no evidence that it has become established there. With the exception of Keirans and Durden (2001), all authors listed below refer to this species as *Haemaphysalis leachi muhsami.*

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Elbl, A. & Anastos, G. 1966. Ixodid ticks (Acarina, Ixodidae) of Central Africa. Vol. IV. Genera *Aponomma* Neumann, 1899, *Boophilus* Curtice, 1891, *Dermacentor* Koch, 1844, *Haemaphysalis* Koch, 1844, *Hyalomma* Koch, 1844 and *Rhipicentor* Nuttall and Warburton, 1908. Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (148), 412 pp.

Hoogstraal, H. 1956. African Ixodoidea. I. Ticks of the Sudan (with special reference to Equatoria Province and with preliminary reviews of the genera *Boophilus*, *Margaropus* and *Hyalomma*). Research Report NM 005 050.29.07, Department of the Navy Bureau of Medicine and Surgery, Washington D.C. 1101 pp.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Santos Dias, J.A.T. 1955. Sobre uma pequena colecçao de carraças provenientes de Tete (Moçambique). Moçambique (81): 117–132

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.

101 – *H. nadchatrami* Hoogstraal, Trapido & Kohls, 1965 (J. Parasitol., 51: 433–451)

Type depositories: USNTC (holotype, paratypes), BMNH, FMNH, HH, IMRKL, MCZ, MNHN, UM, ZMB (paratypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*) as *H. papuana nadchatrami.*

Known stages: male, female, nymph

Zoogeographic Region: Oriental

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: Rodentia: Muridae (ANL)
Artiodactyla: Bovidae, Suidae; Carnivora: Canidae, Felidae, Mustelidae; Perissodactyla: Equidae, Tapiridae (A)
Artiodactyla: Tragulidae (NL)
Carnivora: Viverridae; Rodentia: Sciuridae (N)

Human infestation: yes (Tanskul et al. 1983)

Remarks: hosts for the undescribed larva of *H. nadchatrami* are recorded in Hoogstraal et al. (1972), and we regard these records as provisionally valid. Tanskul et al. (1983) identified adults of *H. nadchatrami* from Muridae. This host family is ignored for imagoes of *H. nadchatrami* in Kolonin (2009) but we consider this record provisionally valid.

References

Hoogstraal, H., Trapido, H. & Kohls, G.M. 1965. Southeast Asian *Haemaphysalis* ticks (Ixodoidea, Ixodidae). *H.* (*Kaiseriana*) *papuana nadchatrami* ssp. n. and redescription of *H.* (*K.*) *semermis* Neumann. J. Parasitol., 51: 433–451.

Hoogstraal, H., Lim, B.L., Nadchatram, M. & Anastos, G. 1972. The Gunong Benom Expedition 1967. 8. Ticks (Ixodidae) of Gunong Benom and their altitudinal distribution, hosts and medical relationships. Bull. Br. Mus. (Nat. Hist.) Zool., 23: 167–186.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Tanskul, P., Stark, H.E. & Inlao, I. 1983. A checklist of ticks of Thailand (Acari: Metastigmata: Ixodoidea). J. Med. Entomol., 20: 330–341.

102 – *H. nepalensis* Hoogstraal, 1962 (J. Parasitol., 48: 195–203)

Type depositories: USNTC (holotype, paratype), HH (paratype) (Hoogstraal, H. 1962. *Haemaphysalis nepalensis* sp. n. from a Himalayan rodent and man, and description of the male of *H. aponommoides* Warburton (n. comb.) (Ixodoidea, Ixodidae). J. Parasitol., 48: 195–203)

Known stages: male, female, nymph

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: montane grasslands and shrublands

Hosts: Artiodactyla: Bovidae (AN)
Carnivora: Felidae, Ursidae; Rodentia (unknown family) (A)

Human infestation: yes (Hoogstraal 1962)

Remarks: Camicas et al. (1998) list this species as exclusively Oriental, but there are also *bona fide* records for the Palearctic Region. Mitchell (1979) lists Carnivora: Ailuridae and Soricomorpha: Soricidae as hosts of *H. nepalensis* without stating which stages of this tick were found on these hosts, and we have therefore tentatively excluded them from our host list. Hoogstraal and Kim (1985) and Kolonin (2009) state that the immature stages of *H. nepalensis* feed on the same hosts as adults, but apart from nymphs found on Bovidae by Dhanda (1964) we were unable to confirm this. Mitchell and Dick (1978) present a record of *H. nepalensis* from Aves (tick stages unknown), but Aves are not included in Hoogstraal and Kim (1985) and are not included in our list above.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Dhanda, V. 1964. *Haemaphysalis nepalensis* Hoogstraal, 1962 (Ixodoidea: Ixodidae), systematic position based on description of the nymph, and new host and locality records. J. Parasitol., 50: 783–785.
Hoogstraal, H. 1962. *Haemaphysalis nepalensis* sp. n. from a Himalayan rodent and man, and description of the male of *H. aponommoides* Warburton (n. comb.) (Ixodoidea, Ixodidae). J. Parasitol., 48: 195–203.
Hoogstraal, H. & Kim, K.C. 1985. Tick and mammal coevolution, with emphasis on *Haemaphysalis. In* K.C. Kim (editor), Coevolution of parasitic arthropods and mammals. John Wiley & Sons, New York, pp. 505–568.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Mitchell, R.M. 1979. A list of ectoparasites from Nepalese mammals, collected during the Nepal ectoparasite program. J. Med. Entomol., 16: 227–233.
Mitchell, R.M. & Dick, J.A. 1978. Ectoparasites from Nepal birds. J. Bombay Nat. Hist. Soc., 74: 264–274.
Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.

103 – *H. nesomys* Hoogstraal, Uilenberg & Klein, 1966 (J. Parasitol., 52: 1199–1202)

Type depository: USNTC (holotype) (Keirans and Clifford, 1984, *op. cit.* under *H. bartelsi*)

Known stages: male

Zoogeographic Region: Afrotropical

Ecoregion: Madagascar subhumid forests

Hosts: Rodentia: Nesomyidae (A)

Human infestation: no

Reference

Uilenberg, G., Hoogstraal, H. & Klein, J.-M. 1979. Les tiques (Ixodoidea) de Madagascar et leur rôle vecteur. Arch. Inst. Pasteur Madagascar Num. Spéc., 153 pp.

104 – *H. norvali* Hoogstraal & Wassef, 1983 (Onderstepoort J. Vet. Res., 50: 183–189)

Type depositories: USNTC (holotype, paratypes), VRLH, OVI, ORSTOM (paratypes) (Hoogstraal, H. & Wassef, H.Y. 1983. Notes on African *Haemaphysalis* ticks. XV. *H.* (*Rhipistoma*) *norvali* sp. n., a hedgehog parasite of the *H.* (*R.*) *spinulosa* group in Zimbabwe (Acarina: Ixodidae). Onderstepoort J. Vet. Res., 50: 183–189)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregion: Southern Africa bushveld

Hosts: Erinaceomorpha: Erinaceidae (A)

Human infestation: no

Remarks: the larva and nymph of *H. norvali* are known only from laboratory-reared specimens (Hoogstraal and Wassef 1983).

Reference

Hoogstraal, H. & Wassef, H.Y. 1983. Notes on African *Haemaphysalis* ticks. XV. *H.* (*Rhipistoma*) *norvali* sp. n., a hedgehog parasite of the *H.* (*R.*) *spinulosa* group in Zimbabwe (Acarina: Ixodidae). Onderstepoort J. Vet. Res., 50: 183–189.

105 – *H. novaeguineae* Hirst, 1914 (Trans. R. Soc. Lond., 20: 325–334)
This name should not be confused with *Haemaphysalis novaguineae* Krijgsman and Ponto, 1932, a synonym of *H. bancrofti* as explained in Roberts (1963, *op. cit.* under *H. bremneri*).

Type depository: BMNH (lectotype, paralectotypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Australasian

Ecoregions: tropical and subtropical moist broadleaf forests; tropical and subtropical grasslands, savannas and shrublands

Hosts: Artiodactyla: Cervidae, Suidae; Peramelemorphia: Peramelidae (ANL)
Diprotodontia: Macropodidae (AN)
Cuculiformes: Cuculidae (AL)
Carnivora: Canidae; Monotremata: Tachyglossidae; Perissodactyla: Equidae; Rodentia: Muridae; Gruiformes: Rallidae (A)
Carnivora: Felidae (N)
Artiodactyla: Bovidae; Chiroptera: Pteropodidae (stage unknown)

Human infestation: yes (Unsworth et al. 2007)

Remarks: Camicas et al. (1998) state that *H. novaeguineae* is found in the Australasian and Oriental Zoogeographic Regions, but we follow Hoogstraal and Kim (1985), who categorized *H. novaeguineae* as an exclusively Australasian species. Although Hoogstraal (1982) found several specimens of *H. novaeguineae* on Aves, these records are ignored by Kolonin (2009).

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.
Hoogstraal, H. 1982. Ticks (Acari: Ixodoidea): a preliminary study. Monogr. Biol., 42: 537–544.

Hoogstraal, H. & Kim, K.C. 1985. Tick and mammal coevolution, with emphasis on *Haemaphysalis. In* K.C. Kim (editor), Coevolution of parasitic arthropods and mammals. John Wiley & Sons, New York, pp. 505–568.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Owen, I.L. 2011. Parasites of animals in Papua New Guinea recorded at the National Veterinary Laboratory: a catalogue, historical review and zoogeographical affiliations. Zootaxa, 3143: 1–163.
Roberts, F.H.S. 1963. A systematic study of the Australian species of the genus *Haemaphysalis* Koch (Acarina: Ixodidae). Aust. J. Zool., 11: 35–80.
Roberts, F.H.S. 1969, The larvae of Australian Ixodidae (Acarina: Ixodoidea). J. Aust. Entomol. Soc., 8: 37–78.
Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.
Unsworth, N.B., Stenos, J., Graves, S.R., Faa, A.G., Cox, G.E., Dyer, J.R., Boutlis, C.S., Lane, A.M., Shaw, M.D., Robson, J. & Nisse, M.D. 2007. Flinders Island spotted fever rickettsioses caused by a "marmionii" strain of *Rickettsia honei*, eastern Australia. Emerg. Inf. Dis., 13: 566–572.

106 – *H. obesa* Larrousse, 1925 (Ann. Parasitol. Hum. Comp., 3: 301–305)

Type depository: IP (lectotype) (Hoogstraal et al. 1966, *op. cit.* under *H. hirsuta*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregions: tropical and subtropical dry broadleaf forests

Hosts: Mammalia (several orders) (A)
Carnivora: Canidae, Mustelidae (N and/or L)

Human infestation: yes (Tanskul et al. 1983)

Remarks: Tanskul et al. (1983) and Hoogstraal and Kim (1985) use the term "immatures" without indicating whether larvae, nymphs or both stages were found on hosts; consequently, the hosts for the larvae and nymphs of *H. obesa* are not known with certainty.

References

Hoogstraal, H. & Kim, K.C. 1985. Tick and mammal coevolution, with emphasis on *Haemaphysalis. In* K.C. Kim (editor), Coevolution of parasitic arthropods and mammals. John Wiley & Sons, New York, pp. 505–568.
Hoogstraal, H., Saito, Y., Dhanda, V. & Bhat, H.R. 1971. *Haemaphysalis* (*H.*) *obesa* Larrousse (Ixodoidea: Ixodidae) from Northeast India and Southeast Asia: description of immature stages and biological observations. J. Parasitol., 57: 177–184.
Tanskul, P., Stark, H.E. & Inlao, I. 1983. A checklist of ticks of Thailand (Acari: Metastigmata: Ixodoidea). J. Med. Entomol., 20: 330–341.

107 – *H. obtusa* Dönitz, 1910 (Denkschr. Med.-Naturw. Ges. Jena, 16: 397–494)
See remarks below.

Type depositories: ZMB, BMNH (syntypes) (Moritz and Fischer 1981, *op. cit*. under *H. cinnabarina*; Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph

Zoogeographic Region: Afrotropical

Ecoregion: Madagascar subhumid forests

Hosts: usual hosts for adult ticks are Carnivora: Eupleridae and Viverridae.
Carnivora: Eupleridae (ANL)
Carnivora: Viverridae (AN)
Canidae (A)
Afrosoricida: Tenrecidae; Rodentia: Muridae, Nesomyidae (NL)

Human infestation: no

Remarks: the larva of *H. obtusa* has not been described. Uilenberg et al. (1979) feel that determinations of nymphs and larvae from Afrosoricida and Muridae, in the absence of adult ticks, should be considered tentative. We too regard these records as only provisionally valid. Furthermore, Uilenberg et al. (1979) state that there are "typical" and "atypical" specimens of *H. obtusa*, thus implying that more than one species may be represented under this name.

Reference

Uilenberg, G., Hoogstraal, H. & Klein, J.-M. 1979. Les tiques (Ixodoidea) de Madagascar et leur rôle vecteur. Arch. Inst. Pasteur Madagascar Num. Spéc., 153 pp.

108 – *H. oliveri* Apanaskevich & Horak, 2008 (J. Parasitol., 94: 594–607)
Some specimens of *H. oliveri* collected before its description were identified as members of the *H. leachi* group, as noted in Apanaskevich and Horak (2008, *op. cit*. under *H. colesbergensis*). Kolonin (2009, *op. cit*. under *H. anomaloceraea*) does not include this species in his list of Ixodidae of the world.

Type depositories: USNTC (holotype, paratypes), OVI, ZIAC (paratypes) (Apanaskevich and Horak 2008, *op. cit*. under *H. colesbergensis*)

Known stages: male, female, larva

Zoogeographic Region: Afrotropical

Ecoregions: Sahelian acacia savanna; east Sudanian savanna

Hosts: usual hosts for adult ticks are Carnivora: Canidae and Felidae.
Carnivora: Canidae, Felidae, Viverridae; Artiodactyla: Bovidae (A)

Human infestation: no

Remarks: the larva of *H. oliveri* is known only from laboratory-reared specimens (Apanaskevich and Horak 2008).

Reference

Apanaskevich, D.A. & Horak, I.G. 2008. Two new species of African *Haemaphysalis* ticks (Acari: Ixodidae), carnivore parasites of the *H.* (*Rhipistoma*) *leachi* group. J. Parasitol., 94: 594–607.

109 – *H. orientalis* Nuttall & Warburton, 1915 (Ticks. A monograph of the Ixodoidea. Part III. The genus *Haemaphysalis*. Cambridge University Press, London, pp. 349–550)
See remarks below.

Type depository: BMNH (lectotype, paralectotypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*), originally named *H. hoodi orientalis*.

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for adult ticks are Hyracoidea: Procaviidae.
Artiodactyla: Bovidae; Hyracoidea: Procaviidae (A)

Human infestation: no

Remarks: Santos Dias (1953) refers to this tick as *Haemaphysalis zambeziae* Santos Dias, 1953, which Hoogstraal (1956) classifies as a synonym of *H. orientalis.* Although Santos Dias later (1962) recognized this synonymy, he continued to maintain his earlier (1953) assertion that Bovidae are hosts of this species, which Hoogstraal (1956) believes to be an error, as inferred from correspondence between Santos Dias and Theiler, (quoted on page 168 of Hoogstraal 1956). Therefore, our acceptance of this host-parasite relationship in the above list is provisional. Kolonin (2009) excludes Bovidae as hosts for *H. orientalis.*

References

Hoogstraal, H. 1956. Notes on African *Haemaphysalis* ticks. III. The hyrax parasites, *H. bequaerti* sp. nov., *H. orientalis* N. and W., 1915 (new combination), and *H. cooleyi* Bedford, 1929 (Ixodoidea, Ixodidae). J. Parasitol., 42: 156–172.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Santos Dias, J.A.T. 1953. Sobre uma nova espécie de carraça do gênero *Haemaphysalis* Koch, 1844, (Acarina; Ixodoidea) para a fauna de Moçambique. Mem. Estud. Mus. Zool. Univ. Coimbra (219), 7 pp.

Santos Dias, J.A.T. 1962. Tipos entomológicos em colecçao no laboratorio central de patología veterinária de Lourenço Marques. An. Serv. Vet. Moçambique (8): 63–67.

110 – *H. ornithophila* Hoogstraal & Kohls, 1959 (J. Parasitol., 45: 417–420)

Type depositories: MCZ (holotype, paratypes), HH, USNTC (paratypes) (Hoogstraal, H. & Kohls, G.M. 1959. The *Haemaphysalis* ticks (Acarina, Ixodidae) of birds. I. *H. ornithophila* n. sp. from Burma and Thailand. J. Parasitol., 45: 417–420)

Known stages: male, female

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: northern triangle subtropical forests; lower Gangetic plains moist deciduous forests

Hosts: Galliformes: Phasianidae (ANL)
Passeriformes: Turdidae (AN)
Passeriformes: Pittidae, Chloropseidae; Carnivora: Mustelidae; Lagomorpha: Leporidae; Artiodactyla: Bovidae (A)

Human infestation: no

Remarks: we have been unable to find descriptions of the larva and nymph of *H. ornithophila*. Wilson (1970), however, discusses several records of these stages from Aves that we consider tentatively valid. Kolonin (1995) states that specimens of *H. ornithophila* found on Chloropseidae are equivalent to *H. bacthaiensis* Phan Trong, 1977. Mitchell (1979) regards Cervidae as hosts of *H. ornithophila*, but this view has not been corroborated in subsequent works (Kim et al. 2009).

References

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Hoogstraal, H. & Kohls, G.M. 1959. The *Haemaphysalis* ticks (Acarina, Ixodidae) of birds. I. *H. ornithophila* n. sp. from Burma and Thailand. J. Parasitol., 45: 417–420.

Hoogstraal, H. & Wassef, H.Y. 1973. The *Haemaphysalis* ticks (Ixodoidea: Ixodidae) of birds. 3.*H.* (*Ornithophysalis*) subgen. n.: definition, species, hosts and distribution in the Oriental, Palearctic, Malagasy, and Ethiopian Faunal Regions. J. Parasitol., 59: 1099–1117.

Kang, J.-G., Kim, H.-C., Choi, C.-Y., Nam, H.-Y., Chae, H.-Y., Chong, S.-T., Klein, T.A., Ko, S. & Chae, J.-S. 2013. Molecular detection of *Anaplasma*, *Bartonella*, and *Borrelia* species in ticks collected from migratory birds from Hong-do Island, Republic of Korea. Vector- Borne Zoon. Dis., 13: 215–225.

Kim, H.C., Ko, S., Choi, C.-Y., Nam, H.-Y., Chae, H.Y., Chong, S.T., Klein, T.A., Sames, W.J., Robbins, R.G. & Chae, J.-S. 2009. Migratory bird tick surveillance, including a new record of *Haemaphysalis ornithophila* Hoogstraal and Kohls 1959 (Acari: Ixodidae) from Hong-do (Hong Island), Republic of Korea. Syst. Appl. Acarol., 14: 3–10.

Kolonin, G.V. 1995. Review of the ixodid tick fauna (Acari: Ixodidae) of Vietnam. J. Med. Entomol., 32: 276–282.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Mitchell, R.M. 1979. A list of ectoparasites from Nepalese mammals, collected during the Nepal ectoparasite program. J. Med. Entomol., 16: 227–233.
Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.
Wilson, N. 1970. New distributional records of ticks from Southeast Asia and the Pacific (Metastigmata: Argasidae, Ixodidae). Oriental Insects, 4: 37–46.
Xu, R. & Li, K. 1997. A collection of ticks from Guizhou, China. Syst. Appl. Acarol., 2: 245–246.

111 – *H. palawanensis* Kohls, 1950 (Natl. Inst. Health Bull. (192), 28 pp)

Type depositories: CNHM (holotype, paratypes), USNTC, PNM (paratypes) (Kohls 1950, *op. cit.* under *H. hoogstraali*)

Known stages: male, female

Zoogeographic Region: Oriental

Ecoregion: Palawan rain forests

Hosts: Carnivora (several families); Rodentia: Hystricidae, Muridae, Sciuridae; Artiodactyla: Suidae, Cervidae (A)

Human infestation: no

Remarks: Kohls (1950) found a female *H. palawanensis* crawling on a human, but we have not included humans in our host list above. Cervids are not listed as hosts of this tick in Kolonin (2009), but there is a valid record for this type of host in Kohls (1950). Durden and Keirans (1996) regard *H. palawanensis* as an endangered species.

References

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.
Kohls, G.M. 1950. Ticks (Ixodoidea) of the Philippines. Natl. Inst. Health Bull. (192), 28 pp.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

112 – *H. papuana* Thorell, 1883 (Ann. Mus. Civ. Stor. Nat. Genova, 18: 21–69)

Type depository: GM (syntypes) (Anastos 1950, *op. cit.* under *H. hylobatis*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Australasian, Oriental

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Artiodactyla: Suidae. Aves are considered exceptional hosts for this tick.
Artiodactyla: Suidae; Carnivora: Canidae (AN)
Carnivora: Ursidae (AL)
Rodentia: Muridae (A, N and/or L)
Artiodactyla: Cervidae, Moschidae; Carnivora: Felidae, Mustelidae, Viverridae; Rodentia: Hystricidae; Galliformes: Phasianidae (A)
Passeriformes: Muscicapidae (stage unknown)

Human infestation: yes (Tanskul et al. 1983)

Remarks: Camicas et al. (1998) list the larva of *H. papuana* as undescribed, but it was earlier described in Kadarsan (1971). Reports of this species published prior to Trapido et al. (1964), who refer to it as *H. papuana papuana*, have not been included in our analyses because of diagnostic uncertainties. Tanskul et al. (1983) use the term "immatures" without specifying whether they found larvae, nymphs or both stages on hosts. Yamaguti et al. (1971) state that reports of this tick from Korea, which lies within the Palearctic Region, are erroneous. According to Keirans (1985), a larva of *H. papuana* from Ursidae should be considered tentative, and we have therefore provisionally included it in our host list above. Kolonin (2009) excludes Muridae as hosts for this tick, but we accept records from these hosts in Tanskul et al. (1983) and also an odd record from Aves in Gould et al. (1970).

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Durden, L.A., Merker, S. & Beati, L. 2008. The tick fauna of Sulawesi, Indonesia (Acari: Ixodoidea: Argasidae and Ixodidae). Exp. App. Acarol., 45: 85–110.

Gould, D.J., Clifford, C.M., Lakshana, P., Emerson, K.C., Hoogstraal, H., Marshall. J.T., Stark, H.E., Nadchatram, M., Davis, E.W., Inlao, I., Maneechai, N., Klaimanee, N. & Punthusiri, P. 1970. Distribution and ecology of ectoparasites of vertebrates in Southeast Asia. Annual Program Report SEATO Medical Research Laboratory, April 1969-March 1970, United States Army Medical Component, Bangkok, Thailand, pp, 97–105.

Hoogstraal, H. 1982. Ticks (Acari: Ixodoidea): a preliminary study. Monogr. Biol., 42: 537–544.

Kadarsan, S. 1971. Larval ixodid ticks of Indonesia (Acarina: Ixodidae). Ph.D. Dissertation, University of Maryland, 182 pp.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Phan Trong, C. 1977. Ve bet va con trung ky sinh o Viet Nam. Tap 1. Ve (Ixodoidea), mo ta va phan loai. Ha Noi: Khoa hoc va ky thuat, 489 pp. In Vietnamese.

Tanskul, P., Stark, H.E. & Inlao, I. 1983. A checklist of ticks of Thailand (Acari: Metastigmata: Ixodoidea). J. Med. Entomol., 20: 330–341.
Trapido, H., Hoogstraal, H. & Varma, M.G.R. 1964. Status and descriptions of *Haemaphysalis p. papuana* Thorell (n. comb.) and of *H. papuana kinneari* Warburton (n. comb.) (Ixodoidea, Ixodidae) of southern Asia and New Guinea. J. Parasitol., 50: 172–188.
Yamaguti, N., Tipton, V.J., Keegan, H.L. & Toshioka, S. 1971. Ticks of Japan, Korea, and the Ryukyu Islands. Brigham Young Univ. Sci. Bull. Biol. Ser., 15 (1), 226 pp.

113 – *H. paraleachi* Camicas, Hoogstraal & El Kammah, 1983 (J. Parasitol., 69: 400–404)
See remarks below

Type depositories: USNTC (holotype, paratypes), ORSTOM, CM (paratypes) (Camicas, J.-L., Hoogstraal, H. & El Kammah, K.M. 1983. Notes on African *Haemaphysalis* ticks. XIV. Description of adults of *H.* (*Rhipistoma*) *paraleachi* sp. n., a carnivore parasite of the *H.* (*R.*) *leachi* group (Ixodoidea: Ixodidae). J. Parasitol., 69: 400–404)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregions: several Afrotropical ecoregions

Hosts: usual hosts for adult ticks are Carnivora: Canidae, Felidae and Viverridae.
Rodentia: Muridae (AN)
Carnivora (several families); Artiodactyla: Bovidae; Primates: Cercopithecidae (A)

Human infestation: yes (El Kammah et al. 1992)

Remarks: Kolonin (2009) does not list hosts for nymphs of this tick, probably because the nymph has not been described, but we provisionally accept the records of this stage in Cornet (1995). Prior to its description, *H. paraleachi* was confused with *H. leachi* by several authors (Camicas et al. 1983).

References

Camicas, J.-L., Hoogstraal, H. & El Kammah, K.M. 1983. Notes on African *Haemaphysalis* ticks. XIV. Description of adults of *H.* (*Rhipistoma*) *paraleachi* sp. n., a carnivore parasite of the *H.* (*R.*) *leachi* group (Ixodoidea: Ixodidae). J. Parasitol., 69: 400–404
Cornet, J.-P. 1995. Contribution à l'étude des tiques (Acarina: Ixodina) de la République Centrafricaine 4. Inventaire et répartition. Acarologia, 36: 203–212.
El Kammah, K.M., Hoogstraal, H. & Camicas, J.-L. 1992. Notes on African ticks: XI. *H.* (*Rhipistoma*) *paraleachi* (Ixodoidea: Ixodidae) distribution and hosts of adults. Int. J. Acarol., 18: 205–212.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

114 – *H. paraturturis* Hoogstraal, Trapido & Rebello, 1963 (J. Parasitol., 49: 686–691)

Type depositories: USNTC (holotype, paratypes), BMNH, VRC, IM (paratypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*). This species was originally identified as *H. bispinosa intermedia* Warburton & Nuttall, 1909, a synonym of *H. intermedia*, by Nuttall and Warburton (1915, *op. cit.* under *H. celebensis*), as noted in Hoogstraal. H., Trapido, H. & Rebello, M.J. (1963. *Haemaphysalis paraturturis* sp. n., a carnivore parasite of the *H. turturis* group in India (Ixodoidea, Ixodidae). J. Parasitol., 49: 686–691).

Known stages: male, female, nymph

Zoogeographic Region: Oriental

Ecoregion: lower Gangetic Plains moist deciduous forests

Hosts: Carnivora: Canidae, Felidae, Ursidae; Artiodactyla: Bovidae, Suidae (A)
Cuculiformes: Cuculidae (N)
Rodentia: Muridae, Sciuridae; Soricomorpha: Soricidae; Passeriformes: Timaliidae (N and/or L)

Human infestation: no

Remarks: Kolonin (2009) does not list Rodentia, Soricomorpha and Passeriformes as hosts for this tick, but we provisionally accept records from these hosts reported by Geevarghese and Dhanda (1995), who do not specify whether their collections contained larvae, nymphs or both stages.

References

Geevarghese, G. & Dhanda, V. 1995. Ixodid ticks of Maharashtra State, India. Acarologia, 36: 309–313.
Hoogstraal. H., Trapido, H. & Rebello, M.J. 1963. *Haemaphysalis paraturturis* sp. n., a carnivore parasite of the *H. turturis* group in India (Ixodoidea, Ixodidae). J. Parasitol., 49: 686–691.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

115 – *H. parmata* Neumann, 1905 (Arch. Parasitol., 9: 225–241)

Type depository: BMNH (syntypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical moist broadleaf forests; few ticks in tropical and subtropical grasslands, savannas and shrublands; montane grassland and shrublands

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae. We consider Squamata exceptional hosts for this tick, while Aves are considered exceptional hosts for adult ticks.
Mammalia (several orders); Galliformes: Phasianidae, Numididae (ANL)
Squamata: Elapidae (A)
Passeriformes: Strildidae (N)
Passeriformes: Viduidae; Squamata: Atractaspididae (L)
Ciconiiformes: Bucorvidae (N and/or L)

Human infestation: yes (Cornet 1995)

Remarks: Theiler (1962) uses the term "immatures" without specifying whether larvae, nymphs or both preimaginal stages of *H. parmata* were found on hosts. Infestations of adult ticks on Aves and any stage of development on Squamata appear to be infrequent events and have been ignored in Kolonin (2009). We, however, consider the occasional records from these hosts in Keirans (1985) and Morel (2003), among others, provisionally valid.

References

Aeschlimann, A. 1967. Biologie et écologie des tiques (Ixodoidea) de Côte d'Ivoire. Acta Trop., 24: 281–405.

Cornet, J.-P. 1995. Contribution à l'étude des tiques (Acarina: Ixodina) de la République Centrafricaine 4. Inventaire et répartition. Acarologia, 36: 203–212.

Elbl, A. & Anastos, G. 1966. Ixodid ticks (Acarina, Ixodidae) of Central Africa. Vol. IV. Genera *Aponomma* Neumann, 1899, *Boophilus* Curtice, 1891, *Dermacentor* Koch, 1844, *Haemaphysalis* Koch, 1844, *Hyalomma* Koch, 1844 and *Rhipicentor* Nuttall and Warburton, 1908. Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (148), 412 pp.

Horak, I.G., Boomker, J. & Flamand, J.R.B. 1991. Ixodid ticks and lice infesting red duikers and bushpigs in north-eastern Natal. Onderstepoort J. Vet. Res., 58: 281–284.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

Walker, J.B. 1974. The ixodid ticks of Kenya. A review of present knowledge of their hosts and distribution. Commonwealth Institute of Entomology, London, 220 pp.

Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.

116 – *H. parva* (Neumann, 1897) (Mém. Soc. Zool. Fr., 10: 324–420)
This species was originally designated as *Dermacentor parvus*, but Morel, P.-C. (1963. Sur quelques *Haemaphysalis* paléarctiques (Acariens, Ixodoidea). Ann. Parasitol. Hum. Comp., 38: 915–924) recognized that it was in fact a member of the genus *Haemaphysalis* and identical to *H. otophila* Schulze, 1919. Therefore, *D. parvus* and *H. otophila schulzei* Tonelli-Rondelli, 1926 are synonyms of *H. parva.* Neumann, L.G. (1908. Notes sur les ixodidés. VI. Arch. Parasitol., 12: 5–27) described *H. parva* from Ceylon (Sri Lanka); however, the name was preoccupied and the correct name for the species described by Neumann (1908) is *H. intermedia* Warburton & Nuttall, 1909, as stated in Trapido, H. & Hoogstraal, H. (1963. Status of *Haemaphysalis bispinosa* var. *intermedia* Warburton & Nuttall, 1909, next available name for *H. parva* Neumann, 1908 (preoccupied) (Ixodoidea, Ixodidae). J. Parasitol., 49: 691–692). See also remarks below.

Type depository: MNHN (holotype) (Neumann, 1897, *op. cit*. under *H. flava*) as *Dermacentor parvus*

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: mediterranean forests, woodlands and scrub

Hosts: Testudines are considered exceptional hosts for this tick, while Aves are considered exceptional hosts for adult ticks.
Rodentia: Sciuridae; Lagomorpha: Leporidae (AN)
Erinaceomorpha: Erinaceidae (AL)
Artiodactyla: Bovidae; Carnivora: Mustelidae; Falconiformes: Falconidae; Passeriformes: Sturnidae (A, N and/or L)
Several orders (Mammalia) (A)
Galliformes: Phasianidae (AL)
Rodentia: Cricetidae, Spalacidae; Charadriiformes: Scolopacidae; Squamata: Lacertidae (NL)
Rodentia: Dipodidae, Muridae; Falconiformes: Accipitridae; Gruiformes: Gruidae; Squamata: Colubridae (N)
Passeriformes: Muscicapidae (L)
Charadriiformes: Burhinidae, Charadriidae; Passeriformes (several families); Piciformes: Picidae (N and/or L)
Lagomorpha: Ochotonidae; Rodentia: Gliridae, Calomyscidae; Squamata: Viperidae; Testudines: Testudinidae (stages unknown)

Human infestation: yes (Bursali et al. 2012)

Remarks: Camicas et al. (1998) state that the larva of *H. parva* is undescribed, but there is a description in Filippova (1997). Ter-Vartanov et al. (1954), Hoogstraal (1959), Feider (1964), Theodor and Costa (1967) and Yeruham et al. (1996) refer to this species as *H. otophila*, while Inci et al. (2003) use the names of *H. otophila* and

H. parva simultaneously for ticks parasitizing Bovidae. Hoogstraal and Kim (1985) use the term "immatures" without specifying larvae, nymphs or both, while Morel (2003) presents information on larvae and nymphs of *H. parva*, but it is difficult to infer their hosts from his data. Faizi et al. (2011) recorded infestations of Squamata: Scincidae with adults, nymphs and larvae of *H. parva*, but we believe that these records need confirmation and we have not included them in our host list above. Kolonin (2009) records only Mammalia as hosts for this tick.

References

Aksn, N. & Aksn, N.E. 2002. The prevalence of ectoparasites on wild rabbits in Elazg Region, Turkey. Turk. Parazitol. Derg., 26: 67–70. In Turkish.

Bursali, A., Keskin, A. & Tekin, S. 2012. A review of the ticks (Acari: Ixodida) of Turkey: species diversity, hosts and geographical distribution. Exp. Appl. Acarol., 57: 91–104.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Faizi, H., Rastegar-Pouyani, N. & Yarani, R. 2011. On the occurrence of ectoparasite ticks on *Trachylepis* and *Eumeces* (Reptilia: Scincidae) in Iran. Amphib. Reptile Conserv., 5: 7–10.

Fedorov, V.G. 1972. Ticks of the superfamily Ixodoidea of birds and their nests in western Siberia. *In* A. Cherepanov & L.A. Mater (editors), Transcontinental associations of migratory birds and their role in distribution of arboviruses. 5. Simp. Isuch. Roli Pereletn. Ptits Rasp. Arbovirus, Novosibirsk, Jul. 1969, pp. 384–388. In Russian, NAMRU-3 translation 1494.

Feider, Z. 1964. Les connaissances actuelles sur les Acariens de Roumanie (Ixodides, Gamasides et Trombiculides). Acarologia (Fasc. Hors Sér.): 262–274.

Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian.

Hoogstraal, H. 1959. Biological observations on certain Turkish *Haemaphysalis* ticks (Ixodoidea, Ixodidae). J. Parasitol., 45: 227–232.

Hoogstraal, H. & Kim, K.C. 1985. Tick and mammal coevolution, with emphasis on *Haemaphysalis*. *In* K.C. Kim (editor), Coevolution of parasitic arthropods and mammals. John Wiley & Sons, New York, pp. 505–568.

Inci, A., Nalbantoğlu, S., Çam, Y., Atasever, A., Karaer, Z., Çakmak, A., Sayin, F., Yukari, B.A., Iça, A. & Deniz, A. 2003. Theileriosis and tick infestations in sheep and goats around Kayseri. Turk J. Vet. Anim. Sci., 27: 57–60. In Turkish.

Keysary, A., Eremeeva, M.E., Leitner, M., Din, A.B., Wikswo, M.E., Mumcuoglu, K.Y., Inbar, M., Wallach, A.D., Shanas, U., King, R. & Waner, T. 2011. Spotted fever group rickettsiae collected from wild animals in Israel. Am. J. Trop. Med. Hyg., 85: 919–923.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Ter-Vartanov, V.H., Gusev, V.H., Bakeev, N.N., Labunets, N.F., Guseva, A.A. & Reznik, P.A. 1954. On the question of transmission of mammalian ectoparasites by birds. Zool. Zh., 33: 1116–1125. In Russian, NAMRU-3 translation 52.
Theodor, O. & Costa, M. 1967. A survey of the parasites of wild mammals and birds in Israel. Part one. Ectoparasites. The Israel Academy of Science and Humanities, Jerusalem, 119 pp.
Yeruham, I., Hadani, A., Galker, F. & Rosen, S. 1996. The seasonal occurrence of ticks (Acari: Ixodidae) on sheep and in the field in the Judean area of Israel. Exp. Appl. Acarol., 20: 47–56.

117 – *H. pavlovskyi* Pospelova-Shtrom, 1935 (Trudy Tadzhik. Bazy Akad. Nauk SSSR (5): 205–217. In Russian)
Camicas et al. (1998, *op. cit.* under *H. anomaloceraea*) and Kolonin (2009, *op. cit*. under *H. anomaloceraea*) consider this species a synonym of *H. doenitzi*. Guglielmone et al. (2009, *op. cit*. under *H. colasbelcouri*) discussed the status of this species, concluding that it is valid, and we concur. See also *H. phasiana.*

Type depository: ZIAC (holotype, paratypes) (Filippova 2008, *op. cit*. under *H. caucasica*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: desert and xeric shrublands

Hosts: Galliformes: Phasianidae; Lagomorpha: Leporidae (ANL)
Passeriformes: Sylviidae (L)

Human infestation: no

Remarks: see *H. doenitzi.*

References

Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian.
Hoogstraal, H., Kaiser, M.N., Traylor, M.A., Guindy, E. & Gaber, S. 1963. Ticks (Ixodidae) on birds migrating from Europe and Asia to Africa, 1959–61. Bull. World Health. Org., 28: 236–262.

118 – *H. pedetes* Hoogstraal, 1972 (J. Parasitol., 58: 979–983)

Type depository: BMNH (holotype, paratype) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*), originally identified as *H. cooleyi*. See also *H. cooleyi.*

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for adult ticks are Rodentia: Pedetidae.
Rodentia: Pedetidae (ANL)
Carnivora: Felidae, Mustelidae, Viverridae (A)

Human infestation: no

Remarks: we were unable to find descriptions of the larva and nymph of *H. pedetes*, but we tentatively accept records of nymphs and larvae on Pedetidae (Anderson and Kok 2003), although these have not been included in Kolonin (2009). Cumming (1998) lists Rodentia: Pedetidae as the only hosts for this tick, but Hoogstraal and Kim (1985) record parasitism of Carnivora. See also *H. cooleyi.*

References

Anderson, P.C. & Kok, O.B. 2003. Ectoparasites of springhares in the Northern Cape Province, South Africa. S. Afr. J. Wildl. Res., 33: 23–32.
Cumming, G.S. 1998. Host preference in African ticks (Acari: Ixodida): a quantitative data set. Bull. Entomol. Res., 88: 379–406.
Hoogstraal, H. & Kim, K.C. 1985. Tick and mammal coevolution, with emphasis on *Haemaphysalis. In* K.C. Kim (editor), Coevolution of parasitic arthropods and mammals. John Wiley & Sons, New York, pp. 505–568.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.

119 – *H. pentalagi* Pospelova-Shtrom, 1935 (Trudy Tadzhik. Bazy Akad. Nauk SSSR (5): 205–217. In Russian)

Type depository: ZIAC (holotype) (Filippova 2008, *op. cit*. under *H. caucasica*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregion: Nansei Islands subtropical evergreen forests

Hosts: Lagomorpha: Leporidae (ANL)

Human infestation: no

Remarks: Camicas et al. (1998) state that this tick is found in the Oriental and Palearctic Zoogeographic Regions, but we found no *bona fide* records of *H. pentalagi* from the Palearctic. Mihalca et al. (2011) regard this species as endangered.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.
Hoogstraal, H. & Kim, K.C. 1985. Tick and mammal coevolution, with emphasis on *Haemaphysalis. In* K.C. Kim (editor), Coevolution of parasitic arthropods and mammals. John Wiley & Sons, New York, pp. 505–568.

Kitaoka, S. & Suzuki, H. 1974. Reports of medico-zoology investigations in the Nansei Islands. Part 2. Ticks and their seasonal prevalences in southern Amami-oshima. Jap. J. Sanit. Zool., 26: 21–26. In Japanese.
Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

120 – *H. petrogalis* Roberts, 1970 (Australian ticks. CSIRO, Melbourne, 267 pp)

Type depositories: QM (holotype, paratypes), ANIC, AM, USNTC (paratypes) (Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.; Halliday, B. personal communication to Guglielmone, A.A.)

Known stages: male, female

Zoogeographic Region: Australasian

Ecoregion: Queensland tropical rain forests

Hosts: Diprotodontia: Macropodidae (A)

Human infestation: no

Reference

Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.

121 – *H. phasiana* Saito, Hoogstraal & Wassef, 1974 (J. Parasitol., 60: 198–208)
Kolonin (2009, *op. cit*. under *H. anomaloceraea*) treats *H. phasiana*, as well as *H. pavlovskyi*, as synonyms of *H. doenitzi.* This decision was based on morphological differences ascribed to colonization of the periphery of the geographic range of *H. doenitzi*. We follow Guglielmone et al. (2010, *op. cit.* under *H. anomaloceraea*), maintaining that more convincing evidence is needed to conclude that *H. phasiana* and *H. pavlovskyi* are synonyms of *H. doenitzi.* See also *H. doenitzi* and remarks below.

Type depositories: USNTC (holotype, paratypes), CS (paratypes) (Saito, Y., Hoogstraal, H. & Wassef, H.Y. 1974. The *Haemaphysalis* ticks (Ixodoidea: Ixodidae) of birds. 4. *H.* (*Ornithophysalis*) *phasiana* sp. n. from Japan. J. Parasitol., 60: 198–208)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: temperate broadleaf and mixed forests

Hosts: Galliformes: Phasianidae (ANL)
Passeriformes: Emberizidae; Artiodactyla: Cervidae (AN)
Passeriformes: Muscicapidae; Lagomorpha: Leporidae (A)
Gruiformes: Turnicidae; Passeriformes: Sylviidae (N)
Passeriformes: Emberizidae (stage unknown)

Human infestation: no

Remarks: Sames et al. (2008) believe that more than one taxon is represented under the name *H. phasiana.* Hoogstraal and Kim (1985) state that *H. phasiana* is an exclusive parasite of Aves; however, there are about 20 records for this species (Sames et al. 2008), and three of them refer to ticks found on mammals. We therefore conclude that more information is needed to determine whether *H. phasiana* is indeed an exclusive parasite of Aves and whether records from Mammalia are exceptional. See also *H. doenitzi.*

References

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian.

Hoogstraal, H. & Kim, K.C. 1985. Tick and mammal coevolution, with emphasis on *Haemaphysalis. In* K.C. Kim (editor), Coevolution of parasitic arthropods and mammals. John Wiley & Sons, New York, pp. 505–568.

Sames, W.J., Kim, H.C., Chong, S.T., Lee, I.Y., Apanaskevich, D.A., Robbins, R.G., Bast. J., Moore, R. & Klein, T.A. 2008. *Haemaphysalis* (*Ornithophysalis*) *phasiana* (Acari: Ixodidae) in the Republic of Korea: two province records and habitat descriptions. Syst. Appl. Acarol., 13: 43–50.

Yamauchi, T. 2001. A bibliographical survey of host-parasite relationships between birds and ticks from Japan. Bull. Hoshizaki Green Found., 5: 271–308. In Japanese.

122 – *H. pospelovashtromae* Hoogstraal, 1966 (J. Parasitol., 52: 787–800)
See *H. danieli.*

Type depositories: USNTC (holotype, paratypes), ZMB (paratype) (Moritz and Fischer 1981, *op. cit*. under *H. cinnabarina*; Keirans and Clifford 1984, *op. cit.* under *H. bartelsi*). One paratype was previously determined as *H. warburtoni* by Hoogstraal, H. (1966. *Haemaphysalis* (*Allophysalis*) *pospelovashtromae* sp. n. from USSR and redescription of the type material of *H.* (*A.*) *warburtoni* Nuttall from China (Ixodoidea, Ixodidae). J. Parasitol., 52: 787–800). See "remarks on some invalid names" for a new synonym of *H. pospelovashtromae.*

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: desert and xeric shrublands

Hosts: Artiodactyla: Bovidae, Suidae; Rodentia: Sciuridae (A)

Mammalia (several orders); Passeriformes: Sittidae (NL)

Human infestation: no

Remarks: see *H. warburtoni.*

Reference

Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian.

123 – *H. primitiva* Teng, 1982 (Acta Zootax. Sin., 7: 46–48. In Chinese)

Type depository: IZAS probable (holotype) (Teng, K.-F. 1982. On the subgenus *Alloceraea* of genus *Haemaphysalis* from China, with description of a new species (Ixodoidea: Ixodidae). Acta Zootax. Sin., 7: 46–48. In Chinese, translation RR1 by Robbins, F.-M.Y.; Keirans and Robbins 1999, *op. cit.* under *H. demidovae*)

Known stages: male, female

Zoogeographic Region: Oriental

Ecoregions: temperate broadleaf and mixed forests

Hosts: unknown

Human infestation: no

References

Keirans, J.E. & Robbins, R.G. 1999. A world checklist of genera, subgenera, and species of ticks (Acari: Ixodida) published from 1973 to 1997. J. Vector Ecol., 24: 115–129.

Teng, K.-F. 1982. On the subgenus *Alloceraea* of genus *Haemaphysalis* from China, with description of a new species (Ixodoidea: Ixodidae). Acta Zootax. Sin., 7: 46–48. In Chinese, translation RR1 by Robbins, F.-M.Y.

124 – *H. psalistos* Hoogstral, Kohls & Parrish, 1967 (J. Parasitol., 53: 1096–1102)

Type depositories: USNTC (holotype, paratypes), BMNH, BM, FMNH, HH (paratypes) (Keirans and Hillyard, 2001, *op. cit.* under *H. aciculifer*)

Known stages: male, female, nymph

Zoogeographic Regions: Australasian, Oriental

Ecoregions: Luzon tropical pine forests; Sulawesi montane rain forests

Hosts: Artiodactyla: Cervidae (AN)
Artiodactyla: Bovidae, Suidae (A)
Rodentia: Muridae (NL)

Human infestation: no

Remarks: Camicas et al. (1998) and Kolonin (2009) state that this species is exclusively Oriental, but the records of Durden et al. (2008) for Sulawesi Island belong to the Australasian Region. Kolonin (2009) does not consider Bovidae hosts for *H. psalistos*, but *bona fide* records of this relationship are reported in Durden et al. (2008). The latter authors treat their record of the undescribed larva of this tick on Muridae

as tentative, and we have therefore provisionally included murids in our host list for *H. psalistos.* Mihalca et al. (2011) regard this species as endangered.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Durden, L.A., Merker, S. & Beati, L. 2008. The tick fauna of Sulawesi, Indonesia (Acari: Ixodoidea: Argasidae and Ixodidae). Exp. App. Acarol., 45: 85–110.

Hoogstraal, H., Kohls, G.M. & Parrish, D.W. 1967. Studies on Southeast Asian *Haemaphysalis* ticks (Ixodoidea, Ixodidae). *H.* (*Kaiseriana*) *psalistos* sp. n., a parasite of deer and boars in Luzon, Philippines. J. Parasitol., 53: 1096–1102.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

125 – *H. punctaleachi* Camicas, Hoogstraal & El Kammah, 1973 (J. Parasitol., 59: 563–568)

Guglielmone et al. (2010, *op. cit.* under *H. anomalocerae*) erroneously cite the year of description as 1983.

Type depositories: USNTC (holotype, paratype), ORSTOM (paratypes) (Camicas, J.-L., Hoogstraal, H. & El Kammah, K.M. 1973. Notes on African *Haemaphysalis* ticks. XI. *H.* (*Rhipistoma*) *punctaleachi* sp. n., a parasite of West African forest carnivores (Ixodoidea: Ixodidae). J. Parasitol., 59: 563–568)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregions: central Congolian lowland forests; Guinean lowland forests

Hosts: usual hosts for adult ticks are Carnivora: Viverridae.
Artiodactyla: Bovidae; Carnivora (several families); Rodentia: Hystricidae (A)

Human infestation: no

Remarks: Kolonin (2009) ignores Bovidae as hosts of *H. punctaleachi*, but there is a valid record for this type of host in Camicas et al. (1973).

References

Camicas, J.-L., Hoogstraal, H. & El Kammah, K.M. 1973. Notes on African *Haemaphysalis* ticks. XI. *H.* (*Rhipistoma*) *punctaleachi* sp. n., a parasite of West African forest carnivores (Ixodoidea: Ixodidae). J. Parasitol., 59: 563–568.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Pourrut, X., Emane, K.A., Camicas, J.-L., Leroy, E. & González, J.-P. 2011. Contribution to the knowledge of ticks (Acarina: Ixodidae) in Gabon. Acarologia, 51: 465–471.

126 – *H. punctata* Canestrini & Fanzago, 1878 (Atti R. Ist. Veneto Sci Lett. Arti (1877–1878), Ser. 5, 4: 69–208)

Type depositories: the types are probably lost (Nuttall and Warburton 1915, *op. cit.* under *H. celebensis*). These authors designate this species as *Haemaphysalis cinnabarina punctata.*

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: several Palearctic ecoregions

Hosts: Testudines and Squamata: Viperidae are considered exceptional hosts for this tick.
Mammalia (several orders); Aves (several orders) (ANL)
Squamata: Anguidae, Lacertidae (NL)
Squamata: Viperidae; Testudines: Testudinidae (stages unknown)

Human infestation: yes (Burridge 2011)

Remarks: there are records of introductions of *H. punctata* into the Nearctic Region but no evidence that it has become established there (Burridge 2011). Ekanem et al. (2012) reported a natural population of *H. punctata* in the Afrotropical Region, but this is regarded as an error in identification. Kolonin (2009) ignores hosts other than mammals and birds, but, although rare, there are several valid records of *H. punctata* on Squamata and Testudines in the references listed below. See also *H. cinnabarina.*

References

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Ekanem, M.S., Opara, K.N., Bennie, D.P. & Udo, I.O. 2012. Ectoparasites [sic] of goats in Etinan, Akwa Ibom State, Nigeria. J. Agric. Biol. Sci., 2: 108–113.

Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian.

Garben, A.F.M., Vos, H. & Von Bronswijk, J.E.M.H. 1981. *Haemaphysalis punctata* Canestrini & Fanzago 1877 [sic], a tick of pastured seadunes on the island of Texel (The Netherlands). Acarologia, 23: 19–25.

Grebenyuk, R.V. 1966. Ixodid ticks (Parasitiformes, Ixodidae) of Kirgizia. Akademii Nauk Kirgizkoy SSR, Instituta Biologii, Frunze, 328 pp. In Russian.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Neumann, L.G. 1901. Révision de la famille des ixodidés (4ª mémorie). Mém. Soc. Zool. Fr., 14: 249–372.

Nosek, J. 1971. The ecology, bionomics, and behaviour of *Haemaphysalis* (*Aboimisalis*) *punctata* tick in central Europe. Z. Parasitenkd., 37: 198–210.

Sartbayev, S.K. 1959. Materials on the biology of certain ticks of the genus *Haemaphysalis* in Kirgizia SSR. Trud. Inst. Zool. Parasitol. Akad. Nauk Kirgiz SSR (7): 191–202. In Russian, NAMRU-3 translation 201.

Ter-Vartanov, V.H., Gusev, V.H., Bakeev, N.N., Labunets, N.F., Guseva, A.A. & Reznik, P.A. 1954. On the question of transmission of mammalian ectoparasites by birds. Zool. Zh., 33: 1116–1125. In Russian, NAMRU-3 translation 52.

127 – *H. quadriaculeata* Kolonin, 1992 (*In* V.E. Sokolov (editor), Zoological Researches in Vietnam. Nauka, Moscow, pp. 242–277. In Russian)

Type depository: ZIAC (holotype, paratype) (Filippova 2008, *op. cit*. under *H. caucasica*)

Known stages: male, female

Zoogeographic Region: Oriental

Ecoregion: south China-Vietnam subtropical evergreen forests

Hosts: Carnivora: Canidae, Mustelidae; Rodentia: Spalacidae (A)

Human infestation: no

Remarks: Kolonin (2003) states that the supposed illustration of the male of *H. darjeeling* in Tanskul and Inlao (1989) is closer to *H. quadriaculeata* than to *H. darjeeling.* See also *H. darjeeling.*

References

Kolonin, G.V. 2003. New data on ixodid tick fauna of Vietnam. Entomol. Rev., 83 (Suppl. 2): S190-S192.

Tanskul, P. & Inlao, I. 1989. Keys to the adult ticks of *Haemaphysalis* Koch, 1844, in Thailand with notes on changes in taxonomy (Acari: Ixodoidea: Ixodidae). J. Med. Entomol., 26: 573–601.

128 – *H. quinghaiensis* Teng, 1980 (Acta Zootax. Sin., 5: 144–149. In Chinese)
This name is written as *H. qinghaiensis* in the original description, but Camicas et al. (1998, *op. cit.* under *H. anomaloceraea*) note that the correct Latin spelling is *H. quinghaiensis* and we agree.

Type depository: IZAS (Keirans and Robbins 1999, *op. cit*. under *H. demidovae*) as *Haemaphysalis qinghaiensis*.

Known stages: male, female, nymph, larva

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: temperate broadleaf and mixed forests

Hosts: Artiodactyla: Bovidae; Perissodactyla: Equidae; Lagomorpha: Leporidae (ANL)

Human infestation: yes

Remarks: Camicas et al. (1998) state that *H. quinghaiensis* is found exclusively in the Oriental Region; however, most records in Teng and Jiang (1991) are from Palearctic localities. Camicas et al. (1998) regard ungulates as the only significant hosts for this tick species, but Teng and Cui (1984) stress the importance of Leporidae as hosts for *H. quinghaiensis*.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Teng, K.-F. & Cui, Y.-Q. 1984. Biological observations and descriptions of immature stages of *Haemaphysalis qinghaiensis* Teng. Acta Entomol. Sin., 27: 330–333. In Chinese, NAMRU-3 translation 1778.

Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.

129 – *H. ramachandrai* Dhanda, Hoogstraal & Bhat, 1970 (J. Parasitol., 56: 823–831)

Type depositories: VRC (holotype, paratypes), BMNH, IM, HH, USNTC, ZIAC (paratypes) (Keirans and Hillyard 2001, *op. cit.* under *H. aciculifer*; Filippova 2008, *op. cit*. under *H. caucasica*).

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregion: Upper Gangetic plains moist deciduous forests

Hosts: Artiodactyla: Cervidae; Carnivora: Felidae (ANL)
Artiodactyla: Bovidae (A)

Human infestation: yes (Dhanda et al. 1970)

Reference

Dhanda, V., Hoogstraal, H. & Bhat, H.R. 1970. *Haemaphysalis* (*Kaiseriana*) *ramachandrai* sp.n. (Ixodoidea, Ixodidae), a parasite of man and domestic and wild mammals in northern India and Nepal. J. Parasitol., 56: 823–831.

130 – *H. ratti* Kohls, 1948 (J. Parasitol., 34: 154–157)

Type depositories: USNTC (holotype, paratypes), AM, BMNH (paratypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Australasian

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: Rodentia: Muridae (ANL)
Dasyuromorphia: Dasyuridae (AL)
Peramelemorphia: Peramelidae; Diprotodontia: Phalangeridae (A)

Human infestation: no

Remarks: Kolonin (2009) states that "small marsupials" are hosts for all stages of *H. ratti*, but we have been unable to confirm this statement.

References

Bennett, M.D., Woolford, L., Banazis, M.J., O'Hara, J., Warren, K.S., Nicholls, P.K., Sims, C. & Fenwick, S.G. 2011. *Coxiella burnetti* in western barred bandicoots (*Perameles bougainville*) from Bernier and Dorre Islands in Western Australia. Ecohealth, 8: 519–524.

Hoogstraal, H. 1982. Ticks (Acari: Ixodoidea): a preliminary study. Monogr. Biol., 42: 537–544.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Lorch, D., Fisher, D.O. & Spratt, D.M. 2007. Variation in ectoparasite infestation on the brown antechinus *Antechinus stuartii*, with regard to host, habitat and environmental parameters. Aust. J. Zool., 55: 169–176.

Roberts, F.H.S. 1963. A systematic study of the Australian species of the genus *Haemaphysalis* Koch (Acarina: Ixodidae). Aust. J. Zool., 11: 35–80.

Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.

131 – *H. renschi* Schulze, 1933 (Arch. Hydrobiol. Suppl., 12, 4: 490–502)

Type depository: USNTC (neotype) (Keirans and Clifford, 1984, *op. cit.* under *H. bartelsi*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Australasian, Oriental

Ecoregions: Sumatra and Java rain forest; Lesser Sundas deciduous forests

Hosts: Artiodactyla: Bovidae, Cervidae; Perissodactyla: Equidae (ANL)
Artiodactyla: Suidae; Carnivora: Canidae (A)
Charadriiformes: Sternidae (N)
Rodentia: Muridae (L)

Human infestation: no

Remarks: Camicas et al. (1998) maintain that *H. renschi* is a strictly Oriental species, but the records of Durden et al. (2008) for Sulawesi Island indicate that this tick is also present in the Australasian Region. Additionally, Durden et al. (2008) recorded the larva of *H. renschi* from Muridae, but this, as well as the record from Aves in Hoogstraal and Anastos (1968), is ignored in Kolonin (2009).

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Durden, L.A., Merker, S. & Beati, L. 2008. The tick fauna of Sulawesi, Indonesia (Acari: Ixodoidea: Argasidae and Ixodidae). Exp. Appl. Acarol., 45: 85–110.

Hoogstraal, H. & Anastos, G. 1968. Studies on Southeast Asian *Haemaphysalis* ticks (Ixodoidea: Ixodidae). Redescription of *H.* (*Kaiseriana*) *renschi* Schulze (resurrected), and its hosts and distribution in Indonesia. J. Parasitol., 54: 1214–1222.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

132 – *H. roubaudi* Toumanoff, 1940 (Rev. Méd. Fr. Extr.-Orient, 18: 463–490)

Type depositories: IPP, USNTC (syntypes) (Hoogstraal et al. 1966, *op. cit.* under *H. hirsuta*)

Known stages: male

Zoogeographic Region: Oriental

Ecoregion: southeastern Indochina dry evergreen forests

Hosts: Artiodactyla: Cervidae (A)

Human infestation: yes (Kolonin 1995)

References

Hoogstraal, H., Trapido, H. & Kohls, G.M. 1966. Studies on Southeast Asian *Haemaphysalis* ticks (Ixodoidea, Ixodidae). Speciation in the *H.* (*Kaiseriana*) *obesa* group: *H. semermis* Neumann, *H. obesa* Larrousse, *H. roubaudi* Toumanoff, *H. montgomeryi* Nuttall, and *H. hirsuta* sp. n. J. Parasitol., 52: 169–191.

Kolonin, G.V. 1995. Review of the ixodid tick fauna (Acari: Ixodidae) of Vietnam. J. Med. Entomol., 32: 276–282.

133 – *H. rugosa* Santos Dias, 1956 (Mem. Estud. Mus. Zool. Univ. Coimbra (242), 9 pp.)

Type depository: BMNH (holotype) (Hoogstraal, H. & El Kammah, K.M. 1972. Notes on African *Haemaphysalis* ticks. X. *H.* (*Kaiseriana*) *aciculifer* Warburton and *H.* (*K.*) *rugosa* Santos Dias, the African representatives of the *spinigera* subgroup (Ixodoidea: Ixodidae). J. Parasitol., 58: 960–978; Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.), as *H. aciculifer rugosa*, originally identified as *H. aciculifer*, as stated in Santos Dias, J.A.T. (1956. Notas ixodológicas. Sobre duas entidades do género *Haemaphysalis* C.L. Koch, 1844. Mem. Estud. Mus. Zool. Univ. Coimbra (242), 9 pp.). Surprisingly, Keirans and Hillyard (2001, *op. cit*. under *H. aciculifer*) do not record the presence of the holotype of *H. rugosa* in BMNH.

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Carnivora: Viverridae (ANL)
Carnivora: Herpestidae (AN)
Artiodactyla: Bovidae (A)
Lagomorpha: Leporidae; Rodentia: Muridae (N)

Human infestation: no

Remarks: we regard records by Camicas (1978) of *H. rugosa* from Muridae and Leporidae as valid, but Cumming (1998) seemingly does not recognize these. A record of *H. rugosa* from Felidae that was considered questionable by Hoogstraal and El-Kammah (1972) has not been included in the host list above. Cornet (1995) makes a general statement, which we have been unable to confirm, that ungulates and carnivores are specific hosts for all parasitic stages of *H. rugosa*, but he is probably confusing *H. aciculifer* with *H. rugosa.* Cornet (1995), supported by Rousselot (1951), states that Canidae are hosts of *H. rugosa.* However, the latter author lists Canidae as hosts of *H. aciculifer*, not *H. rugosa.* We have been unable to find records of larvae and nymphs of *H. rugosa* from any ungulate host and have excluded them from the list above.

References

Camicas, J.-L. 1978. Contribution à l'étude des tiques du Sénégal (Acarida: Ixodida) 2. Description des stades préimaginales d'*Haemaphysalis* (*Kaiseriana*) *rugosa* Santos Dias, 1956. Cah. ORSTOM Sér. Entomol. Méd. Parasitol., 16: 23–28.

Cornet, J.-P. 1995. Contribution à l'étude des tiques (Acarina: Ixodina) de la République Centrafricaine 4. Inventaire et répartition. Acarologia, 36: 203–212.

Cumming, G.S. 1998. Host preference in African ticks (Acari: Ixodida): a quantitative data set. Bull. Entomol. Res., 88: 379–406.

Hoogstraal, H. & El Kammah, K.M. 1972. Notes on African *Haemaphysalis* ticks. X. *H.* (*Kaiseriana*) *aciculifer* Warburton and *H.* (*K.*) *rugosa* Santos Dias, the African representatives of the *spinigera* subgroup (Ixodoidea: Ixodidae). J. Parasitol., 58: 960–978.

Rousselot, R. 1951. *Ixodes* de l'Afrique noire. Bull. Soc. Pathol. Exot., 44: 307–309.

Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.

134 – *H. rusae* Kohls, 1950 (Natl. Inst. Health Bull. (192), 28 pp.)

Type depository: CNHM (holotype, paratype), USNTC (holotype) (Kohls, 1950, *op. cit.* under *H. hoogstraali*)

Known stages: male, female, nymph

Zoogeographic Regions: Australasian, Oriental

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Artiodactyla: Cervidae and Suidae.
Artiodactyla: Suidae (AN)
Artiodactyla: Cervidae; Diprotodontia: Macropodidae (A)

Human infestation: no

Remarks: Hoogstraal and Wassef (1983) state that the presence of this tick species in the Australasian Region is a result of its hosts having entered this region from the Oriental Region. This is highly speculative and we provisionally consider the Australasian Region to be part of the natural range of *H. rusae.*

Reference

Hoogstraal, H. & Wassef, H.Y. 1983. *Haemaphysalis* (*Garnhamphysalis*) *rusae* (Ixodoidea: Ixodidae): identity, deer and pig hosts, and distribution in Luzon and Mindanao. J. Parasitol., 69: 215–220.

135 – *H. sambar* Hoogstraal, 1971 (J. Parasitol., 57: 173–176)

Type depository: BMNH (holotype) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*). The holotype of this species is in the Nuttall Collection, held in the BMNH, and was previously identified as *H. campanulata* (Hoogstraal, H. 1971. *Haemaphysalis* (*H.*) *sambar* sp. n. (Ixodoidea: Ixodidae), a parasite of the sambar deer in southern India. J. Parasitol., 57: 173–196).

Known stages: male

Zoogeographic Region: Oriental

Ecoregion: south western Ghats montane rain forests

Hosts: Artiodactyla: Cervidae (A)

Human infestation: no

Remarks: Mihalca et al. (2011) regard *H. sambar* as an endangered species.

References

Hoogstraal, H. 1971. *Haemaphysalis* (*H.*) *sambar* sp. n. (Ixodoidea: Ixodidae), a parasite of the sambar deer in southern India. J. Parasitol., 57: 173–196.
Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

136 – *H. sciuri* Kohls, 1950 (Natl. Inst. Health Bull. (192), 28 pp.)

Type depositories: CNHM (holotype, paratype), USNTC (paratype) (Kohls 1950, *op. cit.* under *H. hoogstraali*)

Known stages: male

Zoogeographic Region: Oriental

Ecoregion: Mindanao-eastern visayas rain forests

Hosts: Rodentia: Sciuridae (A)

Human infestation: no

Reference

Kohls, G.M. 1950. Ticks (Ixodoidea) of the Philippines. Natl. Inst. Health Bull. (192), 28 pp.

137 – *H. semermis* Neumann, 1901 (Mém. Soc. Zool. Fr., 14: 249–372)

Type depository: MNHN (holotype) (Trapido, 1965, *op. cit.* under *H. lagrangei*)

Known stages: male, female, nymph

Zoogeographic Region: Oriental

Ecoregions: Sumatra and Java rain forests; Lesser Sundas deciduous forests

Hosts: Artiodactyla: Tragulidae; Rodentia: Muridae (ANL)
Carnivora: Canidae; Viverridae (AN)
Artiodactyla: Cervidae, Suidae; Carnivora: Felidae, Ursidae; Perissodactyla: Tapiridae (A)
Rodentia: Sciuridae; Scandentia: Tupaiidae (N)

Human infestation: yes (Hoogstraal et al. 1972)

Remarks: references to *H. semermis* published prior to Hoogstraal et al. (1965) have not been included in our analyses because of diagnostic uncertainties. Camicas et al. (1998) state that only ungulates are hosts of adults of this tick. We, however, believe that Hoogstraal et al. (1965) provide a reliable source of data indicating that hosts other than ungulates are also important for the natural maintenance of adults of *H. semermis*. We have been unable to find a description of the larva of *H. semermis*; nevertheless, we provisionally accept records of this stage in Hoogstraal et al. (1972). Lim (1972) recorded adults of *H. semermis* on Muridae, but Kolonin (2009) seems to have considered this record invalid and did not include Rodentia as hosts for adults. We regard Lim's record as tentatively valid.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Hoogstraal, H., Trapido, H. & Kohls, G.M. 1965. Southeast Asian *Haemaphysalis* ticks (Ixodoidea, Ixodidae). *H.* (*Kaiseriana*) *papuana nadchatrami* ssp. n. and redescription of *H.* (*K.*) *semermis* Neumann. J. Parasitol., 51: 433–451.

Hoogstraal, H., Lim, B.L., Nadchatram, M. & Anastos, G. 1972. The Gunong Benom Expedition 1967. 8. Ticks (Ixodidae) of Gunong Benom and their altitudinal distribution, hosts and medical relationships. Bull. Br. Mus. (Nat. Hist.) Zool., 23: 167–186.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Lim, B.L. 1972. Host-relationship and seasonal abundance of immature ticks (*Haemaphysalis* spp. and *Dermacentor* spp.) in primary and mixed-secondary rainforests in west Malaysia. Southeast Asia J. Trop. Med. Publ. Health, 3: 605–612.

138 – *H. shimoga* Trapido & Hoogstraal, 1964 (J. Parasitol., 50: 303–310)
Based on a comparison of descriptive illustrations, Kolonin (2009, *op. cit*. under *H. anomaloceraea*) treats *H. shimoga* as a synonym of *H. taiwana*, but we believe that illustrations provide insufficient grounds for such a decision. Camicas et al. (1998, *op. cit*. under *H. anomaloceraea*) regard *H. anomaloceraea* as a synonym of *H. shimoga*, without justifying this decision apart from a vague statement about "Kolonin, 1997 (*in litt.*)," a reference that we have been unable to find. See *H. anomaloceraea.*

Type depositories: USNTC (holotype, paratypes), BMNH, VRC, HH (paratypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*), as *H. cornigera shimoga*

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregions: tropical and subtropical dry broadleaf forests

Hosts: Rodentia: Muridae (A, N and/or L)
Artiodactyla: Bovidae, Cervidae, Suidae; Rodentia: Sciuridae (A)

Human infestation: yes (Tanskul and Inlao 1989)

Remarks: the larva and nymph of *H. shimoga* were described from laboratory-reared specimens (Trapido and Hoogstraal 1964). Tanskul and Inlao (1989) use the term "immatures" without specifying which of the immature stages naturally infested Muridae. These records are treated as provisionally valid here. See also *H. cornigera.*

References

Phan Trong, C. 1977. Ve bet va con trung ky sinh o Viet Nam. Tap 1. Ve (Ixodoidea), mo ta va phan loai. Ha Noi: Khoa hoc va ky thuat, 489 pp. In Vietnamese.
Rajagopalan, P.K., Patil, A.P. & Boshell, J. 1968. Ixodid ticks on their mammalian hosts in the Kyasanur Forest disease area of Mysore State, India, 1961–1964. Ind. J. Med. Res., 56: 510–526.
Tanskul, P. & Inlao, I. 1989. Keys to the adult ticks of *Haemaphysalis* Koch, 1844, in Thailand with notes on changes in taxonomy (Acari: Ixodoidea: Ixodidae). J. Med. Entomol., 26: 573–601.
Trapido, H. & Hoogstraal, H. 1964. *Haemaphysalis cornigera shimoga* subsp. n. from southern India (Ixodoidea, Ixodidae). J. Parasitol., 50: 303–310.

139 – *H. silacea* Robinson, 1912 (Parasitology, 4: 474–484)

Type depository: BMNH (lectotype, paralectotypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for larvae, nymphs and adults are Artiodactyla: Bovidae.
Artiodactyla: Bovidae; Carnivora: Canidae; Lagomorpha: Leporidae (ANL)
Carnivora: Felidae (AN)
Carnivora: Herpestidae (A, N and/or L)
Macroscelidea: Macroscelididae; Galliformes: Numididae; Ciconiiformes: Threskiornithidae (NL)
Passeriformes: Alaudidae, Corvidae, Pycnonotidae (N)
Carnivora: Hyaenidae; Perissodactyla: Rhinocerotidae; Rodentia: Muridae (L)

Human infestation: yes (Horak et al. 2002)

Remarks: Theiler (1962) uses the term "immatures" without specifying whether they are larvae, nymphs or both. She also states that adults infest Aves but provides no data to support this observation.

References

Cumming, G.S. 1998. Host preference in African ticks (Acari: Ixodida): a quantitative data set. Bull. Entomol. Res., 88: 379–406.

Hoogstraal, H. 1963. Notes on African *Haemaphysalis* ticks. V. Redescription and relationships of *H. silacea* Robinson, 1912, from South Africa (Ixodoidea, Ixodidae). J. Parasitol., 49: 830–837.

Horak, I.G. 2001. Conservation of rare parasites. Proc. Int. Joint. Conf. Vet. Conserv. Biol. Wild Manag. Taronga Zoo, Sydney, Australia, Jul. 1–6, 2001, A. Martin & L. Vogelnest (editors), pp. 45–49.

Horak, I.G. & Knight, M.M. 1986. A comparison of the tick burdens of wild animals in a nature reserve and on an adjacent farm where tick control is practised. J. S. Afr. Vet. Ass., 57: 199–203.

Horak, I.G., Jacot Guillarmod, A., Moolman, L.C. & De Vos, V. 1987. Parasites of domestic and wild animals in South Africa. XXII. Ixodid ticks on domestic dogs and on wild carnivores. Onderstepoort J. Vet. Res., 54: 573–580.

Horak, I.G., Fourie, L.J., Heyne, H., Walker, J.B. & Needham, G.R. 2002. Ixodid ticks feeding on humans in South Africa: with notes on preferred hosts, geographic distribution, seasonal occurrence and transmission of pathogens. Exp. Appl. Acarol., 27: 113–136.

Horak, I.G., Welman, S., Hallam, S.L., Lutermann, H. & Mzilikazi, N. 2011. Ticks of four-toed elephant shrews and Southern African hedgehogs. Onderstepoort J. Vet. Res., 78, doi:10.4102/ojvr.v78i1.243

Knapp, S.E., Krecek, R.C., Horak, I.G. & Penzhorn, B.L. 1997. Helminths and arthropods of black and white rhinoceroses in southern Africa. J. Wildl. Dis., 33: 492–502.
Norval, R.A.I. 1975. Studies on the ecology of *Haemaphysalis silacea* Robinson 1912 (Acarina: Ixodidae). J. Parasitol., 61: 730–736.
Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

140 – *H. silvafelis* Hoogstraal & Trapido, 1963 (J. Parasitol., 49: 346–349)

Type depositories: USNTC (holotype, paratypes), ZSI, HH (paratypes) (Hoogstraal, H. & Trapido H. 1963. *Haemaphysalis silvafelis* sp. n., a parasite of the jungle cat in southern India (Ixodoidea: Ixodidae). J. Parasitol., 49: 346–349)

Known stages: male, female

Zoogeographic Region: Oriental

Ecoregion: eastern highlands moist deciduous forests

Hosts: usual hosts for adult ticks are Carnivora: Felidae.
Carnivora: Felidae; Lagomorpha: Leporidae (A)
Rodentia: Sciuridae; Cuculiformes: Cuculidae (N)

Human infestation: no
Remarks: Kolonin (2009) does not include Aves as hosts of *H. silvafelis* or recognize hosts for nymphs of this tick, probably because this stage remains undescribed. However, we regard the records of nymphs of *H. silvafelis* on Cuculidae and Sciuridae in Geevarghese and Dhanda (1995) as provisionally valid.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.
Geevarghese, G. & Dhanda, V. 1995. Ixodid ticks of Maharashtra State, India. Acarologia, 36: 309–313.
Hoogstraal, H. & Trapido H. 1963. *Haemaphysalis silvafelis* sp. n., a parasite of the jungle cat in southern India (Ixodoidea: Ixodidae). J. Parasitol., 49: 346–349.
Kaul, H.N., Dhanda, V. & Mishra, A.C. 1979. A survey of ixodid ticks in Orissa State, India. Ind. J. Anim. Sci., 49: 707–712.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

141 – *H. simplex* Neumann, 1897 (Mém. Soc. Zool. Fr., 10: 324–420)

Type depository: BMNH (syntypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregion: Madagascar dry deciduous forests

Hosts: usual hosts for larvae, nymphs and adults are Afrosoricida: Tenrecidae. Aves and Primates are considered exceptional hosts for this tick.
Afrosoricida: Tenrecidae (ANL)
Primates: Indriidae (AN)
Rodentia: Muridae; Ciconiiformes: Threskiornithidae (A)
Primates: Cheirogaleidae (N)

Human infestation: no

Remarks: Camicas et al. (1998) list the larva of *H. simplex* as undescribed, but it had previously been described in Uilenberg et al. (1979). Primates are not included as hosts of *H. simplex* in Kolonin (2009), probably because Uilenberg et al. (1979) considered this type of host "accidental." We see no reason to exclude Primates as hosts of this tick, although such parasitism may be unusual. The records of nymphs of *H. simplex* on Cheirogaleidae are considered provisionally valid by Rodríguez et al. (2012).

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Rodríguez, I.A., Rasoazanabary, E. & Godfrey, L.R. 2012. Multiple ectoparasites infest *Microcebus griseorufus* at Beza Mahafaly Special Reserve, Madagascar. Madagascar Cons. Develop., 7: 45–48.

Uilenberg, G., Hoogstraal, H. & Klein, J.-M. 1979. Les tiques (Ixodoidea) de Madagascar et leur rôle vecteur. Arch. Inst. Pasteur Madagascar Num. Spéc., 153 pp.

142 – *H. simplicima* Hoogstraal & Wassef, 1979 (*In* Uilenberg, G., Hoogstraal, H. & Klein, J.-M. 1979. Arch. Inst. Pasteur Madagascar Spec. Numb., 153 pp.)

Type depositories: USNTC (holotype, paratypes), BMNH, IPT (paratypes) (Keirans and Hillyard 2001, *op. cit.* under *H. aciculifer*)

Known stages: male, female, nymph

Zoogeographic Region: Afrotropical

Ecoregion: Madagascar spiny thickets

Hosts: Afrosoricida: Tenrecidae (AN)

Human infestation: no

Remarks: Durden and Keirans (1996) regard *H. simplicima* as an endangered species.

References

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.

Uilenberg, G., Hoogstraal, H. & Klein, J.-M. 1979. Les tiques (Ixodoidea) de Madagascar et leur rôle vecteur. Arch. Inst. Pasteur Madagascar Num. Spéc., 153 pp.

143 – *H. sinensis* Zhang, 1981 (Acta Vet. Zoot. Sin., 12: 169–173. In Chinese)
This tick is ignored in Camicas et al. (1998, *op. cit*. under *H. anomaloceraea*), but it has been included in all recent lists of the ticks of the world. Consequently, we see no reason to question its validity.

Type depository: IAHVS (syntypes inferred by the English summary of the Chinese article) (Zhang, S.-X. 1981. A new species of *Haemaphysalis* Koch, 1844 – *Haemaphysalis sinensis* sp. nov. Acta Vet. Zoot. Sin., 12: 169–173. In Chinese)

Known stages: male, female

Zoogeographic Region: Palearctic

Ecoregions: montane grasslands and shrublands

Hosts: Artiodactyla: Bovidae (A)

Human infestation: no

References

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Keirans, J.E. & Robbins, R.G. 1999. A world checklist of genera, subgenera, and species of ticks (Acari: Ixodida) published from 1973 – 1997. J. Vector Ecol., 24: 115–129.

Zhang, S.-X. 1981. A new species of *Haemaphysalis* Koch, 1844 – *Haemaphysalis sinensis* sp. nov. Acta Vet. Zoot. Sin., 12: 169–173. In Chinese.

144 – *H. spinigera* Neumann, 1897 (Mém. Soc. Zool. Fr., 10: 324–420)

Type depository: ENV (holotype) (Trapido 1965, *op. cit*. under *H. lagrangei*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregions: tropical and subtropical dry broadleaf forests

Hosts: Mammals (several orders) (ANL)
Galliformes: Phasianidae (A?, NL)
Aves (several orders) (NL)

Human infestation: yes (Mitchell et al. 1966)

Remarks: Rajagopalan (1972) found adults of *H. spinigera* on Phasianidae, but Kolonin (2009) did not include Aves as hosts for adults of this tick, probably because Rajagopalan (1972) stated that adults found on Galliformes were teneral and apparently not feeding on these hosts.

References

Bhat, H.R. & Sreenivasan, M.A. 1981. Further records of the ticks of some reptilian and mammalian hosts in the Kyasanur Forest disease area, Karnataka, India. Ind. J. Parasitol., 5: 207–210.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Kolonin, G.V. 1995. Review of the ixodid tick fauna (Acari: Ixodidae) of Vietnam. J. Med. Entomol., 32: 276–282.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Mitchell, R.M. & Dick, J.A. 1978. Ectoparasites from Nepal birds. J. Bombay Nat. Hist. Soc., 74: 264–274.

Mitchell, C.J., Hoogstraal, H., Schaller, G.B. & Spillett, J. 1966. Ectoparasites from mammals in Kanha National Park, Madhya Pradesh, India, and their potential disease relationships. J. Med. Entomol., 3: 113–124.

Rajagopalan, P.K. 1972. Ixodid ticks (Acarina: Ixodidae) parasitizing wild birds in the Kyasanur Forest disease area of Shimoga District, Mysore State, India. J. Bombay Nat. Hist. Soc., 69: 55–78.

Rajagopalan, P.K., Patil, A.P. & Boshell, J. 1968. Ixodid ticks on their mammalian hosts in the Kyasanur Forest disease area of Mysore State, India, 1961–1964. Ind. J. Med. Res., 56: 510–526.

Seneviratna, P. 1965. The Ixodoidea (ticks) of Ceylon. Parts II and III. Ceylon Vet. J., 13: 28–54.

Trapido, H., Goverdhan, M.K., Rajagopalan, P.K. & Rebello, M.J. 1964. Ticks ectoparasitic on monkeys in the Kyasanur Forest disease area of Shimoga District, Mysore State, India. Am. J. Trop. Med. Hyg., 13: 763–772.

145 – *H. spinulosa* Neumann, 1906 (Arch. Parasitol., 10: 195–219)

Type depository: BMNH (syntypes) (Neumann, L.G. 1906. Notes sur les Ixodidés. IV. Arch. Parasitol., 10: 195–219), but Keirans and Hillyard (2001, *op. cit*. under *H. aciculifer*) state that there are no types of *H. spinulosa* in BMNH.

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands; few ticks in tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Carnivora (several families).
Mammalia (several orders) (A)

Human infestation: no

Remarks: Horak et al. (1987) and Fourie et al. (1992) note the difficulties involved in distinguishing larvae and nymphs of *H. spinulosa* from those of *H. elliptica* (at the time identified as *H. leachi*). Consequently, references to these stages of *H. spinulosa* have been omitted, including those of Hussein and Mustafa (1985), who allegedly worked with larvae and nymphs of this species. Cumming (1998) includes Aves as hosts for *H. spinulosa*, but sound records for this tick on birds have not been found. Matthysse and Colbo (1987) state that the type specimen of *H. spinulosa* was collected from Rodentia: Thryonomyidae, but we have been unable to confirm this in Neumann (1906) or any subsequent publication. See also *H. zumpti*.

References

Cumming, G.S. 1998. Host preference in African ticks (Acari: Ixodida): a quantitative data set. Bull. Entomol. Res., 88: 379–406.

Fourie, L.J., Horak, I.G. & Van den Heever, J.J. 1992. The relative host status of rock elephant shrews *Elephantulus myurus* and Namaqua rock mice *Aethomys namaquensis* for economically important ticks. S. Afr. J. Zool., 27: 108–114.

Horak, I.G., Jacot Guillarmod, A., Moolman, L.C. & De Vos, V. 1987. Parasites of domestic and wild animals in South Africa. XXII. Ixodid ticks on domestic dogs and wild carnivores. Onderstepoort J. Vet. Res., 54: 573–580.

Hussein, H.S. & Mustafa, B.E. 1985. *Haemaphysalis spinulosa* and *Rhipicephalus simus* (Acari: Ixodidae): seasonal abundance of immature stages and host range in the Shambat area, Sudan. J. Med. Entomol., 22: 72–77.

Iori, A., Lanfranchi, P. & Manilla, G. 1996. Contribution to the knowledge of Ixodidae ticks of wild mammals of Somalia. Parassitologia, 38: 571–573.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Matthysse, J.G. & Colbo, M.H. 1987. The ixodid ticks of Uganda. Entomological Society of America, College Park, Maryland, 426 pp.

Morel, P.-C. & Rodhain, F. 1972. Contribution à la connaissance des tiques du sud de l'Éthiopie. Bull. Soc. Pathol. Exot., 65: 725–732.

Neumann, L.G. 1906. Notes sur les Ixodidés. IV. Arch. Parasitol., 10: 195–219.

Norval, R.A.I. 1984. The ticks of Zimbabwe. IX. *Haemaphysalis leachi* and *Haemaphysalis spinulosa*. Zimbabwe Vet. J., 15: 9–17.

146 – *H. subelongata* Hoogstraal, 1953 (Bull. Mus. Comp. Zool., 111: 37–113)

Type depositories: USNTC (holotype, paratypes), BMNH, FMNH, HH, MCZ, OVI, ISM (paratypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregion: Madagascar lowlands forests

Hosts: usual hosts for larvae, nymphs and adults are Afrosoricida-Tenricidae.
Afrosoricida: Tenricidae (ANL)
Rodentia: Muridae (N)
Rodentia: Nesomyidae (L)

Human infestation: no

Remarks: Durden and Keirans (1996) regard *H. subelongata* as an endangered species.

References

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.

Uilenberg, G., Hoogstraal, H. & Klein, J.-M. 1979. Les tiques (Ixodoidea) de Madagascar et leur rôle vecteur. Arch. Inst. Pasteur Madagascar Num. Spéc., 153 pp.

147 – *H. subterra* Hoogstraal, El Kammah & Camicas, 1992 (Int. J. Acarol., 18: 213–220)

Type depositories: USNTC (holotype, paratypes), HH, ORSTOM (paratypes) (Hoogstraal, H., El Kammah, K.M. & Camicas, J.-L. 1992. Notes on African *Haemaphysalis* ticks: XVI. *H. (Rhipistoma) subterra* sp. n., a new member of the *leachi* group (Ixodoidea: Ixodidae). Int. J. Acarol., 18: 213–220)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for adult ticks are Carnivora: Herpestidae.
Rodentia: Spalacidae (ANL)
Carnivora: Herpestidae (AN)
Artiodactyla: Viverridae; Rodentia: Muridae (A)

Human infestation: no

Remarks: Hoogstraal et al. (1992) do not explicitly identify some hosts of the larvae of *H. subterra*. In the abstract of their paper, they state that "immatures" are found mainly on Rodentia (Muridae and Spalacidae), but in "material examined" there is no clear reference to larvae or nymphs of *H. subterra* feeding on Muridae. We thus provisionally exclude Muridae as hosts for the sub-adult stages of this tick.

Reference

Hoogstraal, H., El Kammah, K.M. & Camicas, J.-L. 1992. Notes on African *Haemaphysalis* ticks: XVI. *H. (Rhipistoma) subterra* sp. n., a new member of the *leachi* group (Ixodoidea: Ixodidae). Int. J. Acarol., 18: 213–220.

148 – *H. sulcata* Canestrini & Fanzago, 1878 (Atti R. Ist. Veneto Sci. Lett. Arti (1877–1878), Ser. 5, 4: 69–208)
See the initial section of this chapter for the synonymy of *H. cholodkovskyi* and *H. cretica* with *H. sulcata*.

Type depositories: undetermined

Known stages: male, female, nymph, larva

Zoogeographic Regions: Afrotropical, Oriental, Palearctic

Ecoregions: several ecoregions in the Afrotropical, Oriental and Palearctic Zoogeographic Regions

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae, while Testudines are considered exceptional hosts for adults and Chiroptera for larvae of this tick.
Testudines: Testudinidae (ANL)
Artiodactyla: Bovidae; Carnivora: Canidae (AN)
Several orders (Mammalia) (A)
Aves (several orders); Squamata (several families); Carnivora: Mustelidae; Lagomorpha: Ochotonidae; Rodentia: Cricetidae, Muridae (NL)
Chiroptera: Vespertilionidae; Rodentia: Calomyscidae, Dipodidae, Sciuridae (L)

Human infestation: yes (Bursali et al. 2012)

Remarks: Camicas et al. (1998) state that *H. sulcata* is found in the Oriental and Palearctic Regions, but Al-Khalifa et al. (2006) present sound records for the Afrotropical Region. Yeruham et al. (1996) refer to this tick as *H. cretica*.

References

Al-Khalifa, M.S., Diab, F.M., Al-Asgah, N.A., Hussein, H.S. & Khalil, G.M. 2006. Ticks (Acari: Argasidae, Ixodidae) recorded on wild animals in Saudi Arabia. Fauna Arabia, 22: 225–231.

Bursali, A., Keskin, A. & Tekin, S. 2012. A review of the ticks (Acari: Ixodida) of Turkey: species diversity, hosts and geographical distribution. Exp. Appl. Acarol., 57: 91–104.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian.

Filippova, N.A., Neronov, V.M. & Farhang-Azad, A. 1976. Materials on the fauna of ixodids (Acarina, Ixodidae) of small mammals in Iran. Entomol. Obozr., 55: 467–478. In Russian.

Hoogstraal, H. & Kim, K.C. 1985. Tick and mammal coevolution, with emphasis on *Haemaphysalis. In* K.C. Kim (editor), Coevolution of parasitic arthropods and mammals. John Wiley & Sons, New York, pp. 505–568.

Keskin, A., Bursali, A., Kumlutas, Y., Ilgaz, C. & Tekin, S. 2013. The parasitism of immature stages of the *Haemaphysalis sulcata* (Acari: Ixodidae) on some reptiles in Turkey. J. Parasitol., in press.

Krčmar, S. 2012. Hard ticks (Acari, Ixodidae) of Croatia. ZooKeys, 234: 19–57.

Mihalca, A.D., Dumitrache, M.O., Magdaş, C., Gherman, C.M., Domşa, C., Mircean, V., Ghira, I.V., Pocora, V., Ionescu, D.T., Sikó Barabási, S., Cozma, V. & Sandor, A.D. 2012. Synopsis of the hard ticks (Acari: Ixodidae) of Romania with update on host associations and geographical distribution. Exp. Appl. Acarol., 58: 183–206.

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Osipova, N.Z., Karas, F.R., Vargina, S.G. & Grebenyuk, Yu. I. 1975. Ectoparasites of wild animals in Crimean hemorrhagic fever natural focus of southern Kirgizia. *In* A.I. Protsenko (editor), Entomological investigations in Kirgizia. Akad. Nauk Kirgiz. SSR, Kirgiz. Otd. Vses. Entomol. Obshch. Izd., Frunze, pp. 124–125. In Russian, NAMRU-3 translation 1164.

Široký, P., Petrželková, K.J., Kamler, D., Mihalca, A.D. & Modrý, D. 2006. *Hyalomma aegyptium* as dominant tick in tortoises of the genus *Testudo* in Balkan countries, with notes on its host preferences. Exp. Appl. Acarol., 40: 279–290.

Yeruham, I., Hadani, A., Galker, F. & Rosen, S. 1996. The seasonal occurrence of ticks (Acari: Ixodidae) on sheep and in the field in the Judean area of Israel. Exp. Appl. Acarol., 20: 47–56.

149 – *H. sumatraensis* Hoogstraal, El Kammah, Kadarsan & Anastos, 1971 (J. Parasitol., 57: 1104–1109)

Type depositories: MZB (holotype, paratypes), USNTC, BMNH, HH (paratypes) (Hoogstraal, H., El Kammah, K.M., Kadarsan, S. & Anastos, G. 1971. *Haemaphysalis* (*H.*) *sumatraensis* sp. n. (Ixodoidea: Ixodidae), a tick parasitizing the tiger, boar and sambar deer in Indonesia. J. Parasitol., 57: 1104–1109), but Keirans and Hillyard (2001, *op. cit*. under *H. aciculifer*) state that there are no types of *H. sumatraensis* in BMNH.

Known stages: male, female, larva

Zoogeographic Region: Oriental

Ecoregions: Sumatra and western Java rain forests

Hosts: Artiodactyla: Cervidae, Suidae; Carnivora: Canidae, Felidae (A)
Carnivora: Viverridae (N and/or L)

Human infestation: no

Remarks: Camicas et al. (1998) list the larva of *H. sumatraensis* as undescribed, but it was described by Kadarsan (1971). Hoogstraal and Kim (1985) use the term "immatures" without specifying whether they mean larvae, nymphs or both stages. The nymph of *H. sumatraensis* has not been described, but we consider the records of undetermined sub-adult stages in Hoogstraal and Kim (1985) provisionally valid.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Hoogstraal, H. & Kim, K.C. 1985. Tick and mammal coevolution, with emphasis on *Haemaphysalis*. *In* K.C. Kim (editor), Coevolution of parasitic arthropods and mammals. John Wiley & Sons, New York, pp. 505–568.

Hoogstraal, H., El Kammah, K.M., Kadarsan, S. & Anastos, G. 1971. *Haemaphysalis* (*H.*) *sumatraensis* sp. n. (Ixodoidea: Ixodidae), a tick parasitizing the tiger, boar and sambar deer in Indonesia. J. Parasitol., 57: 1104–1109.

Kadarsan, S. 1971. Larval ixodid ticks of Indonesia (Acarina: Ixodidae). Ph.D. Dissertation, University of Maryland, 182 pp.

150 – *H. sundrai* Sharif, 1928 (Rec. Ind. Mus., 30: 217–344)

Ghosh, S., Bansal, G.C., Gupta, S.C., Ray, D., Khan, M.Q., Irshad, H., Shahiduzzaman, Md., Seitzer, U. & Ahmed, J.S. (2007. Status of tick distribution in Bangladesh, India and Pakistan. Parasitol. Res., 101 (Suppl. 2): 207–216) and Barker and Murrell (2008, *op. cit*. under *H. colasbelcouri*) treat *Haemaphysalis himalaya* Hoogstraal, 1966 and *H. sundrai* as valid species, but, as discussed in Guglielmone et al. (2009, *op. cit*. under *H. colasbelcouri*), the former is a synonym of the latter.

Type depository: USNTC (lectotype) (Keirans and Clifford 1984, *op. cit*. under *H. bartelsi*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: Artiodactyla: Bovidae, Cervidae (ANL)

Human infestation: no

Remarks: Hoogstraal and El Kammah (1970) refer to this species as *H. himalaya*.

Reference

Hoogstraal, H. & El Kammah, K.M. 1970. *Haemaphysalis (Herpetobia) himalaya* Hoogstraal (Ixodoidea: Ixodidae), description of immature stages, hosts, and distribution. J. Parasitol., 56: 1023–1027.

151 – *H. suntzovi* Kolonin, 1993 (J. Med. Entomol., 30: 996–968)

Type depositories: ZIAC (holotype, paratypes), BMNH, MCZ, USNTC (paratypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female

Zoogeographic Region: Oriental

Ecoregion: northern Indochina subtropical forests

Hosts: Artiodactyla: Suidae; Rodentia: Hystricidae (A)

Human infestation: no

Reference

Kolonin, G.V. 1995. Review of the ixodid tick fauna (Acari: Ixodidae) of Vietnam. J. Med. Entomol., 32: 276–282.

152 – *H. susphilippensis* Hoogstraal, Kohls & Parrish, 1968 (J. Parasitol., 54: 616–621)

Type depositories: USNTC (holotype, paratypes), BMNH, FMNH, HH, BM (paratypes). (Hoogstraal, H., Kohls, G.M. & Parrish, D.W. 1968. Studies on Southeast Asian *Haemaphysalis* ticks (Ixodoidea, Ixodidae). *H. (Kaiseriana) susphilippensis* sp. n., a parasite of Luzon and Mindanao boars. J. Parasitol., 54: 616–621). Keirans and Hillyard (2001, *op. cit*. under *H. aciculifer)* report that there are no types of this species in BMNH.

Known stages: male, female

Zoogeographic Region: Oriental

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Artiodactyla: Suidae.
Artiodactyla: Cervidae, Suidae (A)

Human infestation: no

Reference

Hoogstraal, H., Kohls, G.M. & Parrish, D.W. 1968. Studies on Southeast Asian *Haemaphysalis* ticks (Ixodoidea, Ixodidae). *H. (Kaiseriana) susphilippensis* sp. n., a parasite of Luzon and Mindanao boars. J. Parasitol., 54: 616–621.

153 – *H. taiwana* Sugimoto, 1936 (J. Soc. Trop. Agric. Taiwan, 8: 336–346. In Japanese)
Considerable confusion exists concerning this name. Teng, K.-F. & Jiang, Z.-J. (1991. Economic insect fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese) regard *H. taiwana* as a synonym of *H. cornigera*, but Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. (2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404) list *H. taiwana* as present in China. Kolonin (2009, *op. cit*. under *H. anomaloceraea*) reduces *H. shimoga* to a synonym of *H. taiwana*. We consider *H. taiwana* a valid name, as discussed in Guglielmone et al. (2010, *op. cit*. under *H. anomaloceraea*), but it is obvious that a comparative study of these taxa is needed in order to solve this problem. See also *H. anomaloceraea* and *H. shimoga*.

Type depository: undetermined, as *Haemaphysalis cornigera taiwana*

Known stages: male, female

Zoogeographic Region: Oriental

Ecoregions: tropical and subtropical dry broadleaf forests

Hosts: Artiodactyla: Bovidae (A)

Human infestation: no

Remarks: Camicas et al. (1998) list the larva and nymph of *H. taiwana* as described, but we have been unable to find descriptions of either stage. Kolonin (2009) extends the host range of *H. taiwana* to include Cervidae and "small mammals," probably because he includes hosts of *H. shimoga* among the hosts of *H. taiwana*. There are records of *H. cornigera taiwana* in the Chinese tick literature (*i.e.,* Guo et al. 2000) that were not included in our analysis. See above.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Guo, Y., Wan, K., Xu, S. et al. [sic] 2000. The discovery and study on the natural focus of Lyme disease in eastern Guandong Province. Chin. J. Zoon., 16: 42–45. In Chinese.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Luh, P.-L. & Woo, W.-C. 1950. A list of Chinese ticks. Chin. J. Entomol., 1: 195–222. In Chinese, NAMRU-3 translation 19.

154 – *H. tauffliebi* Morel, 1965 (Acarologia, 7: 281–285)

Type depository: not stated (Morel, P.-C. 1965. Description de *Haemaphysalis tauffliebi* n. sp. d'Afrique Central (Acariens, Ixodoidea). Acarologia, 7: 281–285)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: Rodentia: Hystricidae (ANL)
Passeriformes: Motacillidae (AN)
Rodentia: Muridae; Carnivora: Felidae (N)

Human infestation: no

Remarks: Hoogstraal and Wassef (1973) state that the larva and nymph of *H. tauffliebi* are known, but we have been unable to find any description of them. Consequently, we regard records of larvae and nymphs on the hosts above as only provisionally valid. Cumming (1998) recognizes only Rodentia as hosts for this tick, but there are records in Morel and Rodhain (1972) from other orders of mammals,

and Hoogstraal and Wassef (1973) and Hoogstraal and Kim (1985) list Aves as hosts for *H. taufflebi*. Kolonin (2009) does not recognize Felidae, as reported by Morel and Rodhain (1972), or Aves as hosts.

References

Cumming, G.S. 1998. Host preference in African ticks (Acari: Ixodida): a quantitative data set. Bull. Entomol. Res., 88: 379–406.

Hoogstraal, H. & Kim, K.C. 1985. Tick and mammal coevolution, with emphasis on *Haemaphysalis*. *In* K.C. Kim (editor), Coevolution of parasitic arthropods and mammals. John Wiley & Sons, New York, pp. 505–568.

Hoogstraal, H. & Wassef, H.Y. 1973. The *Haemaphysalis* ticks (Ixodoidea: Ixodidae) of birds. 3.*H.* (*Ornithophysalis*) subgen. n.: definition, species, hosts and distribution in the Oriental, Palearctic, Malagasy, and Ethiopian Faunal Regions. J. Parasitol., 59: 1099–1117.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Morel, P.-C. & Rodhain, F. 1972. Contribution à la connaissance des tiques du sud de l'Éthiopie. Bull. Soc. Pathol. Exot., 65: 725–732.

Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.

155 – *H. theilerae* Hoogstraal, 1953 (Bull. Mus. Comp. Zool., 111: 37–113)

Type depositories: USNTC (holotype, paratypes), BMNH, FMNH, MCZ, MNHN, OVI (paratypes) (Hoogstraal, H. 1953. Ticks (Ixodoidea) of the Malagasy Faunal Region (excepting the Seychelles). Their origins and host-relationships; with descriptions of five new *Haemaphysalis* species. Bull. Mus. Comp. Zool., 111: 37–113), but Keirans and Hillyard (2001, *op. cit*. under *H. aciculifer*) state that there are no type specimens of *H. theilerae* in BMNH.

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregion: Madagascar lowland forests

Hosts: Afrosoricida: Tenrecidae (ANL)

Human infestation: no

Remarks: Durden and Keirans (1996) regard *H. theilerae* as an endangered species.

References

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.

Uilenberg, G., Hoogstraal, H. & Klein, J.-M. 1979. Les tiques (Ixodoidea) de Madagascar et leur rôle vecteur. Arch. Inst. Pasteur Madagascar Num. Spéc., 153 pp.

156 – *H. tibetensis* Hoogstraal, 1965 (J. Parasitol., 51: 452–459)

Type depositories: BMNH (holotype, paratypes), USNTC (paratypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph

Zoogeographic Region: Palearctic

Ecoregions: montane grasslands and shrublands

Hosts: Carnivora: Canidae (AN)
Artiodactyla: Bovidae (A)

Human infestation: no

Remarks: Kolonin (2009) states that the immature stages of *H. tibetensis* have not been described, but the nymph had earlier been described by Hoogstraal (1965). Camicas et al. (1998) list only ungulates as hosts for adults of this tick, but this in error because the original description of *H. tibetensis* includes several specimens collected from Canidae.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Hoogstraal, H. 1965. *Haemaphysalis tibetensis* sp. n., and its significance in elucidating phylogenetic patterns in the genus (Ixodoidea, Ixodidae). J. Parasitol., 51: 452–459.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Teng, K.-F. 1982. Acarina: Ixodidae. *In* Insects of Xizang (Tibet) Volume II, Institute of Zoology, Academia Sinica, pp. 449–461. In Chinese, translation by Robbins, F.-M.Y.

157 – *H. tiptoni* Hoogstraal, 1953 (Bull. Mus. Comp. Zool., 111: 37–113)

Type depositories: USNTC (holotype, paratypes), BMNH, FMNH, HH, MCZ, OVI, MNHN, ISM (paratypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregion: Madagascar lowland forests

Hosts: Afrosoricida: Tenrecidae (A)

Human infestation: no

Remarks: Durden and Keirans (1996) regard *H. tiptoni* as an endangered species.

References

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.

Uilenberg, G., Hoogstraal, H. & Klein, J.-M. 1979. Les tiques (Ixodoidea) de Madagascar et leur rôle vecteur. Arch. Inst. Pasteur Madagascar Num. Spéc., 153 pp.

158 – *H. toxopei* Warburton, 1927 (Parasitology, 19: 405–410)
Kolonin (2009, *op. cit*. under *H. anomaloceraea*) excludes *H. toxopei* from his list of ixodids of the world, giving no reason for doing so. Perhaps he followed Anastos (1950, *op. cit*. under *H. hylobatis*), who regards *H. toxopei* as a synonym of *H. kinneari* based on Warburton, C. (1927. On five new species of ticks (Arachnida Ixodoidea), *Ornithodorus* [sic] *nattereri, Ixodes theodori, Haemaphysalis toxopei, Amblyomma robinsoni* and *A. dammermani*, with a note on the ornate nymph of *A. latum*. Parasitology, 19: 405–410). However, Warburton's statement is treated as a *lapsus* in Trapido, H., Hoogstraal, H. & Varma, M.G.R. (1964. Status and descriptions of *Haemaphysalis p. papuana* Thorell (n. comb.) and of *H. papuana kinneari* Warburton (n. comb.) (Ixodidae) of southern Asia and New Guinea. J. Parasitol., 50: 172–188). *Haemaphysalis toxopei* is a valid species.

Type depository: BMNH (lectotype, paralectotypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female

Zoogeographic Regions: Australasian, Oriental

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: Chiroptera: Pteropodidae (AN)
Carnivora: Canidae (A)

Human infestation: no

Remarks: although the nymphal stage of *H. toxopei* has not been described, we regard a single collection from Chiroptera in Durden et al. (2008) as provisionally valid. Hoogstraal (1964) refers to this tick as *H. papuana toxopei*.

References

Durden, L.A., Merker, S. & Beati, L. 2008. The tick fauna of Sulawesi, Indonesia (Acari: Ixodoidea: Argasidae and Ixodidae). Exp. App. Acarol., 45: 85–110.

Hoogstraal, H. 1964. Studies on Southeast Asian *Haemaphysalis* ticks (Ixodoidea, Ixodidae). Redescription, hosts, and distribution of *H. traguli* Oudemans. The larva and nymph of *H. vidua* W. and N. Identity of *H. papuana toxopei* Warburton (n. comb.). J. Parasitol., 50: 765–782.

159 – ***H. traguli*** Oudemans, 1928 (Entomol. Ber., 7 (164): 374–383)

Type depository: LMNH (syntypes) (Hoogstraal, H. 1964. Studies on Southeast Asian *Haemaphysalis* ticks (Ixodoidea, Ixodidae). Redescription, hosts, and distribution of *H. traguli* Oudemans. The larva and nymph of *H. vidua* W. and N. Identity of *H. papuana toxopei* Warburton. J. Parasitol., 50: 765–782)

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregions: tropical and subtropical moist broadleaf forests; few ticks in tropical and subtropical dry broadleaf forests

Hosts: usual hosts for larvae, nymphs and adults are Artiodactyla: Tragulidae.
Artiodactyla: Tragulidae (ANL)
Artiodactyla: Suidae; Rodentia: Muridae (A)

Human infestation: no

Remarks: Nadchatram et al. (1966) regard diagnoses of nymphs of *H. traguli* from Scandentia as tentative, and these hosts have therefore not been included in our list. These authors also erroneously refer to *H. traguli* as *H. atheruri* on page 133 of their paper. Kolonin (2009) excludes Suidae from his list of hosts for this tick, but we regard the record from this type of host in Keirans (1985) as valid.

References

Hoogstraal, H. 1964. Studies on Southeast Asian *Haemaphysalis* ticks (Ixodoidea, Ixodidae). Redescription, hosts, and distribution of *H. traguli* Oudemans. The larva and nymph of *H. vidua* W. and N. Identity of *H. papuana toxopei* Warburton. J. Parasitol., 50: 765–782.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Nadchatram, M., Domrow, R. & Ng, C.K. 1966. Parasitic Acarina of the mammals. Bull. Nat. Mus. State Singapore (34): 129–140.

160 – *H. traubi* Kohls, 1955 (J. Parasitol., 41: 312–315)

Type depositories: USNTC (holotype, paratype), BMNH (paratype) (Keirans and Hillyard, 2001, *op. cit*. under *H. aciculifer*).

Known stages: male, female

Zoogeographic Region: Oriental

Ecoregion: Borneo rain forests

Hosts: Artiodactyla: Cervidae, Suidae (A)

Human infestation: no

Reference

Hoogstraal, H. & El Kammah, K.M. 1971. Studies on Southeast Asian *Haemaphysalis* ticks (Ixodoidea: Ixodidae). *H.* (*H.*) *traubi* Kohls, redescription of male, description of female, and new artiodactyl host and Malayan distribution records. J. Parasitol., 57: 426–431.

161 – *H. turturis* Nuttall & Warburton, 1915 (Ticks. A monograph of the Ixodoidea. Part III. The genus *Haemaphysalis*. Cambridge University Press, London, pp. 349–550)

Type depository: ZMB (holotype) (Moritz and Fischer 1981, *op. cit*. under *H. cinnabarina*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregions: tropical and subtropical dry broadleaf forests

Hosts: Aves are considered exceptional hosts for adults of this tick.
Mammalia (several orders); Cuculiformes: Cuculidae; Galliformes: Phasianidae; Passeriformes: Turdidae (ANL)
Columbiformes: Columbidae (A)
Passeriformes (several families); Piciformes: Picidae (NL)
Psittaciformes: Psittacidae (N)

Human infestation: yes (Prakasan and Ramani 2003)

Remarks: Camicas et al. (1998) unaccountably do not specify any hosts for the larvae and nymphs of *H. turturis*. Kolonin (2009) ignores Aves as hosts for adult *H. turturis*, but there is evidence for this host-parasite relationship in Trapido et al. (1963), who redescribed the holotype collected from Columbidae, and in Rajagopalan (1972), who found small numbers of adult *H. turturis* on Aves.

References

Bhat, H.R. & Sreenivasan, M.A. 1981. Further records of the ticks of some reptilian and mammalian hosts in the Kyasanur Forest disease area, Karnataka, India. Ind. J. Parasitol., 5: 207–210.

Boshell, J. & Rajagopalan, P.K. 1968. Observations on the experimental exposure of monkeys, rodents and shrews to infestation of ticks in forest in Kyasanur Forest disease area. In. J. Med. Res., 56 (4) (Suppl.): 573–588.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Hoogstraal, H. & Rack, G. 1967. Ticks (Ixodidae) collected by Deutsche Indien-Expedition, 1955–1958. J. Med. Entomol., 3: 284–288.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Prakasan, K. & Ramani, M. 2003. Human infesting ixodid ticks of Kerala. J. Parasit. Dis., 27: 108–112.
Rajagopalan, P.K. 1972. Ixodid ticks (Acarina: Ixodidae) parasitizing wild birds in the Kyasanur Forest disease area of Shimoga District, Mysore State, India. J. Bombay Nat. Hist. Soc., 69: 55–78.
Rajagopalan, P.K. & Sreenivasan, M.A. 1981. Ixodid ticks on cattle and buffaloes in the Kyasanur Forest disease area of Karnataka State. Ind. J. Med. Res., 73: 880–889.
Rajagopalan, P.K., Patil, A.P. & Boshell, J. 1968. Ixodid ticks on their mammalian hosts in the Kyasanur Forest disease area of Mysore State, India, 1961–1964. Ind. J. Med. Res., 56: 510–526.
Trapido, H., Hoogstraal, H. & Varma, M.G.R. 1963. Redescription of the holotype and description of all stages of *Haemaphysalis turturis* Nuttall and Warburton from Ceylon and India (Ixodoidea, Ixodidae). J. Parasitol., 49: 678–685.
Trapido, H., Goverdhan, M.K., Rajagopalan, P.K. & Rebello, M.J. 1964. Ticks ectoparasitic on monkeys in the Kyasanur Forest disease area of Shimoga District, Mysore State, India. Am. J. Trop. Med. Hyg., 13: 763–772.

162 – *H. verticalis* Itagaki, Noda & Yamaguchi, 1944 (*In* Ticks parasitic on domestic animals of Asia. Japanese Horse-Racing Association, Tokyo, 97 pp. In Japanese)

Type depository: NSM (syntypes, but apparently lost) (Emel'yanova, N.D. & Hoogstraal, H. 1973. *Haemaphysalis verticalis* Itagaki, Noda, and Yamaguchi: rediscovery in China, adult and immature identity, rodent hosts, distribution, and medical relationships (Ixodoidea: Ixodidae). J. Parasitol., 59: 724–733)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: temperate grasslands, savannas and shrublands

Hosts: usual hosts for larvae, nymphs and adults are Rodentia: Sciuridae. Aves are considered exceptional hosts for this tick.
Rodentia: Sciuridae, Muridae (ANL)
Mammalia (several orders); Passeriformes: Passeridae (A)

Human infestation: no

Remarks: the information obtained on host relationships in Teng and Jiang (1991) and Ma (1996) is inferred, and because of our inability to fully understand what stages were found on particular hosts, we have limited ourselves to adult ticks. Kolonin (2009) excludes Aves as hosts for *H. verticalis*, but we consider a record in Teng and Jiang (1991) from Passeriformes as provisionally valid.

References

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Emel'yanova, N.D. & Hoogstraal, H. 1973. *Haemaphysalis verticalis* Itagaki, Noda, and Yamaguchi: rediscovery in China, adult and immature identity, rodent hosts, distribution, and medical relationships (Ixodoidea: Ixodidae). J. Parasitol., 59: 724–733.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Ma, L. 1996. Observation on the behaviour of *Haemaphysalis verticalis* in the meadow of Jilin Province. Acta Entomol. Sin., 39: 219–222. In Chinese.
Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.
Zhuo, H.-M. & Su, J.-Y. 2003. Study of Lyme disease in Xilinguole District of Inner Mongolia. Chin. J. Vet. Med., 39: 6–7. In Chinese.

163 – *H. vidua* Warburton & Nuttall, 1909 (Parasitology, 2: 57–76)

Type depository: BMNH (holotype) (Keirans and Hillyard, 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: Carnivora: Viverridae (ANL)

Human infestation: no

Reference

Hoogstraal, H. 1964. Studies on Southeast Asian *Haemaphysalis* ticks (Ixodoidea, Ixodidae). Redescription, hosts, and distribution of *H. traguli* Oudemans. The larva and nymph of *H. vidua* W. and N. Identity of *H. papuana toxopei* Warburton (n. comb.). J. Parasitol., 50: 765–782.

164 – *H. warburtoni* Nuttall, 1912 (Parasitology, 5: 50–60)

Type depository: BMNH (lectotype, paralectotypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Oriental, Palearctic

Ecoregion: lower Gangetic Plains moist deciduous forests

Hosts: Artiodactyla: Bovidae (ANL)
Rodentia: Muridae; Galliformes: Phasianidae (NL)

Human infestation: no

Remarks: papers on *H. warburtoni* adults published prior to Hoogstraal (1966) and those on larvae and nymphs published prior to Hoogstraal (1971) have not been

considered in our analyses because of diagnostic uncertainties. Mitchell (1979) listed all the hosts of Nepalese ticks collected from 1966 to 1970, including those of *H. warburtoni* (no developmental stage provided), which was allegedly found on Cricetidae. This host is not included in Hoogstraal (1971) and it has been excluded from our list for *H. warburtoni*. There is also a record of *H. warburtoni* feeding on a human in Kirghizia (Sartbaev 1955), but according to the range statement in Hoogstraal (1966), the species was probably *H. pospelovashtromae*. Pending resolution of this matter, we have excluded humans from our list of hosts of *H. warburtoni* and *H. pospelovashtromae*.

References

Hoogstraal, H. 1966. *Haemaphysalis (Allophysalis) pospelovashtromae* sp. n. from USSR and redescription of the type material of *H. (A.) warburtoni* Nuttall from China (Ixodoidea, Ixodidae). J. Parasitol., 52: 787–800.

Hoogstraal, H. 1971. *Haemaphysalis (Allophysalis) warburtoni* Nuttall: description of immature stages, adult structural variation, and hosts and ecology in Nepal, with a redefinition of the subgenus *Allophysalis* Hoogstraal (Ixodoidea: Ixodidae). J. Parasitol., 57: 1083–1095.

Mitchell, R.M. 1979. A list of ectoparasites from Nepalese mammals, collected during the Nepal ectoparasite program. J. Med. Entomol., 16: 227–233.

Sartbaev, S.K. 1955. Materials on the biology of *Haemaphysalis warburtoni* Nutt., 1912, in conditions of Kirghizia (preliminary information). Trudy Inst. Zool. Parasitol. Akad. Nauk Kirgiz, SSR (4): 121–127. In Russian, NAMRU-3 translation 12.

165 – *H. wellingtoni* Nuttall & Warburton, 1908 (Proc. Cambr. Philos. Soc., 14: 392–416)

Type depository: BMNH (lectotype, paralectotypes) (Keirans and Hillyard, 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Australasian, Oriental

Ecoregions: tropical and subtropical moist broadleaf forests; few ticks in tropical and subtropical dry broadleaf forests

Hosts: usual hosts for larvae, nymphs and adults are Galliformes: Phasianidae. Mammalia (several orders); Aves (several orders) (ANL)

Human infestation: yes (Durden et al. 2008)

Remarks: Yamaguti et al. (1971) and Miyamoto et al. (1993) provide *bona fide* records of *H. wellingtoni* for the Palearctic Region, but the ticks had been found on migratory birds and this species is probably not established there. Joyce (1965) reports its introduction into remote Pacific islands, where it has also failed to become established.

References

Bhat, H.R. & Sreenivasan, M.A. 1981. Further records of the ticks of some reptilian and mammalian hosts in the Kyasanur Forest disease area, Karnataka, India. Ind. J. Parasitol., 5: 207–210.

Boshell, J. & Rajagopalan, P.K. 1968. Observations on the experimental exposure of monkeys, rodents and shrews to infestation of ticks in forest in Kyasanur Forest disease area. Ind. J. Med. Res., 56 (4) (Suppl.): 573–588.

Durden, L.A., Merker, S. & Beati, L. 2008. The tick fauna of Sulawesi, Indonesia (Acari: Ixodoidea: Argasidae and Ixodidae). Exp. App. Acarol., 45: 85–110.

Emel'yanova, N.D. & Shikhorbeev, B.V. 1971. *Haemaphysalis wellingtoni* Nutt. and W. 1907 – a new ixodid tick in the USSR fauna. Dokl. Irkutsk. Protiv. Inst. (9): 249. In Russian, NAMRU-3 translation 574.

Hoogstraal, H., Lim, B.L., Nadchatram, M. & Anastos, G. 1972. The Gunong Benom Expedition 1967. 8. Ticks (Ixodidae) of Gunong Benom and their altitudinal distribution, hosts and medical relationships. Bull. Br. Mus. (Nat. Hist.) Zool., 23: 167–186.

Joyce, C.R. 1965. Notes and exhibitions. Proc. Hawaiian Entomol. Soc., 19: 25.

Miyamoto, K., Nakao, M, Fujita, H. & Sato, F. 1993. The ixodid ticks on migratory birds in Japan and the isolation of Lyme disease spirochetes from bird-feeding ticks. Jap. J. Sanit. Zool., 44: 315–326.

Parola, P., Cornet, J.-P., Sanogo, Y.O., Miller, R.S., Thien, H.V., González, J.-P., Raoult, D., Telford, S.R. & Wongsrichanalai, C. 2003. Detection of *Ehrlichia* spp., *Anaplasma* spp., *Rickettsia* spp., and other eubacteria in ticks from the Thai-Myanmar border and Vietnam. J. Clin. Microbiol., 41: 1600–1608.

Rajagopalan, P.K. 1972. Ixodid ticks (Acarina: Ixodidae) parasitizing wild birds in the Kyasanur Forest disease area of Shimoga District, Mysore State, India. J. Bombay Nat. Hist. Soc., 69: 55–78.

Tanskul, P., Stark, H.E. & Inlao, I. 1983. A checklist of ticks of Thailand (Acari: Metastigmata: Ixodoidea). J. Med. Entomol., 20: 330–341.

Trapido, H., Goverdhan, M.K., Rajagopalan, P.K. & Rebello, M.J. 1964. Ticks ectoparasitic on monkeys in the Kyasanur Forest disease area of Shimoga District, Mysore State, India. Am. J. Trop. Med. Hyg., 13: 763–772.

Xu, R. & Li, K. 1997. A collection of ticks from Guizhou, China. Syst. Appl. Acarol., 2: 245–246.

Yamaguti, N., Tipton, V.J., Keegan, H.L. & Toshioka, S. 1971. Ticks of Japan, Korea, and the Ryukyu Islands. Brigham Young Univ. Sci. Bull. Biol. Ser., 15 (1), 226 pp.

166 – *H. yeni* Toumanoff, 1944 (*In* Les tiques (Ixodoidea) de l'Indochine. Instituts Pasteur de l'Indochine, S.I.L.I., Saigon, 220 pp.)

Type depository: IPP (lectotype) (Hoogstraal, H. & Trapido, H. 1966. Redescription of the type materials of *Haemaphysalis (Kaiseriana) bispinosa* Neumann (India), *H. (K.) neumanni* Dönitz (Japan), *H. (K.) lagrangei* Larrousse (Vietnam), and *H. (K.) yeni* Toumanoff (Vietnam) (Ixodoidea: Ixodidae). J. Parasitol., 52: 1188–1198)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: tropical and subtropical dry broadleaf forests

Hosts: usual hosts for adult ticks are Artiodactyla: Cervidae.
Artiodactyla: Cervidae; Lagomorpha: Leporidae (ANL)
Carnivora: Canidae (AN)
Carnivora: Felidae, Viverridae (A, N and/or L)
Artiodactyla: Bovidae (A)

Human infestation: no

Remarks: Camicas et al. (1998) state that this tick is found exclusively in the Oriental Zoogeographic Region, but there are now also *bona fide* records of *H. yeni* for the Palearctic Region in Inokuma et al. (2002), among others. Kolonin (2009) mentions immature stages feeding on several hosts without specifying whether larvae, nymphs or both stages of *H. yeni* were found on Viverridae. He also ignores Leporidae as hosts for this tick, but we accept records from this type of host in Xu and Luo (1998).

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Cao, W.-C., Gao, Y.-M., Zhang, P.-H., Zhang, X.-T., Dai, Q.-H., Dumler, J.S., Fang, L.-Q. & Yang, H. 2000. Identification of *Ehrlichia chaffensis* by nested PCR in ticks from southern China. J. Clin. Microbiol., 38: 2778–2880.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Inokuma, H., Fujimoto, T., Hoso, E., Tanaka, S., Fujisaki, K., Okuda, M. & Onishi, T. 2002. Tick infestation of sika deer (*Cervus nippon*) in the western part of Yamaguchi Prefecture, Japan. J. Vet. Med. Sci., 64: 615–617.

Kolonin, G.V. 1995. Review of the ixodid tick fauna (Acari: Ixodidae) of Vietnam. J. Med. Entomol., 32: 276–282.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Phan Trong, C. 1977. Ve bet va con trung ky sinh o Viet Nam. Tap 1. Ve (Ixodoidea), mo ta va phan loai. Ha Noi: Khoa hoc va ky thuat, 489 pp. In Vietnamese.

Saito, Y. & Hoogstraal, H. 1972. *Haemaphysalis (Kaiseriana) yeni* Toumanoff (Ixodoidea: Ixodidae): discovery in Japan, description of female and immature stages, environment and life cycle. J. Parasitol., 58: 950–959.

Xu, R. & Luo, G. 1998. Ticks parasitic on *Muntiacus reevesi* and *Lepus sinensis* in Wuyi Mountains, Fujian, China. Syst. Appl. Acarol., 3: 197.

167 – *H. zumpti* Hoogstraal & El Kammah, 1974 (J. Parasitol., 60: 188–197)

Type depositories: USNTC (holotype, paratypes), BMNH, FMNH, HH, OVI, SAIMR, CM (paratypes) (Keirans and Hillyard 2001, *op. cit*. under *H. aciculifer*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregion: southern Africa bushveld

Hosts: Carnivora: Herpestidae, Hyaenidae; Rodentia: Sciuridae (ANL)
Carnivora: Viverridae (AN)
Carnivora (several orders) (A)

Human infestation: no

Remarks: Cumming (1998) states that Carnivora are the only hosts for *H. zumpti*, but this species has also been collected from Sciuridae (Hoogstraal and El Kammah 1974). Walker (1991) stresses the difficulties involved in separating larvae and nymphs of *H. zumpti* from those of *H. leachi* and *H. spinulosa*. However, we accept the records in Hoogstraal and El Kammah (1974) and Horak et al. (2000) of larval and nymphal *H. zumpti* on the hosts listed above.

References

Cumming, G.S. 1998. Host preference in African ticks (Acari: Ixodida): a quantitative data set. Bull. Entomol. Res., 88: 379–406.

Hoogstraal, H. & El Kammah, K.M. 1974. Notes on African *Haemaphysalis* ticks. XII. *H. (Rhipistoma) zumpti* sp. n., a parasite of small carnivores and squirrels in southern Africa (Ixodoidea: Ixodidae). J. Parasitol., 60: 188–197.

Horak, I.G., Braack, L.E.O., Fourie, L.J. & Walker, J.B. 2000. Parasites of domestic and wild animals in South Africa. XXXVIII. Ixodid ticks collected from 23 wild carnivore species. Onderstepoort J. Vet. Res., 67: 239–250.

Matthee, S., Lovely, C., Gaugler, A., Beeker, R., Venter, H.R. & Horak, I.G. 2010. Ixodid ticks on domestic dogs in the Northern Cape Province of South Africa and in Namibia. J. S. Afr. Vet. Assoc., 81: 126–128.

Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.

Synopsis of the Genus *Haemaphysalis*

A synopsis of the genus *Haemaphysalis* is presented in Tables 1 and 2. The Oriental Region contains the greatest number of species occurring exclusively in a single zoogeographic region (64, or 38 % of the total), while the Neotropical and Nearctic Regions contain the least number of species confined to a single region, namely *H. cinnabarina* (known from two specimens collected almost 170 years ago) and *H. chordeilis*, respectively. Six species are widely distributed. Four of these species – *H. cornigera, H. doenitzi, H. hystricis* and *H. longicornis* – occur in the Australasian, Oriental and Palearctic Zoogeographic Regions, while two species – *H. indica* and *H. sulcata* – occur in the Afrotropical, Oriental and Palearctic Regions. As a genus, haemaphysalids are confined to 12 combinations of zoogeographic regions.

Table 1 Numbers and percentages of all species of *Haemaphysalis*, by zoogeographic region(s), number known to feed on humans (% of the total number of species in a particular region) and number of species for which all stages (larva, nymph, male and/or female) are known (% of the total number of species in a particular region)

Regions	No. of species	%	No. of species on humans	No. of species of which all stages are known
Oriental	64	38.3	20 (31.2)	30 (46.9)
Afrotropical	38	22.8	5 (13.2)	19 (50.0)
Oriental-Palearctic	19	11.4	9 (47.4)	17 (89.5)
Palearctic	19	11.4	7 (36.8)	14 (73.7)
Australasian	8	4.8	3 (37.5)	3 (37.5)
Australasian-Oriental	7	4.2	3 (42.9)	4 (57.1)
Australasian-Oriental-Palearctic	4	2.4	4 (100)	4 (100)
Nearctic-Neotropical	2	1.2	2 (100)	2 (100)
Afrotropical-Oriental-Palearctic	2	1.2	1 (50.0)	2 (100)
Afrotropical-Palearctic	1	0.6	1 (100)	1 (100)
Nearctic	1	0.6	1 (100)	1 (100)
Neotropical	1	0.6	0	0
Undetermined	1	0.6	0	1 (100)
Total	**167**		**56 (33.5)**	**98 (58.7)**

Table 2 Number and percentages of the 85 species of *Haemaphysalis* whose adult (female and/or male), larval and nymphal stages as well as natural hosts are known, including or excluding exceptional hosts

Hosts	No. of species	%	No. of species	%
	Including exceptional hosts		Excluding exceptional hosts	
Aves + Mammalia	45	52.9	34	40.0
Mammalia	29	34.1	41	48.2
Aves + Mammalia + Squamata + Testudines	4	4.7	1	1.2
Aves + Mammalia + Squamata	3	3.5	3	3.5
Aves + Mammalia + Testudines	2	2.4	0	0
Aves	1	1.2	5	5.9
Mammalia + Squamata	1	1.2	1	1.2
Total	**85**		**85**	

Our overall analyses indicate that 118 species (71 %) occur in regions that constituted Gondwanaland, 20 species (12 %) are found in lands that formed Laurasia, and the remaining 28 species (17 %) occur in areas that were part of both ancient continents.

A total of 56 species (33 %) have been recorded as feeding on humans.

The larva, nymph and at least one adult stage are known for just 98 (59 %) of the 167 species of *Haemaphysalis* that we recognize as valid. Clearly, efforts should be made to expand our knowledge of the taxonomy of the subadult stages of this genus in order to better understand the phylogenetic relationships of haemaphysalids as a whole. Nevertheless, most parasitic stages of species within the Palearctic and Oriental-Palearctic Region are known.

Host utilization by the 85 species of *Haemaphysalis* whose adult (female and/or male) and sub-adult stages are known, together with their natural hosts, is presented in Table 2, first including exceptional hosts, and then excluding these hosts. Although all parasitic stages of *H. colasbelcouri, H. colesbergensis, H. fujisana, H. kitaokai, H. megaspinosa, H. norvali*, and *H. shimoga* are known, one or more of these stages are known only from laboratory-reared specimens. On the other hand, the natural hosts of the larva or the nymph of *H. indoflava, H. leachi, H. montgomeryi, H. obesa* and *H. spinulosa* are not known with certainty, and while the male, female, nymph and larva of *H. kumaonensis* are known, their hosts are not. These 13 species have therefore been excluded from our analysis.

When exceptional hosts are included, *Haemaphysalis* ticks parasitize seven categories of hosts (Table 2). The only exclusive hosts are Mammalia (29 species or 34 % of the total), and Aves, which are exclusive hosts for the Oriental *H. megalaimae*. However, Mammalia are exclusive and non-exclusive hosts for 84 species (99 %), and Aves are exclusive or non-exclusive hosts for 55 species (65 %). The most common combination of hosts is Mammalia + Aves (45 species or 53 %). By comparison, the contribution of Squamata and Testudines is insignificant because these groups are hosts of just 8 and 6 species of *Haemaphysalis*, respectively, and even then only in combination with two to three other types of hosts for the corresponding species (Table 2). Anura and Crocodilia are not known to host *Haemaphysalis* ticks.

The pattern of host utilization undergoes important changes when exceptional hosts are excluded from the analysis. First, the categories of hosts diminish to six, because the combination Aves + Mammalia + Testudines drops out. Mammalia increases its share as exclusive hosts for almost half of the species (41, or 48 %). Four species – *H. chordeilis, H. doenitzi, H. hoodi* and *H. minuta* – join *H. megalaimae* as exclusive parasites of Aves (6 % of the total). The most common combination of hosts is still Mammalia + Aves (34 species, or 40 %), followed by the three combinations of hosts shown in Table 2. The representation of Squamata as hosts is now reduced to five species, the Palearctic *H. caucasica, H. parva* and *H. punctata*, the Oriental *H. kashmirensis*, and the Afrotropical, Oriental and Palearctic species *H. sulcata*. However, the role of Squamata is certainly relevant for the maintenance of larvae and nymphs of *H. kashmirensis*. *Haemaphysalis sulcata* is the only species with Testudinidae as non-exclusive hosts when exceptional hosts are excluded from the analysis; among other types of hosts, the larvae and nymphs of *H. sulcata* are also found on Testudinidae and on Squamata.

Part III
The Genus *Amblyomma*

Remarks on Some Invalid Names

Amblyomma acutangulatum Neumann, 1899 is treated as valid by Barker and Murrell (2008), but it is a *nomen nudum* because the description is poor and the type has been lost, as explained in Guglielmone et al. (2009). However, according to the International Commission on Zoological Nomenclature (1999), names published before 1931 should not be classified as *nomina nuda* if they are accompanied by a figure or a drawing (even if equivocal) (Dunlop 2011). Therefore, *A. acutangulatum* is a *nomen dubium*.

Amblyomma bispinosum Neumann, 1906 is known to be a synonym of *A. coelebs* (Santos Dias 1958; Jones et al. 1972; Camicas et al. 1998). However, Keirans and Hillyard (2001) list *A. bispinosum* as a valid species, despite the fact that the synonymy proposed by Santos Dias (1958) was based on examination of the type. For this reason we do not regard *A. bispinosum* as valid.

Amblyomma calcaris Nakatsudi, 1942 is treated as a synonym of *A. calcaratum* Neumann, 1899 in Camicas et al. (1998), a view apparently shared by Yamauchi (2010). However, the figures of the female of *A. calcaris* collected in Manchuria that appear in Nakatsudi (1942) clearly do not depict the female of *A. calcaratum*, and, given the peculiar morphology of its palps and hypostome, it is unclear whether the tick described by Nakatsudi belongs in the genus *Amblyomma*. The supposed specimen of *A. calcaris* is stated to have been deposited in TAU, an acronym for Tokyo Agricultural University, which may be the present-day Tokyo University of Agriculture. Any tick collection at the Tokyo University of Agriculture should be examined for *A. calcaris* in order to determine this tick's specific status. We currently regard *A. calcaris* as *incertae sedis.*

Amblyomma colasbelcouri (Santos Dias, 1958) is recognized as a valid name by Barker and Murrell (2008). This species was originally named *Aponomma colasbelcouri* but is now recognized as a member of the genus *Haemaphysalis* (Guglielmone et al. 2009).

A.A. Guglielmone et al., *The Hard Ticks of the World: (Acari: Ixodida: Ixodidae)*,
DOI 10.1007/978-94-007-7497-1_6, © Springer Science+Business Media Dordrecht 2014

Amblyomma decorosum (Koch, 1867) is treated as a valid species by Barker and Murrell (2008) when in fact it is a synonym of *Bothriocroton undatum* (Fabricius, 1775) (Guglielmone et al. 2009).

Amblyomma diemeniae Schulze, 1950 was collected from Australasian Squamata in the Berlin Aquarium. The types are deposited in the USNTC, but a recent search of that collection failed to locate them. Camicas et al. (1998) consider *A. diemeniae* a synonym of *A. argentinae* Neumann, 1905, and in fact the description of Schulze (1950) provides no evidence that these are separate species. We provisionally agree with Camicas et al. (1998), pending type comparison.

Amblyomma grossum (Pallas, 1772) is a name proposed for a female tick collected from a crocodile in Suriname. The specimen was originally named *Acarus grossus*, but Neumann (1899) considered it a probable *Amblyomma.* This name had been almost entirely absent from the literature until 1993, when Rawlins et al. (1993) resurrected it. The description and figure in Pallas (1772) provide no clues to its identity, rendering comparison with related tick species impossible. Nevertheless, we regard *A. grossum* as a *nomen dubium* for the reasons detailed above under *A. acutangulatum.*

Amblyomma guianense Neumann, 1907 and *A. trimaculatum* Neumann, 1908. Jones et al. (1972) treat *A. guianense* as a possible synonym of *A. multipunctum.* However, Camicas et al. (1998) consider *A. guianense* to be a synonym of *A. oblongoguttatum.* Also, *A. guianense* is treated as valid in Rawlins et al. (1993). *Amblyomma guianense* is known from two males and one female collected in Suriname and deposited in the LMNH, but van Niekerken, E. (personal communication to Guglielmone, A.A.) failed to locate these specimens there. On the other hand, *A. trimaculatum* is known from a female collected in Liberia that is also deposited in the LMNH (Neumann 1908), but this species is treated as a synonym of *A. paulopunctatum* by Robinson (1926) and Camicas et al. (1998). Guglielmone et al. (2003) noticed that the females of both species are similar, but the first to recognize similarities between the females of *A. guianense* and *A. trimaculatum* was Neumann (1908), who subsequently ignored the latter (Neumann 1911). Currently, we are unable to solve this problem and regard both species as *incertae sedis.*

Amblyomma laticaudae Warburton, 1933 is treated as a valid species in Camicas et al. (1998) and Guglielmone et al. (2009), among other studies. Audy et al. (1960) determined that *A. laticaudae* is a synonym of *A. nitidum* Hirst & Hirst, 1910. Therefore, the name *A. laticaudae* is invalid. This position has been accepted by Kolonin (2009) and Guglielmone et al. (2010).

Amblyomma mantiguinensa is listed as species number 15 in Liu et al. (2005). We have been unable to find any description or authority for this name, and we therefore consider it a *nomen nudum.*

The genus *Aponomma* was invalidated by Klompen et al. (2002), who transferred all Australasian species to the genus *Bothriocroton*, while the remaining *Aponomma* were reclassified in the genus *Amblyomma*. Kolonin (2009) and a number of other workers continue to regard *Aponomma* as a valid genus.

References

Audy, J.R., Nadchatram, M. & Lim, B.-L. 1960. Malaysian parasites. XLIX. Host distribution of Malayan ticks (Ixodoidea). Stud. Inst. Med. Res. Malaya, 29: 225–246.

Barker, S.C. & Murrell, A. 2008. Systematics and evolution of ticks with a list of valid genus and species names. *In* A.S. Bowman & P.A. Nuttall (editors), Ticks: biology, disease and control. Cambridge University Press, Cambridge, pp. 1–39.

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Dunlop, J.A. 2011. The fate and status of the supposed fossil tick *Ixodes tertiarius* Scudder, 1885. Acarologia, 51: 399–404.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands. 173 pp.

Guglielmone, A.A., Robbins, R.G., Apaneskevich, D.A., Petney, T.N., Estrada-Peña, A. & Horak, I.G. 2009. Comments on controversial tick (Acari: Ixodida) species names and species described or resurrected from 2003 to 2008. Exp. Appl. Acarol., 48: 311–327.

Guglielmone, A.A., Robbins, R.G., Apanaskevich, D.A., Petney, T.N., Estrada-Peña, A., Horak, I.G., Shao, R. & Barker, S.C. 2010. The Argasidae, Ixodidae and Nuttalliellidae (Acari: Ixodida) of the world: a list of valid species names. Zootaxa, 2528: 1–28.

International Commission on Zoological Nomenclature. 1999. International Code of Zoological Nomenclature, 4th edition, The International Trust for Zoological Nomenclature 1999, 306 pp.

Jones, E.K., Clifford, C.M., Keirans, J.E. & Kohls, G.M. 1972. The ticks of Venezuela (Acarina: Ixodoidea) with a key to the species of *Amblyomma* in the Western Hemisphere. Brigham Young Univ. Sci. Bull. Biol. Ser., 17 (4), 40 pp.

Keirans, J.E. & Hillyard, P.D. 2001. A catalogue of the type specimens of Ixodida (Acari: Argasidae, Ixodidae) deposited in The Natural History Museum, London. Occ. Pap. Syst. Entomol. (13), 74 pp.

Klompen, H., Dobson, S.J. & Barker, S.C. 2002. A new subfamily, Bothriocrotoninae n. subfam., for the genus *Bothriocroton* Keirans, King & Sharrad, 1994 status amend. (Ixodida: Ixodidae), and the synonymy of *Aponomma* Neumann, 1899 with *Amblyomma* Koch, 1844. Syst. Parasitol., 53: 101-107

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Liu, M.-s., Huang, K.-c., Zhao, Z.-f., Zhang, L.-z., Wu, Y.-j. & Guo, P.-r. 2005. Research on distribution of ticks in nine provinces in China. J. Changzhi Med. Col. (4): 1–5.

Nakatsudi, K. 1942. One new tick from North Manchukou [sic]. J. Agric. Sci., 1: 329–332. In Japanese, Spanish translation by Terashima, Elizabeth.

Neumann, L.G. 1899. Révision de la famille des ixodidés (3e mémoire). Mém. Soc. Zool. Fr., 12: 107–294.

Neumann, L.G., 1907. Quatre espèces nouvelles d'ixodidés. Notes Leyden Mus., 29: 88–100.

Neumann, L.G., 1908. Notes sur les ixodidés. Notes Leyden Mus., 30: 73–91.

Neumann, L.G. 1911. Ixodidae. Das Tierreich (26), 169 pp.

Pallas, P.S. 1772. Spicilegia Zoologica, vol. 40, fasc. 9, 87 pp.

Rawlins, S.C., Mahadeo, S. & Martínez, R. 1993. A list of the ticks affecting man and animals in the Caribbean. CARAPHIN News, (6): 8–9.

Robinson, L.E. 1926. Ticks. A monograph of the Ixodoidea. Part IV. The genus *Amblyomma*. Cambridge University Press, London, 302 pp.

Santos Dias, J.A.T. 1958. Notes on various ticks (Acarina-Ixodoidea) in collection at some entomological institutes in Paris and London. An. Inst. Med. Trop., 15: 459–563.

Schulze, P. 1950. *Amblyomma diemeniae*, eine neue Schlangenzecke aus Australien nebst Bemerkungen über abweichende Clavalbildungen in der Gattung *Amblyomma.* Z. Parasitnkd., 14: 432–441.

Yamauchi, T. 2010. On the author's names in ixodid ticks named by Mr. Kodi Nakatsudi. J. Acarol. Soc. Jap., 19: 23–25. In Japanese.

Individual Species Accounts

1 – *A. albolimbatum* Neumann, 1907 (Notes Leyden Mus., 28: 218–220)
Roberts, F.H.S. (1964. Further observations on the Australian species of *Aponomma* and *Amblyomma* with descriptions of the nymphs of *Amblyomma moreliae* (L. Koch) and *Amb. loculosum* Neumann (Acarina: Ixodidae). Aust. J. Zool., 12: 288–313) refers to extensive variation among specimens of *A. albolimbatum*, implying that more than one taxon may be included under this name.

Type depository: LMNH (syntypes) (Neumann, L.G. 1907. Note XVI. Ixodidé nouveau de l'Australie. Notes Leyden Mus., 28: 218–220)

Known stages: male, female, nymph, larva

Zoogeographic Region: Australasian

Ecoregions: mediterranean forests, woodlands and scrub

Hosts: usual hosts for larvae, nymphs and adults are Squamata: Scincidae. Testudines are considered exceptional hosts for this tick.
Squamata: Agamidae, Scincidae (ANL)
Squamata: Elapidae, Boidae; Testudines: Chelidae (stages unknown)

Human infestation: no

Remarks: Kolonin (2009) does not recognize Testudines as hosts for *A. albolimbatum*, but while there is only one record from this host in Roberts (1964), we have no reason to consider it erroneous.

References

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Roberts, F.H.S. 1964. Further observations on the Australian species of *Aponomma* and *Amblyomma* with descriptions of the nymphs of *Amblyomma moreliae* (L. Koch) and *Amb. loculosum* Neumann (Acarina: Ixodidae). Aust. J. Zool., 12: 288–313.

DOI 10.1007/978-94-007-7497-1_7,

Roberts, F.H.S. 1969. The larvae of Australian Ixodidae (Acarina: Ixodoidea). J. Aust. Entomol. Soc., 8: 37–78.
Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.
Smyth, M. 1973. The distribution of three species of reptile ticks, *Aponomma hydrosauri* (Denny), *Amblyomma albolimbatum* Neumann, and *Amb. limbatum* Neumann. I. Distribution and hosts. Aust. J. Zool., 21: 91–101.

2 – *A. albopictum* Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)
See remarks below.

Type depositories: MNHN, BMNH (syntypes) (Neumann, L.G. 1899. Révision de la famille des ixodidés (3e mémoire). Mém. Soc. Zool. Fr., 12: 107–294 ; Keirans, J.E. & Hillyard, P.D. 2001. A catalogue of the type specimens of Ixodida (Acari: Argasidae, Ixodidae) deposited in The Natural History Museum, London. Occ. Pap. Syst. Entomol. (13), 74 pp.). This species was originally named *Ixodes variegatus* Lucas, 1852, a name preoccupied by *Ixodes variegatus* (Fabricius, 1805), and consequently renamed.

Known stages: male, female, larva

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical dry broadleaf forests, deserts and xeric shrublands

Hosts: usual hosts for larvae, nymphs and adults are Squamata: Iguanidae.
Squamata: Iguanidae (ANL)
Squamata: Boidae (AN)

Human infestation: no

Remarks: Guglielmone et al. (2003) compiled observations on morphological variation in *A. albopictum*, concluding that this taxon is poorly defined and may perhaps be a complex of sibling species. Camicas et al. (1998) list the larva of *A. albopictum* as undescribed, but there is a description in Černý (1969), who also presents records for the undescribed nymph that we consider provisionally valid. Keirans and Durden (2001) provide a record of the introduction of *A. albopictum* into the Nearctic Region, but there is no evidence that it has become established there. Records from Mammalia from Brazil are included in Neumann's (1899) original description of *A. albopictum* but it is unclear whether these were used when preparing the original description. Freire (1972) also lists mammals as hosts for this tick. Records from mammals require confirmation and are therefore not included in our list of hosts of *A. albopictum.* Barros-Battesti et al. (2009) cite Squamata: Iguanidae as hosts for *A. albopictum* in Cuba but also list hosts that are not members of this family and repeat doubtful records from Mammalia that are not included in the list above. Mihalca et al. (2011) describe this species as endangered.

References

Barros-Battesti, D.M., Reyes Hernández, M., Famadas, K.M., Onofrio, V.C., Beati, L. & Guglielmone, A.A. 2009. The ixodid ticks (Acari: Ixodidae) of Cuba. Syst. Appl. Acarol., 14: 101–128.

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Černý, V. 1969. Nuevos conocimientos sobre la ixodofauna cubana. Torreia (21), 12 pp.

Freire, J.J. 1972. Revisão das espécies da familia Ixodidae. Rev. Med. Vet. (São Paulo), 8: 1–16.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

Neumann, L.G. 1899. Révision de la famille des ixodidés (3e mémoire). Mém. Soc. Zool. Fr., 12:107–294.

3 – *A. americanum* (Linnaeus, 1758) (*In Systema naturae per regna tria naturae, secundum classes, ordines, genera, species cum characteribus, differentiis, synonymis, locis*. Editio decima, reformata. Holmiae, 1, 823 pp.)

Type depository: LC, but apparently lost (Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp)

Known stages: male, female, nymph, larva

Zoogeographic Region: Nearctic

Ecoregions: temperate broadleaf and mixed forests

Hosts: Aves are considered exceptional hosts for adult ticks.
Mammalia (several orders) (ANL)
Ciconiiformes: Ardeidae (A)
Aves (several orders) (NL)

Human infestation: yes (Bishopp and Trembley 1945; Heath and Hardwick 2011 among others)

Remarks: Camicas et al. (1998) list the distribution of this species as Nearctic and Neotropical, but Guglielmone et al. (2003) concluded that all *bona fide* records of *A. americanum* are Nearctic. The locality for *A. foreli* Stoll, 1894 is in Guatemala (Neotropical) and this tick is treated as a synonym of *A. americanum* in Camicas et al. (1998), among others; however, the description of *A. foreli* is too vague for such a decision, and the type locality unknown. The name *A. foreli* is therefore *incertae sedis*. Joyce (1965) and Jameson et al. (2010), among others, record the introduction of *A. americanum* to remote Pacific islands and the Palearctic Region, while Heath and Hardwick (2011) record its introduction into the Australasian Region, but there is no evidence that this tick has become established in any of these regions. Kolonin (2009) limited the host range of *A. americanum* on Aves to turkeys and quails, but the references below show a broader range of Aves infested. Allan et al. (2010) determined that 22 % of questing *A. americanum* nymphs had ingested avian blood as larvae and almost one percent had fed on Squamata or Testudines, while Scott et al. (2012) mention that a nymph of *A. americanum* ingested blood from a turtle – data that we feel should be confirmed through additional studies.

References

Allan, B.F., Goessling, L.S., Storch, G.A. & Thach, R.E. 2010. Blood meal analysis to identify reservoir hosts for *Amblyomma americanum* ticks. Emerg. Inf. Dis., 16: 433–440.

Bishopp, F.C. & Trembley, H.L. 1945. Distribution and hosts of certain North American ticks. J. Parasitol., 31: 1–54.

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Heath, A.C.G. & Hardwick, S. 2011. The role of humans in the importation of ticks to New Zealand: a threat to public health and biosecurity. N. Zeal. Med. J., 124: 67–82.

Jameson, L.J., Phipps, L.P. & Medlock, J.M. 2010. Surveillance for exotic ticks on companion animals in the UK. Vet. Rec., 166: 202–203.

Joyce, C. R. 1965. Notes and exhibitions. Proc. Hawaiian Entomol. Soc., 19: 22–23.

Koch, H.G. & Dunn, J.E. 1980. Ticks collected from small and medium-sized wildlife hosts in Le Flore County, Oklahoma. Southwest. Entomol., 5: 214–221.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Lancaster, J.L. 1973. A guide to the ticks of Arkansas. Bull. Agric. Exp. Stn. Univ. Arkansas, (779), 39 pp.

Scott, C.M., Harmon, J.R., Tsao, J.I., Jones, C.J. & Hickling, G.J. 2012. Reverse line blot probe design and polymerase chain reaction optimization for bloodmeal analysis of tick from the eastern United States. J. Med. Entomol., 49: 697–709.

Wilson, N. & Baker, W.W. 1972. Ticks of Georgia (Acarina: Metastigmata). Bull. Tall Timbers Res. Stn. (10), 29 pp.

4 – *A. antillorum* Kohls, 1969 (J. Med. Entomol., 6: 439–442)

Type depositories: USNTC (holotype, paratypes), FMNH (paratypes) (Kohls, G. M. 1969. A new species of *Amblyomma* from iguanas in the Caribbean (Acarina: Ixodoidea). J. Med. Entomol., 6: 439–442)

Known stages: male, female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregion: desert and xeric shrublands

Hosts: Squamata: Iguanidae (ANL)

Human infestation: no

Remarks: Keirans (1985) states that *A. antillorum* and its hosts are at risk of extinction.

References

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Keirans, J.E . 1985. *Amblyomma antillorum* Kohls, 1969 (Acari: Ixodidae): description of the immature stages from the rock iguana, *Iguana pinguis* (Sauria: Iguanidae) in the British Virgin Islands. Proc. Entomol. Soc. Wash., 87: 821–825.

5 – *A. arcanum* Karsch, 1879 (Z. Ges. Naturw., 52, 3 F., 4: 329–373)

Horak, I.G., Camicas, J.-L. & Keirans, J.E. (2002. The Argasidae, Ixodidae and Nuttalliellidae (Acari: Ixodida): a world list of valid tick names. Exp. Appl. Acarol., 28: 27–54) enclose the describer's name in brackets, which is an error because this species was originally classified in the genus *Amblyomma*. Kolonin, G.V. (2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/) writes "?*Aponomma arcanum*" under *Aponomma exornatum*, probably considering the former name a synonym of the latter, which is in agreement with Kaufman, T.S. (1972. A revision of the genus *Aponomma* Neumann, 1899 (Acarina: Ixodidae). Ph.D. Dissertation, University of Maryland, 390 pp.). We treat *A. arcanum* as provisionally valid, pending comparison of types of this species with those of *A. exornatum* and *A. flavomaculatum* (see remarks below).

Type depository: ZMB (syntypes) (Moritz, M. & Fischer, S.C. 1981. Die Typen der Arachniden-Sammlung des Zoologischen Museums Berlin. Mitt. Zool. Mus. Berlin, 57: 341–364)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: Squamata: Varanidae (AN)
Crocodilia: Crocodylidae; Rodentia: Anomaluridae; Chiroptera: Pteropodidae; Pholidota: Manidae (A)

Human infestation: no

Remarks: difficulties may be encountered in differentiating *A. arcanum* from *A. exornatum* and *A. flavomaculatum* (Santos Dias, 1993); therefore, many host records of these species should be considered tentatively valid. The nymph of *A. arcanum* remains undescribed, but we provisionally accept the records of this stage from Varanidae reported by Morel (2003). The authors cited below recognize this tick as *Aponomma arcanum.* See also *A. exornatum.*

References

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Santos Dias, J.A.T. 1993. Contribuição para o estudo da sistemática e taxonomia das espécies do género *Aponomma* Neumann, 1899 (Acarina-Ixodoidea). Estud. Ens. Doc. (157), 204 pp.

6 – *A. argentinae* Neumann, 1905 (Arch. Parasitol., 9: 225–241)
This species was originally named *Ixodes testudinis* Conil, 1877, a name preoccupied by *Ixodes testudinis* Leydig, 1855; therefore the correct name for this species is *A. argentinae.*
Guglielmone, A.A., Robbins, R.G., Apaneskevich, D.A., Petney, T.N., Estrada-Peña, A. & Horak, I.G. (2009. Comments on controversial tick (Acari: Ixodida) species names and species described or resurrected from 2003 to 2008. Exp. Appl. Acarol., 48: 311–327) regard 1904 as the year of the description of *A. argentinae*, but this is in error because Neumann considered 1905 the correct year, as recognized in Guglielmone, A.A., Robbins, R.G., Apanaskevich, D.A., Petney, T.N., Estrada-Peña, A., Horak, I.G., Shao, R. & Barker, S.C. (2010. The Argasidae, Ixodidae and Nuttalliellidae (Acari: Ixodida) of the world: a list of valid species names. Zootaxa, 2528: 1–28). See also *A. diemeniae*, a synonym of *A. argentinae*, in "remarks on some invalid names" at the beginning of this chapter.
Amblyomma testudinis (Conil, 1877) is a synonym of *A. argentinae*, as discussed in Guglielmone et al. (2009, *op. cit.* above), but both names are incorrectly included in Barker, S.C. & Murrell, A. (2008. Systematics and evolution of ticks with a list of valid genus and species names. *In* A.S. Bowman & P.A. Nuttall (editors), Ticks: biology, disease and control. Cambridge University Press, Cambridge, pp. 1–39). See also remarks below.

Type depository: BMNH (syntypes) (Keirans and Hillyard 2001, *op. cit*. under *A. albopictum*, Neumann, L.G. 1904. Notes sur les ixodidés. III. Arch. Parasitol., 9: 225–241)

Known stages: male, female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical dry broadleaf forests; temperate grasslands, savannas and shrublands

Hosts: usual hosts for larvae, nymphs and adults are Testudines: Testudinidae, while Passeriformes: Turdidae are exceptional hosts for *A. argentinae.*
Testudines: Testudinidae (ANL)
Squamata: Viperidae (AN)
Testudines: Chelidae; Squamata: Boidae; Anura: Bufonidae; Passeriformes: Turdidae (A)

Human infestation: no

Remarks: hosts of *A. argentinae* are based on Guglielmone et al. (2001) and Guglielmone and Nava (2006), who do not include unconfirmed records of this tick found outside its usual range in Argentina. *Amblyomma testudinis* described by Conil (1877) (under the name *Ixodes testudinis*) was a widely used synonym for *A. argentinae*, while *A. testudinis* described by Supino (1897) (also under the name *Ixodes testudinis*) is a synonym of *Amblyomma supinoi* Neumann, 1905. Becklund (1968) stated that *A. testudinis* had been introduced into the Nearctic Region but that its origin was unknown. Keirans and Durden (2001) cited the data of Becklund (1968) in their review of ticks imported into the USA, but cited Supino as the author of *A. testudinis*. The specimen was found on Boidae, a known host of *A. argentinae*, but not of *A. supinoi*, leaving doubts about what species of tick the authors were referencing. Krefft (1951) published a *bona fide* record of the presence of *A. argentinae* (under the name *A. testudinis*) in the Palearctic Region, but this species failed to become established there. Guglielmone et al. (2001) believe that *A. argentinae* and its principal host may be at risk of extinction in the southern portion of its range. Kolonin (2009) lists only Testudinidae as hosts for this species, but infestation of Squamata: Boidae is not an infrequent event (Guglielmone et al. 2001) and there is an odd record on Aves in González-Acuña et al. (2003).

References

Becklund, W.W. 1968. Ticks of veterinary significance found on imports in the United States. J. Parasitol., 54: 622–628.

Conil, P.A. 1877. Description d'une nouvelle espèce d'ixode, *Ixodes testudinis*. Acta Acad. Nac. Cienc. Exactas (Argentina), 3: 25–37.

González-Acuña, D., Venzal, J.M., Keirans, J.E. & Guglielmone, A.A. 2003. The genus *Amblyomma* Koch, 1844 (Acari: Ixodidae) in Chile, with new records of *A. argentinae* Neumann, 1904 and *A. tigrinum* Koch, 1844. Syst. Appl. Acarol., 8: 85–88.

Guglielmone, A.A. & Nava, S. 2006. Las garrapatas argentinas del género *Amblyomma* (Acari: Ixodidae): distribución y hospedadores. Rev. Inv. Agropec., 35 (3): 135–155.

Guglielmone, A.A., Luciani, C.A. & Mangold, A.J. 2001. Aspects of the ecology of *Amblyomma argentinae* Neumann, 1904 [= *Amblyomma testudinis* (Conil, 1877)] (Acari: Ixodidae). Syst. Appl. Acarol. Spec. Publ. (8): 1–12.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Krefft, G. 1951. Zecke und Kriechtier, ein parasitologisches Kapitel. Aquar. Terrer. Z., 4: 330–332.
Supino, F. 1897. Nuovo *Ixodes* della Birmânia. Nota preventiva. Atti Soc. Ven. Trentina Sci. Nat. Residente Padova, Ser. 2, 3: 230–238.

7 – *A. astrion* Dönitz, 1909 (Sber. Ges. Naturf. Freunde Berlin (8): 440–482)

Type depository: ZMB (holotype) (Moritz and Fischer 1981, *op. cit.* under *A. arcanum*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands; montane grasslands and shrublands

Hosts: usual hosts for adult are Artiodactyla: Bovidae. Aves are exceptional hosts.
Artiodactyla: Bovidae (ANL)
Artiodactyla: Suidae; Carnivora: Canidae (AN)
Afrosoricida: Tenricidae; Proboscidea: Elephantidae (A)
Galliformes: Phasianidae (L)

Human infestation: no

Remarks: the larva of *A. astrion* is considered undescribed by Voltzit and Keirans (2003), but it was described in Van der Borght-Elbl (1977). Kolonin (2009) restricts the hosts of *A. astrion* to Bovidae and Canidae, but the references below demonstrate that the host range is broader. As discussed by Elbl and Anastos (1966), it can be difficult to differentiate *A. astrion* from *A. cohaerens*, and some records published prior to this work should be considered cautiously.

References

Elbl, A. & Anastos, G. 1966. Ixodid ticks (Acarina: Ixodidae) of Central Africa. Vol. I. General introduction. Genus *Amblyomma.* Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (145), 275 pp.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.
Morel, P.-C. & Finelle, P. 1961. Les tiques des animaux domestiques du Centrafrique. Rev. Élev. Med. Vet. Pays Trop., 14: 191–197.
Santos Dias, J.A.T. 1961. Nova contribução para o conhecimiento da ixodofauna angolana. Carraças colhidas por uma missão de estudo do Museu de Hamburgo. An. Serv. Vet. Ind. Anim. Mocambique, 9: 79–98.

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.
Van der Borght-Elbl, A. 1977. Ixodid ticks (Acarina: Ixodidae) of Central Africa. Vol. V. The larval and nymphal stages of the more important species of the genus *Amblyomma* Koch, 1844. Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (222), 158 pp.
Voltzit, O.V. & Keirans, J.E. 2003. A review of African *Amblyomma* species (Acari, Ixodida, Ixodidae). Acarina, 11: 135–214.

8 – *A. aureolatum* (Pallas, 1772) (Spicilegia Zoologica, vol. 40, fasc. 9, 87 pp.)
Amblyomma striatum Koch, 1844 is a well-known synonym of *A. aureolatum*, as discussed by Guglielmone et al. (2009, *op. cit.* under *A. argentinae*), but both names are incorrectly included in Barker and Murrell (2008, *op. cit.* under *A. argentinae*).

Type depository: unknown (Guglielmone et al. 2003, *op. cit*. under *A. americanum*) as *Acarus aureolatus.*

Known stages: male, female, nymph

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: usual hosts of adult ticks are Carnivora: Canidae, Felidae and Procyonidae; usual hosts of nymphs are Passeriformes: Turdidae, while usual hosts of larvae are Passeriformes: Formicariidae, Troglodytidae and Turdidae.
Rodentia: Echimyidae (ANL)
Carnivora: Canidae, Felidae (AN)
Rodentia: Ctenomyidae; Pilosa: Bradypodidae (AL)
Mammalia (several orders) (A)
Passeriformes (several families) (NL)

Human infestation: yes (Guglielmone et al. 2006 among others)

Remarks: *A. aureolatum* and *A. ovale* are related species that were meticulously redescribed by Aragão and Fonseca (1961). Records of these species prior to their redescription should be treated cautiously. The nymph of *A. aureolatum* was recently described by Martins et al. (2010) and the larva remains undescribed, but we consider provisionally valid records of larvae and nymphs on the hosts listed above in Guglielmone et al. (2003), Arzua et al. (2003, 2005) and Ogrzewalska et al. (2012). Sha et al. (2004), based on Arzua et al. (2003), state that "poultry" are infested with this tick, but no domestic or game birds are listed as hosts of *A. aureolatum* by these authors.

References

Aragão, H. B. & Fonseca, F. da. 1961. Nota de ixodologia. 9. O complexo *ovale* do gênero *Amblyomma*. Mem. Inst. Oswaldo Cruz, 59: 131–148.

Arzua, M., Navarro da Silva, M.A., Famadas, K.M., Beati, L. & Barros-Battesti, D.M. 2003. *Amblyomma aureolatum* and *Ixodes auritulus* (Acari: Ixodidae) on birds in southern Brazil, with notes on their ecology. Exp. Appl. Acarol., 31: 283–296.

Arzua, M., Onofrio, V.C. & Barros-Battesti, D.M. 2005. Catalogue of the tick collection (Acari, Ixodida) of the Museu de História Natural Capão da Imbuia, Curitiba, Paraná, Brazil. Rev. Bras. Zool., 22: 623–632.

Guglielmone, A.A., Estrada-Peña, A., Mangold, A.J., Barros-Battesti, D.M., Labruna, M.B., Martins, J.R., Venzal, J.M., Arzua, M. & Keirans, J.E. 2003. *Amblyomma aureolatum* (Pallas, 1772) and *Amblyomma ovale* Koch, 1844 (Acari: Ixodidae): hosts, distribution and 16S rDNA sequences, Vet. Parasitol., 113: 273–288.

Guglielmone, A.A., Beati, L., Barros-Battesti, D.M., Labruna, M.B., Nava, S., Venzal, J.M., Mangold, A.J., Szabó, M.P.J., Martins, J.R., González-Acuña, D. & Estrada-Peña, A. 2006. Ticks (Ixodoidea) on humans in South America. Exp. Appl. Acarol., 40: 83–100.

Martins, J.R., Salomão, E.L., Doyle, R.L., Teixeira, M.C., Onofrio, V.C. & Barros-Battesti, D.M. 2006. First record of *Amblyomma aureolatum* (Pallas, 1772) (Acari: Ixodidae) parasitizing *Alouatta guariba* (Humboldt, 1812) (Primata: Atelidae) in southern Brazil. Rev. Bras. Parasitol. Vet., 15 (4): 203–205.

Martins, T.F., Onofrio, V.C., Barros-Battesti, D.M. & Labruna, M.B. 2010. Nymphs of the genus *Amblyomma* (Acari: Ixodidae) of Brazil: descriptions, redescriptions, and identification key. Ticks Tick-borne Dis., 1: 75–99.

Ogrzewalska, M., Saraiva, D.G., Moraes-Filho, J., Martins, T.F., Costa, F.B., Pinter, A. & Labruna, M.B. 2012. Epidemiology of Brazilian spotted fever in the Atlantic Forest, State of São Paulo, Brazil. Parasitology, 139: 1283–1300.

Sha, A.H., Khan, M.N., Iqbal, Z. & Sajid, M.S. 2004. Tick infestation in poultry. Int. J. Agr. Biol., 6: 1162–1165.

9 – *A. auricularium* (Conil, 1878) (Acta Acad. Nac. Cienc. Exactas (Argentina), 3: 99–110)

Amblyomma curruca Schulze, 1936 is a synonym of *A. auricularium*, as discussed in Guglielmone et al. (2009, *op. cit.* under *A. argentinae*), but both names are included in Barker and Murrell (2008, *op. cit.* under *A. argentinae*), who spell the name of this species as *A. curraca. Amblyomma concolor* Neumann, 1899, is also considered a synonym of *A. auricularium*, as discussed in Guglielmone et al. (2009, *op. cit.* under *A. argentinae*), but Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. (1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.) treat them both as valid. See also *A. beaurepairei.*

Type depository: unknown (Guglielmone et al. 2003, *op. cit*. under *A. americanum*) as *Ixodes auricularius*

Known stages: male, female, nymph, larva

Zoogeographic Regions: Nearctic, Neotropical

Ecoregions: several ecoregions, mainly in tropical and subtropical grasslands, savannas and shrublands, and broadleaf forests

Hosts: usual hosts of larvae, nymphs and adults are Cingulata: Dasypodidae. Squamata: Iguanidae are exceptional hosts.
Carnivora: Mephitidae; Cingulata: Dasypodidae (ANL)
Mammalia (several orders) (AN)
Squamata: Iguanidae (A)

Human infestation: no

Remarks: Camicas et al. (1998) state that this tick is found only in the Neotropics and list the larva and nymph of *A. auricularium* as undescribed. However, the nymph was described in Robinson (1926) (under the name *A. concolor*) and was subsequently redescribed by Martins et al. (2010), and the larva was described in Amorim and Serra-Freire (2000). Guglielmone et al. (2003) and Mertins et al. (2011) present *bona fide* records of *A. auricularium* for the Nearctic. Guglielmone and Nava (2006) stress the difficulties involved in differentiating the male of *A. auricularium* from the male of *A. pseudoconcolor*, stating that several Argentinean records of *A. auricularium* are in error. Rawlins et al. (1993) list amphibians and reptiles as hosts of *A. auricularium* (under the name *A. concolor*), probably due to a typographical error.

References

Amorim, M. & Serra-Freire, N.M. 2000. Morphological study of tick larval stage (Acari: Ixodidae).7. *Amblyomma auricularium* (Conil, 1878). Entomol. Vectores, 7: 297–309.

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Guglielmone, A.A. & Nava, S. 2006. Las garrapatas argentinas del género *Amblyomma* (Acari: Ixodidae): distribución y hospedadores. Rev. Inv. Agropec., 35 (3): 135–155

Guglielmone, A.A., Estrada-Peña, A., Luciani, C.A., Mangold, A.J. & Keirans, J.E. 2003. Hosts and distribution of *Amblyomma auricularium* (Conil 1878) and *Amblyomma pseudoconcolor* Aragão, 1908 (Acari: Ixodidae). Exp. Appl. Acarol., 29: 131–139, 2003.

Guzmán-Cornejo, C., Robbins, R.G., Guglielmone, A.A., Montiel-Parra, G. & Pérez, T.M. 2011. The *Amblyomma* (Acari: Ixodida: Ixodidae) of Mexico: identification keys, distribution and hosts. Zootaxa, 2998, 16–38.

Horta, M.C., Nascimento, G.F., Martins, T.F., Labruna, M.B., Machado, L.C.P. & Nicola, P.A. 2011. Ticks (Acari: Ixodida) parasitizing free-living wild animals in the Caatinga biome in the State of Pernambuco, northeastern Brazil. Syst. Appl. Acarol., 16: 207–211.

Martins, T.F., Onofrio, V.C., Barros-Battesti, D.M. & Labruna, M.B. 2010. Nymphs of the genus *Amblyomma* (Acari: Ixodidae) of Brazil: descriptions, redescriptions, and identification key. Ticks Tick-borne Dis., 1: 75–99.

Mertins, J.W., Hanson, B.A. & Corn, J.L. 2011. *Echimyopus dasypus* Fain et al. (Acari: Astigmatina: Echimyopodidae) from a nine-banded armadillo, *Dasypus novemcinctus* L. (Mammalia: Dasypodidae) in Florida. USA. Syst. Appl. Acarol., 16: 252–254.

Rawlins, S.C., Mahadeo, S. & Martínez, R. 1993. A list of the ticks affecting man and animals the Caribbean. CARAPHIN News, (6): 8–9.

Robinson, L.E. 1926. Ticks. A monograph of the Ixodoidea. Part IV. The genus *Amblyomma*. Cambridge University Press, London, 302 pp.

10 – *A. australiense* Neumann, 1905 (Arch. Parasitol., 9: 225–241)
See *A. echidnae.*

Type depository: BMNH (syntypes) (Keirans and Hillyard 2001, *op. cit*. under *A. albopictum*)

Known stages: male, female, nymph

Zoogeographic Region: Australasian

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for adult ticks are Monotremata: Tachyglossidae.
Monotremata: Tachyglossidae (AN)
Squamata (unknown families) (A)

Human infestation: no

References

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Neumann, L.G. 1905. Notes sur les ixodidés. III. Arch. Parasitol., 9: 225–241.

Roberts, F.H.S. 1964. Further observations on the Australian species of *Aponomma* and *Amblyomma* with descriptions of the nymphs of *Amblyomma moreliae* (L.Koch) and *Amb. loculosum* Neumann (Acarina: Ixodidae). Aust. J. Zool., 12: 288–313.

11– *A. babirussae* Schulze, 1933 (Zool. Anz., 104: 317–323)

Type depository: USNTC (lectotype, paralectotypes) (Keirans, J.E. & Robbins, R.G., 1987. *Amblyomma babirussae* Schulze (Acari: Ixodidae): redescription of the male, female, and nymph and description of the larva. Proc. Entomol. Soc. Wash., 89: 646–659).

Known stages: male, female, nymph, larva

Zoogeographic Region: Australasian

Ecoregion: Sulawesi montane rain forests

Hosts: Muridae are considered exceptional hosts for this tick.
Artiodactyla: Bovidae, Suidae; Rodentia: Muridae (ANL)
Artiodactyla: Cervidae; Perissodactyla: Equidae (AN)
Carnivora: Viverridae (N)

Human infestation: yes (Durden et al. 2008)

Remarks: Camicas et al. (1998) state that *A. babirussae* occurs within the Australasian and Oriental Zoogeographic Regions, but all collections of this species are from the islands of Sulawesi and Buru ("Boeroe" in Keirans and Robbins 1987), both in the Australasian Region. Durden et al. (2008) consider the association of adult *A. babirussae* and Muridae atypical. Durden and Keirans (1996) list this species as at risk of extinction.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.

Durden, L.A., Merker, S. & Beati, L. 2008. The tick fauna of Sulawesi, Indonesia (Acari: Ixodoidea: Argasidae and Ixodidae). Exp. App. Acarol., 45: 85–110.

Keirans, J.E. & Robbins, R.G., 1987. *Amblyomma babirussae* Schulze (Acari: Ixodidae): redescription of the male, female, and nymph and description of the larva. Proc. Entomol. Soc. Wash., 89: 646–659.

12 – *A. beaurepairei* Vogelsang & Santos Dias, 1953 (Rev. Med. Vet. Parasitol., 12: 3–62)
Kolonin (2009, *op.cit.* under *A. arcanum*) treats *A. beaurepairei* as a synonym of *A. auricularium*. Guglielmone et al. (2009, *op. cit.* under *A. argentinae*) state that this tick is close to *A. auricularium* and *A. inornatum* but consider it provisionally valid since the types have not been compared. However, the type of *A. beaurepairei* is not available for comparison (see below), complicating further studies of this species' validity.

Type depository: LP but probably lost (Guglielmone et al. 2003, *op. cit.* under *A. americanum*)

Known stages: male, female

Zoogeographic Region: Neotropical

Ecoregion: tropical and subtropical grasslands, savannas and shrublands

Hosts: Cingulata: Dasypodidae (A)

Human infestation: no

References

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Vogelsang, E.G. & Santos Dias, J.A. 1953. Contribución al estudio de la fauna ixodológica en Venezuela. Rev. Med. Vet. Parasitol., 12: 3–62.

13 – *A. boeroi* Nava, Mangold, Mastropaolo, Venzal, Oscherov & Guglielmone, 2009 (Syst. Parasitol., 73: 161–174)

Type depositories: USNTC (holotype and paratypes), INTA, CFCV, CDPV, IBU, CFMVZ, DPFV, OVI (paratypes) (Nava, S., Mangold, A.J., Mastropaolo, M., Venzal, J.M., Oscherov, E.B. & Guglielmone, A.A. 2009. *Amblyomma boeroi* n. sp. (Acari: Ixodidae), a parasite of the Chacoan peccary *Catagonus wagneri* (Rusconi) (Artiodactyla: Tayassuidae) in Argentina: Syst. Parasitol., 73: 161–174).

Known stages: male, female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregion: dry Chaco

Hosts: Artiodactyla: Tayassuidae (ANL)

Human infestation: no

Remarks: Mihalca et al. (2011) regard *A. boeroi* as an endangered species.

References

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

Mastropaolo, M., Nava, S., Schmidt, E., Guglielmone, A.A. & Mangold, A.J. 2012. First report of *Amblyomma boeroi* Nava, Mangold, Mastropaolo, Venzal, Oscherov and Guglielmone (Acari: Ixodidae) from the chacoan peccary, *Catagonus wagneri* (Artiodactyla: Tayassuidae), in Paraguay. Syst. Appl. Acarol., 17: 7–9.

Nava, S., Mangold, A.J., Mastropaolo, M., Venzal, J.M., Oscherov, E.B. & Guglielmone, A.A. 2009. *Amblyomma boeroi* n. sp. (Acari: Ixodidae), a parasite of the Chacoan peccary *Catagonus wagneri* (Rusconi) (Artiodactyla: Tayassuidae) in Argentina: Syst. Parasitol., 73: 161–174.

14 – *A. boulengeri* Hirst & Hirst, 1910 (Ann. Mag. Nat. Hist. Ser. 8, 6: 299–308)

Type depository: BMNH (syntype) (Keirans and Hillyard 2001, *op. cit*. under *A. albopictum*)

Known stages: male, female

Zoogeographic Region: Neotropical

Ecoregions: deserts and xeric shrublands in the Galapagos Islands

Hosts: Squamata: Tropiduridae (A)

Human infestation: no

Remarks: Camicas et al. (1998) state that the hosts of *A. boulengeri* are Iguanidae, but the only *bona fide* records of this species are from Tropiduridae in Hirst and Hirst (1910). These authors state that they found ticks on Iguanidae that resemble *A. boulengeri* but were not identical to the type material. Kolonin (2009) accepts records from *Conolophus* (Iguanidae), but we prefer to be cautious and have not included Iguanidae in our host list for *A. boulengeri*. Durden and Keirans (1996) regard this species as at risk of extinction.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Hirst, S. & Hirst, L.F. 1910. Description of five new species of ticks (Ixodidae). Ann. Mag. Nat. Hist., Ser. 8, 6: 299–308.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

15 – *A. brasiliense* Aragão, 1908 (Braz. Med., 22: 111–115)

Type depository: unknown, but probably in IOC (Guglielmone et al. 2003, *op. cit.* under *A. americanum*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: Aves are considered exceptional hosts for this tick.
Artiodactyla: Cervidae; Perissodactyla: Tapiridae (AN)
Artiodactyla: Tayassuidae; Rodentia: Caviidae (A)
Carnivora: Canidae (NL)
Carnivora: Procyonidae; Didelphimorphia: Didelphidae; Rodentia: Cuniculidae, Dasyproctidae; Galliformes: Cracidae (N)
Cingulata: Dasypodidae (stage unknown)

Human infestation: yes (Guglielmone et al. 2006 among others)

Remarks: Camicas et al. (1998) do not list the nymph and larva as described, but the nymph was described by Aragão (1908), and recently redescribed by Martins et al. (2010), while the larva of *A. brasiliense was* described in Sanches et al. (2009). The larva of this species is known only from laboratory-reared material. The references below provide a wide range of hosts for *A. brasiliense*, but Kolonin (2009) lists only peccary, dog and capybara.

References

Aragão, H. B. 1908. Algunas novas especies de carrapatos brazileiros. Braz. Med., 22: 111–115.

Aragão, H. B. 1918. Notas ixodológicas. Rev. Mus. Paulista, 10: 375–417.

Arzua, M., Onofrio, V.C. & Barros-Battesti, D.M. 2005. Catalogue of the tick collection (Acari, Ixodida) of the Museu de História Natural Capão da Imbuia, Curitiba, Paraná, Brazil. Rev. Bras. Zool., 22: 623–632.

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Correa, O. 1955. Carrapatos determinados no R. G. do Sul. Biología, patología e controle. Arq. Inst. Pesqui. Vet. Desiderio Finamor, 1: 35–50.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Guglielmone, A.A., Beati, L., Barros-Battesti, D.M., Labruna, M.B., Nava, S., Venzal, J.M., Mangold, A.J., Szabó, M.P.J., Martins, J.R., González-Acuña, D. & Estrada-Peña, A. 2006. Ticks (Ixodoidea) on humans in South America. Exp. Appl. Acarol., 40: 83–100.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Labruna, M.B., Jorge, R.S.P., Sana, D.A., Jácomo, A.T.A., Kashivakura, C.K., Furtado, M.M., Ferro, C., Pérez, S.A., Silveira, L., Santos, T.S., Marques, S.R., Morato, R.G., Nava, A., Adania, C.H., Teixeira, R.H.F., Gomes, A.A.B., Conforti, V.A., Azevedo, F.C.C., Prada, C.S., Silva, J.C.R., Batista, A.F., Marvulo, M.F.V., Morato, R.L.G., Alho, C.J.R., Pinter, A., Ferreira, P.M., Ferreira, F. & Barros-Battesti, D.M. 2005. Ticks (Acari: Ixodida) on wild carnivores in Brazil. Exp. Appl. Acarol., 36: 149–163.

Martins, T.F., Onofrio, V.C., Barros-Battesti, D.M. & Labruna, M.B. 2010. Nymphs of the genus *Amblyomma* (Acari: Ixodidae) of Brazil: descriptions, redescriptions, and identification key. Ticks Tick-borne Dis., 1: 75–99.

Sanches, G.S., Bechara, G.H. & Camargo-Mathias, M.I. 2009. Morphological description of *Amblyomma brasiliense* Aragão, 1908 (Acari: Ixodidae) larvae [sic] and nymphs [sic]. Rev. Bras. Parasitol. Vet., 18 (3): 15–21.

Spolidorio, M.G., Szabó, M.P.J., Nieri-Bastos, M.A., Martins, T.F., Brandão, P.E. & Labruna, M.B. 2011. Tick-borne pathogens in small rodents and marsupials from an Atlantic rainforest perimeter in southeast Brazil. Ticks Tick-borne Pathogens Int. Conf., August-September 2011, Zaragoza, Spain, p. 328.

Szabó, M.P.J., Nieri-Bastos, F.A., Spolidorio, M.G., Martins, T.F., Barbieri, A.M. & Labruna, M.B. 2013. *In vitro* isolation from *Amblyomma ovale* (Acari: Ixodidae) and ecological aspects of the Atlantic rainforest *Rickettsia*, the causative agent of a novel spotted fever rickettsiosis in Brazil. Parasitology, 140: 719–728.

16 – *A. breviscutatum* Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)
Amblyomma cyprium Koch & Neumann in Neumann (1899, *op. cit.* under *Amblyomma albopictum*) is a synonym of *A. breviscutatum* because of page priority as explained in Guglielmone et al. (2009, *op. cit.* under *A. argentinae*), but both names are included in Barker and Murrell (2008, *op. cit.* under *A. argentinae*). Kolonin (2009, *op. cit.* under *A. arcanum*) recognizes *A. cyprium* as valid and *A. breviscutatum* as a probable synonym; however, this statement is wrong, as noted above.

Type depository: MNHN (holotype) (Neumann 1899, *op. cit.* under *A. albopictum*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Australasian, Oriental

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: Testudines and Squamata are considered exceptional hosts for this tick.
Artiodactyla: Bovidae, Cervidae, Suidae; Perissodactyla: Equidae; Trogoniformes: Trogonidae; Testudines: Emydidae (A)
Rodentia: Muridae (NL)
Coraciiformes: Alcedinidae; Galliformes: Phasianidae (N)
Diprotodontia: Phalangeridae; Columbiformes: Columbidae (L)
Carnivora: Canidae; Squamata: Iguanidae (stage unknown)

Human infestation: yes (Durden et al. 2008)

Remarks: except for Rageau (1967) and Durden et al. (2008), all authors cited below refer to this species as *A. cyprium.* Neumann (1899) described *A. breviscutatum* from specimens allegedly collected in the Congo (Afrotropical), probably because of an error in collection labeling. Keirans and Durden (2001) cite a record of *A. breviscutatum* (unknown stage) on an *Iguana* introduced into the Nearctic Region, although the species was unable to become established there. Camicas et al. (1998) and Kolonin (2009) consider Suidae to be the only principal hosts for adult *A. breviscutatum*, but there are several *bona fide* records below of other hosts, so this limitation seems unjustified. However, records of such hosts as Testudines and Squamata do not appear to be frequent.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Durden, L.A., Merker, S. & Beati, L. 2008. The tick fauna of Sulawesi, Indonesia (Acari: Ixodoidea: Argasidae and Ixodidae). Exp. App. Acarol., 45: 85–110.
Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.
Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.
Kemp, D.H. & Wilson, N. 1979. The occurrence of *Amblyomma cyprium cyprium* (Acari: Ixodidae) in Australia, with additional records from the southwest Pacific. Pacific Insects, 21: 224–226.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Neumann, L.G. 1899. Révision de la famille des ixodidés (3e mémoire). Mém. Soc. Zool. Fr., 12: 107–294.
Rageau, J. 1967. Observations biologiques sur les tiques (Acari, Argasidae et Ixodidae) des îles françaises d'océanie. Wiad. Parazytol., 13: 547–553.

17 – *A. cajennense* (Fabricius, 1787) (*Mantisa insectorum sistens species nuper detectas adiectis synonymis, observationibus, descriptionibus, emendationibus*. Hafniae, 2, 382 pp.)
See remarks below.

Type depository: ZMUC (holotype? Lost?) Scharf, N., in a personal communication to Guglielmone, A.A. states that there is a dry specimen of *A. cajennense* in ZMUC, labeled *Acarus cajennensis*. However, Beati, L. (personal communication to Guglielmone A.A.) examined this specimen and found that it is not the holotype of *A. cajennense*.

Known stages: male, female, nymph, larva

Zoogeographic Regions: Nearctic, Neotropical

Ecoregions: several ecoregions, but mainly tropical and subtropical broadleaf forests and tropical and subtropical grasslands, savannas and shrublands

Hosts: Anura, Squamata and Testudines are considered exceptional hosts for this tick.
Mammalia (several orders); Falconiformes: Falconidae (ANL)
Ciconiiformes: Ardeidae; Falconiformes: Accipitridae; Testudines: Pelomedusidae; Anura: Bufonidae (AN)
Struthioniformes: Struthionidae; Testudines: Emydidae, Testudinidae; Squamata: Iguanidae, Viperidae (A)
Cuculiformes: Cuculidae; Galliformes: Phasianidae; Passeriformes (several families); Squamata (unknown family) (NL)
Aves (several orders); Squamata: Teiidae (N)
Columbiformes: Columbidae; Passeriformes: Thamnophilidae (L)
Galliformes: Odontophoridae (N and/or L)
Squamata: Colubridae (stage unknown)

Human infestation: yes (Heath and Hardwick 2011 among others)

Remarks: Beati, L., in a personal communication to Guglielmone, A.A., believes that *A. cajennense* comprises a complex of sibling species, a fact reinforced by the studies of Labruna et al. (2011) and Mastropaolo et al. (2011). Burridge (2011) emphasizes the ability of this tick to infest hosts from outside the Nearctic and Neotropical Regions. Heath and Hardwick (2011) cite a record of *A. cajennense* introduced into the Australasian Region, although the species was unable to become established there. Labruna et al. (2007) doubt the records of *A. cajennense* nymphs and larvae from several families of Passeriformes, as compiled by Rojas et al. (1999); however, we tentatively include these records pending their re-evaluation. Kolonin (2009) lists only Mammalia as hosts of *A. cajennense*, although there are several records for non-mammalian hosts. Hightower et al. (1953) and Santolin et al. (2012) do not specify whether larvae, nymphs or both immature stages of *A. cajennense* were present on Odontophoridae and Aves, respectively. The records of *A. cajennense* on Falconiformes: Falconidae (Teixeira et al. 2008) are from captive birds. Romero-Castañón et al. (2008) regard their records of *A. cajennense* as the first for Mexico when, in fact, there are many previous Mexican reports of this tick, starting with Koch (1844), who named this species *A. tenellum* Koch, 1844 and *A. mixtum* Koch, 1844.

References

Arzua, M., Onofrio, V.C. & Barros-Battesti, D.M. 2005. Catalogue of the tick collection (Acari, Ixodida) of the Museu de História Natural Capão da Imbuia, Curitiba, Paraná, Brazil. Rev. Bras. Zool., 22: 623–632.

Bequaert, J.C. 1938. Notes on the arthropods of medical importance in Guatemala. *In* Medical survey of the Republic of Guatemala. Publ. Carnegie Inst. Wash. (499): 223–228.

Bishopp, F.C. & Trembley, H.L. 1945. Distribution and hosts of certain North American ticks. J. Parasitol., 31: 1–54.

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Černý, V. 1969. The tick fauna of Cuba. Folia Parasitol., 16: 279–284.

Díaz Ungría, C. 1957. Nota sobre las especies de Acarina de Venezuela. Rev. San. Asist. Soc., 22: 457–467.

Durden, L.A., Cunningham, M.W., McBride, R. & Ferree, B. 2006. Ectoparasites of free-ranging pumas and jaguars in the Paraguayan Chaco. Vet. Parasitol., 137: 189–193.

Eads, R.B., Menzies, G.C. & Hightower, B.G. 1956. The ticks of Texas, with notes on their medical significance. Texas J. Sci., 8: 7–24.

Ernst, C.H. & Ernst, E.M. 1977. Ectoparasites associated with neotropical turtles of the genus *Callopsis* (Testudines, Emydidae, Batagurinae). Biotropica, 9: 139–142.

Fairchild, G.B., Kohls, G.M. & Tipton, V.J. 1966. The ticks of Panama (Acarina: Ixodoidea). *In* W.R. Wenzel & V.J. Tipton (editors), Ectoparasites of Panama. Field Museum of Natural History, Chicago, pp. 167–219.

Fiasson, R. 1949. Contribución al estudio de los ácaros de Venezuela. Rev. Grancolombina Zoot. Hig. Med. Vet., 3: 567–588.

Guzmán-Cornejo, C., Robbins, R.G., Guglielmone, A.A., Montiel-Parra, G. & Pérez, T.M. 2011. The *Amblyomma* (Acari: Ixodida: Ixodidae) of Mexico: identification keys, distribution and hosts. Zootaxa, 2998, 16–38.

Heath, A.C.G. & Hardwick, S. 2011. The role of humans in the importation of ticks to New Zealand: a threat to public health and biosecurity. N. Zeal. Med. J., 124: 67–82.

Hightower, B.G., Lehman, V.W. & Eads, R.B. 1953. Ectoparasites from mammals and birds on a quail preserve. J. Mammal., 34: 268–271.

Ivancovich, J.C. & Luciani, C.A. 1992. Las garrapatas de Argentina. Monografía de la Asociación Argentina de Parasitología Veterinaria, Buenos Aires, 95 pp.

Koch, C.L. 1844. Systematische Übersicht über die Ordnung der Zecken. Arch. Naturgesch., 10: 217–239.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Labruna, M.B., Jorge, R.S.P., Sana, D.A., Jácomo, A.T.A., Kashivakura, C.K., Furtado, M.M., Ferro, C., Perez, S.A., Silveira, L., Santos, T.S., Marques, S.R., Morato, R.G., Nava, A., Adania, C.H., Teixeira, R.H.F., Gomes, A.A.B., Conforti, V.A., Azevedo, F.C.C., Prada, C.S., Silva, J.C.R., Batista, A.F., Marvulo, M.F.V., Morato, R.L.G., Alho, C.J.R., Pinter, A., Ferreira, P.M., Ferreira, F. & Barros-Battesti, D.M. 2005. Ticks (Acari: Ixodida) on wild carnivores in Brazil. Exp. Appl. Acarol., 36: 149–163.

Labruna, M.B., Sanfilippo, L.F., Demetrio, C., Menezes, A.C., Pinter, A., Guglielmone, A.A. & Silveira, L.F. 2007. Ticks collected on birds in the State of São Paulo, Brazil. Exp. Appl. Acarol., 43: 147–160.

Labruna, M.B., Soares, J.F., Martins, T.F., Soares, H.S. & Cabrera, R.R. 2011. Cross-mating experiments with geographically different populations of *Amblyomma cajennense* (Acari: Ixodidae). Exp. Appl. Acarol., 54: 41–49.

Lemos, E.R.S., Machado, R.D., Coura, J.R., Guimaraes, M.A.A., Serra-Freire, N.M., Amorim, A. & Gazêta, G.S. 1997. Epidemiological aspects of the Brazilian spotted fever: seasonal activity of ticks collected in an endemic area in São Paulo, Brazil. Rev. Soc. Bras. Med. Trop., 30: 181–185.

Mangold, A.J., Gualberto, A. & Guglielmone, A.A. 1990. La distribución geográfica de *Amblyomma cajennense* Fabricius, 1787 (Acari: Ixodoidea: Ixodidae) en Argentina. Vet. Arg., 7: 306–315.

Mastropaolo, M., Nava, S., Guglielmone, A.A. & Mangold, A.J. 2011. Biological differences between two allopatric populations of *Amblyomma cajennense* (Acari: Ixodidae) in Argentina. Exp. Appl. Acarol., 53: 371–375.

Moreira, L.H., Scherer, P.O., Amorim, M. & Serra-Freire, N.M. 2002. *Struthio camelus* Linnaeus, 1758 también hospedeiro de *Amblyomma cajennense* (Fabricius, 1787). Entomol. Vectores, 9: 431–433.

Ogrzewalska, M., Pacheco, R.C., Uezu, A., Richtzenhain, L.J., Ferreira, F. & Labruna, M.B. 2009. Ticks (Acari: Ixodidae) infesting birds in an Atlantic rain forest region in Brazil. J. Med. Entomol., 46: 1225–1229.

Ogrzewalska, M., Uezu, A. & Labruna, M.B. 2011. Ticks (Acari: Ixodidae) infesting wild birds in the Atlantic forest in northeastern Brazil, with notes on rickettsial infection in ticks. Parasitol. Res., 108: 665–670.

Rojas, R., Marini, M.A. & Coutinho, M.T.Z. 1999. Wild birds as hosts of *Amblyomma cajennense* (Fabricius, 1787) (Acari: Ixodidae). Mem. Inst. Oswaldo Cruz, 94: 315–322.

Romero-Castañon, S., Ferguson, B.G., Güiris, D., González, D., López, S., Paredes, A. & Webber, M. 2008. Comparative parasitology of wild and domestic ungulates in the Selva Lacandona, Chiapas, México. Comp. Parasitol., 75: 115–126.

Sanders, D.M., Parker, J.E., Walker, W.W., Buchholz, M.V., Blount, K. & Kiel, J.L. 2008. Field collection and genetic classification of tick-borne rickettsiae and rickettsiae-like pathogens from South Texas: *Coxiella burnetii* isolated from field-collected *Amblyomma cajennense.* Ann. New York Acad. Sci., 1149: 208–211.

Santolin, I.D.A.C., Luz, H.R., Alchorne, N.M., Pinheiro, M.C., Melinski, R.D., Faccini, J.L.H., Ferreira, I. & Famadas, K.M. 2012. Ticks on birds caught on the campus of the Federal Rural University of Rio de Janeiro, Brazil. Rev. Bras. Parasitol. Vet., 21 (3): 213–218.

Spolidorio, M.G., Andreoli, G.S., Martins, T.F., Brandão, P.E. & Labruna, M.B. 2012. Rickettsial infection in ticks collected from road-killed wild animals in Rio de Janeiro, Brazil. J. Med. Entomol., 49: 1510–1514.

Szabó, M.P.J., Olegário, M.M.M. & Santos, A.L.Q. 2007. Tick fauna from two locations in the Brazilian savannah. Exp. Appl. Acarol., 43: 73–84.

Teel, P.D., Fleetwood, S.C., Hopkins, S.W. & Cruz, D. 1988. Ectoparasites of eastern and western meadowlarks from the Rio Grande plains of South Texas. J. Med. Entomol., 25: 32–38.

Teixeira, R.H.F., Ferreira, I., Amorim, M., Gazêta, G.S. & Serra-Freire, N.M. 2008. Carrapatos em aves selvagens no Zoológico de Sorocaba – São Paulo, Brasil. Arq. Bras. Med. Vet. Zoot., 60: 1277–1280.

Tolesano, G.V., Torga, K., Franchin, A.G., Ogrzewalska, M., Gerardi, M., Olegário, M.M.M., Labruna, M.B., Szabó, M.P.J. & Marçal Júnior, O. 2010. Ticks on birds in a forest fragment of Brazilian cerrado (savanna) in the Municipality of Uberlandia, State of Minas Gerais, Brazil. Rev. Bras. Parasitol. Vet., 19 (4): 244–248.

18 – *A. calabyi* Roberts, 1963 (Parasitology, 53: 177–181)

Type depositories: WAM (holotype, paratype), ANIC (paratypes) (Roberts, F.H.S. 1963. *Amblyomma calabyi* n. sp. from Western Australia (Acarina: Ixodidae). Parasitology, 53: 177–181)

Known stages: male, female, nymph

Zoogeographic Region: Australasian

Ecoregions: deserts and xeric shrublands

Hosts: Squamata: Varanidae (AN)

Human infestation: no

References

Roberts, F.H.S. 1963. *Amblyomma calabyi* n. sp. from Western Australia (Acarina: Ixodidae). Parasitology, 53: 177–181.

Sharrad, R.D. & King, D.R. 1981. The geographic distribution of reptile ticks in Western Australia. Aust. J. Zool., 29: 861–873.

19 – *A. calcaratum* Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)
See "remarks on some invalid names" at the beginning of this chapter for the alleged synonymy of *A. calcaris* and *A. calcaratum.* See also remarks below.

Type depositories: ZSH, MNHN, BMNH, USNTC (syntypes) (Neumann 1899, *op. cit.* under *A. albopictum*; Keirans and Hillyard 2001, *op. cit*. under *A. albopictum*). However, Keirans, J.E. & Clifford, C.M. (1984. A checklist of types of Ixodoidea (Acari) in the collection of the Rocky Mountain Laboratories. J. Med. Entomol., 21: 310–320) do not agree that syntypes of this species are deposited in USNTC.

Known stages: male, female, nymph

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical broadleaf forests

Hosts: usual hosts for adult ticks are Pilosa: Myrmecophagidae.
Perissodactyla: Tapiridae (ANL)
Pilosa: Myrmecophagidae (AN)
Mammalia (several orders) (A)
Passeriformes: Dendrocolaptidae (NL)
Coraciiformes: Momotidae; Passeriformes (several families) (N)

Human infestation: yes (Smith 1974)

Remarks: Fairchild et al. (1966) state that *A. calcaratum* is morphologically very similar to *A. nodosum*, and some diagnoses of these species are incorrect. Therefore, supposed records of this tick should be considered cautiously. The nymph of *A. calcaratum* was recently described by Martins et al. (2010), but the larva remains undescribed. We consider tentatively valid the records of nymphs of *A. calcaratum* in Neumann (1899), Jones et al. (1972), Keirans (1982), Labruna et al. (2007) and Ogrzewalska et al. (2009) and the record of larvae of *A. calcaratum* in Keirans (1982). There is an off-host record of *A. calcaratum* from the Nearctic in Bloemer et al. (1987), but we do not regard this as evidence that *A. calcaratum* is established in that region.

References

Bloemer, S.R., Russell, C.L. & Keirans, J.E. 1987. *Amblyomma calcaratum* (Acari: Ixodidae), a Central and South American tick, found in Kentucky, USA. J. Med. Entomol., 24: 117.

Fairchild, G.B., Kohls, G.M. & Tipton, V.J. 1966. The ticks of Panama (Acarina: Ixodoidea). *In* W.R. Wenzel & V.J. Tipton (editors), Ectoparasites of Panama. Field Museum of Natural History, Chicago, pp. 167–219.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Jones, E.K., Clifford, C.M., Keirans, J.E. & Kohls, G.M. 1972. The ticks of Venezuela (Acarina: Ixodoidea) with a key to the species of *Amblyomma* in the Western Hemisphere. Brigham Young Univ. Sci. Bull. Biol. Ser., 17 (4), 40 pp.

Keirans, J.E. 1982. The tick collection (Acarina: Ixodoidea) of the Hon. Nathaniel Charles Rothschild deposited in the Nuttall and general collections of the British Museum (Natural History). Bull. Br. Mus. (Nat. Hist.) Zool. Ser., 42: 1–36.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Labruna, M.B., Sanfilippo, L.F., Demetrio, C., Menezes, A.C., Pinter, A., Guglielmone, A.A. & Silveira, L.F. 2007. Ticks collected on birds in the State of São Paulo, Brazil. Exp. Appl. Acarol., 43: 147–160.

Martins, T.F., Onofrio, V.C., Barros-Battesti, D.M. & Labruna, M.B. 2010. Nymphs of the genus *Amblyomma* (Acari: Ixodidae) of Brazil: descriptions, redescriptions, and identification key. Ticks Tick-borne Dis., 1: 75–99

Neumann, L.G. 1899. Révision de la famille des ixodidés (3e mémoire). Mém. Soc. Zool. Fr., 12: 107–294.

Ogrzewalska, M., Pacheco, R.C., Uezu, A., Richtzenhain, L.J., Ferreira, F. & Labruna, M.B. 2009. Ticks (Acari: Ixodidae) infesting birds in an Atlantic rain forest region in Brazil. J. Med. Entomol., 46: 1225–1229.

Ogrzewalska, M., Uezu, A. & Labruna, M.B. 2010. Ticks (Acari: Ixodidae) infesting wild birds in the eastern Amazon, northern Brazil, with notes on rickettsial infection in ticks. Parasitol. Res., 106: 809–816.

Smith, M.W. 1974. A survey of the distribution of the ixodid ticks *Boophilus microplus* (Canestrini, 1888) and *Amblyomma cajennense* (Fabricius, 1787) in Trinidad & Tobago and the possible influence of the survey results on planned livestock development. Trop. Agric., 51: 559–567.

20 – *A. chabaudi* Rageau, 1964 (Bull. Soc. Pathol. Exot., 57: 408–411)

Type depository: SFCST (holotype, paratypes) (Rageau, J. 1964. Une nouvelle espèce d'*Amblyomma* parasite de tortues malgaches. *A. chabaudi* sp. n. (Acariens, Ixodidae). Bull. Soc. Pathol. Exot., 57: 408–411)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregion: Madagascar succulent woodlands

Hosts: Testudines: Testudinidae (ANL)

Human infestation: no

Remarks: Burridge (2011) mentions the introduction of *A. chabaudi* into the Nearctic, but there is no evidence of its establishment there. According to Durden and Keirans (1996), *A. chabaudi* is an endangered species.

References

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.

Uilenberg, G., Hoogstraal, H. & Klein, J.-M. 1979. Les tiques (Ixodoidea) de Madagascar et leur rôle vecteur. Arch. Inst. Pasteur Madagascar Num. Spéc., 153 pp.

21 – *A. clypeolatum* Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)

Type depository: ZSH (syntypes) (Neumann 1899, *op. cit.* under *A. albopictum*)

Known stages: male, female

Zoogeographic Region: Oriental

Ecoregions: tropical and subtropical moist broadleaf forests; few ticks in tropical and subtropical dry broadleaf forests

Hosts: Squamata are considered exceptional hosts.
Squamata. Boidae; Testudines: Testudinidae (A)

Human infestation: no

Remarks: Keirans and Durden (2001) cite two records of the introduction of *A. clypeolatum* into the Nearctic Region, while Nuttall and Warburton (1908) record its introduction (under the name *A. atrogenatum* Nuttall & Warburton, 1908) into the Palearctic Region, although there is no evidence that this species has become established in either region. Seneviratna (1965) regards Testudinidae as the only hosts of *A. clypeolatum*, but in his list Bovidae and Suidae are recorded as infested with this species. We consider these records a probable result of typographical errors and they are therefore not included in our list above. Burridge (2011) treats both these records as valid. Kolonin (2009) records Testudines as the only hosts for *A. clypeolatum*, but recently Fernando and Kulasena Fernando (2012) present what appears to be a sound record of *A. clypeolatum* from Squamata. Mihalca et al. (2011) regard *A. clypeolatum* as endangered.

References

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Fernando, T.S.P. & Kulasena Fernando, H.K.A.V.A. 2012. Three tick species parasitizing a rock python in Sri Lanka. Taprobanica, 4: 54–56.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.
Nuttall, G.H.F. & Warburton, C. 1908. On a new genus of Ixodoidea together with a description of eleven new species. Proc. Cambr. Phil. Soc. Math. Phys. Sci., 14: 392–416.
Robbins, R.G. & Platt, S.G. 2000. First report of *Amblyomma clypeolatum* Neumann (Acari: Ixodida: Ixodidae) from the Union of Myanmar, with two new records from tortoises. Proc. Entomol. Soc. Wash., 102: 225–226.
Seneviratna, P. 1965. The Ixodoidea (ticks) of Ceylon. Parts II and III. Ceylon Vet. J., 13: 28–54.

22 – *A. coelebs* Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)
See "remarks on some invalid names" at the beginning of this chapter for *A. bispinosum* as a synonym of *A. coelebs.*

Type depository: BMNH (syntypes) (Keirans and Hillyard 2001, *op. cit*. under *A. albopictum*)

Known stages: male, female, nymph

Zoogeographic Regions: Nearctic, Neotropical

Ecoregions: tropical and subtropical broadleaf forests

Hosts: usual hosts for adult ticks are Perissodactyla: Tapiridae.
Perissodactyla: Tapiridae, Equidae (AN)
Rodentia: Caviidae, Cuniculidae (A)
Mammalia (several orders); Coraciiformes: Momotidae; Galliformes: Cracidae; Passeriformes: Conopophagidae, Thamnophilidae, Turdidae (N)
Columbiformes: Columbidae; Passeriformes: Thamnophilidae (L)
Artiodactyla: Bovidae, Cervidae; Pilosa: Megalonychidae, Myrmecophagidae (stages unknown)

Human infestation: yes (Guglielmone et al. 2006 among others)

Remarks: the nymph of *A. coelebs* was recently described by Martins et al. (2010) but the larva remains undescribed. There are *bona fide records* of larvae and nymphs of *A. coelebs* in Ogrzewalska et al. (2009), and nymphs in Floch and Fauran (1958), Fairchild et al. (1966) and Labruna et al. (2002, 2005). Camicas et al. (1998) consider *A. coelebs* an exclusively Neotropical tick, but this species is also established in the Nearctic Region, as discussed in Guglielmone et al. (2003). Mihalca et al. (2011) list this species as endangered.

References

Botelho, J.R., Linardi, P.M., Coutinho, M.T.Z. & Cardoso, V.A. 2004. Ácaros ixodídeos de mamíferos silvestres da regiao de hidrelétrica Samuel, Rondônia, Brasil. Rev. Bras. Parasitol. Vet., 13 (Supl. 1): 326.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Fairchild, G.B., Kohls, G.M. & Tipton, V.J. 1966. The ticks of Panama (Acarina: Ixodoidea). *In* W.R. Wenzel & V.J. Tipton (editors), Ectoparasites of Panama. Field Museum of Natural History, Chicago, pp. 167–219.

Floch, H. & Fauran, P. 1958. Ixodidés de la Guyane et des Antilles Françaises. Arch. Inst. Pasteur Guyane (446), 94 pp.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Guglielmone, A.A., Beati, L., Barros-Battesti, D.M., Labruna, M.B., Nava, S., Venzal, J.M., Mangold, A.J., Szabó, M.P.J., Martins, J.R., González-Acuña, D. & Estrada-Peña, A. 2006. Ticks (Ixodoidea) on humans in South America. Exp. Appl. Acarol., 40: 83–100.

Hoffmann, A. & López-Campos, G. 2000. Biodiversidad de los ácaros en México. Jiménez Editores e Impresores, México, 230 pp.

Jones, E.K., Clifford, C.M., Keirans, J.E. & Kohls, G.M. 1972. The ticks of Venezuela (Acarina: Ixodoidea) with a key to the species of *Amblyomma* in the Western Hemisphere. Brigham Young Univ. Sci. Bull. Biol. Ser., 17 (4), 40 pp.

Labruna, M.B., Paula, C.D., Lima, T.F. & Sana, D.A. 2002. Ticks (Acari: Ixodidae) on wild animals from the Porto-Primavera hydroelectric power station area, Brazil. Mem. Inst. Oswaldo Cruz, 97: 1133–1136.

Labruna, M.B., Camargo, L.M.A., Terrassini, F.A., Ferreira, F., Schumaker, T.T.S. & Camargo, E.P. 2005. Ticks (Acari: Ixodidae) from the State of Rondônia, western Amazon, Brazil. Syst. Appl. Acarol., 10: 17–32.

Labruna, M.B., Romero, M., Martins, T.F., Tobler, M. & Ferreira, F. 2010. Ticks of the genus *Amblyomma* (Acari: Ixodidae) infesting tapirs (*Tapirus terrestris*) and peccaries (*Tayassu pecari*) in Peru. Syst. Appl. Acarol., 15: 109–112.

Martins, T.F., Onofrio, V.C., Barros-Battesti, D.M. & Labruna, M.B. 2010. Nymphs of the genus *Amblyomma* (Acari: Ixodidae) of Brazil: descriptions, redescriptions, and identification key. Ticks Tick-borne Dis., 1: 75–99

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

Nava, S., Lareschi, M., Mangold, A.J. & Guglielmone, A.A. 2004. Registros de garrapatas de importancia médico-veterinaria detectadas ocasionalmente en la Argentina. Rev. FAVE, 3: 61–65.

Ogrzewalska, M., Pacheco, R.C., Uezu, A., Richtzenhain, L.J., Ferreira, F. & Labruna, M.B. 2009. Ticks (Acari: Ixodidae) infesting birds in an Atlantic rain forest region in Brazil. J. Med. Entomol., 46: 1225–1229.

Ogrzewalska, M., Uezu, A. & Labruna, M.B. 2010. Ticks (Acari: Ixodidae) infesting wild birds in the eastern Amazon, northern Brazil, with notes on rickettsial infection in ticks. Parasitol. Res., 106: 809–816.

23 – *A. cohaerens* Dönitz, 1909 (Sber. Ges. Naturf. Freunde Berlin (8): 440–482) See remarks below.

Type depository: ZMB (syntypes) (Moritz and Fischer 1981, *op. cit.* under *A. arcanum*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical moist broadleaf forests; few ticks in grasslands, savannas and shrublands

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae, while Testudines and Aves are considered exceptional hosts for this tick.
Artiodactyla: Bovidae, Suidae (ANL)
Primates: Cercopithecidae (AN)
Mammalia (several orders); Testudines (unknown family) (A)
Carnivora: Viverridae; Rodentia: Muridae, Thryonomyidae (NL)
Artiodactyla: Hippopotamidae; Carnivora: Hyaenidae; Primates: Hominidae; Galliformes: Numididae, Phasianidae; Passeriformes: Turdidae (N)

Human infestation: yes (Matthysse and Colbo 1987)

Remarks: Theiler (1959) tentatively identified adult ticks feeding on Numididae as *A. cohaerens* (spelled *A. chohaerens*), but Hoogstraal (1956), probably working with the same specimens discussed in Theiler (1959), states that *A. cohaerens* from Numididae were tentatively identified by Theiler for his 1956 book, and all the ticks were nymphs. We consider records of *A. cohaerens* nymphs on Numididae to be provisionally valid. Kolonin (2009) lists only ungulates as hosts of adult *A. cohaerens*, but the references below provide a wider variety of hosts for male and female ticks, including Aves and Testudines, hosts rarely infested with this tick. See also *A. astrion.*

References

Elbl, A. & Anastos, G. 1966. Ixodid ticks (Acarina: Ixodidae) of Central Africa. Vol. I. General Introduction. Genus *Amblyomma.* Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (145), 275 pp.

Hoogstraal, H. 1956. African Ixodoidea. I. Ticks of the Sudan (with special reference to Equatoria Province and with preliminary reviews of the genera *Boophilus*, *Margaropus* and *Hyalomma*). Research Report NM 005 050.29.07, Department of the Navy Bureau of Medicine and Surgery, Washington D.C., 1101 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Matthysse, J.G. & Colbo, M.H. 1987. The ixodid ticks of Uganda. Entomological Society of America, College Park, Maryland, 426 pp.
Theiler, G. 1959. African ticks and birds. Ostrich (Suppl. 3), 3: 353–378.
Van der Borght-Elbl, A. 1977. Ixodid ticks (Acarina: Ixodidae) of Central Africa. Vol. V. The larval and nymphal stages of the more important species of the genus *Amblyomma* Koch, 1844. Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (222), 158 pp.
Walker, J.B. 1974. The ixodid ticks of Kenya. A review of present knowledge of their hosts and distribution. Commonwealth Institute of Entomology, London, 220 pp.

24 – *A. compressum* (Macalister, 1872) (Q. J. Microsc. Sci. New. Ser., 12: 287–288)

Type depository: not stated in Macalister, A. (1872. Description of a new genus of Ixodea. Q. J. Microsc. Sci. New Ser., 12: 287–288), as *Adenopleura compressum*. Theiler, G. (1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.) believes that the type specimen is lost.

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical moist broadleaf forests; few ticks in grasslands, savannas and shrublands

Hosts: usual hosts for larvae, nymphs and adult ticks are Pholidota: Manidae. Aves and Squamata are considered exceptional hosts for this tick.
Pholidota: Manidae (ANL)
Rodentia: Hystricidae (A, N and/or L)
Artiodactyla: Bovidae, Suidae; Musophagiformes: Musophagidae; Squamata: Varanidae (A)
Hyracoidea: Procaviidae; Ciconiiformes: Bucorvidae (N)
Galliformes: Numididae (N and/or L)

Human infestation: no

Remarks: Keirans and Durden (2001) cite one record of the introduction of *A. compressum* into the Nearctic Region, but there is no evidence that this tick has become established there. Theiler (1962) and Elbl and Anastos (1966) refer to this species as *A. cuneatum* Neumann, 1899. Theiler (1962) uses the term “immatures” without specifying whether they are nymphs, larvae or both sub-adult stages of *A. compressum*. Kolonin (2009) ignores the few records of *A. compressum* on hosts other than Manidae.

References

Aeschlimann, A. 1967. Biologie et écologie des tiques (Ixodoidea) de Côte d'Ivoire. Acta Trop., 24: 281–405.

Elbl, A. & Anastos, G. 1966. Ixodid ticks (Acarina: Ixodidae) of Central Africa. Vol. I. General introduction. Genus *Amblyomma.* Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (145), 275 pp.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

25 – *A. cordiferum* Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)

Type depository: ZMH (holotype) (Neumann, 1899, *op. cit.* under *A. albopictum*)

Known stages: female, nymph, larva

Zoogeographic Regions: Australasian, Oriental

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: Squamata: Boidae, Colubridae, Elapidae; Artiodactyla: Bovidae, Suidae (A)
Rodentia: Muridae (NL)
Carnivora: Felidae, Herpestidae, Viverridae; Chiroptera: Pteropodidae; Pholidota: Manidae; Squamata: Varanidae; Testudines: Emydidae (stages unknown)

Human infestation: yes (Audy et al. 1960, see below)

Remarks: Camicas et al. (1998) state that immature stages of *A. cordiferum* have been found on Reptilia, but this requires confirmation. Audy et al. (1960) tentatively identified a nymph of *A. cordiferum* from a human, and we regard this determination as provisionally valid. Kolonin (2009) does not include Testudines as hosts of *A. cordiferum*, but we consider the record of Lazell et al. (1991) to be valid.

References

Ahamad, M., Ibrahim, H., Bujang, M.K., Sah, S.-A.M., Mohamad, N., Nor, S.M., Ahmad, A.H. & Ho, T.-M. 2013. A survey of acarine ectoparasites of bats (Chiroptera) in Malaysia. J. Med. Entomol., 50: 140–146.

Anastos, G. 1950. The scutate ticks, or Ixodidae, of Indonesia. Entomol. Am., 30: 1–144.

Audy, J.R., Nadchatram, M. & Lim, B.-L. 1960. Malaysian parasites XLIX Host distribution of Malayan ticks (Ixodoidea). Stud. Inst. Med. Res. Malaya, 29: 225–246.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.
Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.
Durden, L.A., Merker, S. & Beati, L. 2008. The tick fauna of Sulawesi, Indonesia (Acari: Ixodoidea: Argasidae and Ixodidae). Exp. App. Acarol., 45: 85–110.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Lazell, J.D., Keirans, J.E. & Samuelson, G.A. 1991. The Sulawesi black racer, *Coluber* (*Ptyas*) *dipsas*, and a remarkable ectoparasitic aggregation. Pacific Insects, 45: 355–361.
Voltzit, O.V. & Keirans, J.E. 2002. A review of Asian *Amblyomma* species (Acari, Ixodida, Ixodidae). Acarina, 10: 95–136.

26 – *A. crassipes* (Neumann, 1901) (Mem. Soc. Zool. Fr., 14: 249–372)
Kaufman (1972, *op. cit*. under *A. arcanum*) notes that *A. crassipes* is similar to *A. fuscolineatum*, but the former species is considered provisionally valid because little material is available for examination and the types have not been compared, a view endorsed by Guglielmone et al. (2009, *op. cit.* under *A. argentinae*). Kolonin (2009, *op. cit.* under *A. arcanum*) treats *A. crassipes* as a synonym of *A. fuscolineatum* (both within the genus *Aponomma*), but no comparison of types is provided to support this statement, which is based in inferences.

Type depository: ZMB (holtype) (Moritz and Fischer 1981, *op. cit.* under *A. arcanum*) as *Aponomma crassipes*.

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregions: several ecoregions, but mainly tropical and subtropical moist broadleaf forests

Hosts: Squamata: Varanidae (ANL)
Squamata: Boidae; Carnivora: Viverridae (AN)
Squamata: Elapidae; Carnivora: Canidae, Mustelidae; Rodentia: Hystricidae, Sciuridae; Scandentia: Tupaiidae (A)

Human infestation: no

Remarks: all authors cited below refer to this species as *Aponomma crassipes*. The host range presented by Santos Dias (1993) is broad and mostly based on Phan Cung, Van Thu and Van Chi 1977 (Ve Bét Viêt Nam: 114, in Vietnamese), a publication that we have not seen, or it may be a different citation of Phan Trong (1977), referenced below. Keirans and Durden (2001) cite the introduction of this species into the Nearctic Region, but it has not become established there.

References

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Kaufman, T.S. 1972. A revision of the genus *Aponomma* Neumann, 1899 (Acarina: Ixodidae). Ph.D. Dissertation, University of Maryland, 390 pp.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Phan Trong, C. 1977. Ve bet va con trung ky sinh o Viet Nam. Tap 1. Ve (Ixodoidea), mo ta va phan loai. Ha Noi: Khoa hoc va ky thuat, 489 pp. In Vietnamese.

Santos Dias, J.A.T. 1993. Contribuição para o estudo da sistemática e taxonomia das espécies do género *Aponomma* Neumann, 1899 (Acarina-Ixodoidea). Estud. Ens. Doc. (157), 204 pp.

27 – *A. crassum* Robinson, 1926 (Ticks. A monograph of the Ixodoidea. Part IV. The genus *Amblyomma*. Cambridge University Press, London, 302 pp)
See remarks below.

Type depository: BMNH (holotype) (Keirans and Hillyard 2001, *op. cit*. under *A. albopictum*)

Known stages: female

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: Testudines: Testudinidae (A)

Human infestation: no

Remarks: Fairchild (1943) felt that extensive studies of the similar species *A. crassum*, *A. humerale* and *A. sabanerae* would be needed to determine whether or not they were variants of one species. Guglielmone et al. (2003) strongly share this view but provisionally treat all three species as valid. We consider the Nearctic record of *A. humerale* in Bilsing and Eads (1947) to be either doubtful or the result of an introduction from the Neotropical Region, without subsequent establishment. Mihalca et al. (2011) believe that this species is endangered.

References

Bilsing, S.W. & Eads, R.B. 1947. An addition to the tick fauna of the United States. J. Parasitol., 33: 85–86.

Fairchild, G.B. 1943. An annotated list of the blood sucking insects, ticks and mites known from Panama. Am. J. Trop. Med. Hyg., 23: 569–591.

Fairchild, G.B., Kohls, G.M. & Tipton, V.J. 1966. The ticks of Panama (Acarina: Ixodoidea). *In* W.R. Wenzel & V.J. Tipton (editors), Ectoparasites of Panama. Field Museum of Natural History, Chicago, pp. 167–219.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

28 – *A. crenatum* Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)

Type depository: MNHN (holotype) (Neumann, 1899, *op. cit.* under *A. albopictum*)

Known stages: male, female

Zoogeographic Region: Oriental

Ecoregion: Sumatran rain forests

Hosts: Perissodactyla: Rhinocerotidae (A)

Human infestation: no

Remarks: Petney and Keirans (1995) consider alleged African records a consequence of mislabeling, and findings of *A. crenatum* in Europe (Palearctic) on captive hosts a result of introduction into that region, where the ticks failed to become established. According to Durden and Keirans (1996), *A. crenatum* is an endangered species.

References

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91

Petney, T.N. & Keirans, J.E. 1995. Ticks of the genera *Amblyomma* and *Hyalomma* from South-east Asia. Trop. Biomed., 12: 45–56.

29 – *A. cruciferum* Neumann, 1901 (Mem. Soc. Zool. Fr., 14: 249–372)

Type depository: ZMB (syntypes) (Moritz and Fischer 1981, *op. cit.* under *A. arcanum*)

Known stages: male, female, nymph

Zoogeographic Region: Neotropical

Ecoregion: Hispaniolan pine forest

Hosts: Squamata: Iguanidae (AN)

Human infestation: no

Remarks: Mihalca et al. (2011) regard *A. cruciferum* as endangered. See also *A. torrei*.

References

Bequaert, J.C. 1932. On the ornate nymphs of the tick genus *Amblyomma* (Acarina: Ixodidae). Z. Parasitenkd., 4: 776–783.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

30 – *A. darwini* Hirst & Hirst, 1910 (Ann. Mag. Nat. Hist., Ser. 8, 6: 299–308).

Type depository: BMNH (syntypes) (Keirans and Hillyard 2001, *op. cit*. under *A. albopictum*), but also in MCZ (http://mczbase.mcz.harvard.edu/ accessed April 4, 2013)

Known stages: male, female, nymph

Zoogeographic Region: Neotropical

Ecoregions: deserts and xeric shrublands

Hosts: usual hosts for nymphs and adults are Squamata: Iguanidae.
Squamata: Iguanidae (ANL)
Squamata: Tropiduridae (AN)

Human infestation: no

Remarks: Camicas et al. (1998) do not list the nymph as described. Bequaert (1932) described what seems to be the nymph of *A. darwini* and we regard this description as tentatively valid. The larva of *A. darwini* remains undescribed, but we consider provisionally valid records of this developmental stage on Iguanidae in Gadsen and Guerra (1991). Schulze (1936) classified ticks found on Charadriiformes: Scolopacidae as a subspecies of *A. darwini*. This record is not included in our host list because we believe that it requires confirmation. Guglielmone et al. (2003) state that *A. darwini* and its hosts are at risk of extinction.

References

Bequaert, J.C. 1932. On the ornate nymphs of the tick genus *Amblyomma* (Acarina: Ixodidae). Z. Parasitenkd., 4: 776–783.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Gadsen, H. & Guerra, G. 1991. Los ácaros ectoparásitos de *Amblyrhynchus cristatus* Bell (Sauria: Iguanidae) como trazadores zoogeográficos, en las islas Galápagos, Ecuador. Folia Entomol. Mex. (83): 183–197.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases, Atalanta-2, Houten, The Netherlands, 173 pp.

Schulze, P. 1936. The Norwegian zoological expedition to the Galapagos Islands 1925, conducted by Alf Wollebaek. XIII. Die Ixodoidea der Galapagos-Inseln. Medd. Zool. Mus. (45): 155–162.

31 – *A. dissimile* Koch, 1844 (Arch. Naturgesch., 10: 217–239)
Amblyomma bibroni (Gervais, 1842, as *Ixodes bibronii*) and *Amblyomma trinitatis* Turk 1948 are synonyms of *A. dissimile* in Guglielmone et al. (2009, *op. cit.* under *A. argentinae*), but these three names are listed as valid in Barker and Murrell (2008, *op. cit.* under *A. argentinae*), who misspell *A. trinitatis* as *A. trinitatus*. However, *I. bibroni* Gervais, 1842 is a name without description or figure, a *nomen nudum*, while *I. bibroni* Gervais, 1844 is a name *incertae sedis*, and *A. trinitatis* is recognized as a synonym of *A. dissimile.* Camicas et al. (1998, *op. cit.* under *A. auricularium*) treat *A. bibroni* and *A. trinitatis* as valid but we do not share this opinion. See also remarks below.

Type depository: ZMB (syntypes) (Moritz and Fischer 1981, *op. cit.* under *A. arcanum*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Nearctic, Neotropical

Ecoregions: tropical and subtropical dry broadleaf forests, grasslands, savannas and shrublands

Hosts: usual hosts of larvae, nymphs and adult ticks are Anura: Bufonidae, and Squamata: Boidae and Iguanidae. Aves, Crocodilia and Mammalia are considered exceptional hosts for this tick.
Anura: Bufonidae; Squamata (several families); Testudines: Emydidae; Rodentia: Echimyidae (ANL)
Testudines: Kinosternidae; Artiodactyla: Bovidae; Rodentia: Caviidae (AN)
Ciconiiformes: Ardeidae; Crocodilia: Crocodylidae; Rodentia: Dasyproctidae (A), Rodentia: Cricetidae (NL)
Didelphimorphia: Didelphidae; Psittaciformes: Psittacidae (N),
Testudines: Pelomedusidae, Testudinidae; Artiodactyla: Tayassuidae; Rodentia: Capromyidae (stages unknown)

Human infestation: yes (Guglielmone et al. 2010)

Remarks: information on hosts and some of the comments below are from Guglielmone and Nava (2010), who also discussed several synonyms for *A. dissimile*. These authors consider *Ixodes humanus* Koch, 1844 a synonym of *A. dissimile*, but a recent examination of the type of *I. humanus* failed to confirm this synonymy (Nava, S. personal communication to Guglielmone, A.A.). Neumann (1911) treated *A. cooperi* Nuttall & Warburton, 1908 (= *A. dubitatum*) as a synonym of *A. dissimile*

and therefore listed Caviidae as hosts of this tick. However, *A. dubitatum* is a valid species, feeding chiefly on Caviidae (see *A. dubitatum*). Neumann's view has been repeated uncritically by many authors, leaving the impression that Caviidae are relatively important hosts of *A. dissimile*, which is not the case. Jones et al. (1972) found adults, nymphs and larvae of this species on Rodentia: Echimyidae, but there are doubts about the identity of the host so that this record is only tentatively included in our host list for *A. dissimile*. Several reports of Mammalia infestation, as in Botelho et al. (2002), require confirmation. Doss et al. (1974) cited Boero (1944) for supposedly listing five species of Mammalia as hosts for *A. dissimile*, but the sole family in Boero (1944) is Boidae. The errors in Doss et al. (1974) are repeated *in toto* by Serra-Freire and Peralta (1993). Rawlins et al. (1993) list mammals as hosts of *A. dissimile*, probably due to a typing error. Finally, Camacho Escobar and Pérez-Lara (2009) depict a non-tick acarine as the nymph of *A. dissimile.* Burridge (2011) stresses the capacity of this tick to infest hosts outside the Nearctic and Neotropical Regions. Guglielmone and Nava (2010) discuss the introduction of *A. dissimile* into Central Pacific islands and the Palearctic Region, which may have a bearing on alleged findings in the Oriental Region, although there is no evidence of its establishment there.

References

Boero, J.J. 1944. Los ixodideos de la República Argentina. Boletín Técnico de la Dirección de de Ganadería, Ministerio de Agricultura y Ganadería de la República Argentina, 68 pp.

Botelho, M.C.N., Leite, L.M.R.M., Neto, I.P.B., Silva, L.A.M. da, Campello, M.L.C.B., Aguiar, M.C.A., Serra-Freire, N.M. & Oliveira, J.B. de 2002. *Amblyomma dissimile* Kock [sic], 1844 (Acari, Ixodidae) em mamíferos silvestres no Estado de Pernambuco, Brasil. Entomol. Vectores, 9: 71–78.

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Camacho Escobar, M.A. & Pérez-Lara, E. 2009. Ectoparásitos de iguana verde (*Iguana iguana*) y negra (*Ctenosaura pectinata*) en condiciones de crianza intensiva en la costa de Oaxaca, México. Cienc. Mar., 13: 15–22.

Doss, M.A., Farr, M.M., Roach, K.F. & Anastos, G. 1974. Index-catalogue of medical and veterinary zoology. Special publication 3. Ticks and tick borne diseases. I. Genera and species of ticks. Part 1. Genera A-G. United States Department of Agriculture, United States Government Printing Office, Washingtion D.C., 429 pp.

Guglielmone, A.A. & Nava, S. 2010. Hosts of *Amblyomma dissimile* Koch, 1844 and *Amblyomma rotundatum* Koch, 1844 (Acari: Ixodidae). Zootaxa, 2541, 27–49.

Jones, E.K., Clifford, C.M., Keirans, J.E. & Kohls, G.M. 1972. The ticks of Venezuela (Acarina: Ixodoidea) with a key to the species of *Amblyomma* in the Western Hemisphere. Brigham Young Univ. Sci. Bull. Biol. Ser., 17 (4), 40 pp.

Neumann, L.G. 1911. Ixodoidea. Das Tierreich (26), 169 pp.

Rawlins, S.C., Mahadeo, S. & Martínez, R. 1993. A list of the ticks affecting man and animals in the Caribbean. CARAPHIN News, (6): 8–9.

Scofield, A., Bahia, M., Martins, A.L., Góes-Cavalcante, G., Martins, T.F. & Labruna, M.B. 2011. *Amblyomma dissimile* Koch (Acari: Ixodidae) attacking *Primolius maracana* Vieillot (Psittaciformes: Psittacidae) in the Amazon Region, State of Pará, Brazil. Neotr. Entomol., 40: 509–511.

Serra-Freire, N.M. & Peralta, A.S.L. 1993. Primeiro registro do parasitismo do *Caiman crocodilus crocodilus* por *Amblyomma dissimile* no Brasil. Rev. Bras. Parasitol. Vet., 2 (Supl. 1): 7.

32 – *A. dubitatum* Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)

Amblyomma cooperi Nuttall & Warburton, 1908 is a synonym of *A. dubitatum*, a decision reached after inspection of the type of *A. dubitatum*, as discussed in Guglielmone et al. (2009, *op. cit.* under *A. argentinae*). However, both names, *A. cooperi* and *A. dubitatum*, are included in Barker and Murrell (2008, *op. cit.* under *A. argentinae*).

Type depository: ENV (holotype) (Estrada-Peña, A., Venzal, J.M. & Guglielmone, A.A. 2002. *Amblyomma dubitatum* Neumann: description of nymph and redescription of adults, together with the description of the immature stages of *A. triste* Koch. Acarologia, 42: 323–333)

Known stages: male, female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregions: riparian environments in tropical and subtropical moist broadleaf forests, grasslands, savannas and shrublands

Hosts: usual hosts for larvae, nymphs and adults are Rodentia: Caviidae. Aves are considered exceptional hosts for this tick.
Rodentia: Caviidae (ANL)
Mammalia (several orders) (AN)
Didelphimorphia: Didelphidae; Rodentia: Cricetidae (NL)
Struthioniformes: Rheidae (N)
Carnivora: Canidae (stage unknown)

Human infestation: yes (Nava et al. 2010)

Remarks: the nymph of *A. dubitatum* has recently been redescribed by Martins et al. (2010). Kolonin (2009) limits the range of hosts to Caviidae and Tapiridae, but there are several *bona fide* records from other types of hosts, as detailed in Nava et al. (2010). Records from Aves are unusual. See *A. dissimile* for the erroneous synonymy of *A. dubitatum* with *A. dissimile.*

References

Dantas-Torres, F., Siqueira, D.B., Rameh-de-Albuquerque, L.C., Silva e Souza, D.D., Zanotti, A.P., Ferreira, D.R.A., Martins, T.F., Senna, M.B., Wagner, P.G.C., Silva, M.A., Marvulo, M.F.V. & Labruna, M.B. 2010. Ticks infesting wildlife species in northeastern Brazil with new host and locality records. J. Med. Entomol., 47: 1243–1246.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Labruna, M.B., Jorge, R.S.P., Sana, D.A., Jácomo, A.T.A., Kashivakura, C.K., Furtado, M.M., Ferro, C., Perez, S.A., Silveira, L., Santos, T.S., Marques, S.R., Morato, R.G., Nava, A., Adania, C.H., Teixeira, R.H.F., Gomes, A.A.B., Conforti, V.A., Azevedo, F.C.C., Prada, C.S., Silva, J.C.R., Batista, A.F., Marvulo, M.F.V. , Morato, R.L.G., Alho, C.J.R., Pinter, A., Ferreira, P.M., Ferreira, F. & Barros-Battesti, D.M. 2005. Ticks (Acari: Ixodida) on wild carnivores in Brazil. Exp. Appl. Acarol., 36: 149–163.
Martins, T.F., Onofrio, V.C., Barros-Battesti, D.M. & Labruna, M.B. 2010. Nymphs of the genus *Amblyomma* (Acari: Ixodidae) of Brazil: descriptions, redescriptions, and identification key. Ticks Tick-borne Dis., 1: 75–99.
Nava, S., Venzal, J.M., Labruna, M.B., Mastropaolo, M., González, E.M., Mangold, A.J. & Guglielmone, A.A. 2010. Hosts, distribution and genetic divergence (16S rDNA) of *Amblyomma dubitatum* (Acari: Ixodidae). Exp. Appl. Acarol., 51: 335–351.

33 – *A. eburneum* Gerstäcker, 1873 (Gliederthiere (Insekten, Arachniden, Myriopoden und Isopoden). *In* O. Kersten (editor), Baron Carl Claus von der Decken's Reisen in Ost Afrika in den Jahren 1859 bis 1861. C.J. Winter'sche Verlagshandlung, Leipzig und Heidelberg, 542 pp.)

Type depository: ZMB (syntypes) (Moritz and Fischer 1981, *op. cit.* under *A. arcanum*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical moist broadleaf forests, grasslands, savannas and shrublands

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae, while Squamata appear to be exceptional hosts for this tick.
Artiodactyla: Bovidae (ANL)
Artiodactyla: Giraffidae, Suidae; Carnivora: Felidae; Perissodactyla: Rhinocerotidae; Squamata: Varanidae (A)

Human infestation: no

Remarks: Kolonin (2009) does not include Varanidae as hosts for *A. eburneum*, but we consider a record from this type of host, described in Elbl and Anastos (1966), to be valid, although this host-parasite relationship appears to be infrequent.

References

Elbl, A. & Anastos, G. 1966. Ixodid ticks (Acarina: Ixodidae) of Central Africa. Vol. I. General Introduction. Genus *Amblyomma.* Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (145), 275 pp.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Voltzit, O.V. & Keirans, J.E. 2003. A review of African *Amblyomma* species (Acari, Ixodida, Ixodidae). Acarina, 11: 135–214.
Walker, J.B. 1974. The ixodid ticks of Kenya. A review of present knowledge of their hosts and distribution. Commonwealth Institute of Entomology, London, 220 pp.

34 – *A. echidnae* Roberts, 1953 (Aust. J. Zool., 1: 111–161)
Kolonin (2009, *op. cit.* under *A. arcanum*) does not include this species in his list of the Ixodidae of the world. No explanation is given for the exclusion, but perhaps the author regards *A. echidnae* as a synonym of *A. australiense*, as in Camicas et al. (1998, *op. cit.* under *A. calcaratum*). These authors surely agree with the statement by Roberts, F.H.S. (1970. Australian ticks. CSIRO, Melbourne, 267 pp.) that *A. echidnae* may be a subspecies of *A. australiense.* We consider *A. echidnae* tentatively valid as discussed in Guglielmone et al. (2010, *op. cit.* under *A. argentinae*).

Type depositories: QM (holotype), ANIC (paratype) (Roberts, F.H.S. 1953. The Australian species of *Aponomma* and *Amblyomma* (Ixodoidea). Aust. J. Zool., 1: 111–161)

Known stages: male, female

Zoogeographic Region: Australasian

Ecoregion: Brigalow tropical savanna

Hosts: usual hosts for adult ticks are Monotremata: Tachyglossidae. Squamata are considered exceptional hosts for this tick.
Monotremata: Tachyglossidae; Squamata (undetermined family) (A)

Human infestation: no

Remarks: there is one record of the introduction of *A. echidnae* (unknown stage) into the Nearctic Region on a snake (Keirans and Durden 2001), but no evidence that this species has established itself in the Nearctic. Durden and Keirans (1996) list *A. echidnae* as an endangered species.

References

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.
Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.
Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.

35 – *A. elaphense* (Price, 1959) (J. Parasitol., 44: 649–651)
Kolonin (2009, *op. cit.* under *A. arcanum*) classifies this species under *Aponomma.* Burger, T.D., Shao, R., Beati, L., Miller, H. & Barker, S.C. (2012. Phylogenetic analysis of ticks (Acari: Ixodida) using mitochondrial genomes and nuclear rRNA

genes indicates that *Amblyomma* is polyphyletic. Mol. Phylogen. Evol., 66: 45–55) believe that this species belongs to a genus other than *Amblyomma.*

Type depositories: USNTC (holotype, paratype), BMNH, OVI, UM (paratypes) (Keirans and Hillyard 2001, *op. cit*. under *A. albopictum*) as *Aponomma elaphensis*

Known stages: male, female, nymph, larva

Zoogeographic Region: Nearctic

Ecoregion: Chihuahuan desert

Hosts: Squamata: Colubridae (ANL)

Human infestation: no

Remarks: Camicas et al. (1998) record the range of this tick as Nearctic and Neotropical, but *A. elaphense* has not yet been found in the Neotropical Region (Keirans and Degenhardt 1985). All these authors use the name *Aponomma elaphense.*

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Keirans, J.E. & Degenhardt, W.G. 1985. *Aponomma elaphense* Price, 1959 (Acari: Ixodidae): diagnosis of the adults and nymph with first description of the larva. Proc. Biol. Soc. Wash., 98: 711–717.

36 – *A. exornatum* Koch, 1844 (Arch. Naturgesch., 10: 217–239)
Kolonin (2009, *op. cit.* under *A. arcanum*) classifies this species under *Aponomma.* See also *A. arcanum.*

Type depository: ZMB (syntypes) (Moritz and Fischer 1981, *op. cit.* under *A. arcanum*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for larvae, nymphs and adults are Squamata: Varanidae. Aves and Mammalia are considered exceptional hosts for this tick.
Squamata: Varanidae (ANL)
Squamata: Boidae, Scincidae, Elapidae; Artiodactyla: Bovidae; Carnivora: Canidae (A)
Falconiformes: Accipitridae (stage unknown)

Human infestation: no

Remarks: with the exception of Burridge (2011), all authors cited below classify this species under *Aponomma.* Because it can be difficult to differentiate *A. exornatum* from *A. arcanum* and *A. flavomaculatum* (Santos Dias, 1993), we consider some published host records only tentatively valid. Kenny et al. (2004) record the introduction of this tick into the Palearctic Region, but there is no evidence of it having become established there. Burridge (2001) states that this tick has the potential to become established outside the Afrotropical Region because it was found on native Asian hosts introduced into the Nearctic, where it may now occur. Santos Dias (1993) excludes Chiroptera, Crocodilia and Pholidota as hosts of this species because he regards these groups as hosts of *A. arcanum* (a species not recognized by Kaufman 1972); we have followed Santos Dias (1993) in compiling our list of the principal hosts of *A. exornatum.* Theiler (1959) states that unspecified immature stages of *A. exornatum* were found on Accipitridae, and later (Theiler 1962) notes that adults of this tick were also found on *Circaetus pectoralis* (Accipitridae), an eagle whose prey includes varanid lizards. We accept Accipitridae as an exceptional host for *A. exornatum*, but we have no grounds for assigning a particular parasitic stage to this host. In any event, hosts of this tick other than Squamata appear to be infrequent. Burridge (2001) cites all hosts of *A. exornatum* in Kaufman (1972) without discussing his opinion on *A. arcanum.* See also *A. arcanum.*

References

Burridge, M.J. 2001. Ticks (Acari: Ixodidae) spread by the international trade in reptiles and their potential roles in dissemination of diseases. Bull. Entomol. Res., 91: 3–23.

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Cooper, J.E. 1974. Parasites from reptiles in Kenya, with notes on their significance and control. Br. J. Herpetol., 5: 431–438.

Kaufman, T.S. 1972. A revision of the genus *Aponomma* Neumann, 1899 (Acarina: Ixodidae). Ph.D. Dissertation, University of Maryland, 390 pp.

Kenny, M.J., Shaw, S.E., Hillyard, P.D. & Forbes, A.B. 2004. Ectoparasite and haemoparasite risks associated with imported exotic reptiles. Vet. Rec., 154: 434–435.

Santos Dias, J.A.T. 1993. Contribuição para o estudo da sistemática e taxonomia das espécies do género *Aponomma* Neumann, 1899 (Acarina-Ixodoidea). Estud. Ens. Doc. (157), 204 pp.

Theiler, G. 1959. African ticks and birds. Ostrich (Suppl. 3), 3: 353–378.

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

37 – *A. extraoculatum* Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)

Kolonin (2009, *op. cit.* under *A. arcanum*) does not include *A. extraoculatum* in his list of Ixodidae of the world because he treats this species as a synonym of *A. romitii*, but this is incorrect because both species are valid. Voltzit, O.V. (2007. A review of Neotropical *Amblyomma* species (Acari: Ixodidae). Acarina, 15: 3–134) includes *A. extraoculatum* as a valid Neotropical species but excludes *A. romitii*,

although the former taxon is now considered an Oriental species and the latter truly Neotropical. Further confusing this issue, Voltzit (2007) cites Tonelli Rondelli, 1939, as the authority for *A. extraoculatum* when Tonelli Rondelli is, in fact, the author for *A. romitii.* See also remarks below and *A. romitii.*

Type depository: ZSH (holotype) (Neumann 1899, *op. cit.* under *A. albopictum*)

Known stages: female

Zoogeographic Region: Oriental

Ecoregion: unknown

Hosts: unknown

Human infestation: no

Remarks: Santos Dias (1955) gives the type locality as Singapore (Oriental Region), a labeling error, and synonymizes the Neotropical *A. romitii* with *A. extraoculatum.* However, Barros-Battesti et al. (2007) demonstrate the validity of both species, and *A. extraoculatum* is now considered an Oriental tick species. Recently, Serra-Freire et al. (2012) allegedly found *A. extraoculatum* on Testudines in Peru, but the figure of the tick presented in the publication is neither *A. extraoculatum* nor *A. romitii*, a tick species previously considered a synonym of *A. extraoculatum.*

References

Barros-Battesti, D.M., Arzua, M., Onofrio, V.C. & Labruna, M.B. 2007. Validation and redescription of *Amblyomma romitii* Tonelli-Rondelli, 1939 (Acari: Ixodidae). Syst. Parasitol., 68: 79–86.

Santos Dias, J.A.T. 1955. Identidade e sinonímia da espécie *Amblyomma extraoculatum* Neumann, 1899 (Acarina, Ixodoidea). Mem. Estud. Mus. Zool. Univ. Coimbra (229), 6 pp.

Serra-Freire, N.M., Batalla, L.A. & Julca-Lozano, R. 2012. Malformação em gonandro de *Amblyomma* (*Cernyomma*) *extraoculatum* recolhido em *Geochelone denticulada* (Linnaeus, 1766) de ambiente silvestre no Peru – relato de caso. Rev. Bras. Med. Vet., 34: 31–34.

38 – *A. falsomarmoreum* Tonelli-Rondelli, 1935 (Atti Soc. Ital. Sci. Nat., 74: 239–252)
See *A. marmoreum.*

Type depository: MRSN (syntypes) (Tonelli-Rondelli, M. 1935. Ixodoidea del Fezzan e della Somalia italiana raccolti dal Prof. E. Zavattari e dal Prof. C. Tedeschi. Atti. Soc. Ital. Sci. Nat., 74: 239–252)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for adult ticks are Testudines: Testudinidae and Squamata: Varanidae, while Mammalia appear to be exceptional hosts for this tick.
Squamata: Varanidae (A, N and/or L)
Testudines: Testudinidae; Squamata: Boidae; Artiodactyla: Bovidae, Camelidae, Suidae (A)

Human infestation: yes (Morel 2003)

Remarks: Voltzit and Keirans (2003) and Kolonin (2009) state that the nymph of this species is undescribed, but Van der Borght-Elbl (1977) provided a description of the nymph based on laboratory-reared material. Hosts for sub-adult stages of *A. falsomarmoreum* are not known with certainty. In Keirans and Durden (2001) there is a record of the introduction of this species into the Nearctic Region but no evidence that it has become established there. Camicas et al. (1998) consider Testudines the principal hosts for all stages of *A. falsomarmoreum*, but Varanidae also appear to be important hosts of adults. Kolonin (2009) lists Felidae as hosts of *A. falsomarmoreum*, but we were unable to confirm this record and it is not included in the list above. Mammals appear to be unusual hosts for *A. falsomarmoreum.* Theiler (1962) uses the term "immatures" without specifying whether larvae, nymphs or both sub-adult stages were found on Varanidae.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Pegram, R.G. 1976. Ticks (Acarina, Ixodoidea) of the northern regions of the Somali Democratic Republic. Bull. Entomol. Res., 66: 345–363.

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

Van der Borght-Elbl, A. 1977. Ixodid ticks (Acarina: Ixodidae) of Central Africa. Vol. V. The larval and nymphal stages of the more important species of the genus *Amblyomma* Koch, 1844. Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (222), 158 pp.

Voltzit, O.V. & Keirans, J.E. 2003. A review of African *Amblyomma* species (Acari, Ixodida, Ixodidae). Acarina, 11: 135–214.

Walker, J.B. 1974. The ixodid ticks of Kenya. A review of present knowledge of their hosts and distribution. Commonwealth Institute of Entomology, London, 220 pp.

Yeoman, G.H. & Walker, J.B. 1967. The ixodid ticks of Tanzania. A study of the zoogeography of the Ixodidae of an East African country. Commonwealth Institute of Entomology, London, 215 pp.

39 – *A. fimbriatum* Koch, 1844 (Arch. Naturgesch., 10: 217–239)
Kolonin (2009, *op. cit.* under *A. arcanum*) classifies this species under *Aponomma* and stresses the difficulties involved in separating *A. fimbriatum* from *A. trimaculatum.* See also remarks below.

Type depository: ZMB (holotype) (Moritz and Fischer 1981, *op. cit.* under *A. arcanum*). Kaufman, T.S. (1972, *op. cit.* under *A. arcanum*) claims that the holotype is in the USNTC. However, no USNTC types of this species are listed in Keirans and Clifford (1984, *op. cit.* under *A. calcaratum*).

Known stages: male, female, nymph

Zoogeographic Regions: Australasian, Oriental

Ecoregions: several Australasian and Oriental ecoregions

Hosts: Aves and Mammalia are considered exceptional hosts for this tick.
Squamata: Boidae, Elapidae, Varanidae (ANL)
Galliformes: Phasianidae (AN)
Squamata: Agamidae, Colubridae, Hydrophiidae (A)
Squamata: Typhlopidae; Artiodactyla: Bovidae; Perissodactyla: Equidae (stages unknown)

Human infestation: no

Remarks: curiously, Froggatt (1900) claimed that *A. fimbriatum* (under the name *Aponomma ecinctum* Neumann, 1901) occurs in great numbers on large lamellicorn beetles. The larva of *A. fimbriatum* remains undescribed, but we consider provisionally valid records of this developmental stage in Kaufman (1972) on Boidae and Varanidae. Burridge and Simmons (2003) record the introduction of *A. fimbriatum* into the Nearctic Region, but there is no evidence that it has become established there. The authors cited below classify this species as *Aponomma fimbriatum.* See also *A. trimaculatum.*

References

Burridge, M.J. & Simmons, L.-A. 2003. Exotic tick introduced into the United States on imported reptiles from 1962 to 2001 and their potential roles in international dissemination of diseases. Vet. Parasitol., 113: 289–320.

Durden, L.A., Merker, S. & Beati, L. 2008. The tick fauna of Sulawesi, Indonesia (Acari: Ixodoidea: Argasidae and Ixodidae). Exp. App. Acarol., 45: 85–110.

Easton, E.R. 2003. Ecology of ticks, including a new record of *Aponomma* (Ixodoidea: Ixodidae) from *Laticauda colubrina* on Loloata Island of Papua New Guinea. Hamadryad, 27: 256–259.

Froggatt, W.W. 1900. Notes on a collection of ticks, determined by Professor Neumann. Agric. Gaz. New South Wales, 11: 540–542.
Kaufman, T.S. 1972. A revision of the genus *Aponomma* Neumann, 1899 (Acarina: Ixodidae). Ph.D. Dissertation, University of Maryland, 390 pp.
Santos Dias, J.A.T. 1993. Contribuição para o estudo da sistemática e taxonomia das espécies do género *Aponomma* Neumann, 1899 (Acarina-Ixodoidea). Estud. Ens. Doc. (157), 204 pp.
Vilcins, I.-M.E., Fournier, P.-E., Old, J.M. & Deane, E. 2009. Evidence for the presence of *Francisella* and spotted fever group *Rickettsia* DNA in the tick *Amblyomma fimbriatum* (Acari: Ixodidae), Northern Territory, Australia. J. Med. Entomol., 46: 926–933.
Vilcins, I.-M.E., Ujvari, B., Old, J.M. & Deane, E. 2009. Molecular and morphological description of a *Hepatozoon* species in reptiles and their ticks in the Northern Territory, Australia. J. Parasitol., 95: 434–442.

40 – *A. flavomaculatum* (Lucas, 1846) (Ann. Soc. Entomol. Fr. Ser. 2, 4: 53–64)
Kolonin (2009, *op. cit.* under *A. arcanum*) classifies this species under *Aponomma.* Kaufman (1972 *op. cit.* under *A. fimbriatum*) examined the types of *Aponomma pulchrum* Roberts, 1953, concluding that this species is a synonym of *A. flavomaculatum*. Camicas et al. (1998, *op. cit.* under *A. auricularium*) treat *A. pulchrum* as a synonym of *Amblyomma gervaisi* (under the name *Aponomma gervaisi*), while Santos Dias (1993. Contribuição para o estudo da sistematica e taxonomia das especes de genero *Aponomma* Neumann, 1899 (Acarina-Ixodoidea). Estud. Ens. Doc. (157), 204 pp.) regards *A. pulchrum* as valid. We tentatively agree with Kaufman, T.S. (1972, *op. cit.* under *A. arcanum*) because his conclusion was based on examination of the type specimens of *A. pulchrum*. See also *A. inopinatum.*

Type depository: MNHN (lectotype, paralectotypes) (Santos Dias 1993, *op. cit.* above), as *Ixodes flavomaculatus*

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for adult ticks are Squamata: Varanidae and Boidae.
Squamata: Varanidae, Boidae (ANL)
Squamata: Elapidae, Iguanidae (A)

Human infestation: no

Remarks: as discussed in Santos Dias (1993), difficulties may be encountered in differentiating *A. flavomaculatum* from *A. arcanum* and *A. exornatum*, with the result that a number of host records are only tentatively valid. Kaufman (1972) limits the hosts of *A. flavomaculatum* to Squamata, a view shared by Saratsiotis (1972), who also stresses the difficulties in determining this species. Kolonin (2009) lists Squamata as the only hosts of this species and we agree. Santos Dias (1993) and Burridge (2001, 2011) list Bufonidae, Crocodilia, Scincidae and some Mammalia

as hosts of *A. flavomaculatum*, but we consider these records tentatively invalid because our host list is based on Kaufman (1972) and Saratsiotis (1972). Roberts (1970) cites a record of this species (as *Aponomma pulchrum*, a synonym of *A. flavomaculatum*) from the Australasian Zoogeographic Region, but Kaufman (1972) considers this an accidental introduction and we agree. Keirans and Durden (2001), Nowak (2010) and Bermúdez and Miranda (2011) provide records of the introduction of *A. flavomaculatum* into the Nearctic, Palearctic and Neotropical Regions, but there is no evidence that it has become established in any of those regions. With the exception of Burridge (2011) and Nowak (2010), all the authors cited below classify this tick species under *Aponomma.* See also *A. arcanum* and *A. exornatum.*

References

Bermúdez, S.E. & Miranda, R.J. 2011. De mascotas exóticas y turistas: nuevas oportunidades para la introducción de ectoparásitos en Panamá. Bol. Soc. Entomol. Aragonesa (48): 491–492.

Burridge, M.J. 2001. Ticks (Acari: Ixodidae) spread by the international trade in reptiles and their potential roles in dissemination of diseases. Bull. Entomol. Res., 91: 3–23.

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Kaufman, T.S. 1972. A revision of the genus *Aponomma* Neumann, 1899 (Acarina: Ixodidae). Ph.D. Dissertation, University of Maryland, 390 pp.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Nowak, M. 2010. The international trade in reptiles (Reptilia) – the cause of the transfer of exotic ticks (Acari: Ixodida) to Poland. Vet. Parasitol., 165: 373–381.

Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.

Santos Dias, J.A.T. 1993. Contribuição para o estudo da sistemática e taxonomia das espécies do género *Aponomma* Neumann, 1899 (Acarina-Ixodoidea). Estud. Ens. Doc. (157), 204 pp.

Saratsiotis, A. 1972. Contribution a l'étude morphologique et biologique du genre *Aponomma*

Neumann, 1899 (Acariens, Ixodidea) [sic]. I. *Ap. flavomaculatum* (Lucas, 1846). II. *Ap. latum* (Koch, 1844). Acarologia, 13: 476–495.

41 – *A. fulvum* Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)

Type depository: USNTC (holotype) (Keirans and Clifford 1984, *op. cit.* under *A. calcaratum*)

Known stages: male

Zoogeographic Region: Neotropical

Ecoregion: southern Atlantic mangroves

Hosts: Squamata: Boidae (A)

Human infestation: no

References

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Keirans, J.E. 1972. Redescription of *Amblyomma fulvum* Neumann, 1899 (Acarina: Ixodidae), a parasite of the giant anaconda in northern South America. J. Med. Entomol., 9: 138–139.

42 – *A. fuscolineatum* (Lucas, 1847) (Bull. Soc. Entomol. Fr. Ser. 2, 5: 99–101)
Santos Dias (1993, *op. cit*. under *A. flavomaculatum*) treats *A. varanense* as a synonym of *A. fuscolineatum* (both classified as *Aponomma*), while Kolonin (2009, *op. cit.* under *A. arcanum*) considers *A. varanense* and *A. crassipes* synonyms of *A. fuscolineatum* (all classified as *Aponomma*). We tentatively follow Kaufman (1972, *op. cit.* under *A. arcanum*), who accepts *A. crassipes*, *A. fuscolineatum* and *A. varanense*. See also *A. crassipes* and *A. varanense* and remarks below.

Type depository: MNHN (syntypes) (Kaufman 1972, *op. cit.* under *A. fimbriatum*) as *Ixodes fuscolineatus*

Known stages: male, female, nymph

Zoogeographic Region: Oriental

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: Squamata: Boidae (AN)

Human infestation: no

Remarks: Camicas et al. (1998) list the larva and nymph of *A. fuscolineatum* as described, probably because they consider this species a synonym of *A. crassipes*, but we regard both species as valid (see above). The nymph of *A. fuscolineatum* is described in Schulze (1936), but we were unable to find any description of the larva. Santos Dias (1993) presents a wide range of hosts for this species because he considers *A. varanense* (spelled *varanensis*) a synonym of *A. fuscolineatum*. Burridge (2001) and Burridge and Simmons (2003) listed the hosts of both *A. varanense* (spelled *varanensis*) and *A. fuscolineatum*, without critically considering this situation. We have included only those hosts listed by Kaufman (1972), who differentiated *A. fuscolineatum* from *A. varanense* (spelled *varanensis*) and limited the host range of the former species. Keirans and Durden (2001) record two introductions of *A. fuscolineatum* into the Nearctic Region, while Kenny et al. (2004) document the introduction of this species into the Palearctic Region. However, there is no evidence that *A. fuscolineatum* has become established in either of these regions. All authors below cite this species as a member of the genus *Aponomma*.

References

Burridge, M.J. 2001. Ticks (Acari: Ixodidae) spread by the internacional trade in reptiles and their potential roles in dissemination of diseases. Bull. Entomol. Res., 91: 3–23.

Burridge, M.J. & Simmons, L.-A. 2003. Exotic ticks introduced into the United States on imported reptiles from 1962 to 2001 and their potential roles in international dissemination of diseases. Vet. Parasitol., 113: 289–320.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Kaufman, T.S. 1972. A revision of the genus *Aponomma* Neumann, 1899 (Acarina: Ixodidae). Ph.D. Dissertation, University of Maryland, 390 pp.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kenny, M.J., Shaw, S.E., Hillyard, P.D. & Forbes, A.B. 2004. Ectoparasite and haemoparasite risks associated with imported exotic reptiles. Vet. Rec., 154: 434–435.

Santos Dias, J.A.T. 1993. Contribuição para o estudo da sistemática e taxonomia das espécies do género *Aponomma* Neumann, 1899 (Acarina-Ixodoidea). Estud. Ens. Doc. (157), 204 pp.

Schulze, P. 1936. Neue und wenig bekannte Amblyommen und Aponommen aus Afrika, Südamerika, Indien, Borneo und Australien (Ixodidae). Z. Parasitenkd., 8: 619–637.

43 – *A. fuscum* Neumann, 1907 (Notes Leyden Mus., 29: 88–100)
This name is not included in Horak et al. (2002, *op. cit.* under *A. arcanum*).

Type depository: LMNH (syntypes) (Neumann, L.G. 1907. Quatre espèces nouvelles d'ixodidés. Notes Leyden Mus., 29: 88–100)

Known stages: male, female, nymph

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands; moist broadleaf forests

Hosts: Squamata: Boidae, Colubridae, Teiidae; Anura: Bufonidae; Cingulata: Dasypodidae (A)
Carnivora: Canidae (AL)
Didelphimorphia: Didelphidae; Rodentia: Cricetidae (NL)
Rodentia: Echimyidae, Sciuridae (N)

Human infestation: yes (Marques et al. 2006)

Remarks: the nymph of this tick was recently described by Martins et al. (2010b). The larva of *A. fuscum* remains undescribed, but we consider the records of this stage on Didelphidae in Martins et al. (2010a) to be valid. Kolonin (2009) does not include Anura as hosts for *A. fuscum*, but we accept the record cited by Barros-Battesti et al. (2005).

References

Barros-Battesti, D.M., Onofrio, V.C., Labruna, M.B., Martins, J.R. & Guglielmone, A.A. 2005. Redescription of *Amblyomma fuscum* Neumann, 1907 (Acari: Ixodidae), a rare South America tick confirmed in Brazil. Syst. Parasitol., 61: 85–92.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Marques, S., Dal Col, R., Matos, M.O., Gonçalves, E.F.B., Pinter, A. & Labruna, M.B. 2006. Parasitismo de *Amblyomma fuscum* (Acari: Ixodidae) em humanos. Cienc. Rural, 36: 1328–1330.

Martins, T.F., Dantas-Torres, F., Nieri-Bastos, F.A., Marcili, A., Siquiera, D.B., Aléssio, F., Mauffrey, J.-F., Marvulo, M.F.V. Silva, J.C.R. & Labruna, M.B. 2010a. Host records for the immature stages of the South American tick *Amblyomma fuscum* (Acari: Ixodidae). Entomol. News, 120: 370–374.

Martins, T.F., Onofrio, V.C., Barros-Battesti, D.M. & Labruna, M.B. 2010b. Nymphs of the genus *Amblyomma* (Acari: Ixodidae) of Brazil: descriptions, redescriptions, and identification key. Ticks Tick-borne Dis., 1: 75–99.

Szabó, M.P.J., Nieri-Bastos, F.A., Spolidorio, M.G., Martins, T.F., Barbieri, A.M. & Labruna, M.B. 2013. *In vitro* isolation from *Amblyomma ovale* (Acari: Ixodidae) and ecological aspects of the Atlantic rainforest *Rickettsia*, the causative agent of a novel spotted fever rickettsiosis in Brazil. Parasitology, 140: 719–728.

44 – *A. geayi* Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)

Amblyomma perpunctatum (Packard, 1869) is not considered a senior synonym of *A. geayi* because its description is inadequate (Guglielmone et al. 2009, *op. cit.* under *A. argentinae*), but both names are incorrectly included in Barker and Murrell (2008, *op. cit.* under *A. argentinae*). Camicas et al. (1998, *op. cit.* under *A. auricularium*) treat *A. perpunctatum* as valid, but we disagree. See also *A. parkeri.*

Type depositories: MNHN, MCZ (syntypes) (Neumann 1899, *op. cit.* under *A. albopictum*; Guglielmone et al. 2003, *op. cit*. under *A. americanum*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Pilosa: Bradypodidae and Rodentia: Erethizontidae.

Pilosa: Bradypodidae; Didelphimorphia: Didelphidae (AN)

Pilosa: Megalonychidae; Rodentia: Erethizontidae (A)

Passeriformes: Pipridae (NL)
Passeriformes: Dendrocolaptidae, Thamnophilidae, Tyrannidae (L)

Human infestation: no

Remarks: Camicas et al. (1998) state that the larva of *A. geayi* is undescribed, but one year after that publication Amorim and Serra-Freire (1999) presented morphological characters for this stage in a key to 17 species of *Amblyomma*. The nymph of *A. geayi* has recently been described from laboratory-reared specimens by Martins et al. (2013). Keirans and Durden (2001) cite two records of the introduction of *A. geayi* into the Nearctic Region, but there is no evidence that this species has become established there. The nymph of *A. geayi* was undescribed in 1966, nevertheless we accept the several records of this stage in Fairchild et al. (1966) as provisionally valid, while doubting the diagnosis of a single larva from an unidentified sloth by the same authors. Neumann (1901) and Buitendijk (1945) present records on Testudines from Amsterdam (Palearctic Region) without any elaboration. There is disagreement concerning the collector and localities for *A. geayi* between Neumann (1901) and the original description in Neumann (1899), and these records are not included in our host list. Kolonin (2009) ignores Didelphidae as hosts for adult *A. geayi*, but we accept the records from this type of host in Fairchild et al. (1966).

References

Amorim, M. & Serra-Freire, N.M. 1999. Chave dicotômica para identificação de larvas de algumas espécies do gênero *Amblyomma* Koch, 1844 (Acari: Ixodidae). Entomol. Vectores, 6: 75–90.

Buitendijk, A.M. 1945. Voorloopige Catalogus van de Acari in de Collectie-Oudemans. Zool. Meded., 24: 281–391.

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition ORSTOM, Paris, 233 pp.

Fairchild, G.B., Kohls, G.M. & Tipton, V.J. 1966. The ticks of Panama (Acarina: Ixodoidea). *In* W.R. Wenzel & V.J. Tipton (editors), Ectoparasites of Panama. Field Museum of Natural History, Chicago, pp. 167–219.

Floch, H. & Fauran, P. 1958. Ixodidés de la Guyane et des Antilles Françaises. Arch. Inst. Pasteur Guyane (446), 94 pp.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Labruna, M.B., Onofrio, V.C., Beati, L., Arzua, M., Bertola, P.B. & Barros-Battesti, D.M. 2009. Redescription of the female, description of the male, and several new records of *Amblyomma parkeri* (Acari: Ixodidae), a South American tick species. Exp. Appl. Acarol., 49: 243–260.

Martins, T.F., Scofield, A., Oliveira, W.B.L., Nunes, P.H., Ramírez, D.G., Barros-Battesti, D.M., Sá, L.R.M., Ampuero, F., Souza, J.C. & Labruna, M.B. 2013.

Morphological description of the nymphal stage of *Amblyomma geayi*, and new nymphal records of *Amblyomma parkeri.* Ticks Tick-borne Dis., 4: 181–184.
Neumann, L.G. 1899. Révision de la famille des ixodidés (3e mémoire). Mém. Soc. Zool. Fr., 12: 107–294.
Neumann, L.G. 1901. Révision de la famille des ixodidés (4ª mémoire). Mém. Soc. Zool. Fr., 14: 249–372.
Ogrzewalska, M., Uezu, A. & Labruna, M.B. 2010. Ticks (Acari: Ixodidae) infesting wild birds in the eastern Amazon, northern Brazil, with notes on rickettsial infection in ticks. Parasitol. Res., 106: 809–816.

45 – *A. gemma* Dönitz, 1909 (Sber. Ges. Naturf. Freunde Berlin (8): 440–482)

Type depositories: BMNH, ZMB (syntypes) (Keirans and Hillyard 2001, *op. cit*. under *A. albopictum*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts of adult ticks are Artiodactyla: Bovidae, while Aves and Testudines are considered exceptional hosts for adults of this species.
Artiodactyla: Bovidae (ANL)
Artiodactyla: Camelidae, Suidae; Perissodactyla: Equidae (AN)
Mammalia (several orders); Struthioniformes: Struthionidae; Testudines: Testudinidae (A)
Rodentia: Sciuridae (NL)
Lagomorpha: Leporidae; Falconiformes: Accipitridae; Galliformes: Numididae, Phasianidae; Gruiformes: Otidae (N)
Passeriformes: Ploceidae (probably L)

Human infestation: yes (Burridge 2011)

Remarks: there is a record of *A. gemma* in the Palearctic Region in Klyushkina (1972) and many other records of its introduction into the Nearctic and Palearctic Regions (Burridge 2011), but it is uncertain whether this species has become established in these regions; therefore, we continue to consider *A. gemma* an exclusively Afrotropical tick. Walker (1974) found nymphs of *A. gemma* below the roost of a bird belonging to the Family Ploceidae and assumed that the ticks had fed as larvae on this bird. We consider this record tentatively valid. Loveridge (1928) included Viperidae as hosts of *A. gemma*, but this finding was not confirmed by Yeoman and Walker (1967), and we provisionally exclude viperids from our list of hosts of this tick.

References

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Hoogstraal, H. & Feare, J.C. 1984. Ticks and tickborne viruses. *In* Biogeography and ecology of the Seychelles Islands, Junk, W. (publisher), The Hague, pp. 267–280.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Klyushkina, E.A. 1972. The occurrence of *Amblyomma gemma* Dön. (Ixodidae) in Crimea. Parazitologiya, 6: 306. In Russian, NAMRU-3 translation 571.

Loveridge, A. 1928. Field notes on vertebrates collected by the Smithsonian-Chrysler East African expedition of 1926. Proc. U.S. Natl. Mus., 73: 1–69.

Mertins, J.W. & Schlater, J.L. 1991. Exotic ectoparasites of ostriches recently imported into the United States. J. Wildl. Dis., 27: 180–182.

Morel, P.-C. 1976. Contribution à la connaissance de la distribution des tiques (Acariens, Ixodidae et Amblyommidae) en Afrique éthiopienne continentale. Annexe cartographique. Institut d'Élevage et de Médecine Vétérinaire des Pays Tropicaux, Paris, 326 pp.

Morel, P.-C. 1980. Study on Ethiopian ticks (Acarida, Ixodida). Institut d'Élevage et de Médecine Vétérinaire des Pays Tropicaux, Maisons Alfort, 332 pp.

Petney, T.N., Horak, I.G. & Rechav, Y. 1987. The ecology of the African vectors of heartwater, with particular reference to *Amblyomma hebraeum* and *Amblyomma variegatum.* Onderstepoort J. Vet. Res., 54: 381–395.

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

Van der Borght-Elbl, A. 1977. Ixodid ticks (Acarina: Ixodidae) of Central Africa. Vol. V. The larval and nymphal stages of the more important species of the genus *Amblyomma* Koch, 1844. Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (222), 158 pp.

Walker, J.B. 1974. The ixodid ticks of Kenya. A review of present knowledge of their hosts and distribution. Commonwealth Institute of Entomology, London, 220 pp.

Yeoman, G.H. & Walker, J.B. 1967. The ixodid ticks of Tanzania. Commonwealth Institute of Entomology, London, 215 pp.

46 – *A. geochelone* Durden, Keirans & Smith, 2002 (J. Med. Entomol., 39: 398–403)

Type depositories: USNTC (holotype, paratypes), BMNH (paratypes) (Durden L.A., Keirans, J.E. & Smith, L.L. 2002. *Amblyomma geochelone*, a new species of tick (Acari: Ixodidae) from the Madagascan ploughshare tortoise. J. Med. Entomol., 39: 398–403)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregion: Madagascar dry deciduous forest

Hosts: Testudines: Testudinidae (A)

Human infestation: no

Remarks: Mihalca et al. (2011) regard *A. geochelone* as an endangered species.

References

Durden L.A., Keirans, J.E & Smith, L.L. 2002. *Amblyomma geochelone*, a new species of tick (Acari: Ixodidae) from the Madagascan ploughshare tortoise. J. Med. Entomol., 39: 398–403.

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

47 – *A. geoemydae* (Cantor, 1847) (J. Asiatic Soc. Bengal, 16: 607–656)

Type depository: BMNH (holotype) (Anastos, G. 1950. The scutate ticks, or Ixodidae, of Indonesia. Entomol. Am., 30: 1–144), as *Ixodes geoemydae*. However, it is not recorded as being in BMNH, according to Keirans and Hillyard (2001, *op. cit*. under *A. albopictum*).

Known stages: male, female, nymph, larva

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: several Oriental and Palearctic ecoregions

Hosts: usual hosts for adult ticks are Testudines: Emydidae and Testudinidae.
Testudines: Emydidae, Testudinidae; Squamata: Boidae, Varanidae (ANL)
Artiodactyla: Bovidae, Cervidae, Suidae; Carnivora: Canidae, Viverridae; Rodentia: Sciuridae (AN)
Carnivora: Mustelidae; Pholidota: Manidae; Rodentia: Hystricidae (A)
Coraciiformes: Ardeidae; Passeriformes: Pittidae (NL)
Squamata: Elapidae; Carnivora: Felidae; Aves (several orders) (N)
Squamata: Colubridae (L)
Carnivora: Canidae (stage unknown)

Human infestation: yes (Burridge 2011)

Remarks: Phan Trong (1977) refers to this species as *Amblyomma boucadi* Toumanoff, 1944. Camicas et al. (1998) state that the larva of *A. geoemydae* is undescribed, but there is a description in Kadarsan (1971) and Yamaguti et al. (1971). Keirans and Durden (2001) cite two records of the introduction of this species into the Nearctic, but there is no evidence that *A. geoemydae* has become established there. Kolonin (2009) reduces the hosts of *A. geoemydae* to tortoises, monitors and birds, but the references below indicate a wider host range for this tick.

References

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Fujita, H. & Tsuboi, Y. 2000. A survey of ixodid ticks (Acari: Ixodidae) including a list of all known species of Okinawajima island, Japan. J. Acarol. Soc. Jap., 9: 45–59.

Kadarsan, S. 1971. Larval ixodid ticks of Indonesia (Acarina: Ixodidae). Ph.D. Dissertation, University of Maryland, 182 pp.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kitaoka, S. & Suzuki, H. 1974. Reports of medico-zoology investigations in the Nansei Islands. Part 2. Ticks and their seasonal prevalences in southern Amami-oshima. Jap. J. Sanit. Zool., 26: 21–26.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Phan Trong, C. 1977. Ve bet va con trung ky sinh o Viet Nam. Tap 1. Ve (Ixodoidea), mo ta va phan loai. Ha Noi: Khoa hoc va ky thuat, 489 pp. In Vietnamese.

Robbins, R.G. & Platt, S.G. (2011) *Amblyomma geoemydae* (Cantor) (Acari: Ixodida: Ixodidae): first report from the Arakan Forest turtle, *Heosemys depressa* (Anderson) (Reptilia: Testudines: Emydidae), and first documented occurrence of this tick in the Union of Myanmar. Int. J. Acarol., 37: 103–105.

Robbins, R.G., Phong, B.-D., McCormack, T., Behler, J.L., Zwartepoorte, H.A., Hendrie, D.B. & Calle, P.P. 2006. Four new host records for *Amblyomma geoemydae* (Cantor) (Acari: Ixodida: Ixodidae) from captive tortoises and freshwater turtles (Reptilia: Testudines) in the Turtle Conservation Center, Cuc Phuong National Park, Vietnam. Proc. Entomol. Soc. Wash., 108: 726–729.

Simmons, L.-A., & Burridge, M.J. 2000. Introduction of the exotic ticks *Amblyomma humerale* Koch and *Amblyomma geoemydae* (Cantor) (Acari: Ixodidae) into the United States on imported reptiles. Int. J. Acarol., 26: 239–242.

Wilson, N. 1966. Variation in two species of *Amblyomma*. Proc. Entomol. Soc. Wash., 68: 222–224.

Yamaguti, N., Tipton, V.J., Keegan, H.L. & Toshioka, S. 1971. Ticks of Japan, Korea, and the Ryukyu Islands. Brigham Young Univ. Sci. Bull. Biol. Ser., 15 (1), 226 pp.

48 – *A. gervaisi* (Lucas, 1847) (Bull. Soc. Entomol. Fr. Ser. 2, 5: 99–101)
Kolonin (2009, *op. cit.* under *A. arcanum*) considers that this species belongs to *Aponomma.* See also *A. flavomaculatum.*

Type depository: MNHM (syntypes) (Kaufman 1972, *op. cit.* under *A. fimbriatum*) as *Ixodes gervaisii*

Known stages: male, female, nymph

Zoogeographic Regions: Afrotropical, Oriental

Ecoregions: tropical and subtropical dry broadleaf forests; desert and xeric shrublands

Hosts: usual hosts for larvae, nymphs and adults are Squamata: Varanidae; Aves and Mammalia are considered exceptional hosts.
Squamata: Colubridae, Elapidae, Varanidae (ANL)
Squamata: Boidae; Artiodactyla: Bovidae; Rodentia: Sciuridae (AN)
Squamata: Agamidae, Viperidae; Artiodactyla: Suidae; Carnivora: Canidae; Rodentia: Muridae (A)
Anseriformes: Anatidae (N)
Pholidota: Manidae (stage unknown)

Human infestation: no

Remarks: the larva of *A. gervaisi* remains undescribed, but there are several records in the literature below that we consider provisionally valid. Camicas et al. (1998) state that this species is found only in the Oriental Region, but we follow Kaufman (1972), who accepts *A. gervaisi* records from Yemen (Afrotropical Region). Kolonin (2009) ignores the few infestations of this tick on Aves and Mammalia, reducing the hosts of this species to monitors and snakes. Sharma (1993) allegedly removed a larva of *A. gervaisi* from the base of the ala of a blow fly belonging to the genus *Calliphora* (Diptera: Calliphoridae). Frazier and Keirans (1990) question records of *A. gervaisi* on Testudines in Deraniyagala (1939); therefore, Testudines are not included in the host list above. All authors cited below treat this species as a member of *Aponomma.*

References

Bhat, H.R. & Sreenivasan, M.A. 1981. Further records of the ticks of some reptilian and mammalian hosts in the Kyasanur Forest disease area, Karnataka, India. Ind. J. Parasitol., 5: 207–210.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Deraniyagala, P.E.P. 1939. Tetrapod reptiles of Ceylon. Colombo Museum, Colombo, 412 pp.

Frazier, J.G. & Keirans, J.E. 1990. Ticks (Acari: Ixodidae) collected on chelonians (Reptilia) from India and Burma. J. Bombay. Nat. Hist. Soc., 87: 247–249.

Kaufman, T.S. 1972. A revision of the genus *Aponomma* Neumann, 1899 (Acarina: Ixodidae). Ph.D. Dissertation, University of Maryland, 390 pp.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Pandit, P., Bandivdekar, R., Geevarghese, G., Pande, S. & Mandke, O. 2011. Tick infestation on wild snakes in northern part of Western Ghats of India. J. Med. Entomol., 48: 504–507.

Phan Trong, C. 1977. Ve bet va con trung ky sinh o Viet Nam. Tap 1. Ve (Ixodoidea), mo ta va phan loai. Ha Noi: Khoa hoc va ky thuat, 489 pp. In Vietnamese.

Pillai, K.M. & George, P.O. 1997. Tick infestation in an Indian pangolin (*Manis crassicaudata*). Ind. Vet. J., 74: 71–72.
Sharma, B.D. 1993. Medical & veterinary arthropod-disease ecology. Ashish Publishing House, New Delhi, 335 pp.

49 – *A. glauerti* Keirans, King & Sharrad, 1994 (J. Med. Entomol., 31: 132–147)

Type depositories: WAM (holotype, paratypes), NTMD, USNTC, BMNH (paratypes) (Keirans and Hillyard 2001, *op. cit*. under *A. albopictum*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Australasian

Ecoregions: Kimberly and Arnhem land tropical savanna

Hosts: Squamata: Varanidae (ANL)

Human infestation: no

Reference

Keirans, J.E., King, D.R. & Sharrad, R.D. 1994. *Aponomma* (*Bothriocroton*) *glebopalma*, n. subgen., n. sp., and *Amblyomma glauerti* n. sp. (Acari: Ixodida: Ixodidae), parasites of monitor lizards (Varanidae) in Australia. J. Med. Entomol., 31: 132–147.

50 – *A. goeldii* Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)
See remarks below.

Type depositories: ZMB, MNHN, BMNH, (ENV?) (syntypes) (Neumann 1899, *op. cit.* under *A. albopictum*), but Moritz and Fischer (1981, *op. cit.* under *A. arcanum*) do not recognize syntypes of this species in ZMB. Dorchies, P. (personal communication to Guglielmone, A.A.) states that there are specimens of *A. goeldii* in ENV. These specimens may represent syntypes never delivered to ZMB.

Known stages: male, female

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Pilosa: Myrmecophagidae.
Pilosa: Myrmecophagidae, Bradypodidae; Carnivora: Canidae; Squamata: Boidae, Viperidae (A)

Human infestation: no

Remarks: considerable taxonomic problems attend this taxon, which is thought to be in part a synonym of *A. rotundatum* because of apparent confusion of the female of *A. rotundatum* with the female of *A. goeldii* in the original description. Therefore, many early records of this tick have to be treated cautiously. According to Floch and Abonnenc (1942), the first description of the female of *A. goeldii* was published by Floch and Abonnenc (1941) under the name *A. inini* Floch & Abonnenc, 1941.

References

Floch, H. & Abonnenc, E. 1941. Ixodidés de la Guyane Française. II. Publ. Inst. Pasteur Guyane Territ. Inini (3), 31 pp.

Floch, H. & Abonnenc, E. 1942. Ixodidés de la Guyane Française III. Publ. Inst. Pasteur Guyane Territ. Inini (32), 16 pp.

Floch, H. & Fauran, P. 1958. Ixodidés de la Guyane et des Antilles Françaises. Arch. Inst. Pasteur Guyane (446), 94 pp.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

51 – *A. hainanense* Teng, 1981 (Acta Zootax. Sin., 6: 399–401. In Chinese)

Kolonin (2009, *op. cit.* under *A. arcanum*) treats *A. hainanense* as a synonym of *A. helvolum*, but no comparison of types is presented. Therefore, we follow Guglielmone et al. (2010, *op. cit.* under *A. argentinae*) in regarding *A. hainanense* as tentatively valid. Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. (2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404) appear to accept Kolonin's view because *A. hainanense* is not discussed in their list of the ticks of China, but *A. helvolum* is included.

Type depository: IZAS (holotype, paratype) (Teng, K.-F. 1981. A new species of *Amblyomma* from Hainan Island, China. (Acarina: Ixodidae). Acta Zootax. Sin., 6: 399–401. In Chinese, NAMRU-3 translation 1570)

Known stages: female

Zoogeographic Region: Oriental

Ecoregion: south China-Vietnam subtropical evergreen forest

Hosts: Squamata (unknown family) (A)

Human infestation: no

Reference

Teng, K.-F. 1981. A new species of *Amblyomma* from Hainan Island, China. (Acarina: Ixodidae). Acta Zootax. Sin., 6: 399–401. In Chinese, NAMRU-3 translation 1570.

52 – *A. hebraeum* Koch, 1844 (Arch. Naturgesch., 10: 217–239)

Type depository: ZMB (holotype) (Moritz and Fischer 1981, *op. cit.* under *A. arcanum*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae. Squamata are considered exceptional hosts for this tick.
Mammalia (several orders); Aves (several orders); Testudines: Testudinidae (ANL)
Squamata: Varanidae (AN)
Squamata: Gerrhosauridae, Viperidae (A, N and/or L)

Human infestation: yes (Burridge 2011)

Remarks: Guglielmone et al. (2003) discuss the alleged Neotropical records of *A. hebraeum*, concluding that this species is not established in that region. These authors consider all such records to have resulted from accidental importations, erroneous identifications, *lapsus calamorum*, or even incorrect locality labels. This tick is also not established in the Nearctic Region, although there are many records of its detection on imported animals and other sources, such as trophies, in Keirans and Durden (2001) and Burridge (2011). There are also records of its introduction into the Palearctic Region (Okino et al. 2007), but it is not established there. A recent publication by Ghosh et al. (2007), as well as earlier Indian works, listed *A. hebraeum* as a tick established in the Oriental Region. Although there is an Indian record of *A. hebraeum* in Sen (1938), there is no evidence that this species is established there. Theiler (1962) uses the term "immatures" without specifying whether the larva, nymph or both stages of *A. hebraeum* were found on Squamata. Kolonin (2009) recognizes Testudines as hosts of *A. hebraeum* but ignores the unusual records of this tick from Squamata.

References

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Ghosh, S., Bansal, G.C., Gupta, S.C., Ray, D., Khan, M.Q., Irshad, H., Shahiduzzaman, M. D., Seitzer, U. & Ahmed, J.S. 2007. Status of tick distribution in Bangladesh, India and Pakistan. Parasitol. Res., 101 (Suppl. 2): 207–216.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Hoogstraal, H. & Theiler, G. 1959. Ticks (Ixodoidea, Ixodidae) parasitizing lower primates in Africa, Zanzibar, and Madagascar. J. Parasitol., 45: 217–222.

Horak, I.G., MacIvor, KM de F., Petney, T.N. & De Vos, V. 1987. Some avian and mammalian hosts of *Amblyomma hebraeum* and *Amblyomma marmoreum* (Acari: Ixodidae). Onderstepoort J. Vet. Res., 54: 397–403.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.
Okino, T. Ushirogawa, H., Matoba, K. & Hatsushika, R. 2007. A bibliographical study of human cases of hard tick (Acarina: Ixodidae) bites received abroad and found in Japan. Kawasaki Med. J., 33: 189–194.
Paine, G.D. 1982. Ticks (Acari: Ixodoidea) in Botswana. Bull. Entomol. Res., 72: 1–16.
Petney, T.N., Horak, I.G. & Rechav, Y. 1987. The ecology of the African vectors of heartwater, with particular reference to *Amblyomma hebraeum* and *Amblyomma variegatum.* Onderstepoort J. Vet. Res., 54: 381–395.
Sen, P. 1938. A check- and host-list of Ixodoidea (ticks) occurring in India. Ind. J. Vet. Sci., 8: 133–147.
Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.
Wanzala, W. & Okanga, S. 2006. Ticks (Acari: Ixodidae) associated with wildlife and vegetation of Haller Park along the Kenyan coastline. J. Med. Entomol., 43: 789–794.
Zumpt, F. 1958. A. preliminary survey of the distribution and host-specificity of ticks (Ixodoidea) in the Bechuanaland Protectorate. Bull. Entomol. Res., 49: 201–233.

53 – *A. helvolum* Koch, 1844 (Arch. Naturgesch., 10: 217–239)
See *A. hainanense.*

Type depository: ZMB (holotype) (Moritz and Fischer 1981, *op. cit.* under *A. arcanum*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Australasian, Oriental

Ecoregions: Borneo and Sumatra montane rain forests

Hosts: usual hosts for larvae, nymphs and adults are Squamata (several families); all other hosts for this tick are considered exceptional.
Squamata (several families) (ANL)
Testudines: Emydidae; Artiodactyla: Bovidae, Suidae (A)
Rodentia: Muridae (N)

Human infestation: no (see remarks)

Remarks: Camicas et al. (1998) list the larva and nymph of *A. helvolum* as undescribed, but the larva is described in Kadarsan (1971) and the nymph was subsequently described by Voltzit and Keirans (2002). Keirans and Durden (2001) cite two records of the introduction of *A. helvolum* into the Nearctic Region, but there is no evidence that this tick has become established there. We feel that the diagnoses of larvae of *A. helvolum* on Muridae by Nadchatram et al. (1966) require confirmation, and Muridae are not included in our host list for this species. However, we

provisionally accept records of larvae on Squamata. Audy et al. (1960) cite a record of *A. helvolum* crawling on a human, and Burridge (2011) lists *A. helvolum* as a tick that has been found feeding on a human, but we have been unable to confirm this statement and we therefore tentatively reject human parasitism by *A. helvolum.*

References

Anastos, G. 1950. The scutate ticks, or Ixodidae, of Indonesia. Entomol. Am., 30: 1–144.

Audy, J.R., Nadchatram, M. & Lim, B.-L. 1960. Malaysian parasites. XLIX. Host distribution of Malayan ticks (Ixodoidea). Stud. Inst. Med. Res. Malaya, 29: 225–246.

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chao, L.-L., Hsieh, C.-K. & Shih, C.-M. 2013. First report of *Amblyomma helvolum* (Acari: Ixodidae) from the Taiwan stink snake, *Elaphe carinata* (Reptilia: Colubridae), collected in southern Taiwan. Ticks Tick-Borne, Dis., 4: 246–250.

Durden, L.A., Merker, S. & Beati, L. 2008. The tick fauna of Sulawesi, Indonesia (Acari: Ixodoidea: Argasidae and Ixodidae). Exp. App. Acarol., 45: 85–110.

Kadarsan, S. 1971. Larval ixodid ticks of Indonesia (Acarina: Ixodidae). Ph.D. Dissertation, University of Maryland, 182 pp.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kohls, G.M. 1950. Ticks (Ixodoidea) of the Philippines. Natl. Inst. Health Bull. (192), 28 pp.

Nadchatram, M., Domrow, R. & Ng, C.K. 1966. Parasitic Acarina of the mammals. Bull. Nat. Mus. Singapore (34): 129–140.

Voltzit, O.V. & Keirans, J.E. 2002. A review of Asian *Amblyomma* species (Acari, Ixodida, Ixodidae). Acarina, 10: 95–136.

54 – *A. hirtum* Neumann, 1906 (Arch. Parasitol., 10: 195–219)
See remarks below.

Type depository: BMNH (syntypes) (Keirans and Hillyard 2001, *op. cit*. under *A. albopictum*)

Known stages: male, female

Zoogeographic Region: Neotropical

Ecoregions: Galapagos Islands scrubland mosaic; Fernando De Noronha-Atol das Rocas moist forests.

Hosts: unknown

Human infestation: no

Remarks: Santos Dias (1958) regards *A. hirtum* as a synonym of *A. pilosum*; however, the description by Neumann (1906) and the redescription of *A. pilosum* by Keirans et al. (1973) leave no doubt that they are different species. Schulze (1936) states that this tick was found on Aves by Darwin, and Camicas et al. (1998) list Testudines as hosts for this species without presenting evidence for their statement. Neumann (1906, 1911) does not provide hosts for *A. hirtum*, and these remain unknown. See also *A. macfarlandi* and *A. pilosum.*

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Keirans, J.E., Hoogstraal, H. & Clifford, C.M. 1973. The *Amblyomma* (Acarina: Ixodidae) parasitic on giant tortoises (Reptilia: Testudinae) of the Galapagos Islands. Ann. Entomol. Soc. Am., 66: 673–688.

Neumann, L.G. 1906. Notes sur les Ixodidés. IV. Arch. Parasitol., 10: 195–219.

Neumann, L.G. 1911. Ixodidae. Das Tierreich (26), 169 pp.

Santos Dias, J.A.T. 1958. Notas ixodológicas. V. Acerca de alguns ixodídeos do Museu do Hamburgo. Mem. Estud. Mus. Zool. Univ. Coimbra (253), 32 pp.

Schulze, P. 1936. The Norwegian zoological expedition to the Galapagos Islands 1925, conducted by Alf Wollebaek. XIII. Die Ixodoidea der Galapagos Inseln. Medd. Zool. Mus. (45): 155–162.

55 – *A. humerale* Koch, 1844 (Arch. Naturgesch., 10: 217–239)
See remarks below.

Type depository: ZMB (syntypes) (Moritz and Fischer 1981, *op. cit.* under *A. arcanum*)

Known stages: male, female, nymph

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Testudines: Testudinidae. Crocodilia and Mammalia are considered exceptional hosts.
Testudines: Testudinidae; Crocodilia: Crocodylidae (A)
Squamata: Teiidae, Tropiduridae; Didelphimorphia: Didelphidae; Pilosa: Cyclopedidae (N)
Passeriformes: Dendrocolaptidae, Thamnophilidae (NL)
Passeriformes: Scleruridae, Thraupidae (L)

Human infestation: no

Remarks: see *A. crassum* for the problems attending diagnoses of *A. crassum*, *A. humerale* and *A. sabanerae*. Camicas et al. (1998) list the nymph of *A. humerale* as undescribed, but this stage was subsequently described by Martins et al. (2010). Labruna et al. (2002) regard records of adults of this species found on hosts other than Testudines: Testudinidae and outside northern South America as doubtful; however, valid records from Crocodylidae appear in Labruna et al. (2005). Labruna et al. (2002) were also able to identify several nymphal hosts by determining adult ticks reared from engorged nymphs. Records of *A. humerale* "immature stages" on Rodentia by Everard and Tikasingh (1973), repeated in Basu et al. (2012), and adult ticks not clearly differentiated from *A. crassum* and *A. sabanerae* are considered doubtful and are not included in our host list. This tick is not established in the Nearctic Region, although its introduction is recorded in Keirans and Durden (2001). Morshed et al. (2005) discuss a record of a nymph on Aves caught in the Nearctic Region that was tentatively diagnosed as *A. humerale*, but it is not included in our host list for *A. humerale* because Ogrzewalska et al. (2010) consider this specimen to be, in fact, *A. sabanerae.* Thoisy et al. (2001) cite this tick as *A. humeralae.* Mihalca et al. (2011) list this tick as endangered.

References

Basu, A.K., Basu, M. & Adesiyun, A.A. 2012. A review on ticks (Acari: Ixodoidea: Ixodidae, Argasidae), associated pathogens and diseases of Trinidad and Tobago. Acarologia, 52: 5–16.

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Everard, C.O.R. & Tikasingh, E.S. 1973. Ecology of the rodents, *Proechimys guyannensis trinitatis* and *Oryzomys capito velutinus*, on Trinidad. J. Mammal., 54: 875–886.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Labruna, M.B., Camargo, L.M.A., Terrassini, F.A., Schumaker, T.T.S. & Camargo, E.P. 2002. Notes on parasitism by *Amblyomma humerale* (Acari: Ixodidae) in the State of Rondônia, western Amazon, Brazil. J. Med. Entomol., 39: 814–817.

Labruna, M.B., Camargo, L.M.A., Terrassini, F.A., Ferreira, F., Schumaker, T.T.S. & Camargo, E.P. 2005. Ticks (Acari: Ixodidae) from the State of Rondônia, western Amazon, Brazil. Syst. Appl. Acarol., 10: 17–32.

Martins, T.F., Onofrio, V.C., Barros-Battesti, D.M. & Labruna, M.B. 2010. Nymphs of the genus *Amblyomma* (Acari: Ixodidae) of Brazil: descriptions, redescriptions, and identification key. Ticks Tick-borne Dis., 1: 75–99.

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

Morshed, M.G., Scott, J.D., Fernando, K., Beati, L., Mazerolle, D.F., Geddes, G. & Durden, L.A. 2005. Migratory songbirds disperse ticks across Canada, and first isolation of the Lyme disease spirochete, *Borrelia burgdorferi*, from the avian tick, *Ixodes auritulus*. J. Parasitol., 91: 780–790.

Ogrzewalska, M., Uezu, A. & Labruna, M.B. 2010. Ticks (Acari: Ixodidae) infesting wild birds in the eastern Amazon, northern Brazil, with notes on rickettsial infection in ticks. Parasitol. Res., 106: 809–816.

Thoisy, B. de, Vogel, I., Reynes, J.-M., Pouliquen, J.-F., Carme, B., Kazanji, M. & Vie, J.-C. 2001. Health evaluation of translocated free-ranging primates in French Guiana. Am. J. Primatol., 54: 1–16.

56 – *A. imitator* Kohls, 1958 (J. Parasitol., 44: 430–433)

Type depository: USNTC (holotype, paratypes), CNHM, ISET (paratypes) (Keirans and Clifford 1984, *op. cit.* under *A. calcaratum*; Kohls, G.M. 1958. *Amblyomma imitator*, a new species of tick from Texas and Mexico, and remarks on the synonymy of *A. cajennense* (Fabricius) (Acarina – Ixodidae). J. Parasitol., 44: 430–433)

Known stages: male, female, nymph

Zoogeographic Regions: Nearctic, Neotropical

Ecoregions: tropical and subtropical forests

Hosts: Artiodactyla: Bovidae, Tayassuidae; Perissodactyla: Equidae (AN)
Carnivora: Canidae; Rodentia: Sciuridae; Galliformes: Phasianidae; Passeriformes: Emberizidae, Turdidae (N)
Artiodactyla: Cervidae; Didelphimorphia: Didelphidae; Cuculiformes: Cuculidae (stages unknown)

Human infestation: yes (Guglielmone et al. 2003)

Remarks: Kolonin (2009) restricts the hosts of nymphs to Bovidae, but Keirans and Durden (1998) provide a broad range of host records for this stage of development of *A. imitator*.

References

Becklund, W.W. 1959. A note on the distribution of the tick *Amblyomma imitator* Kohls, 1958. J. Parasitol., 45: 430.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Keirans, J.E. & Durden, L.A. 1998. Illustrated key to nymphs of the tick genus *Amblyomma* (Acari: Ixodidae) found in the United States. J. Med. Entomol., 35: 489–495.

Kohls, G.M. 1958. *Amblyomma imitator*, a new species of ticks from Texas and Mexico, and remarks on the synonymy of *A. cajennense* (Fabricius) (Acarina – Ixodidae). J. Parasitol., 44: 430–433.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Meleney, W.P. 1975. Arthropod parasites of the collared peccary, *Tayassu tajacu* (Artiodactyla: Tayassuidae), from New Mexico. J. Parasitol., 61: 530–534.

Scott, J.D., Lee, M.-K., Fernando, K., Durden, L.A., Jorgensen, D.R., Mak, S. & Morshed, M.G. 2010. Detection of Lyme disease spirochete, *Borrelia burgdorferi* sensu lato, including three novel genotypes in ticks (Acari: Ixodidae) collected from songbirds (Passeriformes) across Canada. J. Vector Ecol., 35: 124–139.

Scott, J.D., Anderson, J.F. & Durden, L.A. 2012. Widespread dispersal of *Borrelia burgdorferi*-infected ticks collected from songbirds across Canada. J. Parasitol., 98: 49–59.

57 – *A. incisum* Neumann, 1906 (Arch. Parasitol., 10: 195–219)
See *A. latepunctatum*

Type depository: BMNH (syntypes) (Keirans and Hillyard 2001, *op. cit*. under *A. albopictum*). Notably, Fonseca, F. & Aragão, H.B. (1952. Notas de ixodología. IV. Considerações sobre a nomenclatura de algumas espécies do género *Amblyomma* do Brasil e países limítrofes (Acari: Ixodidae). Mem. Inst. Oswaldo Cruz, 50: 729–731) examined the syntype series (two males) of *A. incisum* in BMNH and found that one was *A. scalpturatum.* This was confirmed in Labruna, M.B., Keirans, J.E., Camargo, L.M.A., Ribeiro, A.F., Soares, R.M. & Camargo, E.P. (2005. *Amblyomma latepunctatum*, a valid tick species (Acari: Ixodidae) long misidentified with both *Amblyomma incisum* and *Amblyomma scalpturatum*. J. Parasitol., 91: 527–541). This specimen of *A. scalpturatum* is probably the holotype (apparently lost) of this species. See also *A. scalpturatum.*

Known stages: male, female, nymph

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical moist broadleaf forests.

Hosts: usual hosts for adult ticks are Perissodactyla: Tapiridae.
Perissodactyla: Tapiridae; Rodentia: Caviidae (A)
Artiodactyla: Cervidae (N)
Didelphimorphia: Didelphidae (stage unknown)

Human infestation: yes (Guglielmone et al. 2006)

Remarks: records of this species published before Labruna et al. (2005) are ignored here because of uncertainties concerning their accuracy. Camicas et al. (1998) list the nymph of *A. incisum* as undescribed but it was recently described by

Martins et al. (2010). Kolonin (2009) regards the record of nymphs of *A. incisum* feeding on Dasyproctidae as valid, but this record, from Floch and Fauran (1958), requires confirmation and is not included in our list above. Also, the record of the introduction of *A. incisum* into the Nearctic Region, discussed by Keirans and Durden (2001), must be considered tentative. Mihalca et al. (2011) list this tick as endangered.

References

Barros-Battesti, D.M. 2008. Biodiversidade de ectoparasitos de pequenos mamíferos e aves silvestres em biomas preservados e degradados no estado do Paraná. Relatório Instituto Ambiental de Paraná, Paraná, Brasil, 54 pp.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Floch, H. & Fauran, P. 1958. Ixodidés de la Guyane et des Antilles Françaises. Arch. Inst. Pasteur Guyane (446), 94 pp.

Guglielmone, A.A., Beati, L., Barros-Battesti, D.M., Labruna, M.B., Nava, S., Venzal, J.M., Mangold, A.J., Szabó, M.P.J., Martins, J.R., González-Acuña, D. & Estrada-Peña, A. 2006. Ticks (Ixodoidea) on humans in South America. Exp. Appl. Acarol., 40: 83–100.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Labruna, M.B., Keirans, J.E., Camargo, L.M.A., Ribeiro, A.F., Soares, R.M. & Camargo, E.P. 2005. *Amblyomma latepunctatum*, a valid tick species (Acari: Ixodidae) long misidentified with both *Amblyomma incisum* and *Amblyomma scalpturatum*. J. Parasitol., 91: 527–541.

Martins, T.F., Onofrio, V.C., Barros-Battesti, D.M. & Labruna, M.B. 2010. Nymphs of the genus *Amblyomma* (Acari: Ixodidae) of Brazil: descriptions, redescriptions, and identification key. Ticks Tick-borne Dis., 1: 75–99.

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

58 – *A. inopinatum* (Santos Dias, 1989) (Bol. Soc. Port. Entomol., 4–3 (105): 29–45). Kolonin (2009, *op. cit.* under *A. arcanum*) does not list *A. inopinatum* as a valid species. This name is included as "?*Aponomma inopinatum*" below the name *Aponomma flavomaculatum* without further discussion, although it is obvious that Kolonin (2009, *op. cit.* under *A. arcanum*) is treating *A. inopinatum* as a synonym of *A. flavomaculatum.* We consider both species valid.

Type depository: MRCB (holotype, paratype) (Santos Dias 1993, *op. cit*. under *A. flavomaculatum*) as *Aponomma inopinatum*

Known stages: male, female.

Zoogeographic Region: Afrotropical.

Ecoregion: central Congolian lowland forest

Hosts: Squamata: Varanidae (A)

Human infestation: no

Reference

Santos Dias, J.A.T. 1993. Contribuição para o estudo da sistemática e taxonomia das espécies do género *Aponomma* Neumann, 1899 (Acarina-Ixodoidea). Estud. Ens. Doc. (157), 204 pp.

59 – *A. inornatum* (Banks, 1909) (Proc. Entomol. Soc. Wash., 10: 170–173)

Type depository: unknown (Guglielmone et al. 2003, *op. cit*. under *A. americanum*) originally named *Aponomma inornata*.

Known stages: male, female, nymph, larva

Zoogeographic Regions: Nearctic, Neotropical

Ecoregions: tropical and subtropical forest

Hosts: Artiodactyla: Bovidae, Cervidae; Cingulata: Dasypodidae; Rodentia: Cricetidae; Cuculiformes: Cuculidae; Passeriformes: Icteridae, Mimidae (ANL)
Artiodactyla: Tayassuidae; Rodentia: Sciuridae (AN)
Carnivora (several families); Didelphimorphia: Didelphidae; Lagomorpha: Leporidae (NL)
Perissodactyla: Equidae; Galliformes: Phasianidae (N)

Human infestation: yes (Guglielmone et al. 2003)

Remarks: Guglielmone et al. (2003) describe *A. inornatum* as a primarily Nearctic tick that also occurs in the northern Neotropics, but recommended that Neotropical specimens be compared with the morphologically similar species *A. parvum* (Neotropical) and even *A. auricularium* (Nearctic-Neotropical) to further confirm the presence of *A. inornatum* in Central America (Neotropical Region). Romero-Castañón et al. (2008) state that their Mexican records of *A. inornatum* are the first for that country when, in fact, there are many earlier records, starting with Cooley and Kohls (1939) (under the name *A. philipi* Cooley & Kohls, 1939).

References

Cooley, R.A. & Kohls, G.M. 1939. *Amblyomma philipi* – a new tick from Texas and Mexico, with a key to known species of *Amblyomma* in the United States. Publ. Health Rep., 54: 44–47.

Eads, R.B. & Borom, M. 1975. Host and distributional records for the tick *Amblyomma inornatum* (Banks) (Acarina: Ixodidae), with description of the immature stages. J. Med. Entomol., 12: 493–496.

Eads, R.B., Menzies, G.C. & Hightower, B.G. 1956. The ticks of Texas, with notes on their medical significance. Texas J. Sci., 8: 7–24.

Gladney, W.J., Dawkins, C.C. & Price, M.A. 1977. *Amblyomma inornatum* (Acarina: Ixodidae): natural hosts and laboratory biology. J. Med. Entomol., 14: 85–88.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Keirans, J.E. & Durden, L.A. 1998. Illustrated key to nymphs of the tick genus *Amblyomma* (Acari: Ixodidae) found in the United States. J. Med. Entomol., 35: 489–495.

Romero-Castañon, S., Ferguson, B.G., Güiris, D., González, D., López, S., Paredes, A. & Webber, M. 2008. Comparative parasitology of wild and domestic ungulates in the Selva Lacandona, Chiapas, México. Comp. Parasitol., 75: 115–126.

Samuel, W.M. & Trainer, D.O. 1970. *Amblyomma* (Acarina: Ixodidae) on white-tailed deer, *Odocoileus virginianus* (Zimmermann), from south Texas with implications for theileriasis. J. Med. Entomol., 7: 567–574.

Teel, P.D., Fleetwood, S.C., Hopkins, S.W. & Cruz, D. 1988. Ectoparasites of eastern and western meadowlarks from the Rio Grande Plains of South Texas. J. Med. Entomol., 25: 32–38.

60 – *A. integrum* Karsch, 1879 (Z. Ges. Naturw., 42, 3 F., 4: 534–562)

Type depository: ZMB (holotype) (Moritz and Fischer 1981, *op. cit.* under *A. arcanum*)

Known stages: male, female, nymph

Zoogeographic Region: Oriental

Ecoregions: tropical and subtropical dry broadleaf forests; desert and xeric shrublands

Hosts: usual hosts for larvae, nymphs and adults are Artiodactyla: Bovidae.
Artiodactyla: Bovidae (ANL)
Artiodactyla: Suidae; Carnivora: Canidae; Lagomorpha: Leporidae (AN)
Mammalia (several orders) (A)
Artiodactyla: Tragulidae; Carnivora: Felidae, Viverridae; Rodentia: Hystricidae; Galliformes: Phasianidae (N)

Human infestation: yes (Keirans 1985)

Remarks: the larva of *A. integrum* remains undescribed but we provisionally accept the record of larvae on Bovidae in Rajagopalan and Sreenivasan (1981).

References

Bhat, H.R. & Sreenivasan, M.A. 1981. Further records of the ticks of some reptilian and mammalian hosts in the Kyasanur Forest disease area, Karnataka, India. Ind. J. Parasitol., 5: 207–210.

Dilrukshi, P.R.M.P. 2006. Taxonomic status of ticks in Sri Lanka. *In* C.N.B. Bambaradeniya (editor), The fauna of Sri Lanka: status of taxonomy, research and conservation. The World Conservation Union, Colombo, Sri Lanka, pp. 65–69.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Rajagopalan, P.K. & Sreenivasan, M.A.1981. Ixodid ticks on cattle and buffaloes in the Kyasanur Forest disease area of Karnataka State. Ind. J. Med. Res., 73: 880–889.

Santos Dias, J.A.T. 1954. Contribuição para o conhecimento da fauna ixodológica da India Portuguesa. An. Inst. Med. Trop., 11: 361–439.

Seneviratna, P. 1965. The Ixodoidea (ticks) of Ceylon. Parts II and III. Ceylon Vet. J., 13: 28–54.

Sharif, M. 1928. A revision of the Indian Ixodidae with special reference to the collection in the Indian Museum. Rec. Ind. Mus., 30: 217–344.

61 – *A. javanense* (Supino, 1897) (Atti. Soc. Veneto-Trentina Sci. Nat. Residente Padova, Ser. 2, 3: 230–238)

Type depository: GM (holotype) (Anastos 1950, *op. cit.* under *A. geoemydae*) as *Rhipicephalus javanensis*

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregions: several ecoregions

Hosts: usual hosts for larvae, nymphs and adults are Pholidota: Manidae.
Pholidota: Manidae (ANL)
Carnivora: Hyaenidae; Squamata: Scincidae (AN)
Mammalia (several orders); Squamata: Boidae, Varanidae; Testudines: Emydidae (A)
Rodentia: Hystricidae (NL)

Human infestation: yes (Gould et al. 1970)

Remarks: Camicas et al. (1998) state that the larva of *A. javanense* is undescribed, but it was described in Kadarsan (1971) and subsequently by Voltzit and Keirans (2002). Keirans and Durden (2001) cite five records of this species in the Nearctic, but there is no evidence that it has become established there. Mihalca et al. (2011) list *A. javanense* as an endangered species.

References

Anastos, G. 1950. The scutate ticks, or Ixodidae, of Indonesia. Entomol. Am., 30: 1–144.

Bhat, H.R. & Sreenivasan, M.A. 1981. Further records of the ticks of some reptilian and mammalian hosts in the Kyasanur Forest disease area, Karnataka, India. Ind. J. Parasitol., 5: 207–210.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Gould, D.J., Clifford, C.M., Lakshana, P., Emerson, K.C., Hoogstraal, H., Marshall. J.T., Stark, H.E., Nadchatram, M., Davis, E.W., Inlao, I., Maneechai, N., Klaimanee, N. & Punthusiri, P. 1970. Distribution and ecology of ectoparasites of vertebrates in Southeast Asia. Annual Program Report SEATO Medical Research Laboratory, April 1969-March 1970, United States Army Medical Component, Bangkok, Thailand, pp, 97–105.

Kadarsan, S. 1971. Larval ixodid ticks of Indonesia (Acarina: Ixodidae). Ph.D. Dissertation, University of Maryland, 182 pp.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kohls, G.M. 1950. Ticks (Ixodoidea) of the Philippines. Natl. Inst. Health Bull. (192), 28 pp.

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

Voltzit, O.V. & Keirans, J.E. 2002. A review of Asian *Amblyomma* species (Acari, Ixodida, Ixodidae). Acarina, 10: 95–136.

62 – *A. komodoense* (Oudemans, 1928) (Zool. Meded. Rijksmus. Nat. Hist. Leiden, 11: 227–231)

Kolonin (2009, *op. cit.* under *A. arcanum*) places this species in the genus *Aponomma.*

Type depository: ZMA (syntypes) (Kaufman 1972, *op. cit.* under *A. arcanum*) as *Aponomma komodoense*

Known stages: male, female

Zoogeographic Region: Australasian

Ecoregion: Lesser Sundas deciduous forest

Hosts: Squamata: Varanidae (AN)

Human infestation: no

Remarks: the nymph of *A. komodoense* remains undescribed, but we provisionally accept Kaufman's (1972) record of this stage on Varanidae. Camicas et al. (1998) state that this species is found in the Australasian and Oriental Regions, but the natural range of *A. komodoense* (Flores and Komodo Islands) lies entirely within the Australasian Region. Kaufman (1972) recorded the introduction of *A. komodoense* into the Oriental Region, and Warburton (1933), among other authors, recorded the introduction of *A. komodoense* (under the name *Aponomma draconis* Warburton, 1933) into the Palearctic Region, while Keirans and Durden (2001) cite a record of introduction into the Nearctic Region, but in all these cases *A. komodoense* failed to establish itself. Durden and Keirans (1996) list *A. komodoense* as an endangered species. The authors cited below classify this species in the genus *Aponomma.*

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.

Kaufman, T.S. 1972. A revision of the genus *Aponomma* Neumann, 1899 (Acarina: Ixodidae). Ph.D. Dissertation, University of Maryland, 390 pp.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Warburton, C. 1933. On five new species of ticks (Arachnida Ixodoidea). *Ixodes petauristae*, *I. ampullaceus*, *Dermacentor imitans*, *Amblyomma laticaudae* and *Aponomma draconis*, with notes on three previously described species, *Ornithodorus* [sic] *franchinii* Tonelli- Rondelli, *Haemaphysalis cooleyi* Bedford and *Rhipicephalus maculatus* Neumann. Parasitology, 24: 558–568.

63 – *A. kraneveldi* (Anastos, 1956) (J. Parasitol., 42: 306–310)
Kolonin (2009, *op. cit.* under *A. arcanum*) places this species in the genus *Aponomma.*

Type depository: USNTC (holotype, paratype) (Kaufman 1972, *op. cit.* under *A. fimbriatum*) as *Aponomma kraneveldi*. Keirans and Clifford (1984, *op. cit.* under *A. calcaratum*) state that only the paratype is in the USNTC.

Known stages: male, female

Zoogeographic Region: Australasian

Ecoregion: Lesser Sundas deciduous forests

Hosts: Squamata: Boidae (A)

Human infestation: no

Remarks: Camicas et al. (1998) state that this species (which they classify in the genus *Aponomma*) is found in the Australasian and Oriental Regions, but we were unable to find Oriental localities for *A. kraneveldi*. There is a record of the introduction of this tick into the Nearctic Region in Burridge et al. (2006), but *A. kraneveldi* has failed to become established there. Burridge et al. (2006) state that this species was described from ticks collected on Varanidae, but Anastos (1956) described "*Aponomma kraneveldi*" from undetermined species of snakes. Burridge (2011) maintains that Varanidae are hosts for this species, but we exclude this family from our host list.

References

Anastos, G. 1956. Two new species of ticks from Soembawa Island, Indonesia (Acarina: Ixodidae). J. Parasitol., 42: 306–310.

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Burridge, M.J., Berube, L.R. & Holt, T.J. 2006. Invasive ticks: introduction of *Amblyomma kraneveldi* (Anastos) and other exotic ticks (Acari: Ixodidae) into Florida on imported reptiles. Int. J. Acarol., 32: 315–321.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

64 – *A. latepunctatum* Tonelli-Rondelli, 1939 (Riv. Parassitol., 3: 39–55)
Labruna et al. (2005, *op. cit.* under *A. incisum*), in a meticulous study, resurrected this species, which was previously confused with *A. incisum* and *A. scalpturatum.*

Type depository: MZNH (syntypes) (Labruna et al. 2005, *op. cit.* under *A. incisum*)

Known stages: male, female, nymph

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: Perissodactyla: Tapiridae (A)
Artiodactyla: Tayassuidae (N)

Human infestation: yes? (see below)

Remarks: the nymph of *A. latepunctatum* was recently described by Martins et al. (2010). Guglielmone et al. (2006) discuss a case where this species may have fed on a human. Mihalca et al. (2011) list this tick as endangered.

References

Guglielmone, A.A., Beati, L., Barros-Battesti, D.M., Labruna, M.B., Nava, S., Venzal, J.M., Mangold, A.J., Szabó, M.P.J., Martins, J.R., González-Acuña, D. & Estrada-Peña, A. 2006. Ticks (Ixodoidea) on humans in South America. Exp. Appl. Acarol., 40: 83–100.

Labruna, M.B., Keirans, J.E., Camargo, L.M.A., Ribeiro, A.F., Soares, R.M. & Camargo, E.P. 2005. *Amblyomma latepunctatum*, a valid tick species (Acari: Ixodidae) long misidentified with both *Amblyomma incisum* and *Amblyomma scalpturatum*. J. Parasitol., 91: 527–541.

Labruna, M.B., Romero, M., Martins, T.F., Tobler, M. & Ferreira, F. 2010. Ticks of the genus *Amblyomma* (Acari: Ixodidae) infesting tapirs (*Tapirus terrestris*) and peccaries (*Tayassu pecari*) in Peru. Syst. Appl. Acarol., 15: 109–112.

Martins, T.F., Onofrio, V.C., Barros-Battesti, D.M. & Labruna, M.B. 2010. Nymphs of the genus *Amblyomma* (Acari: Ixodidae) of Brazil descriptions, redescriptions, and identification key. Ticks Tick-borne Dis., 1: 75–99.

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

65 – *A. latum* Koch, 1844 (Arch. Naturgesch., 10: 217–239)

Aponomma ochraceum Neumann, 1901 is generally treated as a synonym of *A. latum*. Kolonin (2009, *op. cit.* under *A. arcanum*) states that *A. ochraceum* may be a valid species but lists it as "*?Aponomma ochraceum*" under the name *Aponomma latum*, providing no explanation of this apparent contradiction. Santos Dias (1993, *op. cit.* under *A. flavomaculatum*) considers *A. ochraceum* a valid species. We follow Kaufman (1972, *op. cit.* under *A. fimbriatum*), who discusses morphological features of both taxa (under *Aponomma*), concluding that *A. ochraceum* is a synonym of *A. latum.*

Type depository: ZMB (holotype) (Moritz and Fischer 1981, *op. cit.* under *A. arcanum*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: most larvae, nymphs and adult ticks parasitize Squamata (several families), while Anura, Mammalia and Testudines are considered exceptional hosts.
Squamata (several families) (ANL)
Anura: Bufonidae; Testudines: Testudinidae; Rodentia: Hystricidae; Soricomorpha: Soricidae (A)
Rodentia: Muridae (N and/or L)
Pholidota: Manidae (stage unknown)

Human infestation: yes (Burridge 2011)

Remarks: *A. latum* is probably the tick most commonly introduced to different parts of the world through the international reptile trade, as discussed in several references below. There is a possibility that this will eventually result in *A. latum* becoming established outside the Afrotropical Region. Ghosh et al. (2007) and several previous Indian studies indicate that *Aponomma* (or *Amblyomma*) *leave* Neumann, 1899 (a synonym of *A. latum*) is established in India (Oriental Region), but we regard these records as doubtful. Burridge (2011) discusses the ability of *A. latum* to infest Amphibia, Testudines and Squamata that are phylogenetically

distant from its usual Afrotropical hosts. With the exception of González-Acuña et al. (2005) and Burridge (2011), all authors cited below classify this species in the genus *Aponomma.* Theiler (1962) uses the term "immatures" without specifying whether larvae, nymphs or both stages were found on hosts.

References

Burridge, M.J. 2001. Ticks (Acari: Ixodidae) spread by the international trade in reptiles and their potential roles in dissemination of diseases. Bull. Entomol. Res., 91: 3–23.

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Ghosh, S., Bansal, G.C., Gupta, S.C., Ray, D., Khan, M.Q., Irshad, H., Shahiduzzaman, M.D., Seitzer, U. & Ahmed, J.S. 2007. Status of tick distribution in Bangladesh, India and Pakistan. Parasitol. Res., 101 (Suppl. 2): 207–216.

González-Acuña, D., Beldoménico, P.M., Venzal, J.M., Fabry, M., Keirans, J.E. & Guglielmone, A.A. 2005. Reptile trade and the risk of exotic tick introductions into southern South American countries. Exp. Appl. Acarol., 35: 335–339.

Kaufman, T.S. 1972. A revision of the genus *Aponomma* Neumann, 1899 (Acarina: Ixodidae). Ph.D. Dissertation, University of Maryland, 390 pp.

Miyamoto, K., Nakao, M., Kosuge, M. & Bando, G. 1994. Infestation of *Aponomma latum* (Ixodidae) on African ball python imported into Asahikawa, Japan. J. Acarol. Soc. Jap., 3: 79–84.

Pietzsch, M., Quest, R., Hillyard, P.D., Medlock, J.M. & Leach, S. 2006. Importation of exotic ticks into the United Kingdom via the international trade in reptiles. Exp. Appl. Acarol., 38: 59–65.

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

66 – *A. lepidum* Dönitz, 1909 (Sber. Ges. Naturf. Freunde Berlin (8): 440–482)

Type depositories: BMNH, ZMB (syntypes) (Keirans and Hillyard 2001, *op. cit*. under *A. albopictum*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Afrotropical, Palearctic

Ecoregions: tropical and subtropical grasslands, savannas and shrublands; few ticks in desert and montane shrublands.

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Artiodactyla: Bovidae (ANL)
Artiodactyla: Camelidae; Carnivora: Canidae, Hyaenidae; Perissodactyla: Equidae; Ciconiiformes: Ciconiidae; Falconiformes: Accipitridae; Gruiformes: Otidae (AN)
Artiodactyla: Giraffidae, Suidae; Carnivora: Felidae; Perissodactyla: Rhinocerotidae; Charadriiformes: Burhinidae; Struthioniformes: Struthionidae (A)

Aves (several orders) (N)
Columbiformes: Columbidae (L)
Tubulidentata: Orycteropodidae; Musophagiformes: Musophagidae (N and/or L)
Carnivora: Herpestidae (stage unknown)

Human infestation: yes (Van der Borght-Elbl 1977)

Remarks: despite several records from the Palearctic Region, Hoogstraal et al. (1981) maintained that *A. lepidum* had not become established in the Palearctic, but reports of collections from Israel (Yeruham et al. 1996) and Egypt (Adham et al. 2009), among others, indicate the contrary. Mertins and Schlater (1991) found *A. lepidum* on Struthionidae introduced into the Nearctic Region, but the species did not become established there. Theiler (1962), Aeschlimann (1967) and Hoogstraal et al. (1981) use the term "immatures" without specifying whether larvae, nymphs or both stages of *A. lepidum* were found on hosts. Morel (1969) stated that the immature stages of *A. lepidum* are found on Lagomorpha and Primates, but this has not been confirmed in subsequent publications by this author. These hosts are therefore not included in our list above.

References

Adham, F.K., Abd-El-Samie, E.M., Gabre, R.M. & Hussein, H. E. 2009. Detection of tick blood parasites in Egypt using PCR assay I – *Babesia bovis* and *Babesia bigemina.* Parasitol. Res., 105: 721–730.

Aeschlimann, A. 1967. Biologie et écologie des tiques (Ixodoidea) de Côte d'Ivoire. Acta Trop., 24: 281–405.

Hoogstraal, H., Wassef, H.Y. & Büttiker, W. 1981. Ticks (Acarina) of Saudi Arabia Fam. Argasidae, Ixodidae. Fauna Saudi Arabia, 3: 25–110.

Kaiser, M.N., Hoogstraal, H. & Watson, G.E. 1974. Ticks (Ixodoidea) on migrating birds in Cyprus, fall 1967 and spring 1968, and epidemiological considerations. Bull. Entomol. Res., 64: 97–110.

Karrar, G., Kaiser, M.N. & Hoogstraal, H. 1963. Ecology and host-relationships of ticks (Ixodoidea) infesting domestic animals in Kassala Province, Sudan, with special reference to *Amblyomma lepidum* Dönitz. Bull. Entomol. Res., 54: 509–522.

Matthysse, J.G. & Colbo, M.H. 1987. The ixodid ticks of Uganda. Entomological Society of America, College Park, Maryland, 426 pp.

Mertins, J.W. & Schlater, J.L. 1991. Exotic ectoparasites of ostriches recently imported into the United States. J. Wildl. Dis., 27: 180–182.

Morel, P.-C. 1969. Contribution à la connaissance de la distribution des tiques (Acariens, Ixodidae et Amblyommidae) en Afrique éthiopienne continentale. Thèse de Doctorat des Sciences Naturelles, Université de Paris, 398 pp.

Morel, P.-C. 1976. Contribution à la connaissance de la distribution des tiques (Acariens, Ixodidae et Amblyommidae) en Afrique éthiopienne continentale. Annexe cartographique. Institut d'Élevage et de Médecine Vétérinaire des Pays Tropicaux, Paris, 326 pp.

Petney, T.N., Horak, I.G. & Rechav, Y. 1987. The ecology of the African vectors of heartwater, with particular reference to *Amblyomma hebraeum* and *Amblyomma variegatum.* Onderstepoort J. Vet. Res., 54: 381–395.

Scaramella, D. 1986. Gli ixodidi e gli argasidi della Somalia. Parte II. Le specie controllate sugli animali selvatici. Acta Med. Vet., 32: 49–61.
Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.
Van der Borght-Elbl, A. 1977. Ixodid ticks (Acarina: Ixodidae) of Central Africa. Vol. V. The larval and nymphal stages of the more important species of the genus *Amblyomma* Koch, 1844. Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (222), 158 pp.
Yeruham, I., Hadani, A., Galker, F. & Rosen, S. 1996. The seasonal occurrence of ticks (Acari: Ixodidae) on sheep and in the field in the Judean area of Israel. Exp. Appl. Acarol., 20: 47–56.
Yeoman, G.H. & Walker, J.B. 1967. The ixodid ticks of Tanzania. Commonwealth Institute of Entomology, London, 215 pp.

67 – *A. limbatum* Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)

Type depositories: ZMB, MNHN (syntypes) (Neumann 1899, *op. cit.* under *A. albopictum*)

Known stages: male, female, larva

Zoogeographic Region: Australasian

Ecoregions: tropical and subtropical grasslands, savannas and shrublands; few ticks in xeric shrublands

Hosts: Squamata: Scincidae (ANL)
Squamata: Agamidae (AL)
Squamata (several families), see remarks

Human infestation: yes (Bennett et al. 2011)

Remarks: apart from larvae found on Agamidae by Roberts (1969), this author does not specify the stages of the ticks collected from hosts. Smyth (1973) confirms and extends the families of Squamata that serve as hosts but also omits information on life history stages. Bull et al. (1989) provide data on infestation of Scincidae with all life history stages. Vilcins et al. (2009) found adults of *A. limbatum* on Agamidae, and Bennett et al. (2011) found adult ticks on humans.

References

Bennett, M.D., Woolford, L., Banazis, M.J., O'Hara, J., Warren, K.S., Nicholls, P.K., Sims, C. & Fenwick, S.G. 2011. *Coxiella burnetti* in western barred bandicoots (*Perameles bougainville*) from Bernier and Dorre Islands in Western Australia. Ecohealth, 8: 519–524.
Bull, C.M., Burzacott, D. & Sharrad, R.D. 1989. No competition for resources between two tick species at their parapatric boundary. Oecologia, 79: 558–562.
Roberts, F.H.S. 1969. The larvae of Australian Ixodidae (Acarina: Ixodoidea). J. Aust. Entomol. Soc., 8: 37–78.

Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.
Smyth, M. 1973. The distribution of three species of reptile ticks, *Aponomma hydrosauri* (Denny), *Amblyomma albolimbatum* Neumann, and *Amb. limbatum* Neumann. I. Distribution and hosts. Aust. J. Zool., 21: 91–101.
Vilcins, I.-M.E., Fournier, P.-E., Old, J.M. & Deane, E. 2009. Evidence for the presence of *Francisella* and spotted fever group *Rickettsia* DNA in the tick *Amblyomma fimbriatum* (Acari: Ixodidae), Northern Territory, Australia. J. Med. Entomol., 46: 926–933.

68 – *A. loculosum* Neumann, 1907 (Trans. Linn. Soc. Lond., 12: 193–196)

Type depository: ENV (syntypes) (Hoogstraal, H., Wassef, H.Y., Converse, J.D., Keirans, J.E., Clifford, C.M. & Feare, C.J. 1976. *Amblyomma loculosum* (Ixodoidea: Ixodidae): identity, marine bird and human hosts, virus infection, and distribution in the southern oceans. Ann. Entomol. Soc. Am., 69: 3–14)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Afrotropical, Australasian, Oriental

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: Mammalia are considered exceptional hosts, and Squamata are considered exceptional hosts for adult ticks.
Pelecaniformes: Fregatidae, Sulidae; Charadriiformes: Sternidae; Squamata: Scincidae (ANL)
Charadriiformes: Laridae; Procellariiformes: Procellariidae (AN)
Artiodactyla: Bovidae (N)

Human infestation: yes (Hoogstraal et al. 1976)

Remarks: Hoogstraal et al. (1976) demonstrated that most records of *A. loculosum* are from islands near the Afrotropical, Australasian and Oriental mainlands. Kolonin (2009) ignores records from Bovidae in Hoogstraal et al. (1976) and, in fact, parasitization of such hosts by *A. loculosum* appears to be an infrequent event. This author also ignores Squamata as hosts of *A. loculosum*, but Ramos et al. (2002) showed that these hosts are important to larvae of this tick.

References

Hoogstraal, H., Wassef, H.Y., Converse, J.D., Keirans, J.E., Clifford, C.M. & Feare, C.J. 1976. *Amblyomma loculosum* (Ixodoidea: Ixodidae): identity, marine bird and human hosts, virus infection, and distribution in the southern oceans. Ann. Entomol. Soc. Am., 69: 3–14.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Ramos, J.A., Bowler, J., Davis, L., Venis, S., Quinn, J. & Middleton, C. 2002. A different developmental pattern of the seabird tick *Amblyomma loculosum* when lizards are present. Acarologia, 42: 215–222.

69 – *A. longirostre* (Koch, 1844) (Arch. Naturgesch., 10: 217–239)
See *A. parkeri.*

Type depository: unknown (Guglielmone et al. 2003, *op. cit*. under *A. americanum*) as *Haemalastor longirostris*

Known stages: male, female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Rodentia: Erethizontidae, while all other hosts are considered exceptional for adult ticks. Usual hosts for larvae and nymphs are Passeriformes (several families).
Passeriformes: Parulidae, Thamnophilidae, Tyrannidae (ANL)
Pilosa: Bradypodidae; Rodentia: Erethizontidae (AN)
Artiodactyla: Cervidae; Carnivora: Canidae, Mustelidae; Caprimulgiformes: Caprimulgidae; Galliformes: Cracidae (A)
Aves (several orders) (NL)
Carnivora: Felidae; Chiroptera: Phyllostomidae; Rodentia: Sciuridae (N)

Human infestation: yes (Nava et al. 2010)

Remarks: Camicas et al. (1998) list the larva of *A. longirostre* as undescribed, but it was subsequently described by Barros-Battesti et al. (2005). Recently, the nymph was redescribed by Martins et al. (2010). Guglielmone et al. (2003) state that nymphs of *A. longirostre* are found on birds migrating to the Nearctic, but this tick has not yet become established there. Nava et al. (2010) do not include Rodentia (Cricetidae and Echimyidae), Primates other than humans and Cuculiformes as hosts for *A. longirostre*, although Rodentia were included in Everard and Tikasingh (1973), non-human primates in Serra-Freire et al. (1993) and Thoisy et al. (2001), and Cuculiformes in Aragão (1936). We feel that these records require confirmation and they are therefore not included in our host list above. Nava et al. (2010) do not include a Neotropical record of *A. longirostre* (as *A. avicola* Neumann, 1899) on *Muscicapa* sp. ("gobe mouche") by Neumann (1899) because they believe that Neumann was referring to a bird confined to the Eastern Hemisphere. We concur. Kolonin (2009) ignores the few records of Passeriformes as hosts for adult *A. longirostre*.

References

Aragão, H.B. 1936. Ixodidas brasileiros e de algunos paízes limitrophes. Mem. Inst. Oswaldo Cruz, 31: 759–843.

Barros-Battesti, D.M., Arzua, M., Rebello, V.M.M., Barbieri, F. Da S. & Famadas, K.M. 2005. Description of the larva of *Amblyomma longirostre* (Koch, 1844) (Acari: Ixodidae) by light and scanning electron microscopy. Rev. Bras. Parasitol. Vet., 14 (2): 51–57.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Everard, C.O.R. & Tikasingh, E.S. 1973. Ecology of the rodents, *Proechimys guyannensis trinitatis* and *Oryzomys capito velutinus*, on Trinidad. J. Mammal., 54: 875–886.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Luz, H.R., Faccini, J.L.H., Landulfo, G.A., Berto, B.P. & Ferreira, I. 2012. Bird ticks in an area of the Cerrado of Minas Gerais, southeast Brazil. Exp. Appl. Acarol., 58: 88–99.

Martins, T.F., Onofrio, V.C., Barros-Battesti, D.M. & Labruna, M.B. 2010. Nymphs of the genus *Amblyomma* (Acari: Ixodidae) of Brazil: descriptions, redescriptions, and identification key. Ticks Tick-borne Dis., 1: 75–99.

Nava, S., Velazco, P.M. & Guglielmone, A.A. 2010. First record of *Amblyomma longirostre* (Koch, 1844) (Acari: Ixodidae) from Peru, with a review of this tick's host relationships. Syst. Appl. Acarol., 15: 21–30.

Neumann, L.G. 1899. Révision de la famille des ixodidés (3e mémoire). Mém. Soc. Zool. Fr., 12: 107–294.

Scott, J.D., Anderson, J.F. & Durden, L.A. 2012. Widespread dispersal of *Borrelia burgdorferi*- infected ticks collected from songbirds across Canada. J. Parasitol., 98: 49–59.

Serra-Freire, N.M., Luz, S.B., Amorim, M. & Gazêta, G.S. 1993. Primeiro registro do parasitismo por *Amblyomma longirostre* Koch em guariba no Brasil. Rev. Bras. Parasitol. Vet, 2 (Supl. 1): 7.

Thoisy, B. de, Vogel, I., Reynes, J.-M., Pouliquen, J.-F., Carme, B., Kazanji, M. & Vie, J.-C. 2001. Health evaluation of translocated free-ranging primates in French Guiana. Am. J. Primatol., 54: 1–16.

70 – *A. macfarlandi* Keirans, Hoogstraal & Clifford, 1973 (Ann. Entomol. Soc. Am., 66: 673–688)
See remarks below.

Type depositories: USNTC (holotype, paratype), BMNH (paratype) (Keirans and Hillyard 2001, *op. cit*. under *A. albopictum*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregion: deserts and xeric shrublands on the Galapagos Islands

Hosts: Testudines: Testudinidae (ANL)

Human infestation: yes? (see below)

Remarks: Guglielmone et al. (2003) describe the morphological differences between *A. macfarlandi* and *A. hirtum.* Keirans and Hillyard (2001) found that the female of *A. pilosum* depicted by Robinson (1926) is actually *A. macfarlandi.*

Durden and Keirans (1996) state that both tick species and their hosts are at risk of extinction. Guglielmone et al. (2006) provide a possible record of human parasitism by this species. See also *A. hirtum* and *A. pilosum.*

References

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Guglielmone, A.A., Beati, L., Barros-Battesti, D.M., Labruna, M.B., Nava, S., Venzal, J.M., Mangold, A.J., Szabó, M.P.J., Martins, J.R., González-Acuña, D. & Estrada-Peña, A. 2006. Ticks (Ixodoidea) on humans in South America. Exp. Appl. Acarol., 40: 83–100.

Keirans, J.E. & Hillyard, P.D. 2001. A catalogue of the type specimens of Ixodida (Acari: Argasidae, Ixodidae) deposited in The Natural History Museum, London. Occ. Pap. Syst. Entomol. (13), 74 pp.

Keirans, J.E., Hoogstraal, H. & Clifford, C.M. 1973. The *Amblyomma* (Acarina: Ixodidae) parasitic on giant tortoises (Reptilia: Testudinidae) of the Galapagos Islands. Ann. Entomol. Soc. Am., 66: 673–688.

Robinson, L.E. 1926. Ticks. A monograph of the Ixodoidea. Part IV. The genus *Amblyomma*. Cambridge University Press, London, 302 pp.

71 – *A. macropi* Roberts, 1953 (Aust. J. Zool., 1: 111–161)

Type depository: QM (holotype) (Roberts 1953, *op. cit.* under *A. echidnae*)

Known stages: male

Zoogeographic Region: Australasian

Ecoregion: Queensland tropical rain forests

Hosts: Diprotodontia: Macropodidae (A)

Human infestation: no

Reference

Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.

72 – *A. maculatum* Koch, 1844 (Arch. Naturgesch., 10: 217–239)
See remarks below.

Type depository: ZMB (holotype) (Moritz and Fischer 1981, *op. cit.* under *A. arcanum*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Nearctic, Neotropical

Ecoregions: several Nearctic and Neotropical ecoregions

Hosts: Squamata are considered exceptional host for this tick.
Mammalia (several orders) (ANL)
Artiodactyla: Cervidae; Perissodactyla: Equidae (AN)
Artiodactyla: Suidae; Carnivora: Felidae, Mephitidae, Ursidae; Squamata: Teiidae (A)
Rodentia: Cricetidae, Heteromyidae, Muridae; Galliformes: Odontophoridae; Passeriformes (several families) (NL)
Piciformes: Picidae; Charadriiformes: Charadriidae (N)

Human infestation: yes (Merten and Durden 2000)

Remarks: recent records of *A. maculatum* on Galliformes in Pakistan by Khattak et al. (2012) are considered erroneous. Many South American records of *A. maculatum* are in fact *A. tigrinum* and *A. triste* because, as explained in Estrada-Peña et al. (2005), these species were formerly considered synonyms of *A. maculatum*. Mendoza-Uribe and Chávez-Chorocco (2004) stress the difficulties involved in separating *A. maculatum* from *A. triste* on the basis of morphology, and studies in addition to those of Estrada-Peña et al. (2005) are needed to determine whether these ticks are conspecific. Guglielmone et al. (2003) state that the Argentinian records of *A. maculatum* in Keirans (1982) are in fact *A. tigrinum.* Jones et al. (1972) treated *A. complanatum* Berlese, 1888 as a synonym of *A. maculatum*, but this was determined to be incorrect by Guglielmone et al. (2003) because the range of *A. complanatum* lies outside that of *A. maculatum.* By contrast, Camicas et al. (1998) list *A. complanatum* as a synonym of *A. tigrinum* and the range of *A. complanatum* lies within that of *A. tigrinum*, but no formal redescription was presented to support this statement. The name *A. complanatum* is *incertae sedis.* Shah et al. (2004), who cite this tick as *A. macuolatum*, report "poultry" as hosts based on Durden et al. (1997) and Kinsey et al. (2000), but none of these authors listed domesticated or game birds as hosts of *A. maculatum.* Kolonin (2009) ignores Neumann's (1901) unusual record on Squamata from Mexico, but we consider this valid. Hooker et al. (1912) include a beetle as a host of *A. maculatum* (tick stage not given). Romero-Castañón et al. (2008) state that their record of *A. maculatum* is the first for Mexico, but the first record for this country is that of Neumann (1901). Teel et al. (2010) present an extensive list of hosts of *A. maculatum*, but only from the USA. See also *A. tigrinum* and *A. triste.*

References

Allan, S.A., Simmons, L.-A. & Burridge, M.J. 2001. Ixodid ticks on white-tailed deer and feral swine in Florida. J. Vector Ecol., 26: 93–102.

Barker, R.W., Kocan, A.A., Ewing, S.A., Wettemann, R.P. & Payton, M.E. 2004. Occurrence of the Gulf Coast tick (Acari: Ixodidae) on wild and domestic mammals in north-central Oklahoma. J. Med. Entomol., 41: 170–178.

Bishopp, F.C. & Trembley, H.L. 1945. Distribution and hosts of certain North American ticks. J. Parasitol., 31: 1–54.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Díaz Ungría, C. 1957. Nota sobre las especies de Acarina de Venezuela. Rev. San. Asist. Soc., 22: 457–467.

Durden, L.A., McLean, R.G., Oliver, J.H., Ubico, S.R. & James, A.M. 1997. Ticks, Lyme disease spirochetes, trypanosomes and antibody to encephalitis viruses in wild birds from coastal Georgia and South Carolina. J. Parasitol., 83: 1178–1182.

Estrada-Peña, A., Venzal, J.M., Mangold, A.J., Cafrune, M.M. & Guglielmone, A.A. 2005. The *Amblyomma maculatum* Koch, 1844 (Acari: Ixodidae: Amblyomminae) tick group: diagnostic characters, description of the larva of *A. parvitarsum* Neumann, 1901, 16S rDNA sequences, distribution and hosts. Syst. Parasitol., 60: 99–112.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Hooker, W.A., Bishopp, F.C. & Wood, H.P. 1912. The life history and bionomics of some North American ticks. Bull. Bur. Entomol. U. S. Dept. Agric. (106), 214 pp.

Jones, E.K., Clifford, C.M., Keirans, J.E. & Kohls, G.M. 1972. The ticks of Venezuela (Acarina: Ixodoidea) with a key to the species of *Amblyomma* in the Western Hemisphere. Brigham Young Univ. Sci. Bull. Biol. Ser., 17 (4), 40 pp.

Keirans, J.E. 1982. The tick collection (Acarina: Ixodoidea) of the Hon. Nathaniel Charles Rothschild deposited in the Nuttall and general collections of the British Museum (Natural History). Bull. Br. Mus. (Nat. Hist.) Zool. Ser., 42: 1–36.

Khattak, R.M., Ali, S., Jahangir, M., Khan, M.N., Rasul, A. & Iqbal, F. 2012. Prevalence of ectoparasites in wild and domesticated grey (*Francolinus pondicerianus*) and black partridge (*Francolinus francolinus*) from Khyber Pakhtoonkhwa Province of Pakistan. Pakistan J. Zool., 44: 1239–1244.

Kinsey, A.A., Durden, L.A. & Oliver, J.H. 2000. Tick infestations of birds in coastal Georgia and Alabama. J. Parasitol., 86: 251–254.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Mendoza-Uribe, L. & Chávez-Chorocco, J. 2004. Ampliación geográfica de siete especies de *Amblyomma* (Acari: Ixodidae) y primer reporte de *A. oblongoguttatum* Koch, 1844 para Perú. Rev. Per. Entomol., 44: 69–72.

Merten, H.A. & Durden, L.A. 2000. A state-by-state survey of ticks recorded from humans in the United States. J. Vector Ecol., 25: 102–113.

Neumann, L.G. 1901. Révision de la famille des ixodidés (4ª mémoire). Mém. Soc. Zool. Fr., 14: 249–372.

Romero-Castañon, S., Ferguson, B.G., Güiris, D., González, D., López, S., Paredes, A. & Webber, M. 2008. Comparative parasitology of wild and domestic ungulates in the Selva Lacandona, Chiapas, México. Comp. Parasitol., 75: 115–126.

Scott, J.D., Anderson, J.F. & Durden, L.A. 2012. Widespread dispersal of *Borrelia burgdorferi*- infected ticks collected from songbirds across Canada. J. Parasitol., 98: 49–59. Semtner, P.J. & Hair, J.A. 1973. Distribution, seasonal abundance, and hosts of the Gulf Coast tick in Oklahoma. Ann. Entomol. Soc. Am., 66: 1264–1268.

Sha, A.H., Khan, M.N., Iqbal, Z. & Sajid, M.S. 2004. Tick infestation in poultry. Int. J. Agr. Biol., 6: 1162–1165.

Teel, P.D., Ketchum, H.R., Mock, D.E., Wright, R.E. & Strey, O.F. 2010. The Gulf Coast tick: a review of the life history, ecology, distribution, and emergence as an arthropod of medical and veterinary importance. J. Med. Entomol., 47: 707–722.

73 – *A. marmoreum* Koch, 1844 (Arch. Naturgesch., 10: 217–239)

Prior to the work of Theiler, G. & Salisbury, L.E. (1959. Ticks in the South African Zoological Survey Collection – Part IX – "The *Amblyomma marmoreum* group." Onderstepoort J. Vet. Res., 28: 47–124), considerable difficulties attended the determination of *A. marmoreum* and related species (*A. falsomarmoreum*, *A. nuttalli*, *A. paulopunctatum* and *A. sparsum*). These authors also provided detailed explanations of synonymies and corrected several misidentifications of the species of this group.

Type depository: ZMB (holotype) (Moritz and Fischer 1981, *op. cit.* under *A. arcanum*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands; montane grasslands and shrublands

Hosts: usual hosts for adult ticks are Testudines: Testudinidae.
Testudines: Testudinidae; Squamata: Viperidae; Artiodactyla: Bovidae; Carnivora: Canidae (ANL)
Squamata: Elapidae, Varanidae (AN)
Squamata: Boidae (A)
Mammalia (several orders); Aves (several orders) (NL)
Squamata: Colubridae, Gerrhosauridae (N)
Erinaceomorpha: Erinaceidae (stage unknown)

Human infestation: yes (Burridge 2011)

Remarks: Allan et al. (1998) found hundreds of specimens of *A. marmoreum* on hosts and vegetation in the Nearctic (U.S.A.), leaving open the possibility that this tick had established itself in this zoogeographic region. However, Burridge (2011) affirms that *A. marmoreum* has been eradicated from the country. Santos Dias (1989) recorded the introduction of *A. marmoreum* into the Palearctic Region, although it failed to become established there. Theiler (1959) listed Phasianidae as

hosts for *A. marmoreum* adults, but this family was excluded in Theiler (1962); therefore, we concluded that Phasianidae are doubtful hosts for males or females of *A. marmoreum* and we have not included them in the above list. Kolonin (2009) ignores Canidae as hosts for adult ticks, but we consider valid this host-parasite relationship in Burridge (2001, 2011).

References

Allan, S.A., Simmons, L.-A. & Burridge, M.J. 1998. Establishment of the tortoise tick *Amblyomma marmoreum* (Acari: Ixodidae) on a reptile-breeding facility in Florida. J. Med. Entomol., 35: 621–624.

Burridge, M.J. 2001. Ticks (Acari: Ixodidae) spread by the international trade in reptiles and their potential roles in dissemination of diseases. Bull. Entomol. Res., 91: 3–23.

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Fourie, L.J., Horak, I.G. & Woodall, P.F. 2005. Elephant shrews as hosts of immature ixodid ticks. Onderstepoort J. Vet. Res., 72: 293–301.

Harrison, A., Robb, G.N., Bennett, N.C. & Horak, I.G. 2012. Differential feeding success of two paralysis-inducing ticks, *Rhipicephalus warburtoni* and *Ixodes rubicundus* on sympatric small mammal species, *Elephantulus myurus* and *Micaelamys namaquensis*. Vet. Parasitol., 188: 346–354.

Hoogstraal, H. 1954. Noteworthy African tick records in the British Museum (Natural History) collections. Proc. Entomol. Soc. Wash., 56: 273–279.

Horak, I.G., McKay, I.J., Heyne, H. & Spickett, A.M. 2006. Hosts, seasonality and geographic distribution of the South African tortoise tick, *Amblyomma marmoreum*. Onderstepoort J. Vet. Res., 74: 13–25.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Santos Dias, J.A.T. 1989. Ixodídeos (Acarina-Ixodoidea) em colecção no Museu Zoológico de Amsterdão. García de Orta Ser. Zool., 13: 75–87.

Theiler, G. 1959. African ticks and birds. Ostrich (Suppl. 3), 3: 353–378.

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

Theiler, G. & Salisbury, L.E. 1959. Ticks in the South African Zoological Survey Collection – Part IX – "The *Amblyomma marmoreum* group." Onderstepoort J. Vet. Res., 28: 47–124.

74 – *A. moreliae* (Koch, L., 1867) (Verh. K.-K. Zool.-Bot. Ges. Wien, 17: 173–250)

Type depository: ZSH (syntypes) (Neumann 1899, *op. cit.* under *A. albopictum*) as *Ixodes moreliae*

Known stages: male, female, nymph, larva

Zoogeographic Region: Australasian

Ecoregions: tropical and subtropical grasslands, savannas and shrublands; temperate broadleaf and mixed forests

Hosts: Mammalia are exceptional hosts for this tick.
Squamata: Agamidae (ANL)
Squamata: Scincidae (AN)
Squamata (several families) (A)
Squamata: Elapidae (L)
Artiodactyla: Bovidae; Diprotodontia: Macropodidae; Persissodactyla: Equidae (stages unknown)

Human infestation: yes (Burridge 2011)

Remarks: Keirans and Durden (2001) report the introduction of *A. moreliae* into the Nearctic Region, and Keirans (1985) provides a record of *A. moreliae* from the Oriental Region, where it was found in a zoological garden on a colubrid snake of Palearctic origin. Even so, *A. moreliae* has failed to become established in these regions. Roberts (1970) does not specify the stages of *A. moreliae* found on hosts. Infestation of Mammalia with *A. moreliae* does not appear to be a frequent event, and Kolonin (2009) ignores this tick-host relationship.

References

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.
Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.
Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Roberts, F.H.S. 1964. Further observations of the Australian species of *Aponomma* and *Amblyomma* with descriptions of the nymphs of *Amblyomma moreliae* (L. Koch) and *Amb. loculosum* Neumann (Acarina: Ixodidae). Aust. J. Zool., 12: 288–313.
Roberts, F.H.S. 1969. The larvae of Australian Ixodidae (Acarina: Ixodoidea). J. Aust. Entomol. Soc., 8: 37–78.
Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.
Vilcins, I.-M.E., Ujvari, B., Old, J.M. & Deane, E. 2009. Molecular and morphological description of a *Hepatozoon* species in reptiles and their ticks in the Northern Territory, Australia. J. Parasitol., 95: 434–442.

75 – *A. moyi* Roberts, 1953 (Aust. J. Zool., 1: 111–161)

Type depository: QM (holotype, paratype) (Roberts 1953, *op. cit.* under *A. echidnae*)

Known stages: female

Zoogeographic Region: Australasian

Ecoregion: Mitchell grass downs

Hosts: Monotremata: Tachyglossidae (A)

Human infestation: no.

Reference

Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.

76 – *A. multipunctum* Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)
There are discrepancies in the morphological definition of *A. multipunctum* as stated in Guglielmone et al. (2003, *op. cit.* under *A. americanum*), and perhaps more than one taxon is represented under this name. See also remarks below.

Type depository: ENV (syntypes) (Robinson, L.E. 1926. Ticks. A monograph of the Ixodoidea. Part IV. The genus *Amblyomma.* Cambridge University Press, London, 302 pp.)

Known stages: male, female

Zoogeographic Region: Nearctic? Neotropical. See remarks below.

Ecoregions: in the Neotropics, tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Perissodactyla: Tapiridae.
Artiodactyla: Antilocapridae? Perissodactyla: Tapiridae; Testudines (unknown family) (A)

Human infestation: no

Remarks: Neumann (1899) states that a male of *A. multipunctum* was obtained from *Dicranocerus* (= *Antilocapra*), a monotypic genus exclusive to the Nearctic Region, but Neumann (1911) lists Venezuela as the country of origin of this species, casting doubt on the *Antilocapra* collection. A few other records of this rare tick are Neotropical and we therefore provisionally accept *A. multipunctum* as a Neotropical species. Guglielmone et al. (2003) call attention to differences among authors in citing diagnostic morphological characters for *A. multipunctum.* We therefore feel that most records of *A. multipunctum* should be considered provisional, including the record in Keirans and Durden (2001) of its introduction into the Nearctic Region on Testudines. Kolonin (2009) lists Tapiridae as the only hosts of this tick. Mihalca et al. (2011) list *A. multipunctum* as an endangered species.

References

Fonseca, F. da & Aragão, H. B. 1953. Notas de ixodología. IV. Descrição da femea de *Amblyomma multipunctum* Neumann 1899 e redescrição de macho (Acari: Ixodidae). Mem. Inst. Oswaldo Cruz, 51: 493–498.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.
Neumann, L.G. 1899. Révision de la famille des ixodidés (3e mémoire). Mém. Soc. Zool. Fr., 12: 107–294.
Neumann, L.G. 1911. Ixodidae. Das Tierreich (26), 169 pp.

77 – *A. naponense* (Packard, 1869) (First Annual Report of the Trustees of the Peabody Academy of Sciences, Appendix, pp. 56–69)
See remarks below.

Type depositories: MPAS-MCZ? (holotype?). Guglielmone et al. (2003, *op. cit*. under *A. americanum*) state that the type depository was MPAS (as *Ixodes naponensis*), but one of the authors of that article (J.E. Keirans) found a type in the MCZ. The MCZ website (http://mczbase.mcz.harvard.edu/ accessed April 4, 2013) is indeterminate because the specimen deposited there is named as "holotype?" [sic].

Known stages: male, female, nymph

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: usual hosts of adult ticks are Artiodactyla: Tayassuidae.
Artiodactyla: Tayassuidae; Pilosa: Myrmecophagidae; Rodentia: Cuniculidae (AN)
Rodentia: Caviidae (A)
Carnivora: Canidae; Passeriformes: Thamnophilidae (N)
Perissodactyla: Tapiridae (stage unknown)

Human infestation: yes (Guglielmone et al. 2006)

Remarks: the nymph was recently described by Martins et al. (2010), and we found provisionally valid records of nymphs on different types of hosts in Floch and Fauran (1958), Keirans (1985) and Ogrzewalska et al. (2009). Surprisingly, Camicas et al. (1998) include the Australasian Tachyglossidae as hosts for this species (most probably a typographical error), and Serra-Freire et al. (1996) provide a doubtful record of adults, nymphs and larvae on Artiodactyla: Cervidae, which are not included in our list of hosts of *A. naponense*. Serra-Freire et al. (1996) and Floch and Fauran (1958) use the name *A. mantiquirense* Aragão, 1908.

References

Barros, D.M. & Baggio, D. 1992. Ectoparasites Ixodida Leach, 1817 on wild animals in the State of Paraná, Brazil. Mem. Inst. Oswaldo Cruz, 87: 291–296.
Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Floch, H. & Fauran, P. 1958. Ixodidés de la Guyane et des Antilles Françaises. Arch. Inst. Pasteur Guyane (446), 94 pp.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Guglielmone, A.A., Beati, L., Barros-Battesti, D.M., Labruna, M.B., Nava, S., Venzal, J.M., Mangold, A.J., Szabó, M.P.J., Martins, J.R., González-Acuña, D. & Estrada-Peña, A. 2006. Ticks (Ixodoidea) on humans in South America. Exp. Appl. Acarol., 40: 83–100.

Keirans, J.E. 1982. The tick collection (Acarina: Ixodoidea) of the Hon. Nathaniel Charles Rothschild deposited in the Nuttall and general collections of the British Museum (Natural History). Bull. Br. Mus. (Nat. Hist.) Zool. Ser., 42: 1–36.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Martins, T.F., Onofrio, V.C., Barros-Battesti, D.M. & Labruna, M.B. 2010. Nymphs of the genus *Amblyomma* (Acari: Ixodidae) of Brazil: descriptions, redescriptions, and identification key. Ticks Tick-borne Dis., 1: 75–99.

Martins, T.F., Furtado, M.M., Jácomo, A.T., Silveira, L., Sollman, R., Tôrres, N.M. & Labruna, M.B. 2011. Ticks on free-living wild mammals in the region of Emas National Park, Goiás state, central Brazil. Syst. Appl. Acarol., 16: 201–206.

Ogrzewalska, M., Pacheco, R.C., Uezu, A., Richtzenhain, L.J., Ferreira, F. & Labruna, M.B. 2009. Ticks (Acari: Ixodidae) infesting birds in an Atlantic rain forest region in Brazil. J. Med. Entomol., 46: 1225–1229.

Serra-Freire, N.M., Amorim, M., Gazêta, G.S., Guerim, L. & Desidério, M.H.G. 1996. Ixodofauna de cervídeos no Brasil. Rev. Bras. Cienc. Vet., 3: 51–54.

78 – *A. neumanni* Ribaga, 1902 (Zool. Anz., 25: 502–508)
See remarks below.

Type depository: unknown (Guglielmone et al. 2003, *op. cit.* under *A. americanum*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical dry broadleaf forests; few ticks in moist broadleaf forests

Hosts: Artiodactyla: Bovidae, Cervidae; Carnivora: Canidae; Perissodactyla: Equidae (ANL)
Artiodactyla: Suidae, Tayassuidae; Pilosa: Myrmecophagidae (AN)
Perissodactyla: Tapiridae (stage unknown)

Human infestation: yes (Guglielmone et al. 2007, among others)

Remarks: Camicas et al. (1998) list the female of *A. neumanni* as undescribed, but this is an error. Guglielmone et al. (2003) discuss several papers that contain erroneous diagnoses of *A. neumanni*. Morphological characters for correctly identifying

this tick are presented in Estrada-Peña et al. (2005). Nava et al. (2009) note that Voltzit (2007) confuses *A. neumanni* with *A. parvitarsum*, being apparently unfamiliar with these species. Kolonin (2009) states that *A. neumanni* is rarely found on humans, but humans are commonly parasitized by this species, as discussed in Nava et al. (2009).

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Estrada-Peña, A., Venzal, J.M., Mangold, A.J., Cafrune, M.M. & Guglielmone, A.A. 2005. The *Amblyomma maculatum* Koch, 1844 (Acari: Ixodidae: Amblyomminae) tick group: diagnostic characters, description of the larva of *A. parvitarsum* Neumann, 1901, 16S rDNA sequences, distribution and hosts. Syst. Parasitol., 60: 99–112.

Guglielmone, A.A. & Hadani, H. 1981. La distribución geográfica de *Amblyomma neumanni* Ribaga, 1902, en la Argentina. Gac. Vet., 42: 754–760.

Guglielmone, A.A. & Nava, S. 2006. Las garrapatas argentinas del género *Amblyomma* (Acari: Ixodidae): distribución y hospedadores. Rev. Inv. Agropec., 35 (3): 135–155.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Guglielmone, A.A., Nava, S., Mangold, A.J. & Caparrós, J.A. 2007. Las garrapatas del norte de Córdoba, Argentina. Rev. Med. Vet. (Buenos Aires.), 88: 57–61.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Nava, S., Estrada-Peña, A., Mangold, A.J. & Guglielmone, A.A. 2009. Ecology of *Amblyomma neumanni* (Acari: Ixodidae). Acta Trop., 111: 226–236.

Voltzit, O.V. 2007. A review of Neotropical *Amblyomma* species (Acari: Ixodidae). Acarina, 15: 3–134.

Zerpa, C., Venzal, J.M., López, N., Mangold, A.J. & Guglielmone, A.A. 2003. Garrapatas de Catamarca y Tucumán: estudio de una colección de hospedadores silvestres y domésticos. Rev. FAVE Cienc. Vet., 2: 167–171.

79 – *A. nitidum* Hirst & Hirst, 1910 (Ann. Mag. Nat. Hist. Ser. 8, 6: 299–308)
See the first paragraph in the introduction to this chapter for a discussion of the synonymy of *A. laticaudae* and *A. nitidum*.

Type depository: BMNH (syntypes) (Keirans and Hillyard 2001, *op. cit*. under *A. albopictum*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Australasian, Oriental

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: Squamata: Hydrophiidae (ANL)

Human infestation: no

Remarks: Voltzit and Keirans (2002) state that *A. nitidum* is also found in the Palearctic Region, having evidently assumed, as have other workers, that the Ryukyu Islands are part of this region, when in fact they lie within the Oriental Zoogeographic Region, as defined here. Doss et al. (1974) cited Vercammen-Grandjean (1966) as the source for the Galapagos Islands (Neotropical) locality of *A. nitidum*. However, Vercammen-Grandjean (1966) merely speculates that this species may have the ability to disperse with its hosts to the Galapagos.

References

Audy, J.R., Nadchatram, M. & Lim, B.-L. 1960. Malaysian parasites. XLIX. Host distribution of Malayan ticks (Ixodoidea). Stud. Inst. Med. Res. Malaya, 29: 225–246.

Doss, M.A., Farr, M.M., Roach, K.F. & Anastos, G. 1974. Index-catalogue of medical and veterinary zoology. Special publication 3. Ticks and tick borne diseases. I. Genera and species of ticks. Part 1. Genera A-G. United States Department of Agriculture, United States Government Printing Office, Washington D.C., 429 pp.

Easton, E.R. 2003. Ecology of ticks, including a new record of *Aponomma* (Ixodoidea: Ixodidae) from *Laticauda colubrina* on Loloata Island of Papua New Guinea. Hamadryad, 27: 256–259.

Vercammen-Grandjean, P.H. 1966. Evolutionary problems of mite-host specificity and its relevance to studies on Galapagos organisms. *In* R.I. Bowman (editor), The Galapagos. University of California Press, Berkeley, Los Angeles, pp. 236–239.

Voltzit, O.V. & Keirans, J.E. 2002. A review of Asian *Amblyomma* species (Acari, Ixodida, Ixodidae). Acarina, 10: 95–136.

80 – *A. nodosum* Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)

Type depositories: MNHN, BMNH, USNTC (syntypes) (Neumann 1899, *op. cit.* under *A. albopictum*; Keirans and Hillyard 2001, *op. cit.* under *A. albopictum*). However, Keirans and Clifford (1984, *op. cit.* under *A. calcaratum*) do not recognize the syntypes of *A. nodosum* deposited in the USNTC.

Known stages: male, female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Pilosa: Myrmecophagidae; Aves are exceptional hosts for adult ticks. Usual hosts for larvae and nymphs are Passeriformes.
Pilosa: Myrmecophagidae; Carnivora: Canidae; Cingulata: Dasypodidae; Passeriformes: Turdidae (A)
Passeriformes (several families) (NL)
Coraciiformes: Momotidae (N)
Rodentia: Cuniculidae (stage unknown)

Human infestation: no

Remarks: Camicas et al. (1998) list the nymph of *A. nodosum* as undescribed, but it was subsequently described by Martins et al. (2010). Nuttall and Warburton (1908) record the introduction of *A. nodosum* (under the name *A. uncatum* Nuttall & Warburton, 1908) into the Palearctic, while Keirans and Durden (2001) cite records of *A. nodosum* introduced into the Nearctic Region, but there is no evidence that this tick has become established in either region. Burridge (2011) discusses records of *A. nodosum* (unknown stages) from Bovidae and Tapiridae that we were unable to confirm, and they have therefore been excluded from our list of hosts of this tick. Kolonin (2009) erroneously states that the hosts for immature stages of *A. nodosum* are unknown. See also *A. calcaratum*.

References

Bechara, G.H., Szabó, M.P.J., Almeida Filho, W.V., Bechara, J.N., Pereira, R.J.G., Garcia, J.E. & Pereira, M.C. 2002. Ticks associated with armadillo (*Euphractus sexcinctus*) and anteater (*Myrmercophaga tridactyla*) of Emas National Park, State of Goiás, Brazil. Ann. New York Acad. Sci., 969: 290–293.

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Garnham, P.C.C. & Lewis, D.J. 1959. Parasites of British Honduras with special reference to leishmaniasis. Trans. R. Soc. Trop. Med. Hyg., 53: 12–40.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Jones, E.K., Clifford, C.M., Keirans, J.E. & Kohls, G.M. 1972. The ticks of Venezuela (Acarina: Ixodoidea) with a key to the species of *Amblyomma* in the Western Hemisphere. Brigham Young Univ. Sci. Bull. Biol. Ser., 17 (4), 40 pp.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Labruna, M.B., Sanfilippo, L.F., Demetrio, C., Menezes, A.C., Pinter, A., Guglielmone, A.A. & Silveira, L.F. 2007. Ticks collected on birds in the State of São Paulo, Brazil. Exp. Appl. Acarol., 43: 147–160.

Luz, H.R., Faccini, J.L.H., Landulfo, G.A., Berto, B.P. & Ferreira, I. 2012. Bird ticks in an area of the Cerrado of Minas Gerais, southeast Brazil. Exp. Appl. Acarol., 58: 88–99.

Martins, T.F., Onofrio, V.C., Barros-Battesti, D.M. & Labruna, M.B. 2010. Nymphs of the genus *Amblyomma* (Acari: Ixodidae) of Brazil: descriptions, redescriptions, and identification key. Ticks Tick-borne Dis., 1: 75–99.

Nuttall, G.H.F. & Warburton, C. 1908. On a new genus of Ixodoidea together with a description of eleven new species. Proc. Cambr. Phil. Soc. Math. Phys. Sci., 14: 392–416.

Ogrzewalska, M., Pacheco, R.C., Uezu, A., Richtzenhain, L.J., Ferreira, F. & Labruna, M.B. 2009. Ticks (Acari: Ixodidae) infesting birds in an Atlantic rain forest region in Brazil. J. Med. Entomol., 46: 1225–1229.

Ogrzewalska, M., Saraiva, D.G., Moraes-Filho, J., Martins, T.F., Costa, F.B., Pinter, A. & Labruna, M.B. 2012. Epidemiology of Brazilian spotted fever in the Atlantic forest, State of São Paulo, Brazil. Parasitology, 139: 1283–1300.

Sabatini, G.S., Pinter, A., Nieri-Bastos, F.A., Marcilli, A. & Labruna, M.B. 2010. Survey of ticks (Acari: Ixodidae) and their *Rickettsia* in an Atlantic rain forest reserve in the State of São Paulo, Brazil. J. Med. Entomol., 47: 913–916.

Tolesano-Pascoli, G.V., Torga, K., Franchin, A.G., Ogrzewalska, M., Gerardi, M., Olegário, M.M.M., Labruna, M.B., Szabó, M.P.J. & Marçal Júnior, O. 2010. Ticks on birds in a forest fragment of Brazilian cerrado (savanna) in the Municipality of Uberlandia, State of Minas Gerais, Brazil. Rev. Bras. Parasitol. Vet., 19 (4): 244–248.

81 – *A. nuttalli* Dönitz, 1909 (Sber. Ges. Naturf. Freunde Berlin (8): 440–482)
See *A. marmoreum.*

Type depositories: BMNH, ZMB (syntypes) (Keirans and Hillyard 2001, *op. cit*. under *A. albopictum*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for adult ticks are Testudines: Testudinidae.
Erinaceomorpha: Erinaceidae (ANL)
Testudines: Testudinidae; Squamata (several families); Mammalia (several orders) (AN)
Testudines: Pelomedusidae, Tryonichidae (A)
Squamata: Colubridae; Carnivora: Felidae, Herpestidae; Rodentia: Hystricidae, Sciuridae; Cuculiformes: Cuculidae; Galliformes: Numididae, Phasianidae; Passeriformes: Motacillidae (NL)
Passeriformes (several families); Strigiformes: Strigidae (N)
Testudines (unknown family); Carnivora: Viverridae (L)
Coraciiformes: Coraciidae (stage unknown)

Human infestation: yes (Burridge 2011)

Remarks: Keirans and Durden (2001) report several records of *A. nuttalli* imported into the Nearctic, while Kaiser et al. (1974) found this species in the Palearctic Region, and Goff (1985) on remote Pacific islands, but there is no evidence that

this tick has become established in any of these regions. Nonetheless, Burridge (2011) cites the importation of *A. nuttalli* into the Nearctic Region on vertebrate hosts from the Neotropical Region, implying that the distribution of this tick may be wider than currently realized. Theiler (1959) states that adult *A. nuttalli* were found on Phasianidae, but this has not been confirmed in papers published previous or subsequent to Theiler (1959). Therefore, we do not include Phasianidae as hosts for adult *A. nuttalli.* Kolonin (2009) recognizes only Erinaceidae as mammal hosts for adult *A. nuttalli*, but the references below cite other Mammalia as *bona fide* hosts for this tick.

References

Burridge, M.J. 2001. Ticks (Acari: Ixodidae) spread by the international trade in reptiles and their potential roles in dissemination of diseases. Bull. Entomol. Res., 91: 3–23.

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Camicas, J.-L. 1970. Contribution à l'étude des tiques du Sénégal (Acarina, Ixodoidea). I. Les larves d'*Amblyomma* Koch et de *Hyalomma* Koch. Acarologia, 12: 71–102.

Goff, M.L. 1985. Notes and exhibitions. Proc. Hawaiian Entomol. Soc., 25: 28–29.

Kaiser, M.N., Hoogstraal, H. & Watson, G.E. 1974. Ticks (Ixodoidea) on migrating birds in Cyprus, fall 1967 and spring 1968, and epidemiological considerations. Bull. Entomol. Res., 64: 97–110.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Morel, P.-C. 1961. Le Parc National de Niokola-Koba (deuxiéme fascicule). V. Tiques (Acarina, Ixodoidea). Mém. Inst. Fr. Afr. Noire (62): 83–90.

Terenius, O., Mejlon, H.A. & Jaenson, T.G.T. 2000. New and earlier records of ticks (Acari: Ixodidae, Argasidae) from Guinea-Bissau. J. Med. Entomol., 37: 973–976.

Theiler, G. 1959. African ticks and birds. Ostrich (Suppl. 3), 3: 353–378.

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

Voltzit, O.V. & Keirans, J.E. 2003. A review of African *Amblyomma* species (Acari, Ixodida, Ixodidae). Acarina, 11: 135–214.

Yeoman, G.H. & Walker, J.B. 1967. The ixodid ticks of Tanzania. Commonwealth Institute of Entomology, London, 215 pp.

82 – *A. oblongoguttatum* Koch, 1844 (Arch. Naturgesch., 10: 217–239)

Type depository: ZMB (holotype) (Moritz and Fischer 1981, *op. cit.* under *A. arcanum*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Nearctic, Neotropical

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: Artiodactyla: Cervidae (ANL)
Artiodactyla: Tayassuidae, Suidae; Carnivora: Canidae; Galliformes: Cracidae (AN)
Mammalia (several orders) (A)
Falconiformes: Cathartidae (N)
Galliformes: Phasianidae (stage unknown)

Human infestation: yes (Walker et al. 1998; Guglielmone et al. 2006)

Remarks: Camicas et al. (1998) state that this tick is found only in the Neotropical Region; however, the northern limit of the distribution of *A. oblongoguttatum* enters the Nearctic Region (Guglielmone et al. 2003). The larva of *A. oblongoguttatum* was recently redescribed by Barbieri et al. (2012). Kolonin (2009) ignores Aves as hosts for this tick, but there are *bona fide* records cited in the references below.

References

Barbieri, F.S., Brito, L.G., Barros-Battesti, D.M., Famadas, K.F., Labruna, M.B. & Camargo, L.M.A. 2012. Redescription of the larva of *Amblyomma oblongoguttatum* Koch, 1844 (Acari: Ixodidae) by light and scanning electron microscopy. Zootaxa, 3579: 80–88.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Dunn, L.H. 1934. Ticks from tapirs of Panama. J. Parasitol., 14: 312, 1934.

Fairchild, G.B., Kohls, G.M. & Tipton, V.J. 1966. The ticks of Panama (Acarina: Ixodoidea). *In* W.R. Wenzel & V.J. Tipton (editors), Ectoparasites of Panama. Field Museum of Natural History, Chicago, pp. 167–219.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Guglielmone, A.A., Beati, L., Barros-Battesti, D.M., Labruna, M.B., Nava, S., Venzal, J.M., Mangold, A.J., Szabó, M.P.J., Martins, J.R., González-Acuña, D. & Estrada-Peña, A. 2006. Ticks (Ixodoidea) on humans in South America. Exp. Appl. Acarol., 40: 83–100.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Labruna, M.B., Camargo, L.M.A., Schumaker, T.T.S. & Camargo, E.P. 2002. Parasitism of domestic swine (*Sus scrofa*) by *Amblyomma* ticks (Acari: Ixodidae) on a farm at Monte Negro, western Amazon, Brazil. J. Med. Entomol., 39: 241–243.

Martins, T.F., Spolidorio, M.G., Batista, T.C.A., Oliveira, I.A.S., Yoshinari, N.H. & Labruna, M.B. 2009. Ocorrência de carrapatos (Acari: Ixodidae) no município de Goiatins, Tocantins. Rev. Bras. Parasitol. Vet., 18 (2): 52–54.

Walker, E.D., Stobierski, M.G., Poplar, M.L., Smith, T.W., Murphy, A.J., Smith, P.C., Schmitt, S.M., Cooley, T.M. & Kramer, C.M. 1998. Geographic distribution of ticks (Acari: Ixodidae) in Michigan, with emphasis on *Ixodes scapularis* and *Borrelia burgdorferi*. J. Med. Entomol., 35: 872–882.

83 – *A. orlovi* (Kolonin, 1992) (Folia Parasitol., 39: 93–94)

Guglielmone et al. (2009, *op. cit.* under *A. argentinae*) suggest that *A. orlovi* may be a synonym of *A. transversale* but treat this species as provisionally valid pending type comparison. Kolonin (2009, *op. cit.* under *A. arcanum*) classifies this species in the genus *Aponomma*, and Santos-Dias, J.A.T. (1996. Sobre a conveniência em se establecer uma nova posição hierárquica para *Africaniella* Travassos Dias, 1974 (Acarina: Ixodoidea) García de Orta Ser. Zool., 21: 51–54) alleged that this species and *A. transversale* constitute the genus *Africaniella.*

Type depository: ZIAC (holotype), KC (paratype) (Kolonin, G.V. 1992. *Aponomma orlovi* sp. n. – a new species of ixodid ticks (Acarina, Ixodidae) from Vietnam. Folia Parasitol., 39: 93–94) as *Aponomma orlovi*

Known stages: female

Zoogeographic Region: Afrotropical

Ecoregion: eastern Guinean forest

Hosts: Squamata: Boidae (A)

Human infestation: no

Remarks: Camicas et al. (1998) consider *A. orlovi* to be an Oriental tick and, indeed, Kolonin's (1992) very poor description is based on a female tick collected in Vietnam. After examining two females of *A. orlovi* from Ghana, Kolonin (2003) stated that this species is Afrotropical. All authors below treat this species as *Aponomma orlovi*. See above.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Kolonin, G.V. 1992. *Aponomma orlovi* sp. n. – a new species of ixodid ticks (Acarina, Ixodidae) from Vietnam. Folia Parasitol., 39: 93–94.

Kolonin, G.V. 2003. New data on ixodid tick fauna of Vietnam. Entomol. Rev., 83 (Suppl. 2): S190-S192.

84 – *A. ovale* Koch, 1844 (Arch. Naturgesch., 10: 217–239)

See remarks below.

Type depository: ZMB (syntypes) (Moritz and Fischer 1981, *op. cit.* under *A. arcanum*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Nearctic, Neotropical

Ecoregions: tropical and subtropical moist broadleaf forests; tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for adult ticks are Carnivora: Canidae and Felidae, and Perissodactyla: Tapiridae. Testudines and Anura are considered to be exceptional hosts for this tick.
Carnivora: Canidae; Rodentia: Cricetidae, Echimyidae; Passeriformes: Emberizidae (ANL)
Carnivora: Felidae, Mustelidae, Procyonidae; Perissodactyla: Tapiridae
Mammalia (several orders); Galliformes: Cracidae; Gruiformes: Rallidae; Passeriformes: Emberizidae; Testudines (unknown family) (A)
Carnivora: Procyonidae (AN)
Didelphimorphia: Didelphidae; Rodentia: Muridae (NL)
Rodentia: Heteromyidae; Passeriformes (several families) (N)
Coraciiformes: Momotidae; Passeriformes: Tytiridae (L)
Anura: Bufonidae (stage unknown)

Human infestation: yes (Burridge 2011)

Remarks: Camicas et al. (1998) list the preimaginal stages of *A. ovale* as described, but the nymph and the larva were only recently described by Martins et al. (2010) and Barbieri et al. (2008), respectively. Camicas et al. (1998) state that *A. ovale* is found only in the Neotropical Region, but Guglielmone et al. (2003) include records of this tick from the Nearctic Region. Burridge (2011) regards wild and domestic Canidae and Cricetidae in the U.S.A. as exotic hosts for *A. ovale*, but they are natural hosts of *A. ovale*. Guglielmone et al. (2003) and Kolonin (2009) exclude Aves as hosts of the sub-adult stages of *A. ovale*, but Ogrzewalska et al. (2009) and Luz et al. (2012) present convincing evidence to the contrary. Records of this tick on Testudines in Floch and Fauran (1958) and Anura in Alvarez et al. (2005) appear to be rare events. Floch and Fauran (1958) classify this tick as *A. fossum* Neumann, 1899. See also *A. aureolatum.*

References

Alvarez, V.C., Hernández, V.F. & Hernández, J.G. 2005. Catálogo de garrapatas suaves (Acari: Argasidae) y duras (Acari: Ixodidae) de Costa Rica. Brenesia, 63–64: 81–88.

Aragão, H. B. & Fonseca, F. da. 1961. Nota de ixodologia. 9. O complexo *ovale* do gênero *Amblyomma*. Mem. Inst. Oswaldo Cruz, 59: 131–148.

Arzua, M., Onofrio, V.C. & Barros-Battesti, D.M. 2005. Catalogue of the tick collection (Acari, Ixodida) of the Museu de História Natural Capão da Imbuia, Curitiba, Paraná, Brazil. Rev. Bras. Zool., 22: 623–632.

Barbieri, F.S., Brito, L.G., Labruna, M.B., Barros-Battesti, D.M., Camargo, L.M.A. & Famadas, K.M. 2008. Description of the larva of *Amblyomma ovale* Koch, 1844 (Acari: Ixodidae) by light and scanning electron microscopy. Syst. Appl. Acarol., 13: 109–119.

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Dunn, L.H. 1923. The ticks of Panama, their hosts and the diseases they transmit. Am. J. Trop. Med. Hyg., 3: 91–104.

Fairchild, G.B., Kohls, G.M. & Tipton, V.J. 1966. The ticks of Panama (Acarina: Ixodoidea). *In* W.R. Wenzel & V.J. Tipton (editors), Ectoparasites of Panama. Field Museum of Natural History, Chicago, pp. 167–219.

Floch, H. & Fauran, P. 1958. Ixodidés de la Guyane et des Antilles Françaises. Arch. Inst. Pasteur Guyane (446), 94 pp.

Guglielmone, A.A., Estrada-Peña, A., Mangold, A.J., Barros-Battesti, D.M., Labruna, M.B., Martins, J.R., Venzal, J.M., Arzua, M. & Keirans, J.E. 2003. *Amblyomma aureolatum* (Pallas, 1772) and *Amblyomma ovale* Koch, 1844 (Acari: Ixodidae): hosts, distribution and 16S rDNA sequences, Vet. Parasitol., 113: 273–288.

Ivancovich, J.C. & Luciani, C.A. 1992. Las garrapatas de Argentina. Monografía de la Asociación Argentina de Parasitología Veterinaria, Buenos Aires, 95 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Luz, H.R., Faccini, J.L.H., Landulfo, G.A., Berto, B.P. & Ferreira, I. 2012. Bird ticks in an area of the Cerrado of Minas Gerais, southeast Brazil. Exp. Appl. Acarol., 58: 89–99.

Martins, T.F., Onofrio, V.C., Barros-Battesti, D.M. & Labruna, M.B. 2010. Nymphs of the genus *Amblyomma* (Acari: Ixodidae) of Brazil: descriptions, redescriptions, and identification key. Ticks Tick-borne Dis., 1: 75–99.

Murgas, I.L., Castro, A.M. & Bermúdez, S.E. 2013. Current status of *Amblyomma ovale* (Acari: Ixodidae) in Panama. Ticks Tick-borne Dis., 4: 164–166.

Ogrzewalska, M., Pacheco, R.C., Uezu, A., Richtzenhain, L.J., Ferreira, F. & Labruna, M.B. 2009. Ticks (Acari: Ixodidae) infesting birds in an Atlantic rain forest region in Brazil. J. Med. Entomol., 46: 1225–1229.

85 – *A. pacae* Aragão, 1911 (Mem. Inst. Oswaldo Cruz, 3: 145–195)

Type depository: unknown, but probably in IOC (Guglielmone et al. 2003, *op. cit.* under *A. americanum*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical broadleaf forests

Hosts: usual hosts for adult ticks are Rodentia: Cuniculidae.
Rodentia: Cuniculidae (AN)
Mammalia (several orders) (A)
Gruiformes: Cariamidae (NL)
Rodentia: Echimyidae; Didelphimorphia: Didelphidae (N)

Human infestation: yes (Guglielmone et al. 2006)

Remarks: Camicas et al. (1998) list the larva and nymph of *A. pacae* as undescribed, but the larva was recently described by Barbieri et al. (2008) and the nymph by Martins et al. (2010). The records of Teixeira et al. (2008) on Gruiformes: Cariamidae are from Aves in captivity; these records are ignored by Kolonin (2009).

References

Barbieri, F.S., Brito, L.G., Labruna, M.B., Barros-Battesti, D.M., Camargo, L.M.A. & Famadas, K.M. 2008. Description of the larva of *Amblyomma pacae* Aragão, 1911 (Acari: Ixodidae) by light and scanning electron microscopy. Syst. Appl. Acarol., 13: 195–203.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Fairchild, G.B., Kohls, G.M. & Tipton, V.J. 1966. The ticks of Panama (Acarina: Ixodoidea). *In* W.R. Wenzel & V.J. Tipton (editors), Ectoparasites of Panama. Field Museum of Natural History, Chicago, pp. 167–219.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Guglielmone, A.A., Beati, L., Barros-Battesti, D.M., Labruna, M.B., Nava, S., Venzal, J.M., Mangold, A.J., Szabó, M.P.J., Martins, J.R., González-Acuña, D. & Estrada-Peña, A. 2006. Ticks (Ixodoidea) on humans in South America. Exp. Appl. Acarol., 40: 83–100.

Guzmán-Cornejo, C., Pérez, T.M., Nava, S. & Guglielmone, A.A. 2006. First records of the ticks *Amblyomma calcaratum* and *A. pacae* (Acari: Ixodidae) parasitizing mammals of Mexico. Rev. Mex. Biodiversidad., 77: 123–127.

Hernández-Arrieta, F. 1999. Garrapatas (Acari: Ixodoidea) del ganado bovino y controles utilizados en el municipio de Jesús E. Lossada, estado Zulia, (Venezuela). Rev. Cient. Fac. Cienc. Vet., Univ. Zulia, 9: 47–51.

Jones, E.K., Clifford, C.M., Keirans, J.E. & Kohls, G.M. 1972. The ticks of Venezuela (Acarina: Ixodoidea) with a key to the species of *Amblyomma* in the Western Hemisphere. Brigham Young Univ. Sci. Bull. Biol. Ser., 17 (4), 40 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Labruna, M.B., Camargo, L.M.A., Terrassini, F.A., Ferreira, F., Schumaker, T.T.S. & Camargo, E.P. 2005. Ticks (Acari: Ixodidae) from the State of Rondônia, western Amazon, Brazil. Syst. Appl. Acarol., 10: 17–32.
Martins, T.F., Onofrio, V.C., Barros-Battesti, D.M. & Labruna, M.B. 2010. Nymphs of the genus *Amblyomma* (Acari: Ixodidae) of Brazil: descriptions, redescriptions, and identification key. Ticks Tick-borne Dis., 1: 75–99.
Santos Dias, J.A.T. 1989. Ixodídeos (Acarina – Ixodoidea) em coleção no Museu Zoológico de Amsterdão. García de Orta Ser. Zool., 13: 75–87.
Teixeira, R.H.F., Ferreira, I., Amorim, M., Gazêta, G.S. & Serra-Freire, N.M. 2008. Carrapatos em aves selvagens no Zoológico de Sorocaba – São Paulo, Brasil. Arq. Bras. Med. Vet. Zoot., 60: 1277–1280.

86 – *A. papuanum* Hirst, 1914 (Trans. R. Soc. Lond., 20: 325–334)

Type depository: not stated (Hirst, S. 1914. Report on the Arachnida and Myriopoda collected by the British Ornithologists Union Expedition and the Wollaston Expedition in Dutch New Guinea. Trans. R. Soc. Lond., 20: 325–334) as *Amblyomma papuana*

Known stages: male, female

Zoogeographic Region: Australasian

Ecoregion: New Guinea lowland rain forest

Hosts: Casuariformes: Casuariidae (ANL)
Artiodactyla: Cervidae; Monotremata: Tachyglossidae (A)
Columbiformes: Columbidae; Galliformes: Megapodiidae (stages unknown)

Human infestation: no

Remarks: the larva and nymph of *A. papuanum* remain undescribed, but Robbins and Bush (2006) consider their larval collection from Casuariidae to be tentatively valid. Kolonin (2008) classifies *A. papuanum* as a tick whose adults feed on Aves. Robbins and Bush (2006) indicate that the principal hosts for this tick may be Casuariidae, but the few collections of adults of *A. papuanum* include specimens from Cervidae (Roberts 1970; Hoogstraal 1982). We conclude that it is premature to view Aves as the principal hosts of this tick. Mihalca et al. (2011) list *A. papuanum* as an endangered species.

References

Hoogstraal, H. 1982. Ticks (Acari: Ixodoidea): a preliminary study. Monogr. Biol., 42: 537–544.
Kolonin, G.V. 2008. Birds as hosts of ixodid ticks (Acarina: Ixodidae). Entomol. Rev., 88: 1012–1015.
Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

Owen, I.L. 2011. Parasites of animals in Papua New Guinea recorded at the National Veterinary Laboratory: a catalogue, historical review and zoogeographical affiliations. Zootaxa, 3143: 1–163.
Robbins, R.G. & Bush, S.E. 2006. First report of *Amblyomma papuanum* Hirst (Acari: Ixodida: Ixodidae) from the dwarf cassowary, *Casuarius bennetti* Gould (Aves: Struthioniformes: Casuariidae), with additional records of parasitism of *Casuarius* spp. by this tick. Proc. Entomol. Soc. Wash., 108: 1002–1004.
Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.
Wilson, N. 1972. Ticks. Encyclopedia of Papua and New Guinea, 2: 1122–1124.

87 – *A. parkeri* Fonseca & Aragão, 1952 (Mem. Inst. Oswaldo Cruz, 50: 713–726) Kolonin (2009, *op. cit.* under *A. arcanum*) treats *A. parkeri* as a doubtful species, but its validity is beyond question, as argued in Labruna, M.B., Onofrio, V.C., Beati, L., Arzua, M., Bertola, P.B. & Barros-Battesti, D.M. (2009. Redescription of the female, description of the male, and several new records of *Amblyomma parkeri* (Acari: Ixodidae), a South American tick species. Exp. Appl. Acarol., 49: 243–260), who also present convincing morphological characters for separating *A. parkeri* from *A. geayi* and *A. longirostre.*

Type depository: IBU (holotype) (Barros-Battesti, D.M. personal communication to Guglielmone, A.A.)

Known stages: male, female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Rodentia: Erethizontidae.
Rodentia: Erethizontidae (ANL)
Primates: Atelidae (AN)
Passeriformes: Pipridae (NL)
Apodiformes: Trochilidae; Passeriformes (several families) (L)

Human infestation: yes (Martins et al. 2013)

Remarks: Camicas et al. (1998) list the male of *A. parkeri* as undescribed, but it was subsequently described by Labruna et al. (2009). The nymph of *A. parkeri* has recently been redescribed by Martins et al. (2010).

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.
Labruna, M.B., Onofrio, V.C., Beati, L., Arzua, M., Bertola, P.B. & Barros-Battesti, D.M. 2009.Redescription of the female, description of the male, and several new records of *Amblyomma parkeri* (Acari: Ixodidae), a South American tick species. Exp. Appl. Acarol., 49: 243–260.

Martins, T.F., Onofrio, V.C., Barros-Battesti, D.M. & Labruna, M.B. 2010. Nymphs of the genus *Amblyomma* (Acari: Ixodidae) of Brazil: descriptions, redescriptions, and identification key. Ticks Tick-borne Dis., 1: 75–99.

Martins, T.F., Scofield, A., Oliveira, W.B.L., Nunes, P.H., Ramírez, P.H., Barros-Battesti, D.M., Sá, L.R.M., Ampuero, F., Souza, J.C. & Labruna, M.B. 2013. Morphological description of the nymphal stage of *Amblyomma geayi*, and new nymphal records of *Amblyomma parkeri.* Ticks Tick-borne Dis., 4: 181–184.

Ogrzewalska, M., Pacheco, R.C., Uezu, A., Ferreira, F. & Labruna, M.B. 2008. Ticks (Acari: Ixodidae) infesting wild birds in an Atlantic forest area in the State of São Paulo, Brazil, with isolation of *Rickettsia* from the tick *Amblyomma longirostre*. J. Med. Entomol., 45: 770–774.

Ogrzewalska, M., Uezu, A. & Labruna, M.B. 2011. Ticks (Acari: Ixodidae) infesting wild birds in the Atlantic forest in northeastern Brazil, with notes on rickettsial infection in ticks. Parasitol. Res. 108: 665–670.

Ogrzewalska, M., Saraiva, D.G., Moraes-Filho, J., Martins, T.F., Costa, F.B., Pinter, A. & Labruna, M.B. 2012. Epidemiology of Brazilian spotted fever in the Atlantic forest, State of São Paulo, Brazil. Parasitology, 139: 1283–1300.

Pinter, A. 2007. Aspectos ecológicos da febre maculosa brasileira em um foco endêmico no Estado de São Paulo. Tese de doutorado. Universidade de São Paulo, Faculdade de Medicina Veterinária e Zootecnia, 86 pp.

88 – *A. parvitarsum* Neumann, 1901 (Mém. Soc. Zool. Fr., 14: 249–372)

Type depository: ZSH (holotype) (Neumann, L.G. 1901. Revision de la famille des ixodidés. Mém. Soc. Zool. Fr., 14: 249–372)

Known stages: male, female, larva

Zoogeographic Region: Neotropical

Ecoregions: temperate grasslands, savannas and shrublands; Central Andean dry puna

Hosts: usual hosts for adult ticks are Artiodactyla: Camelidae. Aves are considered exceptional hosts.
Artiodactyla: Bovidae, Camelidae; Perissodactyla: Equidae; Sphenisciformes: Spheniscidae; Struthioniformes: Rheidae (A)
Squamata: Liolaemidae (L)

Human infestation: no

Remarks: González-Acuña et al. (2004) discuss several uncertain records of immature stages of *A. parvitarsum* on a diversity of hosts that are not included in the list above because they require confirmation. Guglielmone and Nava (2006) doubt the record from Equidae by Ivancovich and Luciani (1992), and this record is only tentatively included in our host list for *A. parvitarsum.* Recently, Abarca et al. (2011) claimed to have found *A. parvitarsum* on dogs in Chile, but their specimens do not belong to this species (Nava, S. personal communication to Guglielmone, A.A.). See also *A. neumanni.*

References

Abarca, K., López, J., Acosta, G., Lepe, P. 2011. Identificación de garrapatas de caninos de zonas urbanas y rurales de Arica, Chile. Res. 7º Congr. Arg. Zoon., julio 2011, Buenos Aires, Argentina, p. 224.

Estrada-Peña, A., Venzal, J.M., Mangold, A.J., Cafrune, M.M. & Guglielmone, A.A. 2005. The *Amblyomma maculatum* Koch, 1844 (Acari: Ixodidae: Amblyomminae) tick group: diagnostic characters, description of the larva of *A. parvitarsum* Neumann, 1901, 16S rDNA sequences, distribution and hosts. Syst. Parasitol., 60: 99–112.

González-Acuña, D., Venzal, J.M, Fabry, M. & Guglielmone, A.A. 2004. *Liolaemus jamesi* (Boulanger, 1891) (Reptilia: Tropiduridae), a host for the larva of *Amblyomma parvitarsum* Neumann, 1901 (Acari: Ixodidae). Syst. Appl. Acarol., 9: 33–36.

Guglielmone, A.A. & Nava, S. 2006. Las garrapatas argentinas del género *Amblyomma* (Acari: Ixodidae): distribución y hospedadores. Rev. Inv. Agropec., 35 (3): 135–155.

Ivancovich, J.C. & Luciani, C.A. 1992. Las garrapatas de Argentina. Monografía de la Asociación Argentina de Parasitología Veterinaria, Buenos Aires, 95 pp.

89 – *A. parvum* Aragão, 1908 (Braz. Med., 22: 111–115)

Camicas et al. (1998, *op. cit.* under *A. auricularium*) treat *A. minutum* Aragão, 1909 in Rohr, C.J. (1909. Estudos sobre ixódidas do Brasil. Gomes Irmão, Rio de Janeiro, 220 pp.) as a synonym of *A. parvum*, but the name *A. minutum* lacks a description or a figure and is therefore a *nomen nudum*. See also remarks below.

Type depository: USNTC (neotype) (Guglielmone, A.A., Mangold, A.J., Keirans, J.E. 1990. Redescription of the male and female of *Amblyomma parvum* Aragão, 1908, and description of the nymph and larva, and description of all stages of *Amblyomma pseudoparvum* sp.n. (Acari: Ixodida: Ixodidae). Acarologia, 31: 143–159)

Known stages: male, female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical dry broadleaf forests; few ticks in tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for larvae and nymphs are Rodentia: Caviidae. Aves are considered exceptional hosts.
Artiodactyla: Bovidae; Rodentia: Caviidae (ANL)
Artiodactyla: Cervidae, Tayassuidae; Carnivora: Canidae; Perissodactyla: Equidae (AN) Rodentia: Cricetidae (AL)
Mammalia (several orders); Struthioniformes: Struthionidae (A)
Didelphimorphia: Didelphidae; Passeriformes: Emberizidae (NL)
Rodentia: Echimyidae; Passeriformes: Cardinalidae (N)

Human infestation: yes (Nava et al. 2008)

Remarks: Nava et al. (2008) found genetic divergence between populations of *A. parvum* from Argentina and Brazil. Investigations should be conducted to determine whether such differences are compatible with conspecificity. *Amblyomma parvum* was described from ticks collected in Brazil, but the types were lost; therefore, Guglielmone et al. (1990) selected a neotype from Argentina when this species was redescribed. The anticipated split of populations currently known as *A. parvum* into different species may lead to taxonomic problems because the name *A. parvum* was originally applied to Brazilian populations and the Argentinian neotype will therefore represent the holotype of a new species. Also for this reason, a recent collection of *A. parvum* in the Nearctic Region by Corn et al. (2012) is not included here. Nymphs of *A. parvum* from Argentina and Brazil were described by Guglielmone et al. (1990) and Martins et al. (2010), respectively. In Keirans and Durden (2001), there is a record of *A. parvum* from Paraguay imported into the Nearctic Region, but there is no evidence that this species has become established in that region. The records of Teixeira et al. (2008) on Struthioniformes: Struthionidae are from Aves in captivity, but Aves appear to be infrequently infested with *A. parvum*. Mullins et al. (2004) cited Boero (1944) in support their argument that Squamata and Testudines are hosts for *A. parvum.* This is in error because Mullins et al. (2004) confused the hosts of *A. parvum* in Boero (1944) with the hosts of *A. rotundatum.* Recently, Luz et al. (2012) presented several records of nymphs of *A. parvum* from Aves that are not included in the list above because we feel that they require confirmation. See also *A. inornatum* and *A. pseudoparvum.*

References

Boero, J.J. 1944. Los ixodideos de la República Argentina. Boletín Técnico de la Dirección de de Ganadería, Ministerio de Agricultura y Ganadería de la República Argentina, 68 pp.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Corn, J.L., Hanson, B., Okraska, C.R., Muiznieks, B., Morgan, V. & Mertins, J.W. 2012. First at-large record of *Amblyomma parvum* (Acari: Ixodidae) in the United States. Syst. Appl. Acarol., 17, 3–6.

Guglielmone, A.A., Mangold, A.J. & Keirans, J.E. 1990. Redescription of the male and female of *Amblyomma parvum* Aragão, 1908, and description of the nymph and larva, and description of all stages of *Amblyomma pseudoparvum* sp.n. (Acari: Ixodida: Ixodidae). Acarologia, 31: 143–159.

Guglielmone, A.A., Nava, S., Mangold, A.J. & Caparrós, J.A. 2007. Las garrapatas del norte de Córdoba, Argentina. Rev. Med. Vet. (Buenos Aires.), 88: 57–61.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Luz, H.R., Faccini, J.L.H., Landulfo, G.A., Berto, B.P. & Ferreira, I. 2012. Bird ticks in an area of the Cerrado of Minas Gerais, southeast Brazil. Exp. Appl. Acarol., 58: 88–99.

Martins, T.F., Onofrio, V.C., Barros-Battesti, D.M. & Labruna, M.B. 2010. Nymphs of the genus *Amblyomma* (Acari: Ixodidae) of Brazil: descriptions, redescriptions, and identification key. Ticks Tick-borne Dis., 1: 75–99.

Mullins, M.C., Lazzarini, S.M., Picando, M.C.L. & Serra-Freire, N.M. 2004. *Amblyomma parvum* a parasite of *Dasypus kappleri* in the State of Amazonas, Brazil. Rev. Cienc. Agr., 42, 287–291.

Nava, S., Szabó, M.P.J., Mangold, A.J. & Guglielmone, A.A. 2008. Distribution, hosts, 16S rDNA sequences and phylogenetic position of the Neotropical tick *Amblyomma parvum* (Acari: Ixodidae). Ann. Trop. Med. Parasitol., 102: 409–425.

Saraiva, D.G., Fournier, G.F.S.R., Martins, T.F., Leal, K.P.G., Vieira, F.N., Câmara, M.V.C., Costa, C.G., Onofrio, V.C., Barros-Battesti, D.M., Guglielmone, A.A. & Labruna, M.B. 2012. Ticks (Acari: Ixodidae) associated with small terrestrial mammals in the State of Minas Gerais, southeastern Brazil. Exp. Appl. Acarol., 58: 159–166.

Teixeira, R.H.F., Ferreira, I., Amorim, M., Gazêta, G.S. & Serra-Freire, N.M. 2008. Carrapatos em aves selvagens no Zoológico de Sorocaba – São Paulo, Brasil. Arq. Bras. Med. Vet. Zoot., 60: 1277–1280.

90 – *A. pattoni* (Neumann, 1910) (Ann. Sci. Nat. Zool. Ser. 9, 12: 161–176)
Kolonin (2009, *op. cit.* under *A. arcanum*) classifies this species in the genus *Aponomma.* See remarks below.

Type depositories: MNHN, BMNH (syntypes) (Kaufman 1972, *op. cit.* under *A. fimbriatum*; Keirans and Hillyard 2001, *op. cit*. under *A. albopictum*) as *Aponomma pattoni*

Known stages: male, female, nymph

Zoogeographic Region: Oriental

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: usual hosts for larvae, nymphs and adults are Squamata: Colubridae and Elapidae. Aves and Mammalia are considered exceptional hosts for this tick.
Squamata: Colubridae, Elapidae (ANL)
Squamata: Varanidae (AN)
Squamata: Boidae; Artiodactyla: Bovidae; Carnivora: Herpestidae; Passeriformes: Chloropseidae (A)

Human infestation: no

Remarks: the nymph of *A. pattoni* was described as *A. pseudolaeve* Schulze, 1935, a species that was considered valid by Santos Dias (1993) but not by Kaufman (1972), who compared the types of both species. We agree with Kaufman's view.

The larva of *A. pattoni* remains undescribed, but we provisionally accept records of this stage in Keirans (1985). Kolonin (2009) does not include Aves as hosts for adults of *A. pattoni*, but we accept the odd record on Passeriformes in Tanskul et al. (1983) as valid. All authors cited below treat this species as a member of the genus *Aponomma*.

References

Kaufman, T.S. 1972. A revision of the genus *Aponomma* Neumann, 1899 (Acarina: Ixodidae). Ph.D. Dissertation, University of Maryland, 390 pp.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Santos Dias, J.A.T. 1993. Contribuição para o estudo da sistemática e taxonomia das espécies do género *Aponomma* Neumann, 1899 (Acarina-Ixodoidea). Estud. Ens. Doc. (157), 204 pp.

Tanskul, P., Stark, H.E. & Inlao, I. 1983. A checklist of ticks of Thailand (Acari: Metastigmata:Ixodoidea). J. Med. Entomol., 20: 330–341.

91 – *A. paulopunctatum* Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)
See *A. marmoreum.*

Type depository: MNHN (holotype) (Neumann 1899, *op. cit.* under *A. albopictum*)

Known stages: male, female, nymph

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical moist broadleaf forests; tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for nymphs and adult ticks are Artiodactyla: Suidae.
Artiodactyla: Suidae (ANL)
Artiodactyla: Bovidae (AN)
Artiodactyla: Hippopotamidae; Carnivora: Hyaenidae; Rodentia: Thryonomyidae (A)
Galliformes: Phasianidae (NL)

Human infestation: yes (Keirans 1985)

Remarks: Camicas et al. (1998) list the nymph of *A. paulopunctatum* as described, while Voltzit and Keirans (2003) do not recognize any sub-adult stages of this tick as having been described. However, Van der Borght-Elbl (1977) described the nymph of *A. paulopunctatum* from specimens collected from wild pigs. Although the larva of *A. paulopunctatum* remains undescribed, we accept as provisionally valid records of this stage in Van der Borght-Elbl (1977) and Keirans (1985). Morel and Mouchet (1965) state that the records of this species on Proboscidea in Theiler (1962) actually represent *A. tholloni*, and we therefore do not include Proboscidea in our list of hosts for this species. Rageau (1951) reported infestation of Testudines with *A. paulopunctatum*, but this was the result of confusion with *A. nuttalli* (Rageau, 1953).

References

Aeschlimann, A. 1967. Biologie et écologie des tiques (Ixodoidea) de Côte d'Ivoire. Acta Trop., 24: 281–405.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Elbl, A. & Anastos, G. 1966. Ixodid ticks (Acarina: Ixodidae) of Central Africa. Vol. I. General introduction. Genus *Amblyomma.* Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (145), 275 pp.

Keirans, J.E. 1985. *Amblyomma paulopunctatum* Neumann (Ixodoidea: Ixodidae): redescription of the male and female, with an account on its known hosts and distribution. Proc. Entomol. Soc. Wash., 87: 489–497.

Morel, P.-C. & Mouchet, J. 1965. Les tiques du Cameroun (Ixodidae et Argasidae) (2e. note). Ann. Parasitol. Hum. Comp., 40: 477–496.

Ntiamoa-Baidu, Y., Carr-Saunders, C., Matthews, B.E., Preston, P.M. & Walker, A.R. 2004. An updated list of the ticks of Ghana and an assessment of the distribution of the ticks of Ghanaian wild mammals in different vegetation zones. Bull. Entomol. Res., 94: 245–260.

Rageau, J. 1951. Ixodidés du Cameroun. Bull. Soc. Patho. Exot., 44: 441–446.

Rageau, J. 1953. Note complémentaire sur les Ixodidae du Cameroun. Bull. Soc. Patho. Exot., 46: 1090–1098.

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

Van der Borght-Elbl, A. 1977. Ixodid ticks (Acarina: Ixodidae) of Central Africa. Vol. V. The larval and nymphal stages of the more important species of the genus *Amblyomma* Koch, 1844. Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (222), 158 pp.

Voltzit, O.V. & Keirans, J.E. 2003. A review of African *Amblyomma* species (Acari, Ixodida, Ixodidae). Acarina, 11: 135–214.

92 – *A. pecarium* Dunn, 1933 (Parasitology, 25: 353–358)

Type depositories: USNTC (holotype, paratypes), MCZ, GML (paratypes) (Dunn, L.H. 1933. Two new species of ticks from Panama (*Amblyomma tapirellum* and *A. pecarium*). Parasitology, 25: 353–358, and website information (http://mczbase.mcz.harvard.edu/ accessed April 4, 2013)

Known stages: male, female

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Artiodactyla: Tayassuidae.
Artiodactyla: Cervidae, Tayassuidae (A)
Carnivora: Canidae, Procyonidae (stages unknown)

Human infestation: yes (Alvarez et al. 2005)

Remarks: Fairchild et al. (1966) and Guzmán-Cornejo et al. (2011) present information on the undescribed nymph of *A. pecarium*, but there are uncertainties about their host list and their records are not included in the host list above. Kolonin (2009) does not include Carnivora as hosts for *A. pecarium*, but we tentatively accept this tick-host relationship, as reported in Alvarez et al. (2005), as provisionally valid.

References

Alvarez, V.C., Hernández, V.F. & Hernández, J.G. 2005. Catálogo de garrapatas suaves (Acari: Argasidae) y duras (Acari: Ixodidae) de Costa Rica. Brenesia, 63–64: 81–88.

Fairchild, G.B., Kohls, G.M. & Tipton, V.J. 1966. The ticks of Panama (Acarina: Ixodoidea). *In* W.R. Wenzel & V.J. Tipton (editors), Ectoparasites of Panama. Field Museum of Natural History, Chicago, pp. 167–219.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Guzmán-Cornejo, C., Robbins, R.G., Guglielmone, A.A., Montiel-Parra, G. & Pérez, T.M. 2011.The *Amblyomma* (Acari: Ixodida: Ixodidae) of Mexico: identification keys, distribution and hosts. Zootaxa, 2998, 16–38.

Hoffmann, A. 1962. Monografía de los Ixodoidea de México. I parte. Rev. Soc. Mex. Hist. Nat., 23: 191–307.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

93 – *A. personatum* Neumann, 1901 (Mém. Soc. Zool. Fr., 14: 249–372)

Type depository: ZMB (syntypes) (Moritz and Fischer 1981, *op. cit.* under *A. arcanum*)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for adult ticks are Perissodactyla: Rhinocerotidae.
Perissodactyla: Rhinocerotidae; Artiodactyla: Bovidae (A)

Human infestation: yes (Walker 1974)

Remarks: Durden and Keirans (1996) regard *A. personatum* as an endangered species.

References

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.

Walker, J.B. 1974. The ixodid ticks of Kenya. A review of present knowledge of their hosts and distribution. Commonwealth Institute of Entomology, London, 220 pp.

94 – *A. pictum* Neumann, 1906 (Arch. Parasitol., 10: 195–219)

Type depository: BMNH (syntypes) (Keirans and Hillyard 2001, *op. cit*. under *A. albopictum*)

Known stages: male, female

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: Pilosa: Myrmecophagidae; Carnivora: Canidae (A)

Human infestation: no

Remarks: Aragão (1912) named this species *A. conspicuum* Aragão, 1912. There is a host record in Keirans (1985) described as "probably Caviidae," but it is not included in our host list because of the uncertain identification. Keirans and Durden (2001) cite a record of *A. pictum* being introduced into the Nearctic Region, but there is no evidence of its having become established there.

References

Aragão, H. B. 1912. Nota sobre os Ixodidas collecionados durante a expedição do Sr. Coronel Rondon nos estados de Goyaz e Matto Grosso pelo Snr. Dr. Murillo de Campos, medico da expedição. Nova especie de *Amblyomma*: *A. conspicuum.* Braz. Med., 26: 429–430.

Fairchild, G.B., Kohls, G.M. & Tipton, V.J. 1966. The ticks of Panama (Acarina: Ixodoidea). *In* W.R. Wenzel & V.J. Tipton (editors), Ectoparasites of Panama. Field Museum of Natural History, Chicago, pp. 167–219.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases, Atalanta-2, Houten, The Netherlands, 173 pp.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

95 – *A. pilosum* Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)

Type depository: USNTC (holotype) (Keirans and Clifford 1984, *op. cit*. under *A. calcaratum*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregions: deserts and xeric shrublands in the Galapagos Islands

Hosts: Testudines: Testudinidae (ANL)

Human infestation: no

Remarks: Durden and Keirans (1996) state that *A. pilosum* and its hosts are at risk of extinction. See also *A. hirtum* and *A. pilosum.*

References

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases, Atalanta-2, Houten, The Netherlands, 173 pp.

Keirans, J.E., Hoogstraal, H. & Clifford, C.M. 1973. The *Amblyomma* (Acarina: Ixodidae) parasitic on giant tortoises (Reptilia: Testudinidae) of the Galapagos Islands. Ann. Entomol. Soc. Am., 66: 673–688.

96 – *A. pomposum* Dönitz, 1909 (Sber. Ges. Naturf. Freunde Berlin (8): 440–482)
Amblyomma nocens Robinson, 1912 and *Amblyomma superbum* Santos Dias, 1953 are synonyms of *A. pomposum* (Guglielmone et al. 2009, *op. cit.* under *A. argentinae*), but all three names are listed as valid in Barker and Murrell (2008, *op. cit.* under *A. argentinae*). The position of Camicas et al. (1998, *op. cit.* under *A. auricularium*) on this problem reflects previous contradictions among specialists because these authors treat *A. nocens* and *A. pomposum* as valid species but are unclear about the status of *A. superbum*, listing it as either a synonym of *A. pomposum* or a valid species.

Type depository: ZMB (syntypes) (Moritz and Fischer 1981, *op. cit.* under *A. arcanum*)

Known stages: male, female, nymph

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae. Aves and Squamata are considered exceptional hosts.
Artiodactyla: Bovidae (AN)
Mammalia (several orders) (A)
Carnivora: Felidae; Ciconiiformes: Ciconiidae (N)
Primates: Cercopithecidae; Squamata: Agamidae (N and/or L)
Proboscidea: Elephantidae; Rodentia: Thryonomyidae (stages unknown)

Human infestation: yes (Elbl and Anastos 1966)

Remarks: Keirans and Durden (2001) cite one record of the introduction of *A. pomposum* into the Nearctic Region, but no evidence exists that it has become established there. Voltzit and Keirans (2003) state that the nymph of this species is undescribed, but Van der Borght-Elbl (1977) presents a description of the nymph of *A. pomposum*

from field-collected material that we accept as valid. Theiler (1962) does not specify whether larvae, nymphs or both immature stages of this tick were found on Cercopithecidae and Agamidae. Kolonin (2009) lists only ungulates as hosts for *A. pomposum*, but the references below provide a wider range of hosts for this species.

References

Elbl, A. & Anastos, G. 1966. Ixodid ticks (Acarina: Ixodidae) of Central Africa. Vol. I. General introduction. Genus *Amblyomma.* Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (145), 275 pp.

Gomes, A.F. 1993. The tick vectors of cowdriosis in Angola. Rev. Élev. Méd. Vét. Pays Trop., 46: 237–243.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Santos Dias, J.A.T. 1960. Lista das carraças de Moçambique e respectivos hospedeiros. III. An. Serv. Vet. Ind. Anim. Moçambique (1953–1954), 6: 213–287.

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

Van der Borght-Elbl, A. 1977. Ixodid ticks (Acarina: Ixodidae) of Central Africa. Vol. V. The larval and nymphal stages of the more important species of the genus *Amblyomma* Koch, 1844. Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (222), 158 pp.

Voltzit, O.V. & Keirans, J.E. 2003. A review of African *Amblyomma* species (Acari, Ixodida, Ixodidae). Acarina, 11: 135–214.

97 – *A. postoculatum* Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)

Type depository: MNHN (holotype) (Neumann 1899, *op. cit.* under *A. albolimbatum*)

Known stages: female

Zoogeographic Region: Australasian

Ecoregions: Tasmanian temperate forests; Carnarvon xeric shrublands

Hosts: Diprotodontia: Macropodidae (A)

Human infestation: yes (Roberts 1970)

Remarks: Mihalca et al. (2011) regard *A. postoculatum* as an endangered species.

References

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.

98 – *A. pseudoconcolor* Aragão, 1908 (Braz. Med., 22: 431–432)

Type depository: unknown, but probably in IOC (Guglielmone et al. 2003, *op. cit.* under *A. americanum*)

Known stages: male, female, nymph

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical dry broadleaf forests, grasslands, savannas and shrublands

Hosts: usual hosts for adult ticks are Cingulata: Dasypodidae. Aves are considered exceptional hosts for adults of this tick.
Cingulata: Dasypodidae; Tinamiformes: Tinamidae (ANL)
Mammalia (several orders) (A)
Didelphimorphia: Didelphidae (N)

Human infestation: yes (Tomassone et al. 2008)

Remarks: the larva of *A. pseudoconcolor* remains undescribed, but the nymph was recently described by Martins et al. (2010). We tentatively accept determinations of larvae and nymphs on Tinamidae by Aragão (1936) and on Dasypodidae by Superina et al. (2004), as well as Ivancovich's (1973) nymphs on Didelphidae. Keirans and Durden (2001) cite a record of this species for the Nearctic Region, but there is no evidence that *A. pseudoconcolor* has become established there. See also *A. auricularium.*

References

Aragão, H. B. 1936. Ixodidas brasileiros e de algunos paízes limitrophes. Mem. Inst. Oswaldo Cruz, 31: 759–843.

Floch, H. & Fauran, P. 1959. Les Ixodoidea du genre *Amblyomma* en Guyane et aux Antilles Françaises. Acarologia, 1: 216–227.

Guglielmone, A.A., Estrada-Peña, A., Luciani, C.A., Mangold, A.J. & Keirans, J.E. 2003. Hosts and distribution of *Amblyomma auricularium* (Conil 1878) and *Amblyomma pseudoconcolor* Aragão, 1908 (Acari: Ixodidae). Exp. Appl. Acarol., 29: 131–139.

Ivancovich, J.C. 1973 Las garrapatas del Chaco y Formosa. Primera comunicación. Rev. Inv. Agropec. Ser. 4 Patol. Anim., 10, 9–24.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Martins, T.F., Onofrio, V.C., Barros-Battesti, D.M. & Labruna, M.B. 2010. Nymphs of the genus *Amblyomma* (Acari: Ixodidae) of Brazil: descriptions, redescriptions, and identification key. Ticks Tick-borne Dis., 1: 75–99.

Robbins, R.G., Deem, S.L., Noss, A.J. & Greco, V. 2003. First report of *Amblyomma pseudoconcolor* Aragão (Acari: Ixodida: Ixodidae) from Bolivia,

with a new record of this tick from the grey brocket deer, *Mazama gouazoupira* (G. Fischer) (Mammalia: Artiodactyla: Cervidae). Proc. Entomol. Soc. Wash., 105: 1053–1055.

Superina, M., Guglielmone, A.A., Mangold, A.J., Nava, S. & Lareschi, M. 2004. New distributional and host records for *Amblyomma pseudoconcolor* Aragão, 1908 (Acari: Ixodidae: Amblyomminae). Syst. Appl. Acarol., 9: 41–43.

Tomassone, L., Nuñez, P., Gürtler, R.E., Ceballos, L.A., Orozco, M.M., Kitron, U.D. & Farber, M. 2008. Molecular detection of *Ehrlichia chaffensis* in *Amblyomma parvum* ticks, Argentina. Emerg. Inf. Dis., 14: 1953–1955.

99 – *A. pseudoparvum* Guglielmone, Mangold & Keirans, 1990 (Acarologia, 31: 143–159)

Kolonin (2009, *op. cit.* under *A. arcanum*) encloses the names of the authors of *A. pseudoparvum* in parentheses, but the above authors originally described this species in the genus *Amblyomma.*

Type depositories: USNTC (holotype, paratypes), MCN, INTA (paratypes) (Guglielmone et al. 1990, *op. cit.* under *A. parvum*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical dry broadleaf forests

Hosts: usual hosts for adult ticks are Rodentia: Caviidae.
Rodentia: Caviidae (AN)
Mammalia (several orders) (A)

Human infestation: yes (Guglielmone et al. 2006)

Remarks: there are records of larvae and nymphs of *A. pseudoparvum* in Ivancovich and Luciani (1992), identified as *A. parvum*, that are considered doubtful because the authors fail to differentiate them from *A. parvum* (named *A. carenatum* Ivancovich, 1973 a synonym of *A. parvum*, which is *A. pseudoparvum*'s closest relative) and the descriptions of these stages in Guglielmone et al. (1990) are not sufficiently detailed to separate the two species. These records are not included in our list of hosts for *A. pseudoparvum*. The larva of *A. pseudoparvum* is known only from laboratory-reared specimens, as discussed in Guglielmone et al. (1990). Voltzit (2007) and Kolonin (2009) consider "mara" (*Dolichotis patagona*) the principal host of this tick when, in fact, the chief host is a different species colloquially known as "conejo del palo" (*Dolichotis salinicola*).

References

Guglielmone, A.A. & Nava, S. 2006. Las garrapatas argentinas del género *Amblyomma* (Acari: Ixodidae): distribución y hospedadores. Rev. Inv. Agropec., 35 (3): 135–155.

Guglielmone, A.A., Mangold, A.J., Keirans, J.E. 1990. Redescription of the male and female of *Amblyomma parvum* Aragão, 1908, and description of the nymph

and larva, and description of all stages of *Amblyomma pseudoparvum* sp.n. (Acari: Ixodida: Ixodidae). Acarologia, 31: 143–159.
Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases, Atalanta-2, Houten, The Netherlands, 173 pp.
Guglielmone, A.A., Beati, L., Barros-Battesti, D.M., Labruna, M.B., Nava, S., Venzal, J.M., Mangold, A.J., Szabó, M.P.J., Martins, J.R., González-Acuña, D. & Estrada-Peña, A. 2006. Ticks (Ixodoidea) on humans in South America. Exp. Appl. Acarol., 40: 83–100.
Ivancovich, J.C. & Luciani, C.A. 1992. Las garrapatas de Argentina. Monografía de la Asociación Argentina de Parasitología Veterinaria, Buenos Aires, 95 pp.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Voltzit, O.V. 2007. A review of Neotropical *Amblyomma* species (Acari: Ixodidae). Acarina, 15: 3–134.

100 – *A. quadricavum* (Schulze, 1941) (Zool. Anz., 133: 225–229)
Amblyomma arianae Keirans & Garris, 1986 is a well-known synonym of *A. quadricavum*, as discussed in Guglielmone et al. (2009, *op. cit.* under *A. argentinae*), but both names are incorrectly included in Barker and Murrell (2008, *op. cit.* under *A. argentinae*).

Type depository: ZSH (holotype) (Schulze, P. 1941. Ein neues *Amblyomma* und ein neues *Aponomma* mit Augenrudimenten aus Haiti. Zool. Anz., 133: 225–229), as *Aponomma quadricavum*

Known stages: male, female, larva

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Squamata: Boidae and Colubridae.
Squamata: Boidae, Colubridae (AL)
Squamata: Iguanidae (A)

Human infestation: no

Remarks: Keirans and Durden (2001) and Nowak et al. (2010) report records of *A. quadricavum* for the Nearctic and Palearctic Regions, but no evidence is provided that this tick species has become established in these regions. Barros-Battesti et al. (2009) classified Colubridae hosts for *A. quadricavum* as belonging to Iguanidae, thereby confusing the identification of both hosts and ticks; data on hosts of *A. quadricavum* in that paper are not included here. The record on Iguanidae in the above list refers to ticks imported into Poland (Nowak 2010). According to Keirans and Garris (1986), the common host of *A. quadricavum* (named *A. arianae*) is at risk of extinction, a fate shared with this tick.

References

Barros-Battesti, D.M., Reyes Hernández, M., Famadas, K.M., Onofrio, V.C., Beati, L. & Guglielmone, A.A. 2009. The ixodid ticks (Acari: Ixodidae) of Cuba. Syst. Parasitol., 14: 101–128.

Burridge, M.J. & Simmons, L.-A. 2003. Exotic ticks introduced into the United States on imported reptiles from 1962 to 2001 and their potential roles in international dissemination of diseases. Vet. Parasitol., 113: 289–320.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Keirans, J.E. & Garris, G.I. 1986. *Amblyomma arianae* n. sp. (Acari: Ixodidae), a parasite of *Alsophis portoricensis* (Reptilia: Colubridae) in Puerto Rico. J. Med. Entomol., 6: 622–625.

Nowak, M. 2010. The international trade in reptiles (Reptilia) – the cause of the transfer of exotic ticks (Acari: Ixodida) to Poland. Vet. Parasitol., 165: 373–381.

101 – *A. rhinocerotis* (de Geer, 1778) (Mémoire pour servir à l'histoire des insectes, vol. 7, P. Hesselberg, Stockholm, 950 pp)

Type depository: not stated in de Geer, C. (1778, *op. cit.* above) as *Acarus rhinocerotis*

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for adult ticks are Perissodactyla: Rhinocerotidae, while Squamata and Testudines are considered exceptional hosts for this tick.
Artiodactyla: Bovidae, Hippopotamidae, Suidae; Carnivora: Felidae; Perissodactyla: Rhinocerotidae; Squamata: Boidae; Testudines (unknown family) (A)

Human infestation: no

Remarks: Hoogstraal (1956) lists Testudines and Squamata as hosts for *A. rhinocerotis*, but these hosts are infrequently parasitized and are not included by Kolonin (2009). Durden and Keirans (1996) regard *A. rhinocerotis* as an endangered species.

References

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.

Elbl, A. & Anastos, G. 1966. Ixodid ticks (Acarina: Ixodidae) of Central Africa. Vol. I. General introduction. Genus *Amblyomma.* Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (145), 275 pp.

Hoogstraal, H. 1956. African Ixodoidea. I. Ticks of the Sudan (with special reference to Equatoria Province and with preliminary reviews of the genera *Boophilus*, *Margaropus* and *Hyalomma*). Research Report NM 005 050.29.07, Department of the Navy Bureau of Medicine and Surgery, Washington D.C., 1101 pp.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
MacLeod, J. & Mwanaumo, B. 1978. Ecological studies of ixodid ticks (Acari: Ixodidae) in Zambia. IV. Some anomalous infestation patterns in the northern and eastern regions. Bull. Entomol. Res., 68: 409–429.
Walker, J.B. 1974. The ixodid ticks of Kenya. A review of present knowledge of their hosts and distribution. Commonwealth Institute of Entomology, London, 220 pp.
Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.

102 – *A. robinsoni* Warburton, 1927 (Parasitology, 19: 405–410)

Type depository: BMNH (lectotype, paralectotypes) (Keirans and Hillyard 2001, *op. cit*. under *A. albopictum*)

Known stages: male, female

Zoogeographic Region: Australasian

Ecoregion: Lesser Sundas deciduous forests

Hosts: Squamata: Varanidae (A)

Human infestation: no

Remarks: there are records of *A. robinsoni* from several hosts in Toumanoff (1944) and Phan Trong (1977), but Anastos (1950) states that the record in Toumanoff (1944) is a misidentification, while we feel that the findings of Phan Trong (1977) need confirmation and are therefore not included in the host list above. Anastos (1950) reports the introduction of *A. robinsoni* into the Nearctic Region but there is no evidence of its establishment there. Durden and Keirans (1996) list *A. robinsoni* as an endangered species.

References

Anastos, G. 1950. The scutate ticks, or Ixodidae, of Indonesia. Entomol. Am., 30: 1–144.
Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91
Petney, T.N. & Keirans, J.E. 1995. Ticks of the genera *Amblyomma* and *Hyalomma* from South-east Asia. Trop. Biomed., 12: 45–56.
Phan Trong, C. 1977. Ve bet va con trung ky sinh o Viet Nam. Tap 1. Ve (Ixodoidea), mo ta va phan loai. Ha Noi: Khoa hoc va ky thuat, 489 pp. In Vietnamese.
Toumanoff, 1944. Les tiques (Ixodoidea) de l'Indochine. Instituts Pasteur de l'Indochine, S.I.L.I., Saigon, 220 pp

103 – *A. romitii* Tonelli-Rondelli, 1939 (Riv. Parassitol., 3: 39–55)
This species had been treated as a junior synonym of *A. extraoculatum* but was definitively resurrected by Barros-Battesti, D.M., Arzua, M., Onofrio, V.C. & Labruna, M.B. (2007. Validation and redescription of *Amblyomma romitii* Tonelli-Rondelli, 1939 (Acari: Ixodidae). Syst. Parasitol., 68: 79–86). See also *A. extraoculatum* for further details concerning the confused status of this species.

Type depository: MZNH (syntypes) (Barros-Battesti et al. 2007, *op. cit.* above)

Known stages: male, female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: Rodentia: Caviidae (AN)
Didelphimorphia: Didelphidae (A)

Human infestation: yes (Barros-Battesti et al. 2007)

Remarks: Jones et al. (1972) use the name *A. extraoculatum* instead of *A. romitii*. The nymph of this tick was recently redescribed by Martins et al. (2010) and the larva was described from laboratory-reared specimens by Barros-Battesti et al. (2012). There is a record from Testudines, under the name *A. tasquei*, by Amorim et al. (1999), but we have not included it in our list of hosts of *A. romitii* because we feel that this record requires confirmation.

References

Amorim, M., Gazêta, G.S., Peralta, A.S., Teixeira, R.H.F. & Serra-Freire, N.M. 1999. Ixodofauna de quelônios do Brasil. Rev. Univ. Rural, Ser. Cienc. Vida, 20: 31–35.

Barros-Battesti, D.M., Arzua, M., Onofrio, V.C. & Labruna, M.B. 2007. Validation and redescription of *Amblyomma romitii* Tonelli-Rondelli, 1939 (Acari: Ixodidae). Syst. Parasitol., 68: 79–86.

Barros-Battesti, D.M., Ramírez, D.G., Sampaio, J.S., Famadas, K.M., Faccini, J.L.H., Nunes, P.H., Martins, T.F., Ogrzewalska, M., Labruna, M.B., Marcili, A. & Barbieri, F.S. 2012. Description of larva of *Amblyomma romitii* (Acari: Ixodidae) by optical and scanning electron microscopy, including porotaxy and phylogenetic analysis. Exp. Appl. Acarol., 60: 271–280.

Jones, E.K., Clifford, C.M., Keirans, J.E. & Kohls, G.M. 1972. The ticks of Venezuela (Acarina: Ixodoidea) with a key to the species of *Amblyomma* in the Western Hemisphere. Brigham Young Univ. Sci. Bull. Biol. Ser., 17 (4), 40 pp.

Martins, T.F., Onofrio, V.C., Barros-Battesti, D.M. & Labruna, M.B. 2010. Nymphs of the genus *Amblyomma* (Acari: Ixodidae) of Brazil: descriptions, redescriptions, and identification key. Ticks Tick-borne Dis., 1: 75–99.

104 – *A. rotundatum* Koch, 1844 (Arch. Naturgesch., 10: 217–239)
Guglielmone, A.A. & Nava, S. (2010. Hosts of *Amblyomma dissimile* Koch, 1844 and *Amblyomma rotundatum* Koch, 1844 (Acari: Ixodidae). Zootaxa, 2541: 27–49) confuse the name *Ixodes flavomaculatum* with *Ixodes fuscomaculatus* Lucas, 1873 as a synonym of *A. rotundatum*. See remarks below.

Type depository: ZMB (holotype) (Moritz and Fischer 1981, *op. cit.* under *A. arcanum*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Nearctic, Neotropical

Ecoregions: tropical and subtropical moist broadleaf forests; few ticks in dry forests and tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for adult ticks are Anura: Bufonidae and Squamata: Boidae. Crocodilia and Mammalia are considered exceptional hosts for this tick.
Anura: Bufonidae; Squamata: Boidae, Viperidae (ANL)
Squamata: Colubridae, Iguanidae, Phrynosomatidae; Testudines: Testudinidae (AN)
Anura: Pipidae; Crocodilia: Crocodylidae; Squamata: Elapidae, Tropiduridae; Testudines: Emydidae; Mammalia (several orders) (A)
Anura: Leptodactylidae; Rodentia: Caviidae; Squamata: Teiidae; Testudines: Kinosternidae; Rodentia: Caviidae (stage unknown)

Human infestation: yes (Guglielmone and Nava 2010)

Remarks: see also *A. goeldii* for a discussion of the confusion of the female of this species with the female of *A. rotundatum.* We follow the review of Guglielmone and Nava (2010) for hosts (natural, captive and laboratory), which also summarizes the synonymy of this species, together with the study of Labruna et al. (2010), which contains new host data. Morel (1967) stresses the difficulties involved in separating females of *A. dissimile* and *A. rotundatum* in the Antilles, and his records are tentatively included in our host list. There is a valid record of *A. rotundatum*, under the name *A. goeldii*, from Myrmecophagidae in Neumann (1899). Dios and Knopoff (1934) listed several Palearctic hosts for nymphs of *A. rotundatum*, citing Brumpt (no details given) as their source. However, Brumpt (1924), who referred to this tick as *A. agamum* Aragão, 1912, stated that these were laboratory hosts and that his nymphs refused to feed on them. Burridge (2011) maintains that Dasypodidae are important hosts for *A. rotundatum*, but there is just one record from this type of host in Floch and Fauran (1958), which has been cited by several authors, none of whom present new collections from this family. Pietzsch et al. (2006) record the introduction of *A. rotundatum* into the Palearctic Region, but there is no evidence that this species has become established there. Burridge (2011) emphasizes the ability of *A. rotundatum* to feed on hosts whose origins lie outside the Nearctic and Neotropical Regions. Kolonin (2009) excludes Mammalia from his list of hosts of this tick species. Only one male of *A. rotundatum* (a parthenogenetic species) has ever been found on a natural host. This is discussed by Labruna et al. (2005).

References

Brumpt, E. (1924) Particularités évolutives de l'*Amblyomma agamum*. Ann. Parasitol. Hum. Comp., 2: 113–120.

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Dios, R.L. & Knopoff, R. 1934. Sobre Ixodoidea de la República Argentina. Rev. Inst. Bacteriol. Depto. Nac. Hyg., 6: 359–412.
Floch, H. & Fauran, P. 1958. Ixodidés de la Guyane et des Antilles Françaises. Arch. Inst. Pasteur Guyane (446), 94 pp.
Guglielmone, A.A. & Nava, S. 2010. Hosts of *Amblyomma dissimile* Koch, 1844 and *Amblyomma rotundatum* Koch, 1844 (Acari: Ixodidae). Zootaxa, 2541: 27–49.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Labruna, M.B., Terrassini, F.A. & Camargo, L.M.A. 2005. First report of the male of *Amblyomma rotundatum* (Acari: Ixodidae) from a field-collected host. J. Med. Entomol., 42: 945–947.
Labruna, M.B., Barbieri, F.S., Martins, T.F., Brito, L.G. & Ribeiro, F.D.S. 2010. New tick records in Rondônia, western Brazilian Amazon. Rev. Bras. Parasitol. Vet., 19 (3): 192–194.
Morel, P.-C. 1967. Les tiques des animaux sauvages des Antilles (Acariens, Ixodoidea). Acarologia, 9: 341–352.
Neumann, L.G. 1899. Révision de la famille des ixodidés (3e mémoire). Mém. Soc. Zool. Fr., 12: 107–294.
Pietzsch, M., Quest, R., Hillyard, P.D., Medlock, J.M. & Leach, S. 2006. Importation of exotic ticks into the United Kingdom via the international trade in reptiles. Exp. Appl. Acarol., 38: 59–65.

105 – *A. sabanerae* Stoll, 1894 (Biol. Cent. Am. Ser. Zool., pp. 1–55)
The front page of Stoll's publication bears the date range "1886–1893." Consequently, we have concluded that the year 1890, used by several authors, is not the correct date of description for *A. sabanerae* and have instead followed Hoogstraal, H. (1971. Bibliography of ticks and tick-borne diseases. From Homer (about 800 B.C.) to 31 December 1969. Special Publication of the United States Naval Medical Research Unit Number Three, Cairo, Egypt, Vol. 3, 435 pp.), and Guglielmone et al. (2003, *op. cit* under *A. americanum*), who consider 1894 the year of description of *A. sabanerae*. See also remarks below.

Type depository: ENV (syntypes) (Robinson 1926, *op. cit*. under *A. multipunctum*)

Known stages: male, female

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical broadleaf forests

Hosts: usual hosts for nymphs and adult ticks are Testudines: Emydidae. Didelphimorphia are considered exceptional hosts for this tick.
Testudines: Emydidae (ANL)
Testudines: Kinosternidae (AN)
Testudines: Testudinidae; Squamata: Boidae, Iguanidae; Didelphimorphia: Didelphidae (A)

Human infestation: yes (Bermúdez et al. 2012)

Remarks: see *A. crassum* and *A. humerale* for a discussion of the problems attending differentiation of these species from *A. sabanerae*. Given the confused taxonomy of *A. sabanerae*, we have followed Fairchild et al. (1966) and Burridge et al. (2000) in compiling our list of hosts of this species. The larva and the nymph of *A. sabanerae* remain undescribed; therefore, reported collections of these stages on Emydidae by Fairchild et al. (1966) and other authors not cited here should be considered provisionally valid. Burridge et al. (2000) cite records of *A. sabanerae* being introduced into the Nearctic Region, but there is no evidence that this tick has become established there. We doubt the Nearctic record of nymphs of *A. sabanerae* on Aves cited by Scott et al. (2001, 2010) and have excluded it from our list of hosts of this species, but the record of 2001 was not questioned by Guglielmone et al. (2003). Fairchild et al. (1966) recorded a female *A. sabanerae* crawling on but not parasitizing a human; therefore, we do not include humans in our list of hosts of this tick. See also *A. humerale.*

References

Barbieri, A.R.M., Romero, L. & Labruna, M.B. 2012. *Rickettsia belli* infecting *Amblyomma sabanerae* ticks in El Salvador. Pathog. Global Health, 106: 188–189.

Bermúdez, S.E., Castro, A., Esser, M., Liefting, Y., García, G. & Miranda, R.J. 2012. Ticks (Ixodida) on humans from central Panama, Panama. Exp. Appl. Acarol., 58: 81–88.

Burridge, M.J., Simmons, L.-A. & Allan, S.A. 2000. Introduction of potential heartwater vectors and other exotic ticks into Florida on imported reptiles. J. Parasitol., 86: 700–704.

Fairchild, G.B., Kohls, G.M. & Tipton, V.J. 1966. The ticks of Panama (Acarina: Ixodoidea). *In* W.R. Wenzel & V.J. Tipton (editors), Ectoparasites of Panama. Field Museum of Natural History, Chicago, pp. 167–219.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Scott, J.D., Fernando, K., Banerjee, S.N., Durden, L.A., Byrne, S.K., Banerjee, M., Mann, R.B. & Morshed, M.G. 2001. Birds disperse ixodid (Acari: Ixodidae) and *Borrelia burgdorferi*-infected ticks in Canada. J. Med. Entomol., 38: 493–500.

Scott, J.D., Lee, M.-K., Fernando, K., Durden, L.A., Jorgensen, D.R., Mak, S. & Morshed, M.G. 2010. Detection of Lyme disease spirochete, *Borrelia burgdorferi* sensu lato, including three novel genotypes in ticks (Acari: Ixodidae) collected from songbirds (Passeriformes) across Canada. J. Vector Ecol., 35: 124–139.

106 – *A. scalpturatum* Neumann, 1906 (Arch. Parasitol., 10: 195–219)
See *A. latepunctatum.*

Type depository: BMNH (holotype) (Neumann, L.G. 1906. Notes sur les Ixodidés. IV.Arch. Parasitol., 10: 195–219), but Keirans and Hillyard (2001, *op. cit*. under *A. albopictum*) do not list the holotype of *A. scalpturatum* in BMNH. The holotype of *A. scalpturatum* is probably held together with a male of the syntype series of *A. incisum.* See *A. incisum.*

Known stages: male, female, nymph

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical moist broadleaf forests; few ticks in tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts of adult ticks are Perissodactyla: Tapiridae.
Artiodactyla: Suidae (AN)
Perissodactyla: Tapiridae; Pilosa: Myrmecophagidae (A)
Carnivora: Canidae (N)

Human infestation: yes (Guglielmone et al. 2006)

Remarks: records of this species published before Labruna et al. (2005) are ignored here because of uncertainty concerning their validity. Camicas et al. (1998) list the nymph of *A. scalpturatum* as undescribed, but it was recently described by Martins et al. (2010). Kolonin (2009) excludes Suidae as hosts for adult *A. scalpturatum*, but there are *bona fide* records of this association in the redescription of this species by Labruna et al. (2005). Rodríguez and Flores (2003) cite a record of *A. scalpturatum* on goats in Venezuela, but this requires confirmation and was not included in our host list above.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Guglielmone, A.A., Beati, L., Barros-Battesti, D.M., Labruna, M.B., Nava, S., Venzal, J.M., Mangold, A.J., Szabó, M.P.J., Martins, J.R., González-Acuña, D. & Estrada-Peña, A. 2006. Ticks (Ixodoidea) on humans in South America. Exp. Appl. Acarol., 40: 83–100.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Labruna, M.B., Keirans, J.E., Camargo, L.M.A., Ribeiro, A.F., Soares, R.M. & Camargo, E.P. 2005. *Amblyomma latepunctatum*, a valid tick species (Acari: Ixodidae) long misidentified with both *Amblyomma incisum* and *Amblyomma scalpturatum*. J. Parasitol., 91: 527–541.

Martins, T.F., Onofrio, V.C., Barros-Battesti, D.M. & Labruna, M.B. 2010. Nymphs of the genus *Amblyomma* (Acari: Ixodidae) of Brazil: descriptions, redescriptions, and identification key. Ticks Tick-borne Dis., 1: 75–99.

Rodríguez, R. & Flores, A. 2003. Identificación y prevalencia de garrapatas (Acari: Ixodidae) en caprinos del semi-árido falconiano. Vet. Trop., 28: 169–175.

107 – *A. scutatum* Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)
See remarks below.

Type depositories: ZSH, BMNH (syntypes) (Neumann, 1899, *op. cit.* under *A. albopictum*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical dry broadleaf forests

Hosts: usual hosts for nymphs and adults are Squamata: Iguanidae, while Aves and Mammalia are considered exceptional hosts for this tick.
Squamata: Iguanidae (ANL)
Artiodactyla: Cervidae (AN)
Squamata: Boidae, Teiidae, Viperidae; Pilosa: Myrmecophagidae (A)
Chiroptera: Noctilionidae; Didelphimorphia: Didelphidae; Rodentia: Dasyproctidae; Falconiformes: Cathartidae (N)

Human infestation: no

Remarks: Camicas et al. (1998) list the nymph and larva of this species as undescribed, but Hoffmann (1946) described both stages under the name *A. boneti* Hoffmann, 1946. Camacho Escobar and Pérez-Lara (2009) provide a figure of an alleged male of *A. scutatum*, but their figure appears to be a nymphal tick. Kolonin (2009) limits the hosts of *A. scutatum* to iguanas, lizards and snakes, but the references below include a broad range of hosts for this tick. The above records from Cervidae, Noctilionidae, Didelphidae, Dasyproctidae and Cathartidae are taken from Neumann's (1899) original description of *A. scutatum*, although these now appear to be unusual hosts for this tick. However, we have no reason to consider these records invalid. Records on hosts other than Iguanidae are regarded as provisionally valid, but a record from Anura by Walton (1964) is doubtful, as discussed in Guglielmone et al. (2003). We do not include anurans in our host list. This Neotropical species has been introduced into the Nearctic Region, as stated in Keirans and Durden (2001), and the Palearctic Region (Neumann 1899), but there is no evidence of its establishment in those regions.

References

Camacho Escobar, M.A. & Pérez-Lara, E. 2009. Ectoparásitos de iguana verde (*Iguana iguana*) y negra (*Ctenosaura pectinata*) en condiciones de crianza intensiva en la costa de Oaxaca, México. Cienc. Mar, 13: 15–22.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Díaz Ungría, C. 1957. Nota sobre las especies de Acarina de Venezuela. Rev. San. Asist. Soc., 22: 457–467.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication

of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.
Hoffmann, A. 1946. *Amblyomma boneti* n. sp. de México. Rev. Inst. Salubr. Enf. Trop., 7: 207–220.
Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Neumann, L.G. 1899. Révision de la famille des ixodidés (3e mémoire). Mém. Soc. Zool. Fr., 12: 107–294.
Paredes León, R. 2003. Análisis preliminar de los ácaros ectoparásitos de la iguana negra (*Ctenosaura pectinata*) en una población silvestre del estado de Oaxaca. Mem. 6º Taller Nac. Iguanas, mayo 2003, Puerto de Veracruz, Veracruz, México, pp. 65–74.
Walton, A.C. 1964. Miscellaneous parasites of the Bufonidae (Amphibia). J. Parasitol. (Sect. 2, Suppl.): 18–19.

108 – *A. soembawense* (Anastos, 1956) (J. Parasitol., 42: 306–310)
Kolonin (2009, *op. cit.* under *A. arcanum*) classifies this species in the genus *Aponomma*.

Type depository: USNTC (holotype, paratype) (Keirans and Clifford 1984, *op. cit.* under *A. calcaratum*) as *Aponomma soembawensis*

Known stages: male, female, larva

Zoogeographic Region: Australasian

Ecoregion: Lesser Sundas deciduous forests

Hosts: usual hosts for adult ticks are Squamata: Varanidae
Squamata: Varanidae (AN)
Squamata: Boidae (A)

Human infestation: no

Remarks: Camicas et al. (1998) state that the larva of *A. soembawense* is undescribed, but it was described as *A. soembawensis* in Kadarsan (1971). The nymph of *A. soembawense* remains undescribed but we found a *bona fide* record of this stage in Kaufman (1972) that had been determined by the author of this species. Kolonin (2009) ignores Boidae as hosts for this tick, but there is a good record of *A. soembawense* in Kaufman (1972). Kaufman (1972) recorded the introduction of *A. soembawense* into the Oriental Region but there is no evidence of its establishment there. The authors cited below classify this species in the genus *Aponomma*.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Kadarsan, S. 1971. Larval ixodid ticks of Indonesia (Acarina: Ixodidae). Ph.D. Dissertation, University of Maryland, 182 pp.
Kaufman, T.S. 1972. A revision of the genus *Aponomma* Neumann, 1899 (Acarina: Ixodidae). Ph.D. Dissertation, University of Maryland, 390 pp.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

109 – *A. sparsum* Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)
See remarks below.

Type depository: MNHN (holotype) (Neumann 1899, *op. cit.* under *A. albopictum*).
See remarks below.

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: Aves and Macroscelididae are considered exceptional hosts for this tick.
Testudines: Testudinidae; Mammalia (several orders) (ANL)
Squamata: Varanidae, Boidae (AN)
Squamata: Agamidae, Colubridae, Viperidae (A)
Squamata: Elapidae, Iguanidae; Passeriformes: Viduidae (NL)
Macroscelidea: Macroscelididae; Coraciiformes: Upupidae (N)
Galliformes: Numididae (stage unknown)

Human infestation: yes (Gomes 1993)

Remarks: the nymph of *A. sparsum* is considered undescribed by Voltzit and Keirans (2003), but it was described in Van der Borght-Elbl (1977) from laboratory-reared material. Burridge (2001), Kenny et al. (2004) and Takano et al. (2010) report introductions of *A. sparsum* into the Nearctic and Palearctic Regions, but this species has apparently failed to become established outside the Afrotropical Region. Notably, the holotype of *A. sparsum* was collected in the menagerie of the Museum National d'Histoire Naturelle (Paris) on *Spilotes pullatus* (named *Spilotes variabilis*) (Neumann 1899), meaning that an Afrotropical tick was described from a Neotropical host in the Palearctic Region. Burridge (2001) also includes records from Neotropical hosts, demonstrating the ability of *A. sparsum* to adapt to non-Afrotropical hosts. Theiler (1959) described unspecified stages of *A. sparsum* found on Numididae, but Theiler (1962) later states that adults of this tick were found on guinea fowls. We accept the status of Numididae as hosts for *A. sparsum*, but it should be noted that no parasitic stage of this tick has been associated with these hosts in the list above. Theiler (1959) cites a doubtful record of adults of *A. sparsum* from "*Turacus*" sp. (= "*Tauraco*" sp.?) that is not included in subsequent reviews of this tick and has therefore been excluded from our host list. Kolonin (2009) does not include Aves as hosts of *A. sparsum*, but the references below indicate that birds are sometimes infested with this tick. Matthysse and Colbo (1987) hypothesize that the pattern of host utilization and the distribution of *A. sparsum* populations indicate that more than one species may be included under this name.

References

Burridge, M.J. 2001. Ticks (Acari: Ixodidae) spread by the international trade in reptiles and their potential roles in dissemination of diseases. Bull. Entomol. Res., 91: 3–23.

Gomes, A.F. 1993. The tick vectors of cowdriosis in Angola. Rev. Élev. Méd. Vét. Pays Trop., 46: 237–243.

Kenny, M.J., Shaw, S.E., Hillyard, P.D. & Forbes, A.B. 2004. Ectoparasite and haemoparasite risks associated with imported exotic reptiles. Vet. Rec., 154: 434–435.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Matthysse, J.G. & Colbo, M.H. 1987. The ixodid ticks of Uganda. Entomological Society of America, College Park, Maryland, 426 pp.

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Neumann, L.G. 1899. Révision de la famille des ixodidés (3e mémoire). Mém. Soc. Zool. Fr., 12: 107–294.

Takano, A., Goka, K., Une, Y., Shimada, Y., Fujita, H., Shiino, T., Watanabe, H. & Kawabata, H. 2010. Isolation and characterization of a novel *Borrelia* group of tick-borne borreliae from imported reptiles and their associated ticks. Environ. Microbiol., 12: 134–146.

Theiler, G. 1959. African ticks and birds. Ostrich (Suppl. 3), 3: 353–378.

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

Van der Borght-Elbl, A. 1977. Ixodid ticks (Acarina: Ixodidae) of Central Africa. Vol. V. The larval and nymphal stages of the more important species of the genus *Amblyomma* Koch, 1844. Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (222), 158 pp.

Voltzit, O.V. & Keirans, J.E. 2003. A review of African *Amblyomma* species (Acari, Ixodida, Ixodidae). Acarina, 11: 135–214.

Walker, J.B. 1974. The ixodid ticks of Kenya. A review of present knowledge of their hosts and distribution. Commonwealth Institute of Entomology, London, 220 pp.

110 – *A. sphenodonti* (Dumbleton, 1943) (N. Zeal. J. Sci. Technol. Sect. B, 24 (4): 185–190)

Kolonin (2009, *op. cit.* under *A. arcanum*) classifies this species in the genus *Aponomma*, while Miller, H.C., Conrad, A.M., Barker, S.C. & Daugherty, C.H. (2007. Distribution and phylogenetic analysis of an endangered tick, *Amblyomma sphenodonti*. N. Zeal. J. Zool., 34: 97–105) maintain that this species should be classified in a genus other than *Amblyomma*. See also remarks below.

Type depositories: CI (holotype), CG (paratype) (Kaufman 1972 *op. cit.* under *A. fimbriatum*) as *Aponomma sphenodonti*

Known stages: male, female, nymph, larva.

Zoogeographic Region: Australasian

Ecoregion: Richmond temperate forest

Hosts: usual hosts for larvae, nymphs and adults are Sphenodontidae; Squamata are exceptional hosts.
Rhynchocephalia: Sphenodontidae (ANL)
Squamata: Gekkonidae (A)

Human infestation: no

Remarks: Siuda et al. (2005) cite records of the introduction of *A. sphenodonti* into the Palearctic Region but there is no evidence of its establishment in that region. There are records of females, a nymph and larvae from a dog in Poland, under the name *Aponomma ludovici* Siuda, 1972. However, Siuda (1982) corrected the information in Siuda (1972) because he found that the specimens of *A. ludovici* were in fact *A. sphenodonti* and the hosts unknown. Therefore, Carnivora are excluded as hosts of this species. Durden and Keirans (1996) list this tick as an endangered species. The authors cited below refer to this tick as *Aponomma sphenodonti*.

References

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.

Heath, A.C.G. 2006. A reptile tick, *Aponomma sphenodonti* Dumbleton (Acari: Ixodidae), parasitic on tuatara, *Sphenodon punctatus* Gray (Reptilia: Rhynchocephalia), in New Zealand: observations on its life history and biology. Syst. Appl. Acarol., 11: 3–12.

Siuda, K. 1972. New species of a tick – *Aponomma ludovici* n. sp. (Acarina, Ixodidae) collected in Poland. Wiad. Parazytol., 18: 735–743.

Siuda, K. 1982. *Aponomma ludovici* Siuda, 1972 as a junior synonym of *Aponomma sphenodonti* Dumbleton, 1943, (Acarina: Ixodides: Ixodidae). Wiad. Parazytol., 28: 423–425.

Siuda, K., Nowak, M., Karbowiak, G. & Solarz, K. 2005. Transfer of exotic ticks (Acari, Ixodida) on hosts to Poland. Vest. Zool. (Suppl. 19): 336–338.

111 – *A. splendidum* Giebel, 1877 (Z. Ges. Naturw., 49: 293–295)

Type depository: unknown

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Artiodactyla: Bovidae, Suidae (ANL)
Proboscidea: Elephantidae (A)
Carnivora: Canidae; Rodentia: Thryonomyidae; Galliformes: Numididae (NL)
Galliformes: Phasianidae (L)

Human infestation: no

Remarks: there is a record of *A. splendidum* introduced into the Nearctic Region, but no evidence that it has become established there. Voltzit and Keirans (2002) and Kolonin (2009) state that the larva and nymph of *A. splendidum* are undescribed, but Van der Borght-Elbl (1977) provides descriptions of both tick stages.

References

Elbl, A. & Anastos, G. 1966. Ixodid ticks (Acarina: Ixodidae) of Central Africa. Vol. I. General introduction. Genus *Amblyomma*. Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (145), 275 pp.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Robinson, L.E. 1926. Ticks. A monograph of the Ixodoidea. Part IV. The genus *Amblyomma*. Cambridge University Press, London, 302 pp.

Van der Borght-Elbl, A. 1977. Ixodid ticks (Acarina: Ixodidae) of Central Africa. Vol. V. The larval and nymphal stages of the more important species of the genus *Amblyomma* Koch, 1844. Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (222), 158 pp.

Voltzit, O.V. & Keirans, J.E. 2003. A review of African *Amblyomma* species (Acari, Ixodida, Ixodidae). Acarina, 11: 135–214.

112 – *A. squamosum* Kohls, 1953 (J. Parasitol., 39: 264–267)

Type depository: USNTC (holotype, paratypes) (Keirans and Clifford 1984, *op. cit.* under *A. calcaratum*)

Known stages: female, nymph

Zoogeographic Region: Oriental

Ecoregion: Marianas tropical dry forest

Hosts: Squamata: Varanidae (AN)

Human infestation: no

Remarks: Camicas et al. (1998) regard pholeophilic (burrowing) mammals as hosts for the immature stages of this species, but we found no *bona fide* records from such hosts. These authors also state that *A. squamosum* is found in the Australasian Region, but the only locality for this tick (Guam) is treated here as part of the Oriental Region. Durden and Keirans (1996) list *A. squamosum* as an endangered species.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91

Kohls, G.M. 1953. Notes on the ticks of Guam with the description of *Amblyomma squamosum* n. sp. (Acarina: Ixodidae). J. Parasitol., 39: 264–267.

113 – *A. supinoi* Neumann, 1905 (Arch. Parasitol., 9: 225–241).

Type depository: probably in GM, but not stated in Supino, F. (1897. Nuovi *Ixodes* della Birnania (nota preventive). Atti Soc. Veneto-Trentina Sci. Nat. Residente Padova, Ser. 2, 3: 230–238), as *Ixodes testudinis*, a name preoccupied by *Ixodes testudinis* Leydig, 1855 and *Ixodes testudinis* Conil, 1877 and consequently renamed.

Known stages: male, female, nymph

Zoogeographic Region: Oriental

Ecoregions: tropical and subtropical dry broadleaf forests

Hosts: usual hosts for adult ticks are Testudines: Testudinidae; Mammalia are considered exceptional hosts for this tick.
Testudines: Testudinidae, Emydidae; Squamata, Varanidae; Carnivora: Herpestidae; Rodentia: Hystricidae (A)
Testudines (unknown order) (N)

Human infestation: no

Remarks: see *A. argentinae*. Camicas et al. (1998) state that the nymph of *A. supinoi* is undescribed. It was subsequently described in Voltzit and Keirans (2002) using nymphs collected from "tortoise." We regard the record of *A. supinoi* on Herpestidae in Tanskul et al. (1983) as well as the record on Hystricidae in Voltzit and Keirans (2002) as exceptional. Mihalca et al. (2011) list *A. supinoi* as an endangered species.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

Robbins, R.G. & Platt, S.G. 2001. First report of *Amblyomma supinoi* Neumann (Acari: Ixodida: Ixodidae) from the Arakan forest turtle, *Geoemyda depressa* Anderson (Reptilia: Testudines: Emydidae), with additional records of this tick from the Union of Myanmar. Proc. Entomol. Soc. Wash., 103: 1023–1024.

Robinson, L.E. 1926. Ticks. A monograph of the Ixodoidea. Part IV. The genus *Amblyomma*. Cambridge University Press, London, 302 pp.
Tanskul, P., Stark, H.E. & Inlao, I. 1983. A checklist of ticks of Thailand (Acari: Metastigmata:Ixodoidea). J. Med. Entomol., 20: 330–341.
Voltzit, O.V. & Keirans, J.E. 2002. A review of Asian *Amblyomma* species (Acari, Ixodida, Ixodidae). Acarina, 10: 95–136.

114 – *A. sylvaticum* (de Geer, 1778) (Mémoire pour servir à l'histoire des insectes, vol. 7, P. Hesselberg, Stockholm, 950 pp)

Type depository: undetermined, as *Acarus sylvaticus*

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: mediterranean forests, woodlands and scrub

Hosts: usual hosts for larvae, nymphs and adults are Testudines: Testudinidae. Mammalia are considered exceptional hosts for this tick.
Testudines: Testudinidae (ANL)
Squamata: Colubridae (AN)
Rodentia: Muridae; Squamata: Agamidae, Lacertidae (L)

Human infestation: no

Remarks: a record of *A. sylvaticum* from the Nearctic Region is cited in Keirans and Durden (2001), but this species has not become established in that region. There is an unusual but *bona fide* record of *A. sylvaticum* on Rodentia in Matthee et al. (2007), although this category of hosts is ignored in Kolonin (2009). Theiler (1943) notes a case of mislabeling in the Vienna Museum, where a tube of *A. sylvaticum* is alleged to have come from an American scorpion.

References

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.
Horak, I.G., McKay, I.J., Henen, B.T., Heyne, H., Hofmeyr, M.D. & De Villiers, A.L. 2006. Parasites of domestic and wild animals in South Africa. XLVII. Ticks of tortoises and other reptiles. Onderstepoort J. Vet. Res., 73: 215–227.
Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Matthee, S., Horak, I.G., Beaucournu, J.-C., Durden, L.A., Ueckermann, E.A. & McGeoch, M.A. 2007. Epifaunistic arthropod parasites of the four-striped mouse, *Rhabdomys pumilio*, in the Western Cape Province, South Africa. J. Parasitol., 93: 47–59.

Theiler, G. 1943. Ticks in the South African Zoological Survey Collection. Part II. Onderstepoort J. Vet. Sci. Anim. Ind., 18: 85–89.
Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.
Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.

115 – *A. tapirellum* Dunn, 1933 (Parasitology, 25: 353–358)

Type depositories: USNTC (holotype, paratype), MCZ, GML (paratypes) (Dunn 1933, *op. cit.* under *A. pecarium*, MCZ website (http://mczbase.mcz.harvard.edu/ accessed April 4,2013)

Known stages: male, female

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: Perissodactyla: Tapiridae (AN)
Mammalia (several orders) (A)

Human infestation: yes (Bermúdez et al. 2012)

Remarks: the nymph of *A. tapirellum* remains undescribed but we tentatively accept the record of a nymph on Tapiridae in Fairchild et al. (1966). The *A. tapirellum* found on Chiroptera is regarded as "stray" by Fairchild et al. (1966), and it is not included in Kolonin (2009).

References

Bermúdez, S.E., Miranda, R.J. & Smith, D. 2010. Tick species (Ixodida) in the Summit Municipal Park and adjacent areas, Panama City, Panama. Exp. Appl. Acarol., 52: 439–448.
Bermúdez, S.E., Castro, A., Esser, M., Liefting, Y., García, G. & Miranda, R.J. 2012. Ticks (Ixodida) on humans from central Panama, Panama. Exp. Appl. Acarol., 58: 81–88.
Dunn, L.H. 1933. Two new species of ticks from Panama (*Amblyomma tapirellum* and *A. pecarium*). Parasitology, 25: 353–358.
Fairchild, G.B., Kohls, G.M. & Tipton, V.J. 1966. The ticks of Panama (Acarina: Ixodoidea). *In* W.R. Wenzel & V.J. Tipton (editors), Ectoparasites of Panama. Field Museum of Natural History, Chicago, pp. 167–219.
Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

116 – *A. testudinarium* Koch, 1844 (Arch. Naturgesch., 10: 217–239)

Type depository: ZMB (holotype) (Moritz and Fischer 1981, *op. cit.* under *A. arcanum*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Australasian, Oriental, Palearctic

Ecoregions: tropical and subtropical dry broadleaf forests

Hosts: Anura: Microhylidae are considered exceptional hosts for this tick.
Mammalia (several orders); Squamata: Varanidae (ANL)
Squamata: Boidae; Testudines: Emydidae (A)
Charadriiformes: Scolopacidae; Galliformes: Phasianidae (NL)
Passeriformes: Corvidae; Squamata: Colubridae (N)
Anura: Microhylidae (L)

Human infestation: yes (Durden et al. 2008 among others)

Remarks: Camicas et al. (1998) state that this tick species is found in the Oriental and Palearctic Regions, but the record from Sulawesi in Anastos (1950) shows that *A. testudinarium* is also an Australasian species. Keirans and Durden (2001) cite a record of *A. testudinarium* from the Nearctic Region, but no evidence exists of its establishment there. Kolonin (2009) ignores Anura as hosts for *A. testudinarium*; indeed, this is a rare host-parasite relationship, recorded in Yamaguti et al. (1971).

References

Anastos, G. 1950. The scutate ticks, or Ixodidae, of Indonesia. Entomol. Am., 30: 1–144.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Durden, L.A., Merker, S. & Beati, L. 2008. The tick fauna of Sulawesi, Indonesia (Acari: Ixodoidea: Argasidae and Ixodidae). Exp. App. Acarol., 45: 85–110.

Fujita, H. & Tsuboi, Y. 2000. A survey of ixodid ticks (Acari: Ixodidae) including a list of all known species of Okinawajima island, Japan. J. Acarol. Soc. Jap., 9: 45–59.

Hoogstraal, H., Lim, B.L., Nadchatram, M. & Anastos, G. 1972. The Gunong Benom Expedition 1967. 8. Ticks (Ixodidae) of Gunong Benom and their altitudinal distribution, hosts and medical relationships. Bull. Br. Mus. (Nat. Hist.) Zool., 23: 167–186.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kitaoka, S. & Suzuki, H. 1974. Reports of medico-zoology investigations in the Nansei Islands. Part 2. Ticks and their seasonal prevalences in southern Amami-oshima. Jap. J. Sanit. Zool., 26: 21–26.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Kohls, G.M. 1957. Malaysian parasites. XVIII. Ticks (Ixodoidea) of Borneo and Malaya. Malaya (28): 65–94.
Phan Trong, C. 1977. Ve bet va con trung ky sinh o Viet Nam. Tap 1. Ve (Ixodoidea), mo ta va phan loai. Ha Noi: Khoa hoc va ky thuat, 489 pp. In Vietnamese.
Yamaguti, N., Tipton, V.J., Keegan, H.L. & Toshioka, S. 1971. Ticks of Japan, Korea, and the Ryukyu Islands. Brigham Young Univ. Sci. Bull. Biol. Ser., 15 (1), 226 pp.
Yamauchi, T., Yano, S., Yamamoto, T., Yamamoto, E. & Miyamoto, T. 2013. Ticks (Acari: Ixodidae) from medium-sized to large mammals in Ehime Prefecture, Japan. Exp. Appl. Acarol., 60: 263–270.

117 – *A. tholloni* Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)

Type depository: MNHN (syntypes) (Neumann 1899, *op. cit.* under *A. albopictum*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical dry broadleaf forests

Hosts: usual hosts for adult ticks are Proboscidea: Elephantidae.
Artiodactyla: Bovidae, Hippopotamidae; Proboscidea: Elephantidae; Passeriformes: Pittidae (ANL)
Artiodactyla: Suidae; Carnivora: Felidae (AN)
Testudines: Testudinidae (A, N and/or L)
Carnivora: Canidae, Herpestidae; Perissodactyla: Equidae, Rhinocerotidae; Squamata (unknown family) (A)
Squamata: Chamaeleonidae; Falconiformes: Accipitridae; Musophagiformes: Musophagidae (N)

Human infestation: yes (Okino et al. 2007)

Remarks: Keirans and Durden (2001) and Okino et al. (2007) cite records of the introduction of *A. tholloni* into the Nearctic and Palearctic Regions, respectively, but there is no evidence that this tick has become established in either region. Theiler (1962) uses the term "immatures" without specifying whether it refers to larvae, nymphs or both tick stages. Kolonin (2009) excludes Aves, Squamata and Testudines as hosts for *A. tholloni*, but the references below contain *bona fide* records of this tick on these hosts. Mihalca et al. (2011) list this tick as endangered. See also *A. paulopunctatum*.

References

Aeschlimann, A. 1967. Biologie et écologie des tiques (Ixodoidea) de Côte d'Ivoire. Acta Trop., 24: 281–405.
Elbl, A. & Anastos, G. 1966. Ixodid ticks (Acarina: Ixodidae) of Central Africa. Vol. I. General introduction. Genus *Amblyomma*. Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (145), 275 pp.

Hoogstraal, H. 1956. African Ixodoidea. I. Ticks of the Sudan (with special reference to Equatoria Province and with preliminary reviews of the genera *Boophilus, Margaropus* and *Hyalomma*). Research Report NM 005 050.29.07, Department of the Navy Bureau of Medicine and Surgery, Washington D.C., 1101 pp.

Horak, I.G., Braack, L.E.O., Fourie, L.J. & Walker, J.B. 2000. Parasites of domestic and wild animals in South Africa. XXXVIII. Ixodid ticks collected from 23 wild carnivore species. Onderstepoort J. Vet. Res., 67: 239–250.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

MacKenzie, P.K.I. & Norval, R.A.I. 1980. The transmission of *Cowdria ruminantium* by *Amblyomma tholloni*. Vet. Parasitol., 7: 265–268.

Matthysse, J.G. & Colbo, M.H. 1987. The ixodid ticks of Uganda. Entomological Society of America, College Park, Maryland, 426 pp.

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

Norval, R.A.I. 1983. The ticks of Zimbabwe. VII. The genus *Amblyomma*. Zimbabwe Vet. J., 14:3–18.

Okino, T. Ushirogawa, H., Matoba, K. & Hatsushika, R. 2007. A bibliographical study of human cases of hard tick (Acarina: Ixodidae) bites received abroad and found in Japan. Kawasaki Med. J., 33: 189–194.

Petney, T.N., Horak, I.G. & Rechav, Y. 1987. The ecology of the African vectors of heartwater, with particular reference to *Amblyomma hebraeum* and *Amblyomma variegatum*. Onderstepoort J. Vet. Res., 54: 381–395.

Robinson, L.E. 1926. Ticks. A monograph of the Ixodoidea. Part IV. The genus *Amblyomma*. Cambridge University Press, London, 302 pp.

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

Van der Borght-Elbl, A. 1977. Ixodid ticks (Acarina: Ixodidae) of Central Africa. Vol. V. The larval and nymphal stages of the more important species of the genus *Amblyomma* Koch, 1844. Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (222), 158 pp.

Yeoman, G.H. & Walker, J.B. 1967. The ixodid ticks of Tanzania. Commonwealth Institute of Entomology, London, 215 pp.

118 – *A. tigrinum* Koch, 1844 (Arch. Naturgesch., 10: 217–239)
See remarks below.

Type depository: ZMB (holotype) (Moritz and Fischer 1981, *op. cit.* under *A. arcanum*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical dry broadleaf forests; tropical and subtropical grasslands, savannas and shrublands; Central Andean dry puna

Hosts: usual hosts for adult ticks are Carnivora: Canidae; usual hosts for nymphs are Rodentia: Caviidae.
Rodentia: Caviidae, Cricetidae (ANL)
Carnivora: Canidae (AN)
Carnivora: Felidae (AL)
Artiodactyla (several families); Perissodactyla: Equidae (A)
Aves (several orders) (NL)
Rodentia: Muridae (L)
Carnivora: Procyonidae; Cingulata: Dasypodidae (stages unknown)

Human infestation: yes (Guglielmone et al. 2007)

Remarks: Masi Pallarés and Benítez Usher (1982) allegedly found nymphs and larvae of *A. tigrinum* on a variety of mammals, but we regard these records as doubtful because they were published long before the description of the preimaginal stages by Estrada-Peña et al. (1993). They consequently are not included in our host list for this species. The figures in Aragão and Fonseca (1961) labeled *A. tigrinum* in fact represent *A. triste*. The nymph of *A. tigrinum* has recently been redescribed by Martins et al. (2010). See also *A. maculatum* and *A. triste*.

References

Aragão, H. B. & Fonseca, F. da 1961. Nota de ixodologia. VIII. Lista e chave para os representantes da fauna ixodológica brasileira. Mem. Inst. Oswaldo Cruz, 59: 115–129.

Durden, L.A., Cunningham, M.W., McBride, R. & Ferree, B. 2006. Ectoparasites of free-ranging pumas and jaguars in the Paraguayan Chaco. Vet. Parasitol., 137: 189–193.

Estrada-Peña, A., Guglielmone, A.A., Mangold, A.J. & Castellá, J. 1993. A description of *Amblyomma tigrinum* Koch, *A. neumanni* Ribaga and *A. testudinis* (Conil) immatures (Acarina: Ixodidae). Folia Parasitol., 40: 147–153.

Floch, H. & Fauran, P. 1958. Ixodidés de la Guyane et des Antilles Françaises. Arch. Inst. Pasteur Guyane (446), 94 pp.

González-Acuña, D., Venzal, J., Skewes-Ramm, O., Rubilar-Contreras, L., Daugschies, A. & Guglielmone, A.A. 2004. First record of immature stages of *Amblyomma tigrinum* (Acari: Ixodidae) on wild birds in Chile. Exp. Appl. Acarol., 33: 153–156.

Guglielmone, A.A., Mangold, A.J., Luciani, C.E., & Viñabal, A.E. 2000. *Amblyomma tigrinum* (Acari: Ixodidae) in relation to phytogeography of central-northern Argentina with notes on hosts and seasonal distribution. Exp. Appl. Acarol., 24: 983–989.

Guglielmone, A.A., Nava, S., Mangold, A.J. & Caparrós, J.A. 2007. Las garrapatas del norte de Córdoba, Argentina. Rev. Med. Vet. (Buenos Aires), 88: 57–61.

Jones, E.K., Clifford, C.M., Keirans, J.E. & Kohls, G.M. 1972. The ticks of Venezuela (Acarina: Ixodoidea) with a key to the species of *Amblyomma* in the Western Hemisphere. Brigham Young Univ. Sci. Bull. Biol. Ser., 17 (4), 40 pp.

Labruna, M.B., Jorge, R.S.P., Sana, D.A., Jácomo, A.T.A., Kashivakura, C.K., Furtado, M.M., Ferro, C., Perez, S.A., Silveira, L., Santos, T.S., Marques, S.R., Morato, R.G., Nava, A., Adania, C.H., Teixeira, R.H.F., Gomes, A.A.B., Conforti, V.A., Azevedo, F.C.C., Prada, C.S., Silva, J.C.R., Batista, A.F., Marvulo, M.F.V. , Morato, R.L.G., Alho, C.J.R., Pinter, A., Ferreira, P.M., Ferreira, F. & Barros-Battesti, D.M. 2005. Ticks (Acari: Ixodida) on wild carnivores in Brazil. Exp. Appl. Acarol., 36: 149–163.

Martins, T.F., Onofrio, V.C., Barros-Battesti, D.M. & Labruna, M.B. 2010. Nymphs of the genus *Amblyomma* (Acari: Ixodidae) of Brazil: descriptions, redescriptions, and identification key. Ticks Tick-borne Dis., 1: 75–99.

Masi Pallarés, R. & Benítez Usher, C.A. 1982. De la distribución de Ixodina (Vander Hammen, 1968) en el Paraguay. Rev. Paraguaya Microbiol., 17: 49–52.

Mauri, R. &, Navone, G.T. 1993. Ectoparásitos (Siphonaptera y Acari) más comunes en Dasypodidae (Mammalia: Xenarthra) de la República Argentina. Rev. Soc. Entomol. Arg., 52: 121–122.

Nava, S., Mangold, A.J. & Guglielmone, A.A. 2006. The natural hosts of larvae and nymphs of *Amblyomma tigrinum* Koch, 1844 (Acari: Ixodidae). Vet. Parasitol., 140: 124–132.

Venzal, J.M., Castro, O., Cabrera, P.A., Souza, C.G. de & Guglielmone, A.A. 2003. Las garrapatas de Uruguay: especies, hospedadores, distribución e importancia sanitaria. Veterinaria (Montevideo), 38: 17–28.

119 – *A. torrei* Pérez Vigueras, 1934 (Psyche, 41: 13–18)
See remarks below.

Type depositories: MCZ (paratype), USNPC ("type") (Salley, E.J., Lichtenfels, J.R. & Shaw, J.H. 1978. Index-catalogue of medical and veterinary zoology. Special publication 3. Checklist of types in the U.S. National Parasite Collection, United States Department of Agriculture, U. S. Government Printing Office, Washington., 230 pp.) recognize a "type" in the USNPC. The MCZ website (http://mczbase.mcz.harvard.edu/ accessed April 4, 2013) indicates the presence of a paratype in its collection

Known stages: male, female, nymph, larva

Zoogeographic Regions: Nearctic, Neotropical

Ecoregions: tropical and subtropical moist broadleaf forests and mangroves

Hosts: Anura are considered exceptional hosts for this tick.
Squamata: Iguanidae (ANL)
Squamata: Tropiduridae (N)
Anura: Bufonidae; Squamata: Polychrotidae (stages unknown)

Human infestation: no

Remarks: Camicas et al. (1998) state that only the male of this species is known, but we found valid descriptions of the other stages in Whittick (1939) and Černý (1969). Camicas et al. (1988) and Guglielmone et al. (2003) maintain that this species occurs only in the Neotropical Region, but Durden and Knapp (2005) present good records for the Nearctic Region. Separating *A. torrei* from *A. cruciferum* can be difficult, as discussed in Guglielmone et al. (2003), who recommend reexamination of all specimens and comparison of the types. Capriles and Gaud (1977) cite a record of *A. torrei* on Canidae that we consider doubtful; it has not been included in our list of hosts of this species. Mihalca et al. (2011) list this tick as endangered.

References

Barros-Battesti, D.M., Reyes Hernández, M., Famadas, K.M., Onofrio, V.C., Beati, L. & Guglielmone, A.A. 2009. The ixodid ticks (Acari: Ixodidae) of Cuba. Syst. Parasitol., 14: 101–128.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Capriles, J.M. & Gaud, S.M. 1977. The ticks of Puerto Rico (Arachnida: Acarina). J. Agric. Univ. Puerto Rico, 61: 402–404.

Černý, V. 1969. Nuevos conocimientos sobre la ixodofauna cubana. Torreia (21), 12 pp.

Durden, L.A. & Knapp, C.R. 2005. Ticks parasitizing reptiles in the Bahamas. Med. Vet. Entomol., 19: 326–328.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

Whittick, R.J. 1939. On some tick species belonging to the genera *Aponomma* and *Amblyomma*. Parasitology, 31: 434–441.

120 – *A. transversale* (Lucas, 1845) (Ann. Entomol. Soc. Fr. Ser. 2, 3: 61–65)
Kolonin (2009, *op. cit.* under *A. arcanum*) classifies this species in the genus *Aponomma*. See also *A. orlovi*.

The year of description of this species is considered by some authors to be 1844, while others have chosen 1845. Lucas announced the name *Ixodes transversalis* during a scientific session held on February 21, 1844 (séance du 21 Février 1844), but the species is not properly presented there (*nomen nudum*) as can be seen in the excerpts included in Lucas, M.H. (1844. Note sur une nouvelle espèce d'Arachnide qui appartient au genre *Ixodes*. Rev. Zool. Soc. Cuvierienne, 7: 71). The publication of Lucas, M.H. (1845. Sur une nouvelle espèce d'Arachnide qui appartient au genre *Ixodes*, et qui vit dans le contour interne de la cavité orbitaire de *Python sebae*, Duméril et Bibron (*Coluber sebae*, Gmelin). Ann. Entomol. Soc. Fr. Ser. 2, 3: 61–65), contains figures and morphological features of male and female ticks and we therefore regard 1845 as the correct year of description of *A. transversale*. See also *A. orlovi*.

Type depository: MNHN (syntypes) (Kaufman 1972 *op. cit.* under *A. fimbriatum*) as *Ixodes transversalis*

Known stages: male, female, nymph

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for nymphs and adult ticks are Squamata: Boidae. Artiodactyla are considered exceptional hosts for this tick.
Squamata: Boidae (ANL)
Artiodactyla: Bovidae (N)

Human infestation: no

Remarks: the larva of *A. transversale* is undescribed, but we regard as provisionally valid the record of this stage in Morel and Mouchet (1965). Keirans and Durden (2001) cite four records of the introduction of this species into the Nearctic Region, while Nowak (2010) and Takano et al. (2010) provide records for the Palearctic Region, but there is no evidence that *A. transversale* has become established in either region. Burridge (2011) states that this tick was able to infest non-Afrotropical hosts in the Nearctic Region.

References

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Kaufman, T.S. 1972. A revision of the genus *Aponomma* Neumann, 1899 (Acarina: Ixodidae). Ph.D. Dissertation, University of Maryland, 390 pp.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Morel, P.-C. & Mouchet, J. 1965. Les tiques du Cameroun (Ixodidae et Argasidae) (2e. note). Ann. Parasitol. Hum. Comp., 40: 477–496.

Nowak, M. 2010. The international trade in reptiles (Reptilia) – the cause of the transfer of exotic ticks (Acari: Ixodida) to Poland. Vet. Parasitol., 169: 373–381.

Takano, A., Goka, K., Une, Y., Shimada, Y., Fujita, H., Shiino, T., Watanabe, H. & Kawabata, H. 2010. Isolation and characterization of a novel *Borrelia* group of tick-borne borreliae from imported reptiles and their associated ticks. Environ. Microbiol., 12: 134–146.

121 – *A. triguttatum* Koch, 1844 (Arch. Naturgesch., 10: 217–239)

Roberts, F.S.H. (1962. On the status of morphologically divergent tick populations of *Amblyomma triguttatum* Koch (Acarina: Ixodidae). Aust. J. Zool., 10: 367–381), analyzed the morphology of several populations of *A. triguttatum*, creating four

subspecies. The current authors consider it likely that more than one species is included under the name *A. triguttatum*, but additional studies are needed to confirm this hypothesis.

Type depository: ZMB (holotype) (Moritz and Fischer 1981, *op. cit.* under *A. arcanum*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Australasian

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: Squamata are exceptional hosts for this tick.
Artiodactyla: Bovidae, Suidae; Diprotodontia: Macropodidae; Perissodactyla: Equidae (ANL)
Carnivora: Canidae (AN)
Diprotodontia: Phascolarctidae, Potoroidae (A)
Squamata: Scincidae (AN)
Lagomorpha: Leporidae (NL)
Rodentia: Muridae (L)
Dasyuromorphia: Myrmecobiidae; Monotremata: Ornithorhynchidae (stages unknown)

Human infestation: yes (Waudby et al. 2007)

Remarks: Keirans and Durden (2001) cite a record of the introduction of *A. triguttatum* into the Nearctic Region, but there is no evidence that it has become established outside the Australasian Region. The odd record of Petney et al. (2008) of *A. triguttatum* on Squamata is ignored in Kolonin (2009).

References

Cooper, A., Stephens, J., Ketheesan, N. & Govan, B. 2013. Detection of *Coxiella burnetii* DNA in wildlife and ticks in northern Queensland, Australia. Vector-Borne Zoon. Dis., 13: 12–16.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Petney, T.N., Dixon, B.R. & Andrews, R.H. 2008. A new host and disquieting distribution record for *Amblyomma triguttatum triguttatum*. Syst. Appl. Acarol., 13: 182–183.

Roberts, F.H.S. 1962. On the status of morphologically divergent tick populations of *Amblyomma triguttatum* Koch (Acarina: Ixodidae). Aust. J. Zool., 10: 367–381.

Waudby, H.P., Petit, S., Dixon, B. & Andrews, R.H. 2007. Hosts of the exotic ornate kangaroo tick, *Amblyomma triguttatum triguttatum* Koch, on southern Yorke Peninsula, South Australia. Parasitol. Res., 101: 1323–1330.

122 – *A. trimaculatum* (Lucas, 1878) (Ann. Soc. Entomol. Fr. 2e Part. Bull. Séances, Ser. 5, 8: 77–78)
Kolonin (2009, *op. cit.* under *A. arcanum*) classifies this species in the genus *Aponomma*. See also *A. fimbriatum*.

Type depository: MNHN (holotype) (Kaufman 1972, *op. cit.* under *A. fimbriatum*) as *Ixodes trimaculatus*

Known stages: male, female

Zoogeographic Regions: Australasian, Oriental

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: usual hosts for larvae, nymphs and adult ticks are Squamata: Varanidae.
Squamata: Varanidae (ANL)
Squamata: Colubridae, Scincidae (AN)
Squamata: Boidae (A)

Human infestation: no

Remarks: Camicas et al. (1998) state that this tick is found exclusively in the Australasian Region, but Petney and Keirans (1996) describe an Australasian and Oriental distribution. *Bona fide* records of *A. trimaculatum* for the Oriental Region appear in Kaufman (1972). Collections from Artiodactyla and Perissodactyla may be doubtful, according to Petney and Keirans (1996); these records are not included in Roberts (1970) for *A. trimaculatum* but instead are provided for *A. fimbriatum*, and for this reason we have excluded them from our list above. The larva and nymph of *A. trimaculatum* remain undescribed, but we consider provisionally valid the determination of these stages on Varanidae in Kaufman (1972), who ignores the records of adults and nymphs of *A. trimaculatum* on Scincidae in Anastos (1950), although we regard them as provisionally valid. The description of the nymph of *A. trimaculatum* in Roberts (1953) probably applies to *A. fimbriatum* (Roberts 1970). There are records of this tick species outside the Australasian and Oriental Regions, but no evidence exists that it has become established elsewhere. With the exception of Durden et al. (2008) and Takano et al. (2010), all authors cited below classify this species in the genus *Aponomma*.

References

Anastos, G. 1950. The scutate ticks, or Ixodidae, of Indonesia. Entomol. Am., 30: 1–144.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Durden, L.A., Merker, S. & Beati, L. 2008. The tick fauna of Sulawesi, Indonesia (Acari: Ixodoidea: Argasidae and Ixodidae). Exp. App. Acarol., 45: 85–110

Kaufman, T.S. 1972. A revision of the genus *Aponomma* Neumann, 1899 (Acarina: Ixodidae). Ph.D. Dissertation, University of Maryland, 390 pp.

Petney, T.N. & Keirans, J.E. 1996. Ticks of the genus *Aponomma* (Acari: Ixodidae) in South-east Asia. Trop. Biomed., 13: 167–172.
Reeves, W., Durden, L. & Wills, W. 2002. New records of ticks (Acari: Argasidae, Ixodidae) from South Carolina. J. Agric. Urban Entomol., 19: 197–204.
Roberts, F.H.S. 1953. The Australian species of *Aponomma* and *Amblyomma* (Ixodoidea). Aust. J. Zool., 1: 111–161.
Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.
Takano, A., Goka, K., Une, Y., Shimada, Y., Fujita, H., Shiino, T., Watanabe, H. & Kawabata, H. 2010. Isolation and characterization of a novel *Borrelia* group of tick-borne borreliae from imported reptiles and their associated ticks. Environ. Microbiol., 12: 134–146.

123 – *A. triste* Koch, 1844 (Arch. Naturgesch., 10: 217–239)
See remarks below.

Type depository: ZMB (holotype) (Moritz and Fischer 1981, *op. cit.* under *A. arcanum*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Nearctic, Neotropical

Ecoregions: riparian environments in tropical and subtropical grasslands, savannas and shrublands

Hosts: Aves are exceptional hosts for this species.
Carnivora: Felidae, Rodentia: Caviidae; Didelphimorphia: Didelphidae (ANL)
Carnivora: Canidae (AN)
Artiodactyla: Bovidae, Cervidae, Suidae; Perissodactyla: Equidae, Tapiridae (A)
Rodentia: Cricetidae; Passeriformes: Emberizidae, Thraupidae (NL)
Chiroptera: Vespertilionidae; Pilosa: Myrmecophagidae (N)

Human infestation: yes (Nava et al. 2011)

Remarks: Camicas et al. (1998) list the larva and nymph of *A. triste* as undescribed. These stages were subsequently described by Estrada-Peña et al. (2002) and redescribed in Estrada-Peña et al. (2005). The nymph has also recently been redescribed by Martins et al. (2010). *A. triste* was considered strictly Neotropical by Guglielmone et al. (2003), but Guzmán-Cornejo et al. (2006) and Mertins et al. (2010) demonstrated otherwise. However, problems still arise in correctly diagnosing specimens of *A. triste*, as noted in the above discussion of *A. maculatum* and *A. tigrinum*, and many published determinations should be considered tentative. The Nearctic records of nymphs and larvae of *A. triste* on Aves in Mertins et al. (2010) are provisional and are not included in our host list above. Shah et al. (2004) listed "poultry" as infested with *A. triste*, based on Labruna et al. (2002a), but the latter authors used Galliformes as experimental laboratory hosts. Nonetheless, Nava et al. (2011) determined as *A. triste* a small number of larvae and nymphs collected on birds in Argentina. See also *A. maculatum* and *A. tigrinum* above.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Debárbora, V.N., Nava, S., Cirignoli, S., Guglielmone, A.A. & Poi, A.S.G. 2012. Ticks (Acari: Ixodidae) parasitizing endemic and exotic wild mammals in the Esteros del Iberá wetlands, Argentina. Syst. Appl. Acarol., 17: 243–250.

Estrada-Peña, A., Venzal, J.M. & Guglielmone, A.A. 2002. *Amblyomma dubitatum* Neumann: description of nymph and redescription of adults, together with the description of the immature stages of *A. triste* Koch. Acarologia, 42: 323–333.

Estrada-Peña, A., Venzal, J.M., Mangold, A.J., Cafrune, M.M. & Guglielmone, A.A. 2005. The *Amblyomma maculatum* Koch, 1844 (Acari: Ixodidae: Amblyomminae) tick group: diagnostic characters, description of the larva of *A. parvitarsum* Neumann, 1901, 16S rDNA sequences, distribution and hosts. Syst. Parasitol., 60: 99–112.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Guzmán-Cornejo, C., Pérez, T.M., Nava, S. & Guglielmone, A.A. 2006. Confirmation of the presence of *Amblyomma triste* Koch, 1844 (Acari: Ixodidae) in Mexico. Syst. Appl. Acarol., 11: 47–50.

Labruna, M.B., Fugisaki, E.Y.M., Pinter, A., Duarte, J.M.B. & Szabó, M.J.P. 2002a. Life cycle and host specificity of *Amblyomma triste* (Acari: Ixodidae) under laboratory conditions. Exp. Appl. Acarol., 30: 305–316.

Labruna, M.B., Paula, C.D., Lima, T.F. & Sana, D.A. 2002b. Ticks (Acari: Ixodidae) on wild animals from the Porto-Primavera hydroelectric power station area, Brazil. Mem. Inst. Oswaldo Cruz, 97: 1133–1136.

Labruna, M.B., Jorge, R.S.P., Sana, D.A., Jácomo, A.T.A., Kashivakura, C.K., Furtado, M.M., Ferro, C., Perez, S.A., Silveira, L., Santos, T.S., Marques, S.R., Morato, R.G., Nava, A., Adania, C.H., Teixeira, R.H.F., Gomes, A.A.B., Conforti, V.A., Azevedo, F.C.C., Prada, C.S., Silva, J.C.R., Batista, A.F., Marvulo, M.F.V., Morato, R.L.G., Alho, C.J.R., Pinter, A., Ferreira, P.M., Ferreira, F. & Barros-Battesti, D.M. 2005. Ticks (Acari: Ixodida) on wild carnivores in Brazil. Exp. Appl. Acarol., 36: 149–163.

Lemos, E.R.S., Machado, R.D., Coura, J.R., Guimaraes, M.A.A., Serra-Freire, N.M., Amorim, A. & Gazêta, G.S. 1997. Epidemiological aspects of the Brazilian spotted fever: seasonal activity of ticks collected in an endemic area in São Paulo, Brazil. Rev. Soc. Bras. Med. Trop., 30: 181–185.

Martins, T.F., Onofrio, V.C., Barros-Battesti, D.M. & Labruna, M.B. 2010. Nymphs of the genus *Amblyomma* (Acari: Ixodidae) of Brazil: descriptions, redescriptions, and identification key. Ticks Tick-borne Dis., 1: 75–99.

Martins, T.F., Furtado, M.M., Jácomo, A.T., Silveira, L., Sollman, R., Tôrres, N.M. & Labruna, M.B. 2012. Ticks on free-living wild mammals in the region of Emas National Park, Goiás State, central Brazil. Syst. Appl. Acarol., 16: 201–206.

Mertins, J.W., Moorhouse, A.S., Alfred, J.T. & Hutcheson, H.J. 2010. *Amblyomma triste* (Acari: Ixodida): new North American collection records, including the first from the United States. J. Med. Entomol., 47: 536–542.

Nava, S., LareschI, M., Beldoménico, P.M., Zerpa, C., Venzal, J.M., Mangold, A.J. & Guglielmone, A.A. 2004. Sigmodontinae rodents as hosts for larvae and nymphs of *Ixodes loricatus* Neumann, 1899 (Acari: Ixodidae). Parasite, 11: 411–414.

Nava, S., Lareschi,M., Rebollo, C., Benítez Usher, C., Beati, L., Robbins, R.G., Durden, L.A., Mangold, A.J. & Guglielmone, A.A. 2007. The ticks (Acari: Ixodida: Argasidae, Ixodidae) of Paraguay. Ann. Trop. Med. Parasitol., 101: 255–270.

Nava, S., Mangold, A.J., Mastropaolo, M., Venzal, J.M., Fracassi, N. & Guglielmone, A.A. 2011. Seasonal dynamics and hosts of *Amblyomma triste* (Acari: Ixodidae) in Argentina. Vet. Parasitol., 181: 301–308.

Sha, A.H., Khan, M.N., Iqbal, Z. & Sajid, M.S. 2004. Tick infestation in poultry. Int. J. Agr. Biol., 6: 1162–1165.

Sinkoc, A.L., Brum, J.G.W., Muller, G., Begrow, A. & Paulsen, R.M.M. 1997. Ocorrencia de Ixodidae parasitos de capivara (*Hydrochoerus hydrochaeris* Linnaeus, 1776) na Estaçao Ecológica do Taim, Rio Grande-RD, Brasil. Cienc. Rural, 27: 119–122.

Venzal, J.M., Estrada-Peña, A., Castro, O., Souza, C.G. de, Félix, M.L., Nava, S. & Guglielmone, A.A. 2008. *Amblyomma triste* Koch, 1844 (Acari: Ixodidae): hosts and seasonality of the vector of *Rickettsia parkeri* in Uruguay. Vet. Parasitol., 155: 104–109.

124 – *A. tuberculatum* Marx, 1894 (*In* Hubbard, Insect Life, 6: 302–315)

Type depository: USNTC (holotype?) (Robinson 1926, *op. cit.* under *A. multipunctum*) states that the "type" is in the USNTC. However, types of this species are not included in Keirans and Clifford (1984, *op. cit.* under *A. calcaratum*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Nearctic

Ecoregions: Florida Peninsula, South Atlantic coastal plain

Hosts: usual hosts for nymphs and adults are Testudines: Testudinidae; usual hosts for larvae are Mammalia (several orders) and Aves (several orders). Squamata are considered exceptional hosts for this tick.
Testudines: Testudinidae (ANL)
Squamata: Phrynosomatidae (N)
Mammalia (several orders), Aves (several orders) (L)

Human infestation: yes (Merten and Durden 2000)

Remarks: Camicas et al. (1998) state that this species is found in the Nearctic and Neotropical Regions, but Guglielmone et al. (2003) show that *bona fide* records of *A. tuberculatum* are exclusively Nearctic. Cooley and Kohls (1944) found Squamata infested with this tick, but this record is ignored in Kolonin (2009). Mihalca et al. (2011) list *A. tuberculatum* as endangered.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Cooley, R.A. & Kohls, G.M. 1944. The genus *Amblyomma* (Ixodidae) in the United States. J. Parasitol., 30: 77–111.

Cooney, J.C. & Hays, K.L. 1972. The ticks of Alabama (Ixodidae: Acarina). Bull. Auburn Univ. Agric. Exp. Stn. (426), 40 pp.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Merten, H.A. & Durden, L.A. 2000. A state-by-state survey of ticks recorded from humans in the United States. J. Vector Ecol., 25: 102–113.

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

125 – *A. usingeri* Keirans, Hoogstraal & Clifford, 1973 (Ann. Entomol. Soc. Am., 66: 673–688)

Type depository: USNTC (holotype, paratypes) (Keirans and Clifford 1984, *op. cit.* under *A. calcaratum*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Neotropical

Ecoregion: Galapagos Islands scrubland mosaic

Hosts: usual hosts for larvae, nymphs and adults are Testudines: Testudinidae. Testudines: Testudinidae; Squamata: Iguanidae (ANL)

Human infestation: yes? (see below)

Remarks: Durden and Keirans (1996) state that *A. usingeri* and its hosts are at risk of extinction. Guglielmone et al. (2006) cite an instance in which this species may have fed on a human.

References

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases, Atalanta-2, Houten, The Netherlands, 173 pp.

Guglielmone, A.A., Beati, L., Barros-Battesti, D.M., Labruna, M.B., Nava, S., Venzal, J.M., Mangold, A.J., Szabó, M.P.J., Martins, J.R., González-Acuña, D. & Estrada-Peña, A. 2006. Ticks (Ixodoidea) on humans in South America. Exp. Appl. Acarol., 40: 83–100.

Keirans, J.E., Hoogstraal, H. & Clifford, C.M. 1973. The *Amblyomma* (Acarina: Ixodidae) parasitic on giant tortoises (Reptilia: Testudinidae) of the Galapagos Islands. Ann. Entomol. Soc. Am., 66: 673–688.

126 – *A. varanense* (Supino, 1897) (Atti. Soc. Veneto-Trentina Sci. Nat. Residente Padova, Ser 2, 3: 230–238)

Santos Dias (1993, *op. cit.* under *A. flavomaculatum*) and Kolonin (2009, *op. cit.* under *A. arcanum*) treat *A. varanense* as a synonym of *A. fuscolineatum* (both species classified as *Aponomma*). We follow Guglielmone et al. (2010, *op. cit*. under *A. argentinae*), who tentatively consider these separate species, pending evidence that would invalidate *A. varanense*. See also *A. crassipes*.

Type depository: BMNH (syntypes) (Keirans and Hillyard 2001, *op. cit.* under *A. albopictum*) as *Ixodes varanensis*.

Known stages: male, female, nymph, larva

Zoogeographic Regions: Australasian, Oriental

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: usual hosts for larvae, nymphs and adult ticks are Squamata: Varanidae, Boidae and Elapidae. Mammalia and Testudines are considered exceptional hosts for this tick.

Squamata: Varanidae, Boidae, Elapidae; Carnivora: Canidae (ANL)
Artiodactyla: Suidae; Pholidota: Manidae (AN)
Squamata: Colubridae, Viperidae; Testudines: Emydidae; Artiodactyla: Bovidae; Carnivora: Herpestidae, Viverridae (A)
Carnivora: Mustelidae (NL)
Squamata: Agamidae (stage unknown)

Human infestation: no

Remarks: Camicas et al. (1998) state that *A. varanense* is not present in the Australasian Region, but Durden et al. (2008) affirm that it occurs there (Sulawesi) and we concur. With the exception of Durden et al. (2008) and Burridge (2011), all authors cited below classify this tick in the genus *Aponomma*. Tanskul et al. (1983) list hosts for *A. varanense* (as *varanensis*) and *Aponomma lucasi*, a name generally recognized as a synonym of *A. varanense*. Burridge (2001) considers collections from Muridae and Sciuridae in Santos Dias (1993) to be *A. varanense*

(written *varanensis*), although Santos Dias (1993) classifies them as *A. fuscolineatum*; we have excluded these records from our host list for *A. varanense*. There are records of the introduction of *A. varanense* into the Nearctic and Palearctic Regions in Keirans and Durden (2001), Kenny et al. (2004) and other papers, but no evidence exists that this species has established itself in either of those regions. Burridge (2011) states that *A. varanense* is able to feed on Afrotropical Boidae. See also *A. fuscolineatum*.

References

Burridge, M.J. 2001. Ticks (Acari: Ixodidae) spread by the international trade in reptiles and their potential roles in dissemination of diseases. Bull. Entomol. Res., 91: 3–23.

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Burridge, M.J. & Simmons, L.-A. 2003. Exotic ticks introduced into the United States on imported reptiles from 1962 to 2001 and their potential roles in international dissemination of diseases. Vet. Parasitol., 113: 289–320.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Durden, L.A., Merker, S. & Beati, L. 2008. The tick fauna of Sulawesi, Indonesia (Acari: Ixodoidea: Argasidae and Ixodidae). Exp. App. Acarol., 45: 85–110.

Kaufman, T.S. 1972. A revision of the genus *Aponomma* Neumann, 1899 (Acarina: Ixodidae). Ph.D. Dissertation, University of Maryland, 390 pp.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kenny, M.J., Shaw, S.E., Hillyard, P.D. & Forbes, A.B. 2004. Ectoparasite and haemoparasite risks associated with imported exotic reptiles. Vet. Rec., 154: 434–435.

Santos Dias, J.A.T. 1993. Contribuição para o estudo da sistemática e taxonomia das espécies do género *Aponomma* Neumann, 1899 (Acarina-Ixodoidea). Estud. Ens. Doc. (157), 204 pp.

Tanskul, P., Stark, H.E. & Inlao, I. 1983. A checklist of ticks of Thailand (Acari: Metastigmata: Ixodoidea). J. Med. Entomol., 20: 330–341.

127 – *A. variegatum* (Fabricius, 1794) (*Entomologia sistematica emendata et aucta, secundum classes, ordines, genera, species adjectis synonimis, loci, observationibus, descriptionibus*. Hafniae, 4, 472 pp)

Type depository: lost (Guglielmone et al. 2003, *op. cit.* under *A. americanum*) as *Acarus variegatus*

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical, Neotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands; neotropics tropical and sub-tropical moist broadleaf forests

Hosts: usual hosts for larvae, nymphs and adults are Artiodactyla: Bovidae. Squamata are considered exceptional hosts for this tick.
Mammalia (several orders); Aves (several orders) (ANL)
Squamata: Varanidae, Viperidae (AN)
Squamata: Chamaelaeonidae (NL)
Squamata: Agamidae, Colubridae (N)

Human infestation: yes (Burridge 2011)

Remarks: Keirans and Durden (2001) cite several records of the introduction of *A. variegatum* into the Nearctic Region, but there is no evidence that this tick has become established there. There are also records of *A. variegatum* on local mammals in the Oriental and Palearctic Zoogeographic Regions. For the most part there is consensus that this tick is not established in those regions. However, in the Palearctic apparently established tick populations were found on cattle in the Krasnodar Region (Kerbabayev et al. 1997), together with several infestations of local mammals (Burridge 2011). In any case, all regions are at risk because *A. variegatum* has already been able to successfully colonize parts of the Neotropics via cattle trading. Burridge (2011) discusses many reports of *A. variegatum* being introduced with migratory birds to different parts of the world; however, transport of live cattle appears to be the chief factor driving the expansion of this species' *range*. Kolonin (2009) recognizes only large and medium-sized mammals as hosts of *A. variegatum*, but the references below contain *bona fid*e records from Squamata (unusual hosts) and Aves.

References

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kerbabayev, E.B.O., Voltzit, O.V. & Kataeva, T.S. 1997. Detecting of *Amblyomma variegatum* mite in the Krasnodar Region. Veterinariya, 6: 15–19. In Russian.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

MacLeod, J. & Mwanaumo, B. 1978. Ecological studies of ixodid ticks (Acari: Ixodidae) in Zambia. IV. Some anomalous infestation patterns in the northern and eastern regions. Bull. Entomol. Res., 68: 409–429.

Mertins, J.W. & Schlater, J.L. 1991. Exotic ectoparasites of ostriches recently imported into the United States. J. Wildl. Dis., 27: 180–182.

Morel, P.-C. 1966. Étude sur les tiques du bétail en Guadeloupe et Martinique. I. Les tiques et leur distribution (Acariens, Ixodoidea). Rev. Élev. Méd. Vét. Pays Trop., 19: 307–321.
Morel, P.-C. & Mouchet, J. 1965. Les tiques du Cameroun (Ixodidae et Argasidae) (2e. note). Ann. Parasitol. Hum. Comp., 40: 477–496.
Petney, T.N., Horak, I.G. & Rechav, Y. 1987. The ecology of the African vectors of heartwater, with particular reference to *Amblyomma hebraeum* and *Amblyomma variegatum*. Onderstepoort J. Vet. Res., 54: 381–395.
Rahman, M.H. & Mondal, M.M.H. 1985. Tick fauna of Bangladesh. Ind. J. Parasitol., 9: 145–149.
Sylla, M., Molez, J.-F., Cornet, J.-P., Mondet, B. & Camicas, J.-L. 2006. Les tiques (Acari: Ixodida) du Sénégal: fréquence des hôtes répertoriés, dynamique saisonnière et chorologie d'*Amblyomma (Xiphiastor) variegatum* (Fabricius, 1794). Acarologia, 47: 13–23.
Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.
Uilenberg, G., Hoogstraal, H. & Klein, J.-M. 1979. Les tiques (Ixodoidea) de Madagascar et leurrôle vecteur. Arch. Inst. Pasteur Madagascar Num. Spéc., 153 pp.
Van der Borght-Elbl, A. 1977. Ixodid ticks (Acarina: Ixodidae) of Central Africa. Vol. V. The larval and nymphal stages of the more important species of the genus *Amblyomma* Koch, 1844. Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (222), 158 pp.
Voltzit, O.V. & Keirans, J.E. 2003. A review of African *Amblyomma* species (Acari, Ixodida, Ixodidae). Acarina, 11: 135–214.
Walker, J.B. 1974. The ixodid ticks of Kenya. A review of present knowledge of their hosts and distribution. Commonwealth Institute of Entomology, London, 220 pp.

128 – *A. varium* Koch, 1844 (Arch. Naturgesch., 10: 217–239)
See remarks below.

Type depository: ZMB (holotype) (Moritz and Fischer 1981, *op. cit.* under *A. arcanum*)

Known stages: male, female, nymph, larvae

Zoogeographic Region: Neotropical

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Pilosa: Bradypodidae and Megalonychidae. Mammalia other than Pilosa and Squamata are considered exceptional hosts for this tick.
Pilosa: Bradypodidae (AN)
Pilosa: Megalonychidae; Artiodactyla: Tayassuidae; Didelphimorphia: Didelphidae; Rodentia: Caviidae; Squamata: Iguanidae (A)

Human infestation: no

Remarks: Guglielmone et al. (2003) note morphological differences in several descriptions of *A. varium*, but Onofrio et al. (2008) redescribed the male and the female, including type material. Darling (1910) and Keirans and Durden (2001) cite two records of *A. varium* being introduced into the Nearctic Region but there is no evidence that this species has become established in the Nearctic. Camicas et al. (1998) list the larva and nymph of *A. varium* as undescribed, but the larva was described from laboratory-reared specimens (as *A. varius*) by Amorim and Serra-Freire (1996), and the nymph was recently described by Martins et al. (2010). Guglielmone and Nava (2006) cite Lahille (1920) with respect to doubtful records of *A. varium* from Carnivora and Artiodactyla in Argentina, while Darling (1910) asserts that *A. varium* was found on Anura in Panama, but this record was not confirmed by Fairchild et al. (1966). None of these records are included in our host list for *A. varium*, although Burridge (2011) considers them valid. Ogrzewalska et al. (2012) present a speculative record of larvae of *A. varium* on birds from Peru (Neotropical Region) that we provisionally exclude from our host list above. Serra-Freire (2010) and Serra-Freire et al. (2011) claim that *A. varium* has been found on humans in Brazil, but this too needs to be confirmed. Kolonin (2009) does not mention the record of a female of *A. varium* from Squamata in Santos Dias (1958), which we treat as valid.

References

Amorim, M. & Serra-Freire, N.M. 1996. Morphological description of tick larval stage (Acari: Ixodidae). 3. *Amblyomma varius* [sic] Kock [sic], 1844. Entomol. Vectores, 3: 67–80.

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Darling, S.T. 1910. Panama ticks. J. Econ. Entomol., 3: 222.

Fairchild, G.B., Kohls, G.M. & Tipton, V.J. 1966. The ticks of Panama (Acarina: Ixodoidea). *In* W.R. Wenzel & V.J. Tipton (editors), Ectoparasites of Panama. Field Museum of Natural History, Chicago, pp. 167–219.

Guglielmone, A.A. & Nava, S. 2006. Las garrapatas argentinas del género *Amblyomma* (Acari: Ixodidae): distribución y hospedadores. Rev. Inv. Agropec., 35 (3): 135–155.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases, Atalanta-2, Houten, The Netherlands, 173 pp.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Lahille, F. 1920. Enumeración sistemática de los pedicúlidos, malófagos, pulícidos, linguatúlidos y ácaros (1ª parte) encontrados en la República Argentina con una nota sobre una especie de piojo. Ministerio de Agricultura, Buenos Aires, 41 pp.

Marques, S., Barros-Battesti, D.M., Faccini, J.L.H. & Onofrio, V.C. 2002. Brazilian distribution of *Amblyomma varium* Koch, 1844 (Acari: Ixodidae), a common parasite of sloths (Mammalia: Xenarthra). Mem. Inst. Oswaldo Cruz, 97: 1141–1146.

Martins, T.F., Onofrio, V.C., Barros-Battesti, D.M. & Labruna, M.B. 2010. Nymphs of the genus *Amblyomma* (Acari: Ixodidae) of Brazil: descriptions, redescriptions, and identification key. Ticks Tick-borne Dis., 1: 75–99.

Ogrzewalska, M., Literak, I., Cardenas-Callirgos, J.M., Capek, M. & Labruna, M.B. 2012. *Rickettsia belli* in ticks *Amblyomma varium* Koch, 1844, from birds in Peru. Ticks Tick-borne Dis., 3: 254–256.

Onofrio, V.C., Barros-Battesti, D.M., Marques, S., Faccini, J.L.H., Labruna, M.B., Beati, L. & Guglielmone, A.A. 2008. Redescription of *Amblyomma varium* Koch, 1844 (Acari: Ixodidae) based on light and scanning electron microscopy. Syst. Parasitol., 69:137–144.

Robinson, L.E. 1926. Ticks. A monograph of the Ixodoidea. Part IV. The genus *Amblyomma*. Cambridge University Press, London, 302 pp.

Santos Dias, J.A.T. 1958. Notas ixodológicas. V. Acerca de alguns ixodídeos do Museu do Hamburgo. Mem. Estud. Mus. Zool. Univ. Coimbra (253), 32 pp.

Serra- Freire, N.M. 2010. Occurrence of ticks (Acari: Ixodidae) on human hosts, in three municipalities in the State of Pará, Brazil. Rev. Bras. Parasitol. Vet., 19 (3): 141–147.

Serra-Freire, N.M., Sena, L.M.M. & Borsoi, A.B.P. 2011. Parasitismo humano por carrapatos na Mata Atlántica, Rio de Janeiro, Brasil. EntomoBrasilis, 4: 67–72.

129 – *A. vikirri* Keirans, Bull & Duffield, 1996 (Syst. Parasitol., 34: 1–9)

Type depositories: SAM (holotype, paratypes), USNTC (paratypes) (Keirans, J.E., Bull, C.M. & Duffield, G.A. 1996. *Amblyomma vikirri* sp. n. (Acari: Ixodida: Ixodidae), a parasite of the gidgee skink *Egernia stokesii* (Reptilia: Scincidae) from South Australia. Syst. Parasitol., 34: 1–9)

Known stages: male, female, nymph, larva

Zoogeographic Region: Australasian

Ecoregion: Tirari-Sturt stony desert

Hosts: Squamata: Scincidae (ANL)

Human infestation: no

Reference

Keirans, J.E., Bull, C.M. & Duffield, G.A. 1996. *Amblyomma vikirri* n. sp. (Acari: Ixodida: Ixodidae), a parasite of the gidgee skink *Egernia stokesii* (Reptilia: Scincidae) from South Australia. Syst. Parasitol., 34: 1–9.

130 – *A. williamsi* Banks, 1924 (Zoologica (New York), 5: 93–99)

Type depository: MCZ (syntype) (Guglielmone et al. 2003, *op. cit.* under *A. americanum*) state that depositories for type specimens of *A. williamsi* are unknown, but the MCZ website (http://mczbase.mcz.harvard.edu/ accessed April 4, 2013) refers to the presence of a syntype in that museum.

Known stages: male, female

Zoogeographic Region: Neotropical

Ecoregion: Galapagos Islands scrubland mosaic

Hosts: Squamata: Iguanidae (A)

Human infestation: no

Remarks: Durden and Keirans (1996) state that *A. williamsi* and its hosts are at risk of extinction.

References

Banks, N. 1924. Arachnida of the Williams Galapagos Expedition. Zoologica (New York), 5: 93–99.

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Synopsis of the Genus *Amblyomma*

A synopsis of the genus *Amblyomma* appears in Tables 1 and 2. The largest number of *Amblyomma* species – 46 or 35 % of the total – are found exclusively in the Neotropical Region, when *A. multipunctum* is counted as a Neotropical tick (see *A. multipunctum* above), and the smallest number of species found exclusively in a single region is in the Nearctic (three species: *A. americanum*, *A. elaphense* and *A. tuberculatum*). No species are exclusive for the Palearctic Region. Two species are widespread, occurring in three zoogeographic regions: *A. loculosum*, which is found chiefly on islands associated with the Afrotropical, Australasian and Oriental Zoogeographic Regions; and *A. testudinarium*, which is found in the Australasian, Oriental and Palearctic Regions.

The distribution of *Amblyomma* encompasses all zoogeographic regions, with a total of 13 categories of land usage, but this genus is absent on remote islands and around the poles.

Our analyses indicate that 86 % of the *Amblyomma* species (112 taxa) occur exclusively in regions that constituted Gondwana, and only 3 species (2 % of the total), all of them from the Nearctic (see above) occur in lands that constituted Laurasia.

Table 1 Numbers and percentages of all species of *Amblyomma*, by zoogeographic region(s), number known to feed on humans (% of the total number of species in a particular region) and number of species for which all stages (larva, nymph, male and/or female) are known (% of the total number of species in a particular region)

Regions	No. of species	%	No. of species on humans	No. of species of which all stages are known
Neotropical	46[a]	35.4	20 (43.5)[b]	20 (43.5)
Afrotropical	26	20.0	12 (46.2)	17 (65.3)
Australasian	19	14.6	5 (26.3)	7 (36.8)
Nearctic-Neotropical	12	9.2	10 (83.3)	10 (83.3)
Oriental	11	8.5	2 (18.2)	2 (18.2)
Australasian-Oriental	7	5.4	2 (28.6)	5 (71.4)
Nearctic	3	2.3	2 (66.7)	3 (100)
Afrotropical-Neotropical	1	0.8	1 (100)	1 (100)
Afrotropical-Oriental	1	0.8	0	0
Afrotropical-Palearctic	1	0.8	1 (100)	1 (100)
Oriental-Palearctic	1	0.8	1 (100)	1 (100)
Afrotropical-Australasian-Oriental	1	0.8	1 (100)	1 (100)
Australasian-Oriental-Palearctic	1	0.8	1 (100)	1 (100)
Total	**130**		**58 (44.6)**	**69 (53.1)**

[a]*A. multipunctum*, a species definitely known to occur in the Neotropics, but of uncertain status in the Nearctic, is considered a Neotropical species in this analysis

[b]*A. latepunctatum, A. macfarlandi* and *A. usingeri* have all been found on humans, but it is uncertain whether they were feeding on them, and they are therefore excluded in this analysis

The remaining 14 species (11 % of the total) are found in lands derived from both ancient continents.

The larva, nymph and at least one adult stage are known for 69 (54 %) of the 130 species of *Amblyomma* that we recognize as valid. Efforts should be made to increase our knowledge of sub-adult stages to better understand the phylogenetic relationships within this group. This is especially the case for the Neotropical and Oriental Regions, where well under 50 % of the species are known from all stages.

A total of 58 species (45 %) of *Amblyomma* have been recorded feeding on humans.

Host usage by the 63 species of *Amblyomma* whose adult (female and/or male) and sub-adult stages are known, along with their natural hosts, is summarized in Table 2, first with the inclusion of exceptional hosts, and second with the exclusion of these hosts. All parasitic stages of *A. brasiliense, A. falsomarmoreum, A. geayi, A. pseudoparvum, A. romitii* and *A. varium* are known, but the nymph of *A. falsomarmoreum* and *A. geayi*, and the larva of *A. brasiliense, A. pseudoparvum, A. romitii* and *A. varium* are known only from laboratory-reared material and have therefore been excluded from this analysis.

Amblyomma ticks show an ample range of host utilization (18 categories) when exceptional hosts are included in the analysis. The representation of exclusive hosts for species of *Amblyomma* is rather poor in the presence of exceptional hosts,

Table 2 Numbers and percentages of the 63 species of *Amblyomma* whose adult (female and/or male), larval and nymphal stages as well as natural hosts are known, including or excluding exceptional hosts

Hosts	No. of species Including exceptional hosts	%	No. of species Excluding exceptional hosts	%
Aves + Mammalia	14	22.2	14	22.2
Aves + Mammalia + Squamata + Testudines	8	12.7	5	7.9
Squamata	6	9.5	13	20.6
Aves + Mammalia + Squamata	6	9.5	0	0
Mammalia + Squamata	5	7.9	1	1.6
Mammalia + Squamata + Testudines	5	7.9	3	4.8
Mammalia	3	4.8	15	23.8
Testudines	3	4.8	3	4.8
Squamata + Testudines	2	3.2	2	3.2
Aves + Mammalia + Testudines	2	3.2	2	3.2
Anura + Aves + Mammalia + Squamata + Testudines	2	3.2	0	0
Ryncocephalia	0	0	1	1.6
Anura + Squamata	1	1.6	0	0
Anura + Aves + Mammalia + Testudines	1	1.6	0	0
Anura + Aves + Squamata + Testudines	1	1.6	0	0
Anura + Mammalia + Squamata + Testudines	1	1.6	0	0
Anura + Crocodilia + Mammalia + Squamata + Testudines	1	1.6	0	0
Anura + Aves + Crocodilia + Mammalia + Squamata + Testudines	1	1.6	0	0
Anura + Squamata + Testudines	0	0	3	4.8
Aves	0	0	1	1.6
Rhynchocephalia + Squamata	1	1.6	0	0
Total	**63**		**63**	

with only 6, 3 and 3 species exclusive to Squamata, Mammalia and Testudines, respectively. The proportion of Mammalia that are exclusive hosts for *Amblyomma* species is lower than for other major genera, but only the genus *Amblyomma* contains species exclusively found on Testudines. All the species of *Amblyomma* exclusive to Testudines are established on islands of Gondwanan origin: *A. macfarlandi* and *A. pilosum* in the Galapagos Islands (Neotropical Region) and *A. chabaudi* in Madagascar (Afrotropical Region). Six species of *Amblyomma* are exclusive parasites of Squamata. The only other genus containing a species with similar host usage is *Bothriocroton* (*B. glebopalma*). With the exception of *A. elaphense*, all of the Squamata-parasitizing *Amblyomma* occur in lands that constituted the ancient continent of Gondwana.

The genus *Amblyomma* is also unique in that it contains the only species – *A. sphenodonti* from the Australasian Region – that is an almost exclusive parasite of Rhynchocephalia, although some authors believe that *A. sphenodonti* should be

classified in a genus other than *Amblyomma*. In any event, *A. sphenodonti* is likely to be relevant to our understanding of tick evolutionary history and deserves additional studies.

No *Amblyomma* are found exclusively on Aves, but one species, *A. loculosum*, which occurs on islands of Gondwanan origin, feeds chiefly on birds, with a few records from Mammalia and Squamata. When exceptional hosts are included, the contribution of Aves becomes important, accounting for 35 species (55 % of the total) in combination with other types of hosts.

The most common combination of hosts for the genus *Amblyomma* is Mammalia + Aves (14 species), but Mammalia serve as hosts (exclusive and non-exclusive) of 49 species (78 % of all species), Squamata are hosts (exclusive and non-exclusive) of 40 species (63 %), and Testudines are hosts (exclusive and non-exclusive) of 27 species (43 %). Again, no other genus of Ixodidae has a similar pattern of host utilization among Squamata and Testudines.

Anura and Crocodilia are of minor importance as hosts for *Amblyomma* species, accounting for only 8 (13 %) and 2 (3 %) of species, respectively, in combination with one to five other types of hosts for the same tick species. However, no other genus of ticks has a similar proportion of species feeding on anurans and crocodilians. Additionally, two Nearctic-Neotropical species (*A. dissimile* and *A. rotundatum*) utilize Anura during all parasitic stages, a relationship that may have evolutionary implications because no similar pattern of parasitism is seen in other tick genera. On the other hand, crocodilians are always exceptional hosts for *Amblyomma* and appear to be of no importance to the survival of the species involved.

This picture of host utilization changes dramatically when exceptional hosts are excluded from the analysis. Nine host combinations disappear altogether and two new ones emerge, for a total of 12 categories of host usage, as opposed to 18 categories when exceptional hosts are included (Table 2). Notably, host combinations that include Crocodilia drop out as irrelevant.

As exclusive hosts of *Amblyomma*, Squamata increases its representation to 13 species (21 % of the total), but the greatest increase is seen in Mammalia, which are exclusive hosts of 15 *Amblyomma* species (24 %). Aves are exclusive hosts for one species, *A. loculosum* (see above), and no changes are recorded for Testudines.

When exceptional hosts are excluded, the most common host combination continues to be Mammalia + Aves (14 species). Mammalia are exclusive and non-exclusive hosts for 40 species of *Amblyomma* (63 %) and Aves are exclusive and non-exclusive hosts for 22 species (35 %), while Squamata are exclusive and non-exclusive hosts for 27 species (43 % of the total), and Testudines for 18 species (29 %). Anura are non-exclusive hosts for just three species: the Neotropical and Nearctic *A. dissimile* and *A. rotundatum*, and the Neotropical *A. argentinae*. Even so, in no other ixodid genus is utilization of Squamata, Testudines and Anura so frequent.

Part IV
The Genus *Rhipicephalus*

Remarks on Some Invalid Names

Rhipicephalus camelopardalis Walker & Wiley, 1959, is treated as a valid name in Camicas et al. (1998), but this name is a synonym of *R. longicoxatus* Neumann, 1905, as reported in Guglielmone et al. (2009).

Rhipicephalus glabroscutatum Du Toit, 1941 is a misspelling in Latin of *R. glabroscutatus*, as indicated in Morel, P.-C. (1969) and Camicas et al. (1998). Consequently, we support the view that the correct spelling for this species is *R. glabroscutatus.* Guglielmone et al. (2010) had, however, retained the incorrect spelling *glabroscutatum.*

Rhipicephalus hoogstraali Kolonin, 2009 was described contrary to the rules of the International Code of Zoological Nomenclature (articles 8.6 and 9.8) and is therefore a *nomen nudum* (Guglielmone et al. 2010). It has not been included in our list of species of the genus *Rhipicephalus.*

Rhipicephalus houlatus Dana, 2009 (published as *Rhicephalus houlatus* Dana 2009) is a *lapsus* for a tick species that we have been unable to identify. It is a *nomen nudum.*

References

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Dana, A.N. 2009. Diagnosis and treatment of tick infestation and tick-borne diseases with cutaneous manifestations. Dermatol. Ther., 22: 293–326.

Guglielmone, A.A., Robbins, R.G., Apaneskevich, D.A., Petney, T.N., Estrada-Peña, A. & Horak, I.G. 2009. Comments on controversial tick (Acari: Ixodida) species names and species described or resurrected from 2003 to 2008. Exp. Appl. Acarol., 48: 311–327.

Guglielmone, A.A., Robbins, R.G., Apanaskevich, D.A., Petney, T.N., Estrada-Peña, A., Horak, I.G., Shao, R. & Barker, S.C. 2010. The Argasidae, Ixodidae and Nuttalliellidae (Acari: Ixodida) of the world: a list of valid species names. Zootaxa, 2528: 1–28.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Morel, P.-C. 1969. Contribution à la connaissance de la distribution des tiques (Acariens, Ixodidae et Amblyommidae) en Afrique éthiopienne continentale. Thèse de Doctoratdes Sciences Naturelles. Université de Paris, 398 pp.

DOI 10.1007/978-94-007-7497-1_8,

Individual Species Accounts

1 – *R. annulatus* (Say, 1821) (J. Acad. Natl. Sci. Philadelphia, 2: 59–82)
This species was formerly considered a member of the genus *Boophilus.*

Type depository: lost (Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases, Atalanta, Houten, The Netherlands, 173 pp.), as *Ixodes annulatus*

Known stages: male, female, nymph, larva

Zoogeographic Regions: Afrotropical, Nearctic, Palearctic

Ecoregions: mediterranean forests, woodlands and scrub; tropical and subtropical moist broadleaf forests in sub-Saharan Africa

Hosts: usual hosts are Artiodactyla: Bovidae, while Aves and Squamata are considered exceptional hosts.
Mammalia (several orders); Galliformes: Phasianidae; Passeriformes: Alaudidae, Sturnidae; Squamata: Agamidae, Lacertidae

Human infestation: yes (Burridge 2011)

Remarks: because this is a one-host tick, we do not separately record the various life stages present on hosts. Camicas et al. (1998) include the Australasian and Neotropical Regions within the range of this tick. We, however, concur with Guglielmone et al. (2003) and regard Neotropical localities for this species as doubtful. We can find no *bona fide* records for the Australasian Region. Kuntz and Myers (1969) include Oriental localities for this species, but we also consider these records doubtful, while Ghosh et al. (2007) list *R. annulatus* for India, but state that such records require confirmation, a position with which we agree, although Ravindran et al. (2011) assert the opposite. Serdjukova (1956) and Kerbabayev (1965) refer to this tick as *Boophilus calcaratus*, while others cited below refer to it as *Boophilus annulatus.* Kolonin (2009) limits the hosts of this species to ungulates, but in the references cited below there are several records from other occasional hosts.

DOI 10.1007/978-94-007-7497-1_9,

Burridge (2011) excludes Squamata as hosts for *R. annulatus*, but we regard the odd records for this type of host in Serdjukova (1965) as tentatively valid. Leprince et al. (1988) report a male of *R. annulatus* allegedly feeding on *Tabanus americanus* (Diptera: Tabanidae). See also *R. kohlsi.*

References

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chavarría, C. M. 1941. Garrapatas determinadas en México. Caracteres genéricos de las más comunes. Rev. Inst. Pecu., 1: 18–24.

Ghosh, S., Bansal, G.C., Gupta, S.C., Ray, D., Khan, M.Q., Irshad, H., Shahiduzzaman, M., Seitzer, U. & Ahmed, J.S. 2007. Status of tick distribution in Bangladesh, India and Pakistan. Parasitol. Res., 101 (Suppl. 2): 207–216.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Hoogstraal, H. & Kaiser, M.N. 1959. Ticks (Ixodoidea) of Arabia with special reference to the Yemen. Fieldiana Zool., 39: 297–322.

Kerbabayev, E.B. 1965. Ecology of the tick *Boophilus calcaratus* Bir., 1895 in Turkmenia. Izv. Akad. Nauk Turkmen. SSR Ser. Biol. Nauk (6): 73–77. In Russian.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Kuntz, R.E. & Myers, B.J. 1969. A checklist of parasites and commensals reported for the Taiwan macaque (*Macaca cyclopis* Swinhoe, 1862). Primates, 10: 71–80.

Leprince, D.J., Foil, L.D. & Mullen, G.R. 1988. Parasitism of *Tabanus americanus* (Diptera: Tabanidae) by *Boophilus annulatus* (Acari: Ixodidae). J. Entomol. Sci., 23: 274–275.

Ravindran, R., Juliet, S., Sunil, A.R., Kumar, K.G.A., Nair, S.N., Amithamol, K.K., Shynu, M., Rawat, A.K.S. & Ghosh, S. 2011. Eclosion blocking effect of ethanolic extract of *Leucas aspera* (Lamiaceae) on *Rhipicephalus* (*Boophilus*) *annulatus.* Vet. Parasitol., 179: 287–290.

Serdjukova, G.V. 1956. Ixodid ticks of the fauna of USSR. Opred. Faune SSSR. Zool. Inst. Akad. Nauk SSSR (64), 121 pp. In Russian.

2 – *R. appendiculatus* Neumann, 1901 (Mém. Soc. Zool. Fr., 14: 249–372)

Type depositories: BMNH (lectotype, paralectotype), ZMB (paralectotypes) (Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: many ecoregions, most prevalent in montane grasslands and shrublands; tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for larvae, nymphs and adults are Artiodactyla: Bovidae, while Aves and Testudines are exceptional hosts.
Mammalia (several orders); Galliformes: Numididae, Phasianidae (ANL)
Passeriformes: Laniidae; Testudines (unknown order) (A)
Coliiformes: Coliidae; Coraciiformes: Alcedinidae; Passeriformes: Sturnidae; Piciformes: Picidae (N and/or L)
Struthioniformes: Struthionidae (stage unknown)

Human infestation: yes (Walker et al. 2000)

Remarks: Keirans (1985) states that this tick has been confused with several species of *Rhipicephalus*, while Walker et al. (2000) stress the similarities between *R. appendiculatus* and *R. zambeziensis* and confusion with *R. duttoni* and *R. nitens.* Keirans and Durden (2001) record *R. appendiculatus* as having been introduced into the Nearctic Region, but there is no evidence that it has become established there. Clavijo et al. (2009) state that a Venezuelan tick collection contains *R. appendiculatus* from England (Palearctic Region), but we assume that the specimens were collected in Africa and sent to Venezuela from England. Theiler (1962) uses the term "immatures" without specifying whether larvae, nymphs or both immature stages of *R. appendiculatus* were present on hosts. Theiler (1959) lists Coliiformes and Piciformes as hosts for the adults of *R. appendiculatus*, but subsequent evidence indicates that these are exceptional hosts and only of the immature stages. Kolonin (2009) excludes Aves as hosts for *R. appendiculatus*, but birds are recognized as hosts for this species in the references below. We also consider provisionally valid the record in Colbo (1973) of adults of *R. appendiculatus* on Testudines, but this record has been ignored by other workers. See also *R. warburtoni.*

References

Clavijo, J.J., Vásquez, C.L. & Valera, N.C. 2009. Garrapatas duras de los géneros *Amblyomma* Koch y *Rhipicephalus* Koch (Acari: Ixodidae) presentes en la colección de zoología agrícola, decanato de agronomía, Universidad Centro Occidental Lisandro Alvarado, Venezuela. Entomotrópica, 24: 41–50

Colbo, M.H. 1973. Ticks of Zambian wild animals: a preliminary checklist. Puku (7): 97–105.

Cooper, R.G. 2005. Bacterial, fungal and parasitic infections in the ostrich (*Struthio camelus* var. *domesticus*). Anim. Sci. J., 76: 97–106.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Theiler, G. 1959. African ticks and birds. Ostrich (Suppl. 3), 3: 353–378.
Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.
Uys, A.C. & Horak, I.G. 2005. Ticks on crested francolins, *Francolinus sephaena*, and on the vegetation on a farm in Limpopo Province, South Africa. Onderstepoort J. Vet. Res., 72: 339–343.
Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

3 – *R. aquatilis* Walker, Keirans & Pegram, 1993 (Onderstepoort J. Vet. Res., 60: 205–210)

Type depositories: BMNH (holotype, paratypes), OVI, USNTC (paratypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

According to Walker et al. (2000, *op. cit.* under *R. appendiculatus*), this species was originally listed as *Rhipicephalus* sp. III in Yeoman, G.H. & Walker, J.B. (1967. The ixodid ticks of Tanzania. A study of the zoogeography of the Ixodidae of an East African Country. Commonwealth Institute of Entomology, London, 215 pp.)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregion: Victoria Basin forest-savanna mosaic

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Artiodactyla: Bovidae; Carnivora: Felidae (A)

Human infestation: no

Reference

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

4 – *R. armatus* Pocock, 1900 (Proc. Zool. Soc. London, Part 1: 48–55)

Type depositories: BMNH, MHO (syntypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: northern *Acacia-Commiphora* bushlands and thickets; few ticks in Somali *Acacia-Commiphora* bushlands and thickets

Hosts: Artiodactyla: Bovidae; Carnivora: Canidae, Felidae (AN)
Mammalia (several orders) (A)
Lagomorpha: Leporidae (NL)

Human infestation: yes (Walker et al. 2000)

Remarks: Camicas et al. (1998) state that only the male and female of *R. armatus* have been described. However, Walker et al. (2000) subsequently described the larva and nymph. These authors also mention an uncertain record of a nymph of *R. armatus* on Aves, and we have therefore not included this record in our list of hosts for this species.

References

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

5 – *R. arnoldi* Theiler & Zumpt, 1950 (*In* Zumpt, F. 1950. Moçambique (60): 57–169)
This species is usually cited as having been described in 1949, but the publication containing the description of *R. arnoldi* appeared in 1950, as indicated on the cover of the original issue.

Type depositories: OVI, ZSH, ZMB (syntypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*). Moritz, M. & Fischer, S.C. (1981. Die Typen der Arachniden-Sammlung des Zoologischen Museums Berlin. Mitt. Zool. Mus. Berlin, 57: 341–364) state that there are paratypes in the ZMB. This museum was not included as a type depository in Walker et al. (2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands; montane grasslands and shrublands

Hosts: usual hosts for larvae, nymphs and adults are Lagomorpha: Leporidae; usual hosts for larvae and nymphs are also Macroscelidea: Macroscelididae and Hyracoidea: Procaviidae.
Lagomorpha: Leporidae; Hyracoidea: Procaviidae (ANL)
Artiodactyla: Bovidae; Perissodactyla: Equidae; Rodentia (unknown family) (A)
Carnivora: Felidae; Macroscelidea: Macroscelididae; Rodentia: Muridae (NL)
Rodentia: Muridae (N and/or L)

Human infestation: no

Remarks: Kolonin (2009) ignores Rodentia as hosts for *R. arnoldi*, but there are good records of this relationship in Walker et al. (2000), although these authors use the term "immatures" without specifying whether larvae, nymphs or both immature stages of *R. arnoldi* were present on hosts.

References

Fourie, L.J., Horak, I.G. & Woodall, P.F. 2005. Elephant shrews as hosts of immature ixodid ticks. Onderstepoort J. Vet. Res., 72: 293–301.

Horak, I.G., Jacot Guillarmod, A., Moolman, L.C. & De Vos, V. 1987. Parasites of domestic and wild animals in South Africa. XXII. Ixodid ticks on domestic dogs and wild carnivores. Onderstepoort J. Vet. Res., 54: 573–580.

Horak, I.G., Fourie, L.J., Novellie, P.A. & Williams, E.J. 1991. Parasites of domestic and wild animals in South Africa. XXVI. The mosaic of ixodid tick infestations on birds and mammals in the Mountain Zebra National Park. Onderstepoort J. Vet. Res., 58: 125–136.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

6 – *R. aurantiacus* Neumann, 1907 (Notes Leyden Mus., 29: 88–100)
Walker et al. (2000, *op. cit*. under *R. appendiculatus*) treat *R. aurantiacus* as a probable junior synonym of *R. ziemanni*, and Kolonin, G.V. (2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/) does not include this species in his list of Ixodidae of the world. We, however, agree with Guglielmone, A.A., Robbins, R.G., Apaneskevich, D.A., Petney, T.N., Estrada-Peña, A. & Horak, I.G. (2009. Comments on controversial tick (Acari: Ixodida) species names and species described or resurrected from 2003 to 2008. Exp. Appl. Acarol., 48: 311–327), who believe that this synonymy has not been definitively proven and accordingly treat this species as valid.

Type depository: LMNH (syntypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregions: western Guinea lowland forests. This ecoregion is tentative pending validation of this tick species. See below.

Hosts: Artiodactyla: Bovidae, Suidae (A)

Human infestation: yes (Morel 2003)

Remarks: the type locality for *R. aurantiacus* is Liberia. The information contained in Morel (2003) for this country was used when creating a provisional delineation of the ecoregion for this species.

References

Aeschlimann, A. 1967. Biologie et écologie des tiques (Ixodoidea) de Côte d'Ivoire. Acta Trop., 24: 281–405.

Bequaert, J. 1931. Sinopsis des tiques du Congo Belge. Rev. Zool. Bot. Afr., 20: 209–251.

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

7 – *R. australis* Fuller, 1899 (Queensland Agric. J., 4: 389–394)

Type depository: USNTC (neotype) (Estrada-Peña, A., Venzal, J.M., Nava, S., Mangold, A., Guglielmone, A.A., Labruna, M.B. & de la Fuente, J. 2012. Reinstatement of *Rhipicephalus* (*Boophilus*) *australis* Fuller, the Australian cattle tick (Acari: Ixodidae) with redescription of the adult and larval stages. J. Med. Entomol., 49: 794–802)

Known stages: male, female, nymph, larva

Zoogeographic Region: Australasian, Oriental, Pacific islands

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts are Artiodactyla: Bovidae, all other hosts are considered exceptional. Mammalia (several orders)

Human infestation: no

Remarks: because this is a one-host tick, we do not separately record the various life stages present on hosts. This species has been revalidated recently by Estrada-Peña et al. (2012) from specimens from the Australasian and Oriental Regions and remote Pacific islands. *Rhipicephalus australis* was previously treated as *R. microplus*, thereby creating uncertainty about the actual distribution of both taxa. Hosts for *R. australis* were obtained from Estrada-Peña (2012) and from Roberts (1970 as *R. microplus*). See also *R. microplus.*

References

Estrada-Peña, A., Venzal, J.M., Nava, S., Mangold, A., Guglielmone, A.A., Labruna, M.B. & de la Fuente, J. 2012. Reinstatement of *Rhipicephalus* (*Boophilus*) *australis* Fuller, the Australian cattle tick (Acari: Ixodidae) with redescription of the adult and larval stages. J. Med. Entomol., 49: 794–802.

Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.

8 – *R. bequaerti* Zumpt, 1950 (Moçambique (60): 57–169)
This species is usually cited as having been described in 1949, but the publication containing the description of *R. bequaerti* appeared in 1950, as indicated of the cover of the original issue.

Type depository: SAIMR (syntypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical moist broadleaf forests; few ticks in tropical and subtropical grasslands, savannas and shrublands

Hosts: Artiodactyla: Bovidae, Suidae (A)

Human infestation: yes (Walker et al. 2000)

Reference

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

9 – *R. bergeoni* Morel & Balis, 1976 (Rev. Élev. Méd. Vét. Pays Trop., 29: 141–148)
Walker et al. (2000, *op. cit.* under *R. appendiculatus*), on page 95, wrongly state that the pagination for the description of this species is pp. 337–340.

Type depository: unknown (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregions: Ethiopian montane grasslands and woodlands; Ethiopian montane forests

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Artiodactyla: Bovidae, Suidae; Perissodactyla: Equidae; Carnivora: Hyaenidae (A)

Human infestation: no

Remarks: Kolonin (2009) excludes Equidae as hosts for *R. bergeoni*, but we accept the records for this type of host in Walker et al. (2000).

References

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

10 – *R. boueti* Morel, 1957 (Bull. Soc. Pathol. Exot., 50: 696–700)

Type depositories: ENV (holotype), LFE (paratypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregion: Guinean forest-savanna mosaic

Hosts: Hyracoidea: Procaviidae (A)

Human infestation: no

Reference

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

11 – *R. bursa* Canestrini & Fanzago, 1878 (Atti R. Ist. Veneto Sci. Lett. Arti (1877–1878), Ser. 5, 4: 69–208)

Type depository: unknown (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva.

Zoogeographic Region: Palearctic

Ecoregions: mediterranean forests, woodlands and scrub

Hosts: usual hosts for larvae, nymphs and adults are Artiodactyla: Bovidae. Aves and Squamata are considered exceptional hosts.
Mammalia (several orders) (ANL)
Aves (several orders); Squamata: Lacertidae (stages unknown)

Human infestation: yes (Walker et al. 2000; Bursali et al. 2012 among others)

Remarks: a two-host tick, with the larva and nymph feeding on the same first host and adults feeding on the second host. Walker et al. (2000) state that records of this species from outside the Palearctic Region are misidentifications or accidental importations – *R. bursa* has not become established outside the Palearctic. These authors use the term "immatures" without specifying whether larvae, nymphs or both immature stages were present on Rodentia. Walker et al. (2000) and Kolonin (2009) ignore Aves and Squamata as hosts of *R. bursa*; however, we regard these unusual records, described in Gusev et al. (1961) and Serdjukova (1956), as tentatively valid.

References

Bursali, A., Keskin, A. & Tekin, S. 2012. A review of the ticks (Acari: Ixodida) of Turkey: species diversity, hosts and geographical distribution. Exp. Appl. Acarol., 57: 91–104.

Encinas Grandes, A. 1986. Ticks of the Province of Salamanca (Central/NW Spain). Ann. Parasitol. Hum. Comp., 61: 95–107.

Feider, Z. 1964. Les connaissances actuelles sur les Acariens de Roumanie (Ixodides, Gamasides et Trombiculides). Acarologia (Fasc. Hors Sér.): 262–274.

Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian.

Gusev, V.M., Bednyy, S.N., Guseva, A.A., Labunets, N.F. & Bakeyev, N.N. 1961. The ecological groups of birds on the Caucasus and their role in the life cycle of ticks and fleas. Trudy Nauch.-Issled. Protiv. Inst. Kavk. Zakav. (5): 217–267. In Russian.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Krčmar, S. 2012. Hard ticks (Acari, Ixodidae) of Croatia. ZooKeys, 234: 19–57.
Serdjukova, G.V. 1956. Ixodid ticks of the fauna of USSR. Opred. Faune SSSR. Zool. Inst. Akad. Nauk SSSR (64), 121 pp. In Russian.
Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

12 – *R. camicasi* Morel, Mouchet & Rodhain, 1976 (Rev. Élev. Méd. Vét. Pays Trop., 29: 337–340)

Type depository: unknown (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Afrotropical, Palearctic

Ecoregions: tropical and subtropical grasslands, savannas and shrublands; desert and xeric shrublands

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Mammalia (several orders) (A)

Human infestation: no

Remarks: natural hosts for larvae and nymphs of *R. camicasi* have not been found; the immature stages are known only from laboratory-reared specimens (Walker et al. 2000).

Reference

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

13 – *R. capensis* Koch, 1844 (Arch. Naturgesch., 10: 217–239)

Type depository: ZMB (holotype) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: Nama Karoo and succulent Karoo, montane and lowland fynbos and renosterbosveld

Hosts: Artiodactyla: Bovidae; Carnivora: Canidae, Felidae; Perissodactyla: Equidae (A) Rodentia: Muridae (N)

Human infestation: no

Remarks: Camicas et al. (1998) state that the larva and nymph of *R. capensis* have not been described; however, these stages were subsequently described by Walker et al. (2000). Natural hosts for the larvae of *R. capensis* are not known but are probably Rodentia (Matthee et al. 2007); this stage has been described from laboratory-reared specimens (Walker et al. 2000). Keirans and Durden (2001) record a single incident of *R. capensis* being introduced into the Nearctic Region, but there is no evidence of it having become established there. Walker et al. (2000) discuss the earlier confusion attending the diagnosis of this species and we have therefore elected not to include host records prior to their work.

References

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Horak, I.G., Heyne, H. & Donkin, E.F. 2010. Parasites of domestic and wild animals in South Africa. XLVIII. Ticks (Acari: Ixodidae) infesting domestic cats and wild felids in southern Africa. Onderstepoort J. Vet. Res., 36, doi:10.4102/ojvr.v77i1.3

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Matthee, S., Horak, I.G., Beaucournu, J.-C., Durden, L.A., Ueckermann, E.A. & McGeoch, M.A. 2007. Epifaunistic arthropod parasites of the four-striped mouse, *Rhabdomys pumilio*, in the Western Cape Province, South Africa. J. Parasitol., 93: 47–59.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

14 – *R. carnivoralis* Walker, 1966 (Parasitology, 56: 1–12)

Type depositories: BMNH (holotype, paratypes), EAVRO, OVI, HH, WC (paratypes) (Keirans, J.E. & Hillyard, P.D. 2001. A catalogue of the type specimens of Ixodida (Acari: Argasidae, Ixodidae) deposited in The Natural History Museum, London. Occ. Pap. Syst. Entomol. (13), 74 pp.)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands; few ticks in East African montane forests

Hosts: usual hosts for adult ticks are Carnivora: Felidae.
Carnivora (several families); Artiodactyla: Bovidae (A)
Hyracoidea: Procaviidae (N)

Human infestation: yes (Walker et al. 2000)

Remarks: natural hosts for the larvae of *R. carnivoralis* are unknown. This stage was described from laboratory-reared specimens (Walker et al. 2000).

References

Colbo, M.H. & MacLeod, J. 1976. Ecological studies of ixodid ticks (Acari, Ixodidae) in Zambia. II. Ticks found on small mammals and birds. Bull. Entomol. Res., 66: 489–500.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

15 – *R. cliffordi* Morel, 1965 (Rev. Élev. Méd. Vét. Pays Trop., 17, 637–654)
According to Walker et al. (2000, *op. cit*. under *R. appendiculatus*), volume 17 of this journal corresponds to the year 1964, but the issue with the description of *R. cliffordi* was published in 1965. Walker et al. (2000, *op. cit*. under *R. appendiculatus*) treat *R. cliffordi* as a probable junior synonym of *R. pseudolongus*, and Kolonin (2009, *op. cit*. under *R. aurantiacus*) shares this opinion. We, however, concur with Guglielmone et al. (2009, *op. cit*. under *R. aurantiacus*), who argue that this synonymy has not been definitively proven. Walker et al. (2000, *op. cit.* under *R. appendiculatus*) discuss the complex nomenclature and taxonomic problems accompanying the correct identification of *R. cliffordi*, *R. compositus*, *R. longus* and *R. pseudolongus*.

Type depository: unknown (Walker et al. 2000 *op. cit.* under *R. appendiculatus*).

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical moist broadleaf forests. These ecoregions for *R. cliffordi* must be considered tentative, pending validation of the species.

Hosts: Artiodactyla: Bovidae, Suidae (A)

Human infestation: no

References

Morel, P.-C. 1965. Description de *Rhipicephalus cliffordi* n. sp. d'Afrique occidentale (groupe de *Rh. compositus*; Acariens, Ixodoidea). Rev. Élev. Méd. Vét. Pays Trop., 17: 637–654. (see above for year of publication).

Morel, P.-C. 1976. Contribution à la connaissance de la distribution des tiques (Acariens, Ixodidae et Amblyommidae) en Afrique éthiopienne continentale. Annexe cartographique. Institut d'Élevage et de Médecine Vétérinaire des Pays Tropicaux, Paris, 326 pp.

16 – *R. complanatus* Neumann, 1911 (Arch. Parasitol., 14: 415)

Type depository: MNHN (syntypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*) as *Rhipicephalus planus* Neumann, 1910, a name preoccupied by *Rhipicephalus simus planus* Neumann, 1907, as stated in Walker et al. (2000, *op. cit*. under *R. appendiculatus*) and consequently renamed.

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical moist broadleaf forests; tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for adult ticks are Artiodactyla: Suidae.
Artiodactyla: Suidae (AN)
Artiodactyla: Bovidae; Carnivora: Viverridae; Rodentia: Muridae (A)

Human infestation: yes (Walker et al. 2000)

Remarks: the immature stages of *R. complanatus* remain undescribed but we accept the record of a nymph of this tick from Suidae in Elbl and Anastos (1966). Kolonin (2009) recognizes only Artiodactyla as hosts for *R. complanatus*, but we consider infestations on other types of hosts, described in the references below, to be valid.

References

Elbl, A. & Anastos, G. 1966. Ixodid ticks (Acarina, Ixodidae). Vol. III. Genus *Rhipicephalus* Koch, 1844. Ann. Mus. R. Afr. Centr., Ser. 8º Sci. Zool. (147), 555 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

17 – *R. compositus* Neumann, 1897 (Mém. Soc. Zool. Fr., 10: 324–420)
See *R. cliffordi.*

Type depository: MNHN (holotype) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: mainly in central Zambezian miombo woodlands; southern Rift montane forest-grassland mosaic; *Acacia-Commiphora* bushlands and thickets; East African montane forests

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Artiodactyla: Bovidae, Suidae; Perissodactyla: Equidae, Rhinocerotidae; Carnivora: Felidae, Canidae (A)
Rodentia: Muridae (NL)

Human infestation: yes (Walker et al. 2000)

Remarks: Keirans and Durden (2001) record a single instance of *R. compositus* being introduced into the Nearctic Region, but there is no evidence that it has become established there. Walker et al. (2000) discuss the difficulties attending diagnosis of this species, and we have therefore elected not to include records published prior to their work.

References

Fyumagwa, R.D., Runyoro, V., Horak, I.G. & Hoare, R. 2007. Ecology and control of ticks as disease vectors in wildlife of the Ngorongoro Crater, Tanzania. S. Afr. J. Wildl. Res., 37: 79–90.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

18 – *R. congolensis* Apanaskevich, Horak & Mulumba-Mfumu, 2013 (J. Med. Entomol., 50: 479–484)

Type depository: USNTC (holotype, paratypes), OVI, ZIAC (paratypes) (Apanaskevich, D.A., Horak, I.G. & Mulumba-Mfumu, L.K. 2013. A new species of *Rhipicephalus* (Acari: Ixodidae), a parasite of red river hogs and domestic pigs in the Democratic Republic of Congo. J. Med. Entomol., 50: 479–484)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregions: eastern Congolian swamp forests

Hosts: Artiodactyla: Suidae

Human infestation: no

Reference

Apanaskevich, D.A., Horak, I.G. & Mulumba-Mfumu, L.K. 2013. A new species of *Rhipicephalus* (Acari: Ixodidae), a parasite of red river hogs and domestic pigs in the Democratic Republic of Congo. J. Med. Entomol., 50: 479–484.

19 – *R. cuspidatus* Neumann, 1906 (Arch. Parasitol., 10: 195–219)

Type depository: BMNH (syntypes) (Keirans and Hillyard 2001, *op. cit.* under *R. carnivoralis*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: west Sudanian savanna; Sahelian *Acacia* savanna

Hosts: usual hosts for adult ticks are Artiodactyla: Suidae. Aves are exceptional hosts.
Artiodactyla: Suidae; Rodentia: Hystricidae (ANL)
Carnivora: Canidae, Hyaenidae; Rodentia: Thryonomyidae; Tubulidentata: Orycteropodidae (AN)
Artiodactyla: Bovidae; Carnivora: Felidae, Herpestidae; Galliformes: Phasianidae (N)

Human infestation: no

Remarks: Camicas et al. (1998) state that only the male and female of *R. cuspidatus* have been described; however, the larva and nymph were subsequently described by Walker et al. (2000). Kolonin (2009) does not include the only record of this species on Aves (Morel 2003), which we consider valid.

References

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Morel, P.-C. 1978. Tiques d'animaux sauvages en Haute-Volta. Rev. Élev. Méd. Vét. Pays Trop., 31: 69–78.
Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.
Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.
Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

20 – *R. decoloratus* Koch, 1844 (Arch. Naturgesch., 10: 217–239)
This tick species was formerly considered a member of the genus *Boophilus.*

Type depository: ZMB (holotype) (Moritz and Fischer 1981, *op. cit.* under *R. arnoldi*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts are Artiodactyla: Bovidae, while Aves, Squamata and Testudines are exceptional hosts for this tick.
Mammalia (several orders), Aves (several orders); Squamata: Boidae; Testudines: Testudinidae

Human infestation: yes (Horak et al. 2002 as *Boophilus decoloratus*)

Remarks: because this is a one-host tick, we do not separately record the various life stages present on hosts. There are records of the introduction of *R. decoloratus* into the Neotropical and Nearctic Regions in Lahille (1914) and Keirans and Durden (2001), but there is no evidence of its establishment in these regions. The Neotropical records of this tick published by Seifert (1959) are considered erroneous (Guglielmone et al. 2003), as are records of its occurrence outside the Afrotropical Region, such as those of Geevarghese et al. (1997) and other workers in India (Oriental Region). Most authors listed below refer to this tick as *Boophilus decoloratus*.

References

Geevarghese, G., Fernandes, S. & Kulkarni, S.M. 1997. A checklist of Indian ticks (Acari: Ixodoidea). Ind. J. Anim. Sci., 67: 566–574.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Horak, I.G., De Vos, V. & De Klerk, B.D. 1984. Parasites of domestic and wild animals in South Africa. XVII. Arthropod parasites of Burchell's zebra, *Equus burchelli*, in the eastern Transvaal Lowveld. Onderstepoort J. Vet. Res., 51: 145–154.

Horak, I.G., Fourie, L.J., Heyne, H., Walker, J.B. & Needham, G.R. 2002. Ixodid ticks feeding on humans in South Africa: with notes on preferred hosts, geographic distribution, seasonal occurrence and transmission of pathogens. Exp. Appl. Acarol., 27: 113–136.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Lahille, F. 1914. Nota sobre la presencia accidental en Buenos Aires de unas garrapatas del camello. Bol. Minist. Agric. Arg, 17: 289–293.

Okanga, S. & Rebelo, C. 2006. Tick prevalence and species diversity on Aldabran giant tortoises (*Dipsochelys dussumieri*) in relation to host range and host size in a restored ecosystem, Kenya. Afr. J. Ecol., 44: 395–400.

Seifert, H. 1959. Bekampfung der Ekto und Endoparasiten bei Rindern und Schafen in Peru. Vet.-Med. Nachr. (3): 118–135.

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

Uys, A.C. & Horak, I.G. 2005. Ticks on crested francolins, *Francolinus sephaena*, and on the vegetation on a farm in Limpopo Province, South Africa. Onderstepoort J. Vet. Res., 72: 339–343.

Wanzala, W. & Okanga, S. 2006. Ticks (Acari: Ixodidae) associated with wildlife and vegetation of Haller Park along the Kenyan coastline. J. Med. Entomol., 43: 789–794.

21 – *R. deltoideus* Neumann, 1910 (Tijdschr. Entomol., 53: 11–17)

Type depository: BMNH (syntype) (Keirans and Hillyard 2001, *op. cit.* under *R. carnivoralis*)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregion: highveld grasslands

Hosts: unknown but see remarks below.

Human infestation: no

Remarks: Camicas et al. (1998) list pholeophilic (burrowing) mammals as hosts for the adults of *R. deltoideus*; however, Walker et al. (2000) state that ticks previously identified as *R. deltoideus* were re-identified as belonging to other species within *Rhipicephalus*, such as *R. arnoldi* and alleged *R. turanicus*, while the hosts for the original description of this species are unknown. We believe that the hosts for *R. deltoideus* remain unknown. Durden and Keirans (1996) list *R. deltoideus* as an endangered species.

References

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

22 – *R. distinctus* Bedford, 1932 (18th Report of the Director of Veterinary Services and Animal Industry, Union of South Africa, pp. 223–523)

Type depository: OVI (syntypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*) as *Rhipicephalus punctatus* Bedford, 1929, a name preoccupied by *Rhipicephalus neavei punctatus* Warburton, 1912 and consequently renamed.

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: deserts and xeric shrublands; few ticks in tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for larvae, nymphs and adults are Hyracoidea: Procaviidae.
Hyracoidea: Procaviidae; Carnivora: Felidae (ANL)
Lagomorpha: Leporidae (AL)
Carnivora: Herpestidae; Macroscelidea: Macroscelididae; Rodentia: Muridae (NL)
Rodentia: Pedetidae (L)

Human infestation: yes (Walker et al. 2000)

Remarks: Camicas et al. (1998) state that the larva of *R. distinctus* is undescribed, but it was subsequently described by Walker et al. (2000). Walker (1991) considers the record of Theiler (1962) on Artiodactyla: Suidae to be erroneous, and Walker et al. (2000) believe that the adults on Artiodactyla: Bovidae recorded as *Rhipicephalus simpsoni* by Baker and Keep (1970) and as *R. distinctus* by Walker (1991) are in fact *Rhipicephalus oreotragi*. We have not included these records in our list of hosts for *R. distinctus*. Kolonin (2009) ignores hosts other than Procaviidae for the adults of *R. distinctus*, but we regard this as an error.

References

Baker, M.K. & Keep, M.E. 1970. Checklist of the ticks found on the larger game animals in the Natal game reserves. Lammergeyer (12): 41–47.

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Fourie, L.J., Horak, I.G. & Woodall, P.F. 2005. Elephant shrews as hosts of immature ixodid ticks. Onderstepoort J. Vet. Res., 72: 293–301.

Horak, I.G., Fourie, L.J., Novellie, P.A. & Williams, E.J. 1991. Parasites of domestic and wild animals in South Africa. XXVI. The mosaic of ixodid tick infestations on birds and mammals in the Mountain Zebra National Park. Onderstepoort J. Vet. Res., 58: 125–136.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

23 – *R. duttoni* Neumann, 1907 (Ann. Trop. Med. Parasitol., 1: 115–120)

Type depository: unknown. Keirans and Hillyard. (2001, *op. cit.* under *R. carnivoralis*) state that there is a syntype of *R. duttoni* in the BMNH. However, Keirans and Hillyard (2001, *op. cit.* under *R. carnivoralis*) and Walker et al. (2000, *op. cit.* under *R. appendiculatus*) agree that the description of *R. duttoni* was based on a

single male specimen, for which the depository was not stated. We therefore conclude that there are no grounds to designate the specimen deposited in the BMNH as a syntype.

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands.

Hosts: usual hosts for nymphs and adults are Artiodactyla: Bovidae. Aves are exceptional hosts.
Artiodactyla: Bovidae (ANL)
Lagomorpha: Leporidae (AN)
Carnivora: Canidae, Viverridae; Perissodactyla: Equidae; Gruiformes: Otidae (A)

Human infestation: no

Remarks: Camicas et al. (1998) state that the larva and nymph of *R. duttoni* are undescribed; however, they were subsequently described by Walker et al. (2000). Aves are excluded as hosts of *R. duttoni* by Kolonin (2009), but there is a *bona fide* record for this uncommon host-tick relationship in Walker et al. (2000). See also *R. appendiculatus.*

References

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Sousa Dias, V. 1950. Subsídios para o estudo dos ixodídeos de Angola. Pecuária, Loanda (1947–1948), 2: 127–280.

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae). A guide to the brown ticks of the world. Cambridge University Press, London, 643 pp.

24 – *R. dux* Dönitz, 1910 (Sber. Ges. Naturf. Freunde Berlin (6): 275–280)

Type depository: ZMB (syntype) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical moist broadleaf forests; tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Artiodactyla: Bovidae, Suidae; Proboscidea: Elephantidae (A)

Human infestation: no

Remarks: Camicas et al. (1998) consider Proboscidea the main host for *R. dux*, but the information provided in Walker et al. (2000) indicates that the most common hosts for this tick are Artiodactyla. There is a record of unattached *R. dux* on a human in Walker et al. (2000), but we have not included humans as hosts of this tick.

References

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

25 – *R. evertsi* Neumann, 1897 (Mém. Soc. Zool. Fr., 10: 324–420)
This species is generally thought to comprise two subspecies, *R. e. evertsi* and *R. e. mimeticus* (Walker et al. 2000, *op. cit.* under *R. appendiculatus*), an indication that more than one taxon may be included under the name *R. evertsi.*

Type depository: LMNH (syntypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: this tick species is present in many ecoregions, but mainly in montane grasslands and shrublands and tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for larvae, nymphs and adults are Artiodactyla: Bovidae. Macroscelidea and Testudines are considered exceptional hosts.
Mammalia (several orders); Passeriformes: Alaudidae, Hirundinidae (ANL)
Falconiformes: Accipitridae; Testudines: Testudinidae (A)
Aves (several orders) (NL)

Human infestation: yes (Horak et al. 2002)

Remarks: a two-host tick, with larvae and nymphs infesting the same first host and adults infesting the second host. Keirans and Durden (2001) record several introductions of *R. evertsi* into the Nearctic Region, while Morel (2003) lists Neotropical and Palearctic records for this species, and Bouhous et al. (2011) present a Palearctic record as *R. evertsi evertsi*, but there is no evidence that *R. evertsi* has become established in any of these regions. Theiler (1959) lists Coliiformes and Passeriformes (Malaconotidae and Ploceidae) as hosts for adult *R. evertsi*, but subsequent studies

indicate that these birds actually host the immature stages. Fourie et al. (2005) treat as "stragglers" the few immatures of this tick found on Macroscelidea. The references below contain records of adult *R. evertsi* parasitizing Aves and Testudines, but these hosts are not included in Kolonin (2009), probably because such host-parasite relationships are infrequent.

References

Bouhous, A., Aissi, M. & Harhoura, K. 2011. Prevalence of Ixodidae in sheep brought for slaughter in Adrar municipal abattoir, southwest Algeria. Sci. Parasitol., 12: 197–201.

Fourie, L.J., Horak, I.G. & Woodall, P.F. 2005. Elephant shrews as hosts of immature ixodid ticks. Onderstepoort J. Vet. Res., 72: 293–301.

Horak, I.G., Knight, M.M. & De Vos, V. 1986. Parasites of domestic and wild animals in South Africa. XX. Arthropod parasites of the Cape mountain zebra (*Equus zebra zebra*). Onderstepoort J. Vet. Res., 53: 127–132.

Horak, I.G., Fourie, L.J., Heyne, H., Walker, J.B. & Needham, G.R. 2002. Ixodid ticks feeding on humans in South Africa: with notes on preferred hosts, geographic distribution, seasonal occurrence and transmission of pathogens. Exp. Appl. Acarol., 27: 113–136.

Horak, I.G., Fourie, L.J. & Braack, L.E.O. 2005. Small mammals as hosts of immature ixodid ticks. Onderstepoort J. Vet. Res., 72: 255–261.

Horak, I.G., Golezardy, H. & Uys, A.C. 2007. Ticks associated with the three largest wild ruminant species in southern Africa. Onderstepoort J. Vet. Res., 74: 231–242.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Theiler, G. 1959. African ticks and birds. Ostrich (Suppl. 3), 3: 353–378.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

26 – *R. exophthalmos* Keirans & Walker, 1993 (*In* Keirans et al. 1993. Onderstepoort J. Vet. Res., 60: 229–246)

Type depositories: OVI (holotype, paratypes), BMNH, USNTC (paratypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: deserts and xeric shrublands; few ticks in tropical and subtropical grasslands, savannas and shrublands

Hosts: Aves are exceptional hosts for this tick.
Lagomorpha: Leporidae (ANL)
Artiodactyla: Bovidae, Suidae; Carnivora: Canidae, Felidae; Perissodactyla: Equidae (A)
Macroscelidea: Macroscelididae (NL)
Galliformes: Phasianidae (L)

Human infestation: no

Remarks: Uys and Horak (2005) record the collection of larvae from Aves, but these hosts are not included in Kolonin (2009), probably because avian parasitism is an unusual event.

References

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Uys, A.C. & Horak, I.G. 2005. Ticks on crested francolins, *Francolinus sephaena*, and on the vegetation on a farm in Limpopo Province, South Africa. Onderstepoort J. Vet. Res., 72, 339–343.
Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

27 – *R. follis* Dönitz, 1910 (Denkschr. Med.-Naturw. Ges. Jena, 16: 397–494)

Type depository: BMNH (syntypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: Drakensberg montane grasslands, woodlands and forests; highveld grasslands

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae; usual hosts for larvae and nymphs are Rodentia: Muridae.
Carnivora: Canidae (AL)
Artiodactyla: Bovidae, Giraffidae, Suidae; Perissodactyla: Equidae; Carnivora: Felidae (A)
Rodentia: Muridae (NL)

Human infestation: yes (Horak et al. 2002)

Remarks: Kolonin (2009) does not include Carnivora as hosts for *R. follis*, but there is *bona fide* information on this tick-host relationship in Walker et al. (2000).

References

Horak, I.G., Fourie, L.J., Heyne, H., Walker, J.B. & Needham, G.R. 2002. Ixodid ticks feeding on humans in South Africa: with notes on preferred hosts, geographic distribution, seasonal occurrence and transmission of pathogens. Exp. Appl. Acarol., 27: 113–136.

Horak, I.G., Golezardy, H. & Uys, A.C. 2007. Ticks associated with the three largest wild ruminant species in southern Africa. Onderstepoort J. Vet. Res., 74: 231–242.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Petney, T.N., Horak, I.G., Howell, D.J. & Meyer, S. 2004. Striped mice, *Rhabdomys pumilio*, and other murid rodents as hosts for immature ixodid ticks in the Eastern Cape Province. Onderstepoort J. Vet. Res. 71: 313–318.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

28 – *R. fulvus* Neumann, 1913 (Bull. Soc. Zool. Fr., 38: 147–151)

Type depository: unknown (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Afrotropical, Palearctic

Ecoregions: north and south Saharan steppe and woodlands

Hosts: Artiodactyla: Bovidae, Camelidae; Rodentia: Ctenodactylidae (ANL)
Rodentia: Muridae (stage unknown)

Human infestation: yes (Walker et al. 2000)

Remarks: there is a record of *R. fulvus* on Muridae (tick stage unknown) in Walker et al. (2000) that is not included in Kolonin (2009).

References

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

29 – *R. geigyi* (Aeschlimann & Morel, 1965) (Acta Trop., 22: 162–168)
This tick was formerly considered to be a member of the genus *Boophilus.*

Type depository: ITS (holotype, paratype) (Aeschlimann, A. & Morel, P.-C. 1965. *Boophilus geigyi* n. sp. (Acarina: Ixodoidea) une nouvelle tique du bétail de l'Ouest africaine. Acta Trop., 22: 162–168) as *Boophilus geigyi*

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical moist broadleaf forests; few ticks in tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for this tick are Artiodactyla: Bovidae.
Artiodactyla: Bovidae; Carnivora: Canidae, Felidae

Human infestation: no

Remarks: because this is a one-host tick we do not separately record the various life stages present on hosts. All authors cited below refer to this tick as *Boophilus geigyi.* Morel (1978) and Cumming (1998) list Suidae as hosts for this tick. Morel (1978) gives Hoffmann and Lindau (1971) as the source for this host-parasite relationship, but we were unable to confirm this from their publication. Consequently, we have not included Suidae as hosts of *R. geigyi*. Felidae are ignored as hosts for *R. geigyi* in Kolonin (2009), but we regard a record for this type of host in Aeschlimann (1967) as valid.

References

Aeschlimann, A. 1967. Biologie et écologie des tiques (Ixodoidea) de Côte d'Ivoire. Acta Trop., 24: 281–405.
Cumming, G.S. 1998. Host preference in African ticks (Acari: Ixodida): a quantitative data set. Bull. Entomol. Res., 88: 379–406.
Hoffmann, G. & Lindau, M. 1971. Zecken an Nutz- und Wildtieren in Niger. Z. Ang. Entomol., 69: 72–82.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Morel, P.-C. 1978. Tiques d'animaux sauvages en Haute-Volta. Rev. Élev. Méd. Vét. Pays Trop., 31: 69–78.

30 – *R. gertrudae* Feldman-Muhsam, 1960 (J. Parasitol., 46: 101–108)

Type depository: FMC (holotype, paratype), OVI, ZMB (paratypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: deserts and xeric shrublands; montane grasslands and shrublands

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae; usual hosts for larvae and nymphs are Rodentia: Muridae. Aves and Testudines are exceptional hosts for this tick.
Mammalia (several orders); Testudines: Testudinidae (A)
Macroscelidea: Macroscelididae; Rodentia: Muridae (NL)
Lagomorpha: Leporidae; Rodentia: Hystricidae (N)
Galliformes: Numididae; Passeriformes: Muscicapidae, Pycnonotidae (L)

Human infestation: yes (Horak et al. 2002)

Remarks: Camicas et al. (1998) state that the larva and nymph of *R. gertrudae* are undescribed, but they were subsequently described by Walker et al. (2000). Horak et al. (2006) found adult *R. gertrudae* on Testudines, while Van Niekerk et al. (2006) found larvae on Aves, but these unusual hosts were ignored in Kolonin (2009).

References

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Fourie, L.J., Horak, I.G. & Woodall, P.F. 2005. Elephant shrews as hosts of immature ixodid ticks. Onderstepoort J. Vet. Res., 72: 293–301.

Horak, I.G., Fourie, L.J., Heyne, H., Walker, J.B. & Needham, G.R. 2002. Ixodid ticks feeding on humans in South Africa: with notes on preferred hosts, geographic distribution, seasonal occurrence and transmission of pathogens. Exp. Appl. Acarol., 27: 113–136.

Horak, I.G., Fourie, L.J. & Braack, L.E.O. 2005. Small mammals as hosts of immature ixodid ticks. Onderstepoort J. Vet. Res., 72: 255–261.

Horak, I.G., McKay, I.J., Henen, B.T., Heyne, H., Hofmeyr, M.D. & De Villiers, A.L. 2006. Parasites of domestic and wild animals in South Africa. XLVII. Ticks of tortoises and other reptiles. Onderstepoort J. Vet. Res., 73: 215–227.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Van Niekerk, D.J., Fourie, L.J. & Horak, I.G. 2006. Birds as hosts of immature ixodid ticks in Free State Province, South Africa. Onderstepoort J. Vet. Res., 73: 123–130.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

31 – *R. glabroscutatus* Du Toit, 1941 (Onderstepoort J. Vet. Sci. Anim. Ind., 16: 115–118)

See "Remarks on some invalid names" at the beginning of this chapter for the correct spelling of the specific epithet, which in the past has been spelled *R. glabroscutatum.*

Type depository: OVI (syntypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*) as *R. glabroscutatum*

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: montane grasslands and shrublands; mediterranean forests, woodlands and scrub; deserts and xeric shrublands

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae; usual hosts for larvae and nymphs are Artiodactyla: Bovidae and Lagomorpha: Leporidae.

Artiodactyla: Bovidae; Lagomorpha: Leporidae; Perissodactyla: Equidae (ANL)
Hyracoidea: Procaviidae (AL)
Carnivora: Canidae, Felidae; Rodentia: Pedetidae; Galliformes: Numididae (NL)
Rodentia: Muridae (L)

Human infestation: yes (Horak et al. 2002)

Remarks: a two-host tick, with the larva and nymph feeding on the same first host and adults infesting the second host. Kolonin (2009) limits the range of hosts of adult *R. glabroscutatus* to ungulates, adding hares as hosts for larvae and nymphs, but the references cited below reveal a wider array of hosts for this tick.

References

Horak, I.G., Fourie, L.J., Novellie, P.A. & Williams, E.J. 1991. Parasites of domestic and wild animals in South Africa. XXVI. The mosaic of ixodid tick infestations on birds and mammals in the Mountain Zebra National Park. Onderstepoort J. Vet. Res., 58: 125–136.

Horak, I.G., MacIvor K.M. & Greeff, C.J. 2001. Parasites of domestic and wild animals in South Africa. XXXIX. Helminth and arthropod parasites of Angora goats in the southern Karoo. Onderstepoort J. Vet. Res., 68: 27–35.

Horak, I.G., Fourie, L.J., Heyne, H., Walker, J.B. & Needham, G.R. 2002. Ixodid ticks feeding on humans in South Africa: with notes on preferred hosts, geographic distribution, seasonal occurrence and transmission of pathogens. Exp. Appl. Acarol., 27: 113–136.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

32 – *R. guilhoni* Morel & Vassiliades, 1963 (Rev. Élev. Méd. Vét. Pays Trop., 15: 343–386)
According to Walker et al. (2000, *op. cit*. under *R. appendiculatus*) volume 15 of this journal should have been published in 1962, but the issue containing the description of *R. guiloni* was not published until 1963.

Type depository: MNHN (holotype, paratypes) (Walker et al. 2000, *op. cit.* under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical, Palearctic

Ecoregions: Sahelian *Acacia* savanna; west Sudanian savanna; deserts and xeric shrublands

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Mammalia (several orders); Aves (several orders) (A)
Lagomorpha: Leporidae; Rodentia: Muridae, Sciuridae (NL)

Human infestation: yes (Morel 2003)

References

Bouhous, A., Aissi, M. & Harhoura, K. 2011. Prevalence of Ixodidae in sheep brought for slaughter in Adrar municipal abattoir, southwest Algeria. Sci. Parasitol., 12: 197–201.

Hafez, M., Bishara, S.I. & Bassal, T.T.M. 1981. Trials on cross-mating between three species of *Rhipicephalus sanguineus* group (Ixodoidea: Ixodidae). J. Egypt. Soc. Parasitiol., 2: 261–267.

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Morel, P.-C. & Vassiliades, G. 1963. Les *Rhipicephalus* du groupe *sanguineus*: espèces Africaines (Acariens: Ixodoidea). Rev. Élev. Méd. Vét. Pays Trop., 15: 343–386.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

33 – *R. haemaphysaloides* Supino, 1897 (Atti Soc. Veneto-Trentina Sci. Nat. Residente Padova, Ser. 2, 3: 230–238)
Walker et al. (2000, *op. cit.* under *R. appendiculatus*) enclose the author's name in parentheses – (Supino, 1897) – but this is an error because *R. haemaphysaloides* was originally described as a species of *Rhipicephalus.* See also *R. pilans*

Type depository: BMNH (syntypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*). Originally named *R. haemaphysaloides niger* Supino, 1897.

Known stages: male, female, nymph, larva

Zoogeographic Regions: Australasian, Oriental, Palearctic

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: Aves are exceptional hosts for this tick.
Carnivora: Canidae; Rodentia: Muridae (ANL)
Artiodactyla: Bovidae (AN)
Mammalia (several orders) (A)
Carnívora: Herpestidae (N)
Soricomorpha: Soricidae; Cuculiformes: Cuculidae; Passeriformes: Timaliidae (NL)
Galliformes: Phasianidae (stages unknown)

Human infestation: yes (Durden et al. 2008)

Remarks: Camicas et al. (1998) state that *R. haemaphysaloides* is found exclusively in the Oriental Region. However, Teng and Jiang (1991) and Walker et al. (2000) record Palearctic localities for this species, and the latter authors, as well as Durden et al. (2008), clearly indicate the presence of this tick in Sulawesi

(Australasian Region). Kolonin (2009) does not include Aves as hosts for *R. haemaphysaloides*, but we regard the records from Aves reported in the studies of Kaul and co-workers (see below) and Walker et al. (2000) as valid.

References

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Dilrukshi, P.R.M.P. 2006. Taxonomic status of ticks in Sri Lanka. *In* C.N.B. Bambaradeniya (editor), The fauna of Sri Lanka: status of taxonomy, research and conservation. The World Conservation Union, Colombo, Sri Lanka, pp. 65–69

Durden, L.A., Merker, S. & Beati, L. 2008. The tick fauna of Sulawesi, Indonesia (Acari: Ixodoidea: Argasidae and Ixodidae). Exp. App. Acarol., 45: 85–110.

Geevarghese, G. & Dhanda, V. 1995. Ixodid ticks of Maharashtra State, India. Acarologia, 36: 309–313.

Grassman, L.I., Sarataphan, N., Tewes, M.E., Silvy, N.J. & Nakanakrat, T. 2004. Ticks (Acari: Ixodidae) parasitizing wild carnivores in Phu Khieo wildlife sanctuary. J. Parasitol., 90: 657–659.

Kaul, H.N., Mishra, A.C., Dhanda, V., Kulkarni, S.M. & Guttikar, S.N. 1978. Ectoparasitic arthropods of birds and mammals from Rajasthan State, India. Ind. J. Parasitol., 2: 19–25.

Kaul, H.N., Dhanda, V. & Mishra, A.C. 1979. A survey of ixodid ticks in Orissa State, India. Ind. J. Anim. Sci., 49: 707–712.

Kaul, H.N., Shetty, P.S., Ghalsasi, G.R. & Dhanda, V. 1990. Survey of ticks (Acarina: Ixodidae) for Crimean haemorrhagic fever virus activity in Jammu & Kashmir State, India. Ind. J. Med. Res. (A), 91: 5–8.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Mitchell, C.J., Hoogstraal, H., Schaller, G.B. & Spillett, J. 1966. Ectoparasites from mammals in Kanha National Park, Madhya Pradesh, India, and their potential disease relationships. J. Med. Entomol., 3: 113–124.

Rajagopalan, P.K., Patil, A.P. & Boshell, J. 1968. Ixodid ticks on their mammalian hosts in the Kyasanur Forest disease area of Mysore State, India, 1961–1964. Ind. J. Med. Res., 56: 510–526.

Sharma, B.D. 1993. Medical & veterinary arthropod-disease ecology. Ashish Publishing House, New Delhi, 335 pp.

Teng, K. & Jiang, Z.-J. 1991. Economic insect of fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

34 – *R. humeralis* Tonelli Rondelli, 1926 (Res. Biol. 1: 33–43)

Type depository: unknown (Walker et al. 2000, *op. cit*. under *R. appendiculatus*) as *R. pulchellus humeralis*

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: northern *Acacia-Commiphora* bushlands and thickets; few ticks in northern Zanzibar-Inhambane coastal forest mosaic

Hosts: Aves are exceptional hosts for this tick.
Mammalia (several orders); Falconiformes: Accipitridae (A)

Human infestation: yes (Walker et al. 2000)

Remarks: natural hosts for the larvae and nymphs of *R. humeralis* are unknown; these stages were described from laboratory-reared specimens (Walker et al. 2000). There is a valid record of *R. humeralis* on Aves in Walker et al. (2000), but this was not included in Kolonin (2009).

References

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

35 – *R. hurti* Wilson, 1954 (Parasitology, 44: 277–284)

Type depository: BMNH, HH, OVI, SDC, USNTC (syntypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Artiodactyla: Bovidae, Suidae; Carnivora: Canidae, Felidae, Viverridae; Perissodactyla: Rhinocerotidae (A)
Rodentia: Muridae (L)

Human infestation: yes (Walker et al. 2000)

Remarks: Camicas et al. (1998) state that the larva and nymph of *R. hurti* have not been described, but they were subsequently described by Walker et al. (2000), who record a larva of *R. hurti* on Muridae, but no host for the nymph, which was described from laboratory-reared specimens. Kolonin (2009) states that hosts for the immature stages are unknown.

References

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

36 – *R. interventus* Walker, Pegram & Keirans, 1995 (Onderstepoort J. Vet. Res., 62: 89–95)

Type depository: USNTC (holotype, paratypes), BMNH, OVI (paratypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Artiodactyla: Bovidae; Carnivora: Canidae (A)

Human infestation: no

Reference

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

37 – *R. jeanneli* Neumann, 1913 (*In* Voyage de Ch. Alluad et R. Jeannel en Afrique orientale (1911–1912). Résultats scientifiques. A. Schulze, Paris, pp. 25–35)

Type depository: unknown (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: Victoria Basin forest-savanna mosaic; *Acacia* bushlands and thickets

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae, while Aves are considered exceptional hosts for this tick.
Artiodactyla: Bovidae, Suidae; Perissodactyla: Equidae, Rhinocerotidae; Carnivora: Canidae, Felidae; Galliformes: Phasianidae (A)
Rodentia: Muridae, Spalacidae (NL)

Human infestation: yes (Walker et al. 2000)

Remarks: Camicas et al. (1998) state that the larva and nymph of *R. jeanneli* have not been described, but they were subsequently described by Walker et al. (2000). Njanja et al. (1991) recorded this species from Artiodactyla: Camelidae, but we consider this record doubtful because the authors fail to describe how they identified their ticks. Kolonin (2009) limits the host range of *R. jeanneli* to Artiodactyla: Bovidae and Suidae plus Rodentia: Muridae. However, we accept the wide variety of hosts for this species presented in Walker et al. (2000).

References

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Njanja, J.C., Rinkanya, F.G.R. & Kiara, H.K. 1991. Ticks of camels, sheep and goats in northwestern Kenya rangelands. Trop. Pest Manag., 37: 166–168.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

38 – *R. kochi* Dönitz, 1905 (Sber. Ges. Naturf. Freunde Berlin (4): 105–134)

Type depository: ZMB (lectotype), BMNH (paralectotypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands; tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae. Aves are exceptional hosts.
Artiodactyla: Bovidae; Lagomorpha: Leporidae (ANL)
Macroscelidea: Macroscelididae (AN)
Mammalia (several orders); Gruiformes: Otidae (A)
Carnivora: Viverridae (N)

Human infestation: yes (Morel 2003, see below)

Remarks: the difficulties associated with diagnosing *R. kochi* have been discussed by Clifford et al. (1983), and we have therefore excluded earlier records from our analysis. Walker et al. (2000) use the term "immatures" without stating whether it refers to nymphs, larvae (apparently known only from laboratory-reared specimens), or both preimaginal stages of *R. kochi.* However, Horak et al. (1995) and Horak et al. (2003) have collected all development stages from Lagomorpha: Leporidae and Artiodactyla: Bovidae, respectively. Morel (2003) reports humans as parasitized by *R. neavei* = *R. kochi*? [sic]. *Rhipicephalus neavei* is now considered a synonym of *R. kochi*, and we

provisionally include humans as infested by *R. kochi.* Keirans and Durden (2001) record *R. kochi* as having been introduced into the Nearctic Region, but there is no evidence that it has become established there. Kolonin (2009) ignores the record from Aves in Walker et al. (2000), but we accept this record as valid.

References

Clifford, C.M., Walker, J.B. & Keirans, J.E. 1983. Clarification of the status of *Rhipicephalus kochi* Dönitz, 1905 (Ixodoidea, Ixodidae). Onderstepoort J. Vet. Res., 50: 77–89.

Horak, I.G., Spickett, A.M., Braack, L.E.O., Penzhorn, B.L., Bagnall, R.J. & Uys, A.C. 1995. Parasites of domestic and wild animals in South Africa. XXXIII. Ixodid ticks on scrub hares in the north-eastern regions of Northern and Eastern Transvaal and of KwaZulu-Natal. Onderstepoort J. Vet. Res., 62: 123–131.

Horak, I.G., Braack, L.E.O., Fourie, L.J. & Walker, J.B. 2000. Parasites of domestic and wild animals in South Africa. XXXVIII. Ixodid ticks collected from 23 wild carnivore species. Onderstepoort J. Vet. Res., 67: 239–250.

Horak, I.G., Gallivan, G.J., Braack, L.E.O., Boomker, J. & De Vos. V. 2003. Parasites of domestic and wild animals in South Africa. XLI. Arthropod parasites of impalas (*Aepyceros melampus*) in the Kruger National Park. Onderstepoort J. Vet. Res., 70: 131–163.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

39 – *R. kohlsi* (Hoogstraal & Kaiser, 1960) (J. Parasitol., 46: 441–448)
This species was formerly considered to be a member of the genus *Boophilus*.

Type depositories: USNTC (holotype, paratypes), BMNH, EAVRO, FMNH, OVI, UM, USNPC (paratypes) (Keirans and Hillyard 2001, *op. cit.* under *R. carnivoralis*) as *Boophilus kohlsi*

Known stages: male, female, nymph, larva

Zoogeographic Regions: Afrotropical, Palearctic

Ecoregions: southwestern Arabian foothills and savanna

Hosts: usual hosts for this tick are Artiodactyla: Bovidae.
Artiodactyla: Bovidae, Camelidae, Cervidae; Perissodactyla: Equidae

Human infestation: no

Remarks: because this is a one-host tick, we do not separately record the various life stages present on hosts. Camicas et al. (1998) regard *R. kohlsi* as exclusively Palearctic; however, Hussein et al. (1988) provide *bona fide* records for the Afrotropical Region. Rasulov (2007) states that *R. kohlsi* (referred to as *Boophilus kohlsi*) is present in Uzbekistan. However, when listing hosts for various tick species he uses the name *Boophilus calcaratus* (a name commonly considered a synonym of *R. annulatus*). Consequently, we have ignored his results. All authors cited below refer to this tick as *Boophilus kohlsi.*

References

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Feldman-Muhsam, B. & Shechter, R. 1970. Some notes on the genus *Boophilus* (Ixodidae), with special reference to species found in Israel. J. Med. Entomol., 7: 677–686.

Hussein, H.S., Al-Khalifa, M.S., Diab, F.M. & Al-Asgah, N.A. 1988. The distribution, host range and seasonal abundance of the Arabian goat and sheep tick, *Boophilus kohlsi* (Acari: Ixodidae) in Saudi Arabia. Arab Gulf J. Sci. Res. Agric. Biol. Sci., B6: 275–287.

Rasulov, I. 2007. Ticks status in Central Asia with a special emphasis on Uzbekistan. Parasitol. Res., 101 (Suppl. 2): S183-S186.

Wallach, A.D., Shanas, U., Mumcuoglu, K.Y. & Inbar, M. 2008. Ectoparasites on reintroduced roe deer *Capreolus capreolus* in Israel. J. Wildl. Dis., 44: 693–696.

40 – *R. leporis* Pomerantzev, 1946 (Opred. Faune SSR Zool. Inst. Akad. Nauk SSSR (26), 28 pp. In Russian)

Type depository: ZIAC (lectotype, paralectotype) (Filippova, N.A. 2008. Type specimens of argasid and ixodid ticks (Ixodoidea: Argasidae, Ixodidae) in the collection of the Zoological Institute, Russian Academy of Sciences (St. Petersburg). Entomol. Rev., 88: 1002–1011). Walker et al. (2000, *op. cit*. under *R. appendiculatus*) do not record a type depository for *R. leporis.*

Known stages: male, female, nymph

Zoogeographic Region: Palearctic

Ecoregions: deserts and xeric shrublands

Hosts: usual hosts for nymphs and adults are Lagomorpha: Leporidae.
Lagomorpha: Leporidae (ANL)
Carnivora: Canidae (AN)
Mammalia (several orders) (A)

Human infestation: no

Remarks: Camicas et al. (1998) indicate that the larva of this species has been described, but we were unable to find any description of it; nonetheless, Walker et al. (2000) state that the larva of *R. leporis* feeds on Leporidae and we accept this statement. Rasulov (2007) records the presence of *R. leporis* on Aves (tick stage not given), but we feel that this record needs confirmation and have provisionally excluded it from our host list.

References

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian.

Rasulov, I. 2007. Ticks status in Central Asia with a special emphasis on Uzbekistan. Parasitol. Res., 101 (Suppl. 2): S183-S186.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

41 – *R. longiceps* Warburton, 1912 (Parasitology, 5: 1–20)

Type depository: BMNH (lectotype, paralectotypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregions: deserts and xeric shrublands

Hosts: Artiodactyla: Bovidae, Suidae, Giraffidae; Perissodactyla: Rhinocerotidae (A)

Human infestation: no

References

Penzhorn, B.L., Oosthuizen, M.C., Bosman, A.-M., Killan, J.W. & Horak, I.G. 2008. Black rhinoceros (*Diceros bicornis*) populations in northwestern Namibia are apparently not infected with piroplasms. J. Wildl. Dis., 44: 1032–1035.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

42 – *R. longicoxatus* Neumann, 1905 (Arch. Parasitol., 9: 225–241)
See "remarks on some invalid names" at the beginning of this chapter for synonymy of *R. camelopardalis* with *R. longicoxatus.*

Type depository: ZMB (paratype) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, larva

Zoogeographic Region: Afrotropical

Ecoregions: various types of *Acacia-Commiphora* bushlands and thickets

Hosts: most adult ticks on Artiodactyla: Giraffidae. Canidae are exceptional hosts for this tick.
Artiodactyla: Giraffidae; Carnivora: Canidae (A)

Human infestation: no

Remarks: natural hosts for the larva of *R. longicoxatus* are unknown. The larval stage was not included in Camicas et al. (1998) but was later described from laboratory-reared specimens (Walker et al. 2000). These authors discuss the problems attending diagnosis of *R. longicoxatus*, and we have accordingly excluded records published prior to their work.

References

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

43 – *R. longus* Neumann, 1907 (Ann. Trop. Med. Parasitol., 1: 115–120)
See *R. cliffordi.*

Type depository: BMNH (holotype) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: mainly in tropical and subtropical grasslands, savannas and shrublands; few ticks in tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae and Suidae. The immature stages have been collected from rodent burrows.
Mammalia (several orders) (A)
Rodentia; Muridae (NL)

Human infestation: yes (Walker et al. 2000)

Remarks: Camicas et al. (1998) state that the larva of *R. longus* is undescribed; however, it was subsequently described by Walker et al. (2000). These latter authors did not include the record of *R. longus* on Charadriiformes: Recurvirostridae contained in Theiler (1962) and we have also excluded this record from our list. Kolonin (2009) limits the hosts of adult *R. longus* to Artiodactyla and Carnivora. Diagnoses of *R. longus* can be difficult, as discussed in Walker et al. (2000).

References

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

44 – *R. lounsburyi* Walker, 1990 (Onderstepoort J. Vet. Res., 57: 57–75)

Type depository: OVI (holotype, paratypes), USNTC (paratypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*) originally named *Rhipicephalus follis* in Theiler, G. & Robinson, B.N. (1953. Ticks in the South African Zoological Survey Collection. Part VII. Six lesser known African rhipicephalids. Onderstepoort J. Vet. Res., 26, 93–136) as stated in Walker et al. (2000, *op. cit.* under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: montane grasslands and lowland fynbos and renosterbosveld

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Artiodactyla: Bovidae; Carnivora: Felidae (A)
Rodentia: Muridae (N)

Human infestation: no

Remarks: natural hosts for the larva of *R. lounsburyi* are unknown; this stage was described from laboratory-reared specimens (Walker et al. 2000).

References

Horak, I.G., Golezardy, H. & Uys, A.C. 2007. Ticks associated with the three largest wild ruminant species in southern Africa. Onderstepoort J. Vet. Res., 74: 231–242.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

45 – *R. lunulatus* Neumann, 1907 (Arch. Parasitol., 11: 215–232)

Type depository: BMNH (lectotype, paralectotype) (Keirans and Hillyard 2001, *op. cit.* under *R. carnivoralis*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: mainly in tropical and subtropical grasslands, savannas and shrublands; tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae. Aves are exceptional hosts.
Artiodactyla: Bovidae (AL)
Mammalia (several orders); Anseriformes: Anatidae; Gruiformes: Rallidae (A)
Lagomorpha: Leporidae; Rodentia: Muridae (N)

Human infestation: yes (Ntiamoa-Baidu et al. 2004)

Remarks: considerable difficulties attend the determination of *R. lunulatus*, and host records prior to or at variance with those of Walker et al. (2000) have not been included in our list of hosts for this species. Kolonin (2009) omits the records on Aves in Walker et al. (2000), but we regard these odd records as valid.

References

Horak, I.G., Golezardy, H. & Uys, A.C. 2007. Ticks associated with the three largest wild ruminant species in southern Africa. Onderstepoort J. Vet. Res., 74: 231–242.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Ntiamoa-Baidu, Y., Carr-Saunders, C., Matthews, B.E., Preston, P.M. & Walker, A.R. 2004. An updated list of the ticks of Ghana and an assessment of the distribution of the ticks of Ghanaian wild mammals in different vegetation zones. Bull. Entomol. Res., 94: 245–260.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

46 – *R. maculatus* Neumann, 1901 (Mem. Soc. Zool. Fr., 14: 249–372)

Type depository: ZMB (syntypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: mainly in tropical and subtropical grasslands, savannas and shrublands; tropical and subtropical moist broadleaf forests

Hosts: Squamata and Macroscelidea are considered exceptional hosts.
Artiodactyla: Bovidae, Suidae (ANL)
Carnivora: Felidae; Perissodactyla: Rhinocerotidae (A, N and/or L)
Carnivora: Hyaenidae; Perissodactyla: Equidae; Proboscidea: Elephantidae; Squamata: Varanidae (A)

Lagomorpha: Leporidae (N)
Macroscelidea: Macroscelididae (L)
Carnivora: Viverridae; Hyracoidea: Procaviidae (N and/or L)

Human infestation: yes (Horak et al. 2002)

Remarks: the type host for *R. maculatus* is an insect of the family Reduviidae, which is an obvious error, as stated in Walker et al. (2000). The records of immature stages in Theiler (1962) are not considered valid by Walker et al. (2000) and have not been included in either their or our host list for *R. maculatus*. In addition to reporting that nymphs are present on Leporidae and three species of Bovidae, Walker (1991) and Walker et al. (2000) use the term "immatures" without specifying which immature stages of *R. maculatus* are present on different types of hosts. Although Walker et al. (2000) record infestation of Squamata with adult *R. maculatus*, this odd record is not included in Kolonin (2009).

References

Horak, I.G., Boomker, J. & Flamand, J.R.B. 1991. Ixodid ticks and lice infesting red duikers and bushpigs in north-eastern Natal. Onderstepoort J. Vet. Res., 58: 281–284.

Horak, I.G., Boomker, J. & Flamand, J.R.B. 1995. Parasites of domestic and wild animals in South Africa. XXXIV. Arthropod parasites of nyalas in north-eastern KwaZulu-Natal. Onderstepoort J. Vet. Res., 62: 171–179.

Horak, I.G., Fourie, L.J., Heyne, H., Walker, J.B. & Needham, G.R. 2002. Ixodid ticks feeding on humans in South Africa: with notes on preferred hosts, geographic distribution, seasonal occurrence and transmission of pathogens. Exp. Appl. Acarol., 27: 113–136.

Horak, I.G., Welman, S., Hallam, S.L., Lutermann, H. & Mzilikazi, N. 2011. Ticks of four-toed elephant shrews and Southern African hedgehogs. Onderstepoort J. Vet. Res. 78, doi:10.4102/ojvr.v78i1.243

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

47 – *R. masseyi* Nuttall & Warburton, 1908 (Proc. Cambridge Philos. Soc., 14: 392–416)

Type depository: BMNH (lectotype, paralectotypes) (Walker et al. 2000, *op. cit.* under *R. appendiculatus*)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregion: miombo woodlands

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Artiodactyla: Bovidae, Suidae; Carnivora: Canidae, Felidae, Herpestidae; Perissodactyla: Equidae; Tubulidentata: Orycteropodidae (A)

Human infestation: no

Remarks: Walker et al. (2000) discuss the difficulties involved in determining this species, and we have therefore not included records published prior to their work. Camicas et al. (1998) treat the nymph of *R. masseyi* as having been described; however, Walker et al. (2000) discuss this problem and conclude that the nymph remains undescribed, a position with which we agree.

References

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

48 – *R. microplus* (Canestrini, 1888) (Atti Soc. Veneto-Trentina Sci. Nat. Residente Padova, 11: 100–109)
Some authors consider 1887 as the year in which *Rhipicephalus microplus* was described (as *Haemophysalis* [sic] *micropla*), while others believe that it was described in 1888. According to Guglielmone, A.A., Robbins, R.G., Apanaskevich, D.A., Petney, T.N., Estrada-Peña, A., Horak, I.G., Shao, R. & Barker, S.C. (2010. The Argasidae, Ixodidae and Nuttalliellidae (Acari: Ixodida) of the world: a list of valid species names. Zootaxa, 2528: 1–28), an inquiry directed to the Library of Congress, U.S.A., revealed that the Canestrini paper was actually published in Padova by Stabilimento Prosperini in 1888. Consequently, we believe the latter year is correct. See also remarks below.
This tick was previously considered to be a member of the genus *Boophilus.*

Type depository: GM (holotype?) (Kohls, G.M. 1957. Insects of Micronesia. Acarina: Ixodoidea. Insects Micronesia, 3: 85–104), as *Hemophysalis* [sic] *micropla*

Known stages: male, female, nymph, larva

Zoogeographic Regions: Afrotropical, Australasian, Nearctic, Neotropical, Oriental, Palearctic, and several islands around the world

Ecoregions: many ecoregions, chiefly in tropical and sub-tropical areas worldwide

Hosts: usual hosts are Artiodactyla: Bovidae, while Aves, Anura and Squamata are exceptional hosts.
Mammalia (several orders); Aves (several orders); Anura: Bufonidae; Squamata: Chamaeleonidae, Elapidae

Human infestation: yes (Guglielmone et al. 2006 as *Boophilus microplus*)

Remarks: because this is a one-host tick, we do not separately record the various life stages present on hosts. Camicas et al. (1998) state that *R. microplus* is not found in the Palearctic Region, but there are *bona fide* records for this region in Yamaguti et al. (1971) and other authors. Several authors below refer to this species as *Boophilus microplus*. Recent studies by Labruna et al. (2009) present evidence that populations of *R. microplus* from Australia are not conspecific with Afrotropical and Neotropical populations of *R. microplus*, which are conspecific. This conclusion had been anticipated by Guglielmone et al. (2003), who regarded populations of *R. microplus* (named *Boophilus microplus*) from Australia and South Africa as representing sibling species. Consequently, the information on hosts and, especially, the distribution of the tick that we presently know as *R. microplus* may change drastically in the near future. This statement was recently confirmed with the reinstatement of *Rhipicephalus australis* (Estrada-Peña et al. 2012). See also *R. australis.*

References

Barré, N., Garris, G.I., Borel, G. & Camus, E. 1988. Hosts and population dynamics of *Amblyomma variegatum* (Acari: Ixodidae) on Guadeloupe, French West Indies. J. Med. Entomol., 25: 111–115.

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Estrada-Peña, A., Venzal, J.M., Nava, S., Mangold, A., Guglielmone, A.A., Labruna, M.B. & de la Fuente, J. 2012. Reinstatement of *Rhipicephalus* (*Boophilus*) *australis* Fuller, the Australian cattle tick (Acari: Ixodidae) with redescription of the adult and larval stages. J. Med. Entomol., 49: 794–802.

Ghosh, S., Bansal, G.C., Gupta, S.C., Ray, D., Khan, M.Q., Irshad, H., Shahiduzzaman, Md., Seitzer, U. & Ahmed, J.S. 2007. Status of tick distribution in Bangladesh, India and Pakistan. Parasitol. Res., 101 (Suppl. 2): 207–216.

Guglielmone, A.A. & Nava, S. 2005. Las garrapatas de la familia Argasidae y de los géneros *Dermacentor*, *Haemaphysalis*, *Ixodes* y *Rhipicephalus* (Ixodidae) de la Argentina: distribución y hospedadores. Rev. Inv. Agropec., 34 (2): 123–141.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Guglielmone, A.A., Beati, L., Barros-Battesti, D.M., Labruna, M.B., Nava, S., Venzal, J.M., Mangold, A.J., Szabó, M.P.J., Martins, J.R., González-Acuña, D. & Estrada-Peña, A. 2006. Ticks (Ixodoidea) on humans in South America. Exp. Appl. Acarol., 40: 83–100.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Labruna, M.B., Naranjo, V., Mangold, A.J., Thompson, C., Estrada-Peña, A., Guglielmone, A.A., Jongejan, F. & de la Fuente, J. 2009. Allopatric speciation in ticks: genetic and reproductive divergence between geographic strains of *Rhipicephalus (Boophilus) microplus*. BMC Evol. Biol., 9 (46), 12 pp.

Phan Trong, C. 1977. Ve bet va con trung ky sinh o Viet Nam. Tap 1. Ve (Ixodoidea), mo ta va phan loai. Ha Noi: Khoa hoc va ky thuat, 489 pp. In Vietnamese.

Rao, T.R., Dhanda, V., Bhat, H.R. & Kulkarni, S.M. 1973. A survey of haematophagous arthropods in western Himalayas, Sikkim and Hill Districts of West Bengal. A general account. Ind. J. Med. Res., 61: 1421–1461.

Yamaguti, N., Tipton, V.J., Keegan, H.L. & Toshioka, S. 1971. Ticks of Japan, Korea, and the Ryukyu Islands. Brigham Young Univ. Sci. Bull. Biol. Ser., 15 (1), 226 pp.

49 – *R. moucheti* Morel, 1965 (Rev. Élev. Méd. Vét. Pays Trop., 17: 615–617)
According to Walker et al. (2000, *op. cit*. under *R. appendiculatus*), volume 17 of this journal was supposed to have been published in 1964, but the issue containing the description of *R. moucheti* was not published until 1965.

Type depository: unknown (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregion: Sudanian savanna

Hosts: usual hosts for adult ticks are Carnivora: Canidae.
Carnivora: Canidae, Viverridae; Artiodactyla: Bovidae; Primates: Cercopithecidae (A)

Human infestation: no

Remarks: natural hosts for the larva and nymph of *R. moucheti* are unknown; these stages were described from laboratory-reared specimens (Saratsiotis 1981).

References

Saratsiotis, A.G. 1981. Étude morphologique et biologique de *Rhipicephalus moucheti* Morel, 1964, groupe de *R. sanguineus* (Acariens, Ixodoidea). Acarologia, 22: 15–24.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

50 – *R. muehlensi* Zumpt, 1943 (Z. Parasitenkd., 13: 102–117)

Type depository: ZMB (holotype, paratypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands; tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae; usual hosts for larvae and nymphs are Artiodactyla: Bovidae; Lagomorpha: Leporidae; Macroscelidea: Macroscelididae.
Mammalia (several orders) (ANL)

Human infestation: yes (Horak et al. 2002)

Remarks: Walker et al. (2000) discuss the difficulties involved in determining this species, and we have therefore not included records published prior to their work. Keirans and Durden (2001) record an introduction of *R. muehlensi* into the Nearctic Region, but there is no evidence that it has become established there.

References

Horak, I.G., Spickett, A.M., Braack, L.E.O., Penzhorn, B.L., Bagnall, R.J. & Uys, A.C. 1995. Parasites of domestic and wild animals in South Africa. XXXIII. Ixodid ticks on scrub hares in the north-eastern regions of Northern and Eastern Transvaal and of KwaZulu-Natal. Onderstepoort J. Vet. Res., 62: 123–131.

Horak, I.G., Fourie, L.J., Heyne, H., Walker, J.B. & Needham, G.R. 2002. Ixodid ticks feeding on humans in South Africa: with notes on preferred hosts, geographic distribution, seasonal occurrence and transmission of pathogens. Exp. Appl. Acarol., 27: 113–136.

Horak, I.G., Welman, S., Hallam, S.L., Lutermann, H. & Mzilikazi, N. 2011. Ticks of four-toed elephant shrews and Southern African hedgehogs. Onderstepoort J. Vet. Res.,78, doi:10.4102/ojvr.v78i1.243.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

51 – *R. muhsamae* Morel & Vassiliades, 1965 (Rev. Élev. Méd. Vét. Pays Trop., 17: 619–636)
According to Walker et al. (2000, *op. cit*. under *R. appendiculatus*), volume 17 of this journal was supposed to have been published in 1964, but the issue containing the description *R. muhsamae* was not published until 1965.

Type depository: unknown (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: mainly in forest-savanna mosaic; few ticks in tropical and subtropical moist broadleaf forests

Hosts: Mammalia (several orders) (A)
Rodentia: Sciuridae (NL)
Lagomoprha: Leporidae; Rodentia: Muridae (N)

Human infestation: yes (Walker et al. 2000)

Remarks: most hosts of the larvae and nymphs of *R. muhsamae* are inferred from the presence of unfed adult ticks and nymphs in host nests, as reported by Walker et al. (2000) and Morel (2003). We consider this inferred host-parasite relationship to be correct.

References

Dioli, M. & Fox, M.T. 2004. First record of the camel tick *Rhipicephalus muhsamae* in Kenya on a one humped camel (*Camelus dromedarius*). Vet. Rec., 155: 206–208.

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

52 – *R. neumanni* Walker, 1990 (Onderstepoort J. Vet. Res., 57: 57–75)

Type depositories: OVI (holotype, paratypes), BMNH, USNTC (paratypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregion: desert and xeric shrublands

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Artiodactyla: Bovidae; Carnivora: Canidae; Perissodactyla: Equidae (A)
Rodentia: Muridae (N)

Human infestation: no

Remarks: natural hosts for the larva of *R. neumanni* are not known; this stage was described by Walker et al. (2000) from laboratory-reared specimens. These authors include a valid record of adult *R. neumanni* on Equidae that does not appear in Kolonin (2009).

References

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Matthee, S., Lovely, C., Gaugler, A., Beeker, R., Venter, H.R. & Horak, I.G. 2010. Ixodid ticks on domestic dogs in the Northern Cape Province of South Africa and in Namibia. J. S. Afr. Vet. Assoc., 81: 126–128.
Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

53 – *R. nitens* Neumann, 1904 (Arch. Parasitol., 8: 444–464)

Type depository: BMNH, OVI (syntypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: restricted to fynbos and renosterbosveld

Hosts: usual hosts for larvae, nymphs and adults are Artiodactyla: Bovidae and Lagomorpha: Leporidae, while Aves are considered exceptional hosts for this tick.
Artiodactyla: Bovidae; Lagomorpha: Leporidae (ANL)
Carnivora: Canidae (AL)
Perissodactyla: Equidae (A)
Galliformes: Numididae (L)

Human infestation: no

Remarks: Camicas et al. (1998) state that the larva and nymph of *R. nitens* are undescribed, but they were subsequently described by Walker et al. (2000). A valid and unique record of the larva of *R. nitens* on Aves is presented in Walker et al. (2000) but does not appear in Kolonin (2009). See also *R. appendiculatus*.

References

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.
Horak, I.G. & Matthee, S. 2003. Parasites of domestic and wild animals in South Africa. XLIII. Ixodid ticks of domestic dogs and cats in the Western Cape Province. Onderstepoort J. Vet. Res., 70: 187–195.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

54 – *R. oculatus* Neumann, 1901 (Mem. Soc. Zool. Fr., 14: 249–372)

Type depositories: ZMB, ZSH (paratypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: deserts and xeric shrublands and montane grasslands and shrublands

Hosts: usual hosts for larvae, nymphs and adults are Lagomorpha: Leporidae.
Lagomorpha: Leporidae; Artiodactyla: Bovidae (ANL)
Galliformes: Numididae (NL)
Rodentia: Pedetidae (L)

Human infestation: no

Remarks: the records of *R. oculatus* listed in Theiler (1962) have not been included in our host list because Walker (1991) believes that Theiler included several *R. oculatus* group species under this name.

References

Horak, I.G., Spickett, A.M., Braack, L.E.O. & Williams, E.J. 1991. Parasites of domestic and wild animals in South Africa. XXVII. Ticks on helmeted guineafowls in the Eastern Cape Province and Eastern Transvaal Lowveld. Onderstepoort J. Vet. Res., 58: 137–143.

MacIvor, K.M de F. & Horak, I.G. 2003. Ixodid ticks of Angora and Boer goats, grysbok, common duikers, kudus and scrub hares in Valley Bushveld in the Eastern Cape Province, South Africa. Onderstepoort J. Vet. Res., 70: 113–120.

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

55 – *R. oreotragi* Walker & Horak, 2000 (*In* Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.)

Type depositories: OVI (holotype, paratypes), BMNH, USNTC (paratypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregions: southern Africa bushveld

Hosts: Artiodactyla: Bovidae (A)

Human infestation: no

Remarks: see *R. distinctus.*

Reference

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

56 – *R. pilans* Schulze, 1935 (Acarina: Ixodoidea *In* Wissenschaftliche Ergebnisse der Niederländischen Expeditionen in dem Karakorum 1922–1930, 1: 178–186)
Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. (1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.) treat *R. pilans* as a subspecies of *R. haemaphysaloides*, but we agree with Walker et al. (2000, *op. cit*. under *R. appendiculatus*), who describe *R. pilans* as a valid taxon and delineate the morphological differences between these taxa.

Type depository: unknown (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Australasian, Oriental

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: Mammalia (several orders) (ANL)

Human infestation: yes (Durden et al. 2008)

Remarks: Camicas et al. (1998) state that the larva and nymph of *R. pilans* (under the name *R. haemaphysaloides pilans*) are undescribed, but they were subsequently described by Walker et al. (2000). See also above.

References

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Durden, L.A., Merker, S. & Beati, L. 2008. The tick fauna of Sulawesi, Indonesia (Acari: Ixodoidea: Argasidae and Ixodidae). Exp. App. Acarol., 45: 85–110.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

57 – *R. planus* Neumann, 1907 (Ixodidae, *In* Wissenchaftliche Ergebnisse der Schwedischen Zoologischen Expedition nach dem Kilimandjaro, dem Meru und den umgebenden Massaisteppen, Deutsch-Ostafrikas 1905–1906, Almqvist and Wiksells Boktryckeri-A-B, Arachnoidea 3, 20 Arachnoidea (2): 17–30).

Type depository: unknown (Walker et al. 2000, *op. cit*. under *R. appendiculatus*) as *Rhipicephalus simus planus*

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands; few ticks in tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae and Suidae.
Mammalia (several orders) (A)
Rodentia: Muridae (N)
Lagomorpha: Leporidae (L)

Human infestation: yes (Walker et al. 2000)

Reference

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

58 – *R. praetextatus* Gerstäcker, 1873 (Gliederthiere (Insekten, Arachniden, Myriopoden und Isopoden). *In* O. Kersten (editor), Baron Carl Claus von der Decken's Reisen in Ost Afrika in den Jahren 1859 bis 1861. C.J. Winter'sche Verlagshandlung, Leipzig und Heidelberg, 542 pp.)

Type depository: ZMB (holotype) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Afrotropical, Palearctic

Ecoregions: many ecoregions, but prevalent in tropical and subtropical grasslands; tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae, while Aves are considered exceptional hosts.
Mammalia (several orders); Galliformes: Phasianidae (A)
Rodentia: Hystricidae, Muridae (NL)

Human infestation: yes (Walker et al. 2000)

Remarks: Adler et al. (2011) mention the presence of a male of *R. praetextatus* on *Orycteropus afer* in a zoo in the Nearctic Region, but there is no evidence that this tick has become established there. Matthysse and Colbo (1987) provide a valid but unusual record of adult *R. praetextatus* on Aves that was not included in Walker et al. (2000) or Kolonin (2009).

References

Adler, P.H., Tuten, H.C. & Nelder, M.P. 2011. Arthropods of medicoveterinary importance in zoos. Annu. Rev. Entomol., 56: 123–142.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Matthysse, J.G. & Colbo, M.H. 1987. The ixodid ticks of Uganda. Entomological Society of America, College Park, Maryland, 426 pp.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

59 – *R. pravus* Dönitz, 1910 (Denkschr. Med.-Naturw. Ges. Jena, 16: 397–494)

Type depositories: ZMB, BMNH (syntypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands; tropical and subtropical moist broadleaf forests; few ticks in montane grasslands and shrublands

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Lagomorpha: Leporidae (ANL)
Artiodactyla: Bovidae; Carnivora: Viverridae; Macroscelidea: Macroscelididae (AN)
Mammalia (several orders); Falconiformes: Accipitridae; Passeriformes: Laniidae; Struthioniformes: Struthionidae (A)
Gruiformes: Otidae (N)

Human infestation: yes (Walker et al. 2000)

Remarks: there is considerable uncertainty concerning published determinations of *R. pravus*. Walker et al. (2000) present records for *R. pravus* and also for *Rhipicephalus* near *pravus*. This situation is still unresolved and adult ticks in Free State Province, South Africa, identified as *Rhipicephalus pravus*-like in Fourie et al. (1988), are in fact *Rhipicephalus warburtoni* (Walker et al. 2000). Fourie et al. (2005) and Horak et al. (2007) placed immature ticks that they had collected from elephant shrews and adult ticks collected from giraffes in the *R. pravus* group. We therefore based our host list for this tick on that of Walker et al. (2000), who state that Leporidae are infested with "immatures" but do not specify whether larvae, nymphs or both stages of this tick are present. We accept the records of Leporidae infested with larvae and

nymphs of *R. pravus*, as presented in Zumpt (1958). An unconfirmed record on Testudinidae has not been included in our list of hosts of this species. Walker et al. (2000) provide several *bona fide* records of *R. pravus* on Aves that were not included in the Kolonin (2009) host list. See also *R. punctatus* and *R. warburtoni*.

References

Fourie, L.J., Horak, I.G. & Marais, L. 1988. The seasonal abundance of adult ixodid ticks on Merino sheep in the south-western Orange Free State. J. S. Afr. Vet. Assoc., 59: 191–194.

Fourie, L.J., Horak, I.G. & Woodall, P.F. 2005. Elephant shrews as hosts of immature ixodid ticks. Onderstepoort J. Vet. Res., 72: 293–301.

Horak, I.G., Golezardy, H. & Uys, A.C. 2007. Ticks associated with the three largest wild ruminant species in southern Africa. Onderstepoort J. Vet. Res., 74: 231–242.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

Zumpt, F. 1958. Preliminary survey of the distribution and host-specificity of ticks (Ixodoidea) in the Bechuanaland Protectorate. Bull. Entomol. Res., 49: 201–233.

60 – *R. pseudolongus* Santos Dias, 1953 (Mem. Estud. Mus. Zool. Univ. Coimbra (214), 15 pp.)

Guglielmone et al. (2010, *op. cit*. under *R. microplus*) state that some authors consider this name a synonym of *R. longus*, but no evidence has been found to support this view; consequently, we regard *R. pseudolongus* as tentatively valid. See also *R. cliffordi.*

Type depository: unknown (Walker et al. 2000, *op. cit*. under *R. appendiculatus*) as *Rhipicephalus capensis pseudolongus*

Known stages: male, female, nymph

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands; tropical and subtropical moist broadleaf forests

Hosts: Artiodactyla: Bovidae (A)
Rodentia: Muridae (NL)
Macroscelidea: Macroscelididae (L)

Human infestation: no

Remarks: Clifford and Anastos (1964) reported several collections of adults and nymphs of *R. pseudolongus* in nests of Muridae, and a nymph from a burrow of Macroscelididae. These apparently originated from molted engorged larvae and nymphs, and we regard these records as tentatively valid.

References

Clifford, C.M. & Anastos, G. 1964. Ticks. Exploration du Parc National de la Garamba. Mission H. de Saeger. Fascicule 44: 3–39.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

61 – *R. pulchellus* (Gerstäcker, 1873) (Gliederthiere (Insekten, Arachniden, Myriopoden und Isopoden). *In* O. Kersten (editor), Baron Carl Claus von der Decken's Reisen in Ost Afrika in den Jahren 1859 bis 1861. C.J. Winter'sche Verlagshandlung, Leipzig und Heidelberg, 542 pp.)

Type depository: ZMB (syntypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*) as *Dermacentor pulchellus.*

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands; tropical and subtropical moist broadleaf forests; montane grasslands and shrublands; deserts and xeric shrublands

Hosts: Aves are considered exceptional hosts for this tick.
Mammalia (several orders) (ANL)
Galliformes: Phasianidae; Struthioniformes: Struthionidae (A)

Human infestation: yes (Walker et al. 2000)

Remarks: Adham et al. (2009) record the presence of *R. pulchellus* in the Palearctic Region, but we feel that this record requires confirmation and regard this tick as present only in the Afrotropical Region. Keirans and Durden (2001) cite records of the introduction of *R. pulchellus* into the Nearctic Region, but there is no evidence that this species has become established there. Most records of larvae and nymphs in Theiler (1962) and Walker et al. (2000) are tentative because these authors used the term "immatures" extensively without specifying exact developmental stages. Kolonin (2009) ignores the few valid records on Aves presented in Walker et al. (2000).

References

Adham, F.K., Abd-El-Samie, E.M., Gabre, R.M. & Hussein, H. E. 2009. Detection of tick blood parasites in Egypt using PCR assay I – *Babesia bovis* and *Babesia bigemina.* Parasitol. Res., 105: 721–730.

Akinyi, M.Y., Tung, J., Jeneby, M., Patel, N.B., Altmann, J. & Alberts, S.C. 2013. Role of grooming in reducing tick load in wild baboons (*Papio cynocephalus*). Anim. Behav., 85: 559–568.

Clifford, C.M., Flux, J.E.C. & Hoogstraal, H. 1976. Seasonal and regional abundance of ticks (Ixodidae) on hares (Leporidae) in Kenya. J. Med. Entomol., 13: 40–47.
Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.
Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.
Wanzala, W. & Okanga, S. 2006. Ticks (Acari: Ixodidae) associated with wildlife and vegetation of Haller Park along the Kenyan coastline. J. Med. Entomol., 43: 789–794.

62 – *R. pumilio* Schulze, 1935 (Acarina: Ixodoidea *In* Wissenschaftliche Ergebnisse der Niederländischen Expeditionen in dem Karakorum 1922–1930, 1: 178–186)
Zahler, M., Filippova, N.A., Morel, P.-C., Gothe, R. & Rinders, H. (1997. Relationship between species of the *Rhipicephalus sanguineus* group: a molecular approach. J. Parasitol., 83: 802–806) described an identical DNA sequence in *R. pumilio* and *R. rossicus* and suggested that they may be conspecific.

Type depository: ZMA (syntypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: temperate grasslands, savannas and shrublands; xeric shrublands

Hosts: Aves are exceptional hosts for adult ticks.
Erinaceomorpha: Erinaceidae; Lagomorpha: Leporidae, Ochotonidae; Rodentia: Muridae, Sciuridae (ANL)
Mammalia (several orders); Falconiformes: Accipitridae; Gruiformes: Otidae (A)
Rodentia: Dipodidae; Passeriformes: Corvidae, Muscicapidae, Sylviidae (NL)
Coraciiformes: Upupidae; Galliformes: Phasianidae; Passeriformes: Alaudidae, Corvidae (stages unknown)

Human infestation: yes (Walker et al. 2000)

Remarks: this species was thought to be confined to the Palearctic Zoogeographic Region, but Liao and Lai (1995) and Chen et al. (2010) record *R. pumilio* in Guanxi Province (China), thus extending its range into the Oriental Region. Kolonin (2009) ignores Aves as hosts for adult *R. pumilio*, but we accept the few records from these hosts in Filippova (1997) and Morel (2003).

References

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Liao, G.H. & Lai, C.L. 1995. A survey of Ixodidae distribution in Guangxi. Chin. J. Vector. Ecol., 6: 14–16. In Chinese.

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

63 – *R. punctatus* Warburton, 1912 (Parasitology, 5: 1–20)

Type depository: BMNH (lectotype, paralectotypes) (Keirans and Hillyard 2001, *op. cit.* under *R. carnivoralis*) as *Rhipicephalus neavei punctatus*

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands; tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Artiodactyla: Bovidae; Perissodactyla: Equidae; Lagomorpha: Leporidae (A)

Human infestation: no

Remarks: there is considerable uncertainty concerning published determinations of *R. punctatus*. Walker et al. (2000) supply records for both *R. punctatus* and for *Rhipicephalus* sp. near *punctatus*, and map the distribution of *R. punctatus* as chiefly in Tanzania and that of *R.* sp. near *punctatus* as mainly in Zimbabwe, Zambia and northern Mozambique. Adult ticks identified as *R.* sp. near *punctatus* by Fourie and Horak (1990) in Free State Province, South Africa, and as *R. punctatus* by Fourie and Horak (1991) and Fourie et al. (1996), and larvae and nymphs identified as *R. punctatus* by Fourie et al. (1992), are in reality all *Rhipicephalus warburtoni* (Walker et al. 2000). The nymph collected from a helmeted guinea fowl by Horak et al. (1991) and identified as *R. punctatus* is in fact a nymph of *Rhipicephalus* near *pravus*. Colbo (1973) and Njanja et al. (1991) recorded *R. punctatus* from Macroscelidea: Macroscelididae and Artiodactyla: Camelidae, respectively, but we regard these records as doubtful because there is no indication as to how the authors arrived at a diagnosis. Our host records for *R. punctatus* are based exclusively on Walker et al. (2000), excluding records for *Rhipicephalus* sp. near *punctatus* in the same publication. See also *R. pravus* and *R. warburtoni*.

References

Colbo, M.H. 1973. Ticks of Zambian wild animals: a preliminary checklist. Puku (7): 97–105.

Fourie, L.J. & Horak, I.G. 1990. Parasites of cattle in the south western Orange Free State. J. S. Afr. Vet. Assoc., 61: 27–28.

Fourie, L.J. & Horak, I.G. 1991. The seasonal activity of adult ixodid ticks on Angora goats in the south western Orange Free State. J. S. Afr. Vet. Assoc., 62:104–106.

Fourie, L.J., Horak, I.G. & van den Heever, J.J. 1992. The relative host status of rock elephant shrews *Elephantulus myurus* and Namaqua rock mice *Aethomys namaquensis* for economically important ticks. S. Afr. J. Zool., 27: 108–114.

Fourie, L.J., Kok, D.J. & Heyne, H. 1996. Adult ixodid ticks on two cattle breeds in the south-western Free State, and their seasonal dynamics. Onderstepoort J. Vet. Res., 63: 19–23.

Horak, I.G., Spickett, A.M., Braack, L.E.O. & Williams, E.J. 1991. Parasites of domestic and wild animals in South Africa. XXVII. Ticks on helmeted guineafowls in the Eastern Cape Province and Eastern Transvaal lowveld. Onderstepoort J. Vet. Res., 58: 137–143.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Njanja, J.C., Rinkanya, F.G.R. & Kiara, H.K. 1991. Ticks of camels, sheep and goats in northwestern Kenya rangelands. Trop. Pest Manag., 37: 166–168.

Santos Dias, J.A.T. 1951. Mais un ixodídeo do género *Rhipicephalus* s. str. Koch, 1844 para a fauna de Moçambique. *R. punctatus* Warburton, 1912. An. Inst. Med. Trop. Lisboa, 8: 373–390.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

64 – *R. pusillus* Gil Collado, 1936 (Treb. Mus. Cienc. Nat. Barcelona Ser. Entomol., 11: 1–8)

Type depository: unknown (Walker et al. 2000, *op. cit*. under *R. appendiculatus*) as *R. bursa pusillus*

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: Iberian conifer forests; southwest Iberian mediterranean sclerophyllous and mixed forests

Hosts: usual hosts for larvae, nymphs and adults are Lagomorpha: Leporidae, while Aves are considered exceptional hosts.
Lagomorpha: Leporidae; Carnivora: Mustelidae (ANL)
Mammalia (several orders) (AN)
Strigiformes: Strigidae (A)
Rodentia: Gliridae (NL)

Human infestation: yes (Santos-Silva et al. 2011)

Remarks: a report of *R. pusillus* on Aves by Silva et al. (2001) was not included in Kolonin (2009). We consider Aves valid but unusual hosts for this tick.

References

Gilot, B. & Marjolet, M. 1982. Contribution à l'étude du parasitisme humain par les tiques (Ixodidae et Argasidae) plus particulièrement dans le sud-est de la France. Méd. Malad. Inf., 12: 340–351.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Morel, P.-C. & Vassiliades, G. 1963. Les *Rhipicephalus* du groupe *sanguineus*: espèces Africaines (Acariens: Ixodoidea). Rev. Élev. Méd. Vét. Pays Trop., 15: 343–386.

Santos Dias, J.A.T. & Santos Reis M. 1989. A carraça *Ixodes ventalloi* Gil Collado, 1936 como principal ectoparasita de uma população de doninhas (*Mustela nivalis* Linnaeus, 1766) em Portugal. García de Orta Ser. Zool., 14: 35–50.

Santos-Silva, M.M., Beati, L., Santos, A.S., de Sousa, R., Núncio, M.S., Melo, P., Santos-Reis, M., Fonseca, C., Formosinho, P., Vilela, C. & Bacellar, F. 2011. The hard-tick fauna of mainland Portugal (Acari: Ixodidae): an update on geographical distribution and known associations with hosts and pathogens. Exp. Appl. Acarol., 55: 85–121.

Silva, M.M., Formosinho, P., Melo, P., Santos, A. & Filipe, A.R. 2001. Ixodídeos (Acari: Ixodidae) parasitas de aves silváticas em Portugal. Rev. Port. Ciênc. Vet., 96: 197–199.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

65 – *R. ramachandrai* Dhanda, 1966 (J. Parasitol., 52: 1025–1031)

Type depositories: VRC (holotype, paratypes), BMNH, HH, IM, USNTC (paratypes) (Keirans and Hillyard 2001, *op. cit.* under *R. carnivoralis*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregions: tropical and subtropical dry broadleaf forests

Hosts: usual hosts for adult ticks are Rodentia: Muridae.
Rodentia: Muridae (ANL)
Carnivora: Canidae; Rodentia: Sciuridae (A)

Human infestation: no

Reference

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

66 – *R. rossicus* Yakimov & Kohl-Yakimova, 1911 (Arch. Parasitol., 14: 416–425) See *R. pumilio.*

Type depository: BMNH (syntypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*). Filippova, N.A. (1996. Designation of the neotypes for two species of ticks family Ixodidae. Parazitologiya, 30: 404–409. In Russian) designated a neotype for *R. rossicus*; however, because of the existence of syntypes the neotype is considered invalid.

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: deserts and xeric shrublands

Hosts: Aves and Squamata are exceptional hosts.
Mammalia (several orders); Aves (several orders) (ANL)
Squamata: Lacertidae (NL)

Human infestation: yes (Walker et al. 2000)

Remarks: Walker et al. (2000) ignore Aves and Squamata as hosts of *R. rossicus*, and Kolonin (2009) ignores Squamata. We accept the records on these hosts in Filippova (1997) but consider them infrequent events.

References

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.
Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

67 – *R. sanguineus* (Latreille, 1806) (*Genera crustaceorum et insectorum secundum ordinem naturalem infamilia disposita, iconibus exemplisque plurimis explicata*. Parisiis et Argentorati (1), 302 pp.)

Type depository: unknown (Walker et al. 2000, *op. cit*. under *R. appendiculatus*) as *Ixodes sanguineus.*

Known stages: male? female? nymph? larva?

Zoogeographic Region: Palearctic because the species was described in Latreille (1806 *op. cit.* see above) from ticks collected in Gallia [sic]. All other records of *R. sanguineus* from around the world are currently considered speculative. See remarks below.

Ecoregions: impossible to determine from our current muddled knowledge of this species.

Hosts: without doubt Carnivora: Canidae are hosts for all stages of *R. sanguineus*, and several other hosts are possibly infested with this species. However, because the type specimen is probably lost and other descriptions are obviously not based on comparisons with the type specimen, there are no sound descriptions by which ticks resembling *R. sanguineus* can be identified with certainty.

Human infestation: yes? (see below)

Remarks: the conventional identification of *R. sanguineus sensu stricto* is considered difficult enough, and recent biological, morphological and molecular studies have revealed a complex situation involving both *R. turanicus* and probably various cryptic species, as detailed in Beati and Keirans (2001), Szabó et al. (2005), Nava et al. (2009, 2012), Moraes-Filho et al. (2010) and Levin et al. (2012). A recent publication on the systematics and ecology of *R. sanguineus* fails to address the crucial point of species definition despite an assertive title (Gray et al. 2013). Current information indicates that it is impossible to identify *R. sanguineus sensu stricto* with any certainty, and studies with ticks identified as this species, from different parts of the world, will be required to solve this problem. Until this information has been obtained, it will not be possible to definitively assign a specific name to any population worldwide, including Gallia.

References

Beati, L. & Keirans, J.E. 2001. Analysis of the systematic relationships among ticks of the genera *Rhipicephalus* and *Boophilus* (Acari: Ixodidae) based on mitochondrial 12S ribosomal DNA gene sequences and morphological characters. J. Parasitol., 87: 32–48.

Gray, J., Dantas-Torres, F., Estrada-Peña, A. & Levin, M. 2013. Systematics and ecology of the brown dog tick, *Rhipicephalus sanguineus*. Ticks Tick-borne Dis., 4: 171–180.

Levin, M.L., Studer, E., Killmaster, L., Zemtsova, G. & Mumcuoglu, K.Y. 2012. Crossbreeding between different geographical populations of the brown tick dog tick, *Rhipicephalus sanguineus* (Acari: Ixodidae). Exp. Appl. Acarol., 58: 51–68.

Moraes-Filho, J., Marcili, A., Nieri-Bastos, F.A., Richrzenhain, L.J. & Labruna, M.B. 2010. Genetic analysis of ticks belonging to the *Rhipicephalus sanguineus* group in Latin America. Acta Trop., 117: 51–55.

Nava, S., Guglielmone, A.A. & Mangold, A.J. 2009. An overview of systematics and evolution of ticks. Front. Biosci., 14: 2857–2877.

Nava, S., Mastropaolo, M., Venzal, J.M., Mangold, A.J. & Guglielmone, A.A. 2012. Mitochondrial DNA analysis of *Rhipicephalus sanguineus* sensu lato (Acari: Ixodidae) in the Southern Cone of South America. Vet. Parasitol., 190: 547–555.

Szabó, M.P., Mangold, A.J., Fao, C.F., Bechara, G.H. & Guglielmone, A.A. 2005. Biological and DNA evidence of two dissimilar populations of the *Rhipicephalus sanguineus* tick group (Acari: Ixodidae) in South America. Vet. Parasitol., 130: 131–140.

68 – *R. scalpturatus* Santos Dias, 1959 (Mem. Estud. Mus. Zool. Univ. Coimbra (256): 1–6)

Type depository: ZSH (holotype, paratypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female

Zoogeographic Region: Oriental

Ecoregions: Chhota-Nagpur dry deciduous forests

Hosts: unknown

Human infestation: no

Reference

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

69 – *R. schulzei* Olenev, 1929 (Vestn. Sovr. Vet., 5: 191–193. In Russian)

Type depository: ZIAC (lectotype, paralectotype) (Filippova 2008, *op. cit*. under *R. leporis*). Walker et al. (2000, *op. cit*. under *R. appendiculatus*) do not list a depository for the type specimens of *R. schulzei*.

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: deserts and xeric shrublands

Hosts: usual hosts for larvae, nymphs and adults are Rodentia: Sciuridae.
Carnivora: Canidae, Mustelidae; Lagomorpha: Leporidae, Ochotonidae; Rodentia: Muridae, Sciuridae; Falconiformes: Accipitridae (ANL)
Mammalia (several orders) (NL)

Human infestation: yes (Walker et al. 2000)

Remarks: Kolonin (2009) limits the hosts of *R. schulzei* to Rodentia: Sciuridae and Carnivora, while Walker et al. (2000) ignore Lagomorpha and Aves as hosts for this tick. We regard the records from these hosts in Filippova (1997) as valid.

References

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.
Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae). A guide to the brown ticks of the world. Cambridge University Press, London, 643 pp.

70 – *R. sculptus* Warburton, 1912 (Parasitology, 5: 1–20)

Type depository: BMNH (lectotype, paralectotypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: miombo woodlands

Hosts: Artiodactyla: Bovidae, Giraffidae, Suidae; Perissodactyla: Equidae (A)

Human infestation: no

Remarks: natural hosts for the larva and nymph of *R. sculptus* are unknown; these stages were described from laboratory-reared specimens (Walker et al. 2000) and, obviously, not included in Camicas et al. (1998).

References

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.
Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.
Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

71 – *R. senegalensis* Koch, 1844 (Arch. Naturgesch., 10: 217–239)

Type depository: ZMB (syntypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands; few ticks in tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae, while Aves are considered exceptional hosts for this tick.
Rodentia: Muridae (ANL)
Rodentia: Thryonomyidae (AN)
Mammalia (several orders); Anseriformes: Anatidae (A)
Carnivora: Herpestidae; Rodentia: Sciruridae; Macroscelidea: Macroscelididae (N)

Human infestation: yes (Burridge 2011)

Remarks: Walker et al. (2000) discuss the difficulties involved in determining this species, and we have therefore not included records published prior to their work. Burridge (2011) records an introduction of *R. senegalensis* into the Nearctic Region, but there is no evidence that this tick has become established there. Kolonin (2009) limits the hosts of the immature stages of *R. senegalensis* to Rodentia, and does not include Aves as hosts for this tick. We regard the unusual record from Aves in Walker et al. (2000) as valid.

References

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Ntiamoa-Baidu, Y., Carr-Saunders, C., Matthews, B.E., Preston, P.M. & Walker, A.R. 2004. An updated list of the ticks of Ghana and an assessment of the distribution of the ticks of Ghanaian wild mammals in different vegetation zones. Bull. Entomol. Res., 94: 245–260.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

72 – *R. serranoi* Santos Dias, 1950 (Moçambique (63): 143–151)

Camicas et al. (1998, *op. cit.* under *R. pilans*) treat *R. serranoi* as a synonym of *R. punctatus*; however, characters that can be used for separating the two species have been published by Walker et al. (2000, *op. cit*. under *R. appendiculatus*). We regard both these taxa as valid.

Type depository: VLM (syntypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregion: central Zambezian miombo woodlands

Hosts: Hyracoidea: Procaviidae; Artiodactyla: Bovidae; Carnivora: Felidae (A)

Human infestation: no

Reference

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

73 – *R. simpsoni* Nuttall, 1910 (Parasitology, 3: 408–416)

Type depository: BMNH (lectotype, paralectotypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands; few ticks in tropical and subtropical moist broadleaf forests

Hosts: usual hosts for nymphs and adults are Rodentia: Thryonomyidae.
Rodentia: Thryonomyidae (ANL)
Rodentia: Hystricidae (AN)
Mammalia (several orders) (A)

Human infestation: no

Remarks: Camicas et al. (1998) list the larva of *R. simpsoni* as undescribed, but it was subsequently described by Walker et al. (2000). The latter authors present a record of *R. simpsoni* on Passeriformes that is marked with an "X," probably referring to the record in Clifford and Anastos (1962). A second record of *R. simpsoni* from a different species of Passeriformes appears in Clifford and Anastos (1964). In both cases the authors state that their findings on Aves require confirmation, and we have therefore tentatively excluded these records from our host list above.

References

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Clifford, C.M. & Anastos, G. 1962. Ticks. Exploration du Parc National de l'Upemba. Mission G.F. de Witte. Fascicule 66: 3–47.

Clifford, C.M. & Anastos, G. 1964. Ticks. Exploration du Parc National de la Garamba. Mission H. de Saeger. Fascicule 44: 3–39.

Ntiamoa-Baidu, Y., Carr-Saunders, C., Matthews, B.E., Preston, P.M. & Walker, A.R. 2004. An updated list of the ticks of Ghana and an assessment of the distribution of the ticks of Ghanaian wild mammals in different vegetation zones. Bull. Entomol. Res., 94: 245–260.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

74 – *R. simus* Koch, 1844 (Arch. Naturgesch., 10: 217–239)

Type depository: ZMB (holotype) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: montane grasslands and shrublands; tropical and subtropical grasslands, savannas and shrublands; few ticks in deserts and xeric shrublands (Karoo and Namibian shrublands)

Hosts: Aves are exceptional hosts.
Carnivora: Felidae (ANL)
Carnivora: Herpestidae; Lagomorpha: Leporidae; Primates: Cercopithecidae (AN)
Carnivora: Canidae, Hyaenidae, Viverridae (AL)
Mammalia (several orders); Pelecaniformes: Phalacrocoracidae (A)
Lagomorpha: Leporidae; Rodentia: Muridae, Sciuridae (NL)
Soricomorpha: Soricidae (N)

Human infestation: yes (Horak et al. 2002)

Remarks: there are records in Keirans and Durden (2001) of the introduction of *R. simus* into the Nearctic Region, but there is no evidence of its subsequent establishment. Rivas (1919) allegedly found *R. simus* (under the name *R. simus simus*) in the Neotropical Region, but Guglielmone et al. (2003) consider this an incorrect diagnosis and we agree. However, it should be noted that Díaz Ungría (1957), Camicas et al. (1998) and Guglielmone et al. (2003) cite this record under the name *R. sanguineus simus* (*lapsus*). According to Walker et al. (2000), many earlier records of supposed *R. simus* are actually related tick species, and with the exception of the avian record cited below, these have been excluded from our host list. The latter authors also refer to Leporidae being infested with "immatures" without specifying whether larvae, nymphs or both stages of *R. simus* were present. We recognize Leporidae as hosts of *R. simus* larvae and nymphs, as reported in Horak et al. (1993). Kolonin (2009) lists only rodents and hares as hosts for the immature stages of *R. simus*, but the references below suggest a broader pattern of parasitism. Kolonin (2009) also ignores the odd record of adult *R. simus* on Aves, which is listed in Walker et al. (2000) and which we accept.

References

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Díaz Ungría, C. 1957. Nota sobre las especies de Acarina de Venezuela. Rev. San. Asist. Soc., 22: 457–467.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Horak, I.G., Spickett, A.M., Braack, L.E.O. & Penzhorn, B.L. 1993. Parasites of domestic and wild animals in South Africa. XXXII. Ixodid ticks on scrub hares in the Transvaal. Onderstepoort J. Vet. Res., 60: 163–174.

Horak, I.G., Braack, L.E.O., Fourie, L.J. & Walker, J.B. 2000. Parasites of domestic and wild animals in South Africa. XXXVIII. Ixodid ticks collected from 23 wild carnivore species. Onderstepoort J. Vet. Res., 67: 239–250.

Horak, I.G., Fourie, L.J., Heyne, H., Walker, J.B. & Needham, G.R. 2002. Ixodid ticks feeding on humans in South Africa: with notes on preferred hosts, geographic distribution, seasonal occurrence and transmission of pathogens. Exp. Appl. Acarol., 27: 113–136.

Horak, I.G., Fourie, L.J. & Braack, L.E.O. 2005. Small mammals as hosts of immature ixodid ticks. Onderstepoort J. Vet. Res., 72: 255–261.

Maamun, J.M., Suleman, M.A., Akinyi, M., Ozwara, H., Kariuki, T. & Carlsson, H.-E. 2011. Prevalence of *Babesia microti* in free-ranging baboons and African green monkeys. J. Parasitol., 97: 63–67.

Rivas, J.A. 1919. Contribución al estudio de los Ixodidae de Venezuela. An. Dir. San. Nac., 1: 90–96.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

75 – *R. sulcatus* Neumann, 1908 (Bull. Mus. Natl. Hist. Nat., 14: 352–355)

Type depository: MNHN (syntypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: Mammalia (several orders) (A)

Human infestation: yes (Walker et al. 2000)

Remarks: natural hosts of the larva and nymph of *R. sulcatus* are unknown; these stages were described from laboratory-reared specimens (Walker et al. 2000). There is a single record in Keirans and Durden (2001) of the introduction of *R. sulcatus* into the Nearctic Region, but there is no evidence of its subsequent establishment. Rivas (1919) allegedly found this species (under the name *R. sanguineus punctatissimus* Gerstäcker, 1873, which is regarded by some authors as a synonym of *R. sulcatus*) in the Neotropical Region, but because of the difficulties attending determination of this species (Walker et al. 2000), it is considered a misdiagnosis. We have not included records published prior to Walker et al. (2000). These authors also focus on the problem of differentiation of *R. sulcatus* from *R. sanguineus* and *R. turanicus* – a major impediment to accurate identification, as are the large number of unconfirmed host records. We consequently regard the diagnosis and specific host records of *R. sulcatus* as tentative. See also *R. sanguineus* and *R. turanicus*.

References

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Rivas, J.A. 1919. Contribución al estudio de los Ixodidae de Venezuela. An. Dir. San. Nac., 1: 90–96.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

76 – *R. supertritus* Neumann, 1907 (Arch. Parasitol., 11: 215–232)

Type depository: BMNH (syntypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Mammalia (several orders) (A)

Human infestation: yes (Walker et al. 2000)

Remarks: Walker et al. (2000) discuss the difficulties involved in determining this species, and we have therefore not included records published prior to their work. Kolonin (2009) limits the hosts of *R. supertritus* to Bovidae, but we accept as correct the wider array of hosts listed in Walker et al. (2000).

References

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

77 – *R. tetracornus* Kitaoka & Suzuki, 1983 (Trop. Med., 25: 205–219)
Kolonin (2009, *op. cit*. under *R. aurantiacus*) does not include this species in his list of ixodid ticks of the world. On the other hand, Walker et al. (2000, *op. cit*. under *R. appendiculatus*) classify this species as *incertae sedis* because all the adults and some larvae and nymphs have been lost. However, the species is reasonably well described in Kitaoka, S. & Suzuki, H. (1983. Studies on the parasite fauna of Thailand. 5. Parasitic ticks on mammals and description of *Ixodes siamensis* sp. n. and *Rhipicephalus tetracornus* sp. n. (Acarina: Ixodidae). Trop. Med., 25: 205–219) and paratype nymphs are available. We have therefore decided to follow Guglielmone et al. (2009, *op. cit.* under *R. aurantiacus*) in considering this species valid.

Type depository: NSM (paratypes) (Kitaoka and Suzuki 1983, *op. cit.* above)

Known stages: male, female, nymph, (larva?)

Zoogeographic Region: Oriental

Ecoregion: Kayah-Karen montane rain forests

Hosts: Rodentia: Muridae (N)
Rodentia: Muridae, Cricetidae; Soricomorpha: Soricidae (L)

Human infestation: no

Remarks: it is uncertain whether the larva and larval hosts are those of *R. tetracornus* (Kitaoka and Suzuki 1983), but Camicas et al. (1998) accept both as definite.

References

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Kitaoka, S. & Suzuki, H. 1983. Studies on the parasite fauna of Thailand 5. Parasitic ticks on mammals and description of *Ixodes siamensis* sp. n. and *Rhipicephalus tetracornus* sp. n. (Acarina: Ixodidae). Trop. Med., 25: 205–219.

78 – *R. theileri* Bedford & Hewitt, 1925 (S. Afr. J. Nat. Hist., 5: 259–266)

Type depository: OVI (holotype, paratype) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: Kalahari xeric savanna; Namibian savanna woodlands

Hosts: usual hosts for larvae, nymphs and adults are Carnivora: Herpestidae and Rodentia: Sciuridae.
Carnivora: Herpestidae; Rodentia: Sciuridae (ANL)
Carnivora: Canidae (AN)
Mammalia (several orders) (A)

Human infestation: no

Remarks: Camicas et al. (1998) state that the larva and nymph of *R. theileri* are undescribed, but they were subsequently described by Walker et al. (2000). Records from Testudines and Rodentia in Theiler (1962) are questioned by Walker et al. (2000) and have not been included in the present list of hosts of *R. theileri*. The latter authors also use the word "immatures" extensively without specifying whether they are referring to nymphs, larvae or both stages. Horak et al. (1999) have collected all stages of development from Herpestidae.

References

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Horak, I.G., Chaparro, F., Beaucournu, J.-C. & Louw, J.P. 1999. Parasites of domestic and wild animals in South Africa. XXXVI. Arthropod parasites of yellow mongooses, *Cynictis penicillata* (G. Cuvier, 1829). Onderstepoort J. Vet. Res., 66: 33–38.

Horak, I.G., Braack, L.E.O., Fourie, L.J. & Walker, J.B. 2000. Parasites of domestic and wild animals in South Africa. XXXVIII. Ixodid ticks collected from 23 wild carnivore species. Onderstepoort J. Vet. Res., 67: 239–250.

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

79 – *R. tricuspis* Dönitz, 1906 (Sber. Ges. Naturf. Freunde Berlin (5): 143–148)

Type depository: ZMB (lectotype) (Walker, J.B., Keirans, J.E., Pegram, R.G. & Clifford, C.M. 1988. Clarification of the status of *Rhipicephalus tricuspis* Dönitz, 1906 and *Rhipicephalus lunulatus* Neumann, 1907 (Ixodoidea, Ixodidae). Syst. Parasitol., 12: 159–186)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: Mammalia (several orders) (A)

Human infestation: no

Remarks: natural hosts for the larva and nymph of *R. tricuspis* are unknown; these stages were described from laboratory-reared specimens (Walker et al. 2000). *Rhipicephalus tricuspis* is a difficult species to identify, and host records prior to or at variance with those of Walker et al. (2000) have not been included in our list.

Reference

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

80 – *R. turanicus* Pomerantzev, 1940 (*In* Pomerantzev, B.I., Matikashvily, N.V. & Lotozky, B.V. 1940. Parazitol. Sborn. Zool. Inst. Akad. Nauk SSSR, 7: 100–133. In Russian)
Walker et al. (2000, *op. cit*. under *R. appendiculatus*) give the authority for this species as Pomerantzev, B.I. (1936. Parazitol. Sborn. Zool. Inst. Akad. Nauk SSSR, 6: 5–32). We, however, have followed Filippova, N.A. (1997. Ixodid tick of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian) in assigning 1940 as the year of description of this species. Filippova (1997) considered *R. turanicus* in Pomerantzev (1936, *op. cit.* above) a *nomen nudum.* Camicas et al. (1998, *op cit.* under *R. pilans*) record the authority of *R. turanicus* as "1940, Pomerantzev, B.I., Matikashvily, N.V. & Lotozky, B.V.," but this is incorrect. See also remarks below.

Type depository: ZIAC (lectotype, paralectotype) (Filippova 2008, *op. cit*. under *R. leporis*). Walker et al. (2000, *op. cit*. under *R. appendiculatus*) do not give a depository for the types of *R. turanicus* because they believe that the types have been lost, but the information contained in Filippova (2008, *op. cit*. under *R. leporis*) indicates otherwise.

Known stages: male, female, nymph, larva, taking into account the descriptions in Filippova (1997, *op. cit.* above)

Zoogeographic Region: Palearctic. Many records of *R. turanicus* from around the world are currently only speculative (see remarks).

Ecoregions: lowland desert and semi-desert, steppe and open woodlands. These ecoregions were determined through exclusive use of the data in Filippova (1997), confirmed by this author.

Hosts: Aves and Squamata are considered exceptional hosts.
Mammalia (several orders)
Squamata: Agamidae (A)
Passeriformes: Alaudidae (NL)
This list was constructed using only the *R. turanicus* identified by Filippova, N.A. in Filippova (1997). Therefore, many host records identified by other workers and also included in Filippova (1997), as well as records from other sources, are excluded until the relationship of *R. turanicus* with *R. sanguineus* and related species is resolved. Adult ticks from Agamidae refer to specimens found in a burrow. See remarks below.

Human infestation: yes (Filippova 1997)

Remarks: the conventional identification of *R. turanicus sensu stricto* has always been fraught with difficulty, and recent biological, morphological and molecular studies have revealed a complex situation in relation to *R. sanguineus*, with probable cryptic species, as discussed in Beati and Keirans (2001), Szabó et al. (2005) and Nava et al. (2009). All sources indicate that it is extremely difficult to identify *R. turanicus sensu stricto* with certainty, and studies with ticks from different parts

of the world will be needed to solve this problem. Until such studies have been completed, it will not be possible to definitively assign the specific epithet *turanicus* to any population apart from those identified in Filippova (1997). We argue that the study by Pegram et al. (1987), comparing Palearctic and Afrotropical populations, did not clarify the status of *R. turanicus* because there is no guarantee that these investigators were working with *bona fide R. turanicus*. Nevertheless, any problems pertaining to the identification of *R. turanicus* pale in comparison with those relating to *R. sanguineus*. Since we know the type locality and type host of *R. turanicus*, new specimens can be collected from the type host and locality, and compared with the type material. If such specimens prove to be identical to the types, the species can be morphologically and molecularly redescribed, thus providing data for comparison with other so- called *R. turanicus* worldwide.

References

Beati, L. & Keirans, J.E. 2001. Analysis of the systematic relationships among ticks of the genera *Rhipicephalus* and *Boophilus* (Acari: Ixodidae) based on mitochondrial 12S ribosomal DNA gene sequences and morphological characters. J. Parasitol., 87: 32–48.

Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian.

Nava, S., Guglielmone, A.A. & Mangold, A.J. 2009. An overview of systematics and evolution of ticks. Front. Biosci., 14: 2857–2877.

Pegram, R.G., Clifford, C.M., Walker, J.B. & Keirans, J.E. 1987. Clarification of the *Rhipicephalus sanguineus* group (Acari, Ixodoidea, Ixodidae). I. *R. sulcatus* Neumann, 1908 and *R. turanicus* Pomerantzev, 1936. Syst. Parasitol., 10: 3–26.

Szabó, M.P., Mangold, A.J., Fao, C.F., Bechara, G.H. & Guglielmone, A.A. 2005. Biological and DNA evidence of two dissimilar populations of the *Rhipicephalus sanguineus* tick group (Acari: Ixodidae) in South America. Vet. Parasitol., 130: 131–140.

81 – *R. warburtoni* Walker & Horak, 2000 (*In* Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.)

Type depositories: OVI (holotype, paratype), BMNH, USNTC (paratypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregion: Nama Karoo

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae and Lagomorpha: Leporidae; usual hosts for larvae and nymphs are Lagomorpha: Leporidae and Macroscelidea: Macroscelididae. Aves are considered exceptional hosts.
Lagomorpha: Leporidae (ANL)

Artiodactyla: Bovidae; Carnivora: Canidae, Felidae (A)
Macroscelidea: Macroscelididae; Passeriformes: Alaudidae (NL)
Rodentia: Pedetidae (N)
Rodentia: Muridae (L)

Human infestation: yes (Horak et al. 2002)

Remarks: adults of this tick were originally referred to as *Rhipicephalus* near *punctatus* by Fourie and Horak (1990) and as *R. punctatus* by Fourie and Horak (1991) and Fourie et al. (1996); larvae and nymphs were referred to as *R. punctatus* by Fourie et al. (1992). These ticks were subsequently recognized as belonging to a new species, namely *Rhipicephalus warburtoni* (Walker et al. 2000). *Rhipicephalus appendiculatus* in Tonetti et al. (2009) are in fact *R. warburtoni*, as recognized in Tonetti and Walters (2010). Aves are not included as hosts of this tick in Kolonin (2009). See also *R. pravus* and *R. punctatus*.

References

Fourie, L.J. & Horak, I.G. 1990. Parasites of cattle in the south western Orange Free State. J. S. Afr. Vet. Assoc., 61: 27–28.

Fourie, L.J. & Horak, I.G. 1991. The seasonal activity of adult ixodid ticks on Angora goats in the south western Orange Free State. J. S. Afr. Vet. Assoc., 62:104–106.

Fourie, L.J., Horak, I.G. & van den Heever, J.J. 1992. The relative host status of rock elephant shrews *Elephantulus myurus* and Namaqua rock mice *Aethomys namaquensis* for economically important ticks. S. Afr. J. Zool., 27: 108–114.

Fourie, L.J., Kok, D.J. & Heyne, H. 1996. Adult ixodid ticks on two cattle breeds in the south-western Free State, and their seasonal dynamics. Onderstepoort J. Vet. Res., 63: 19–23.

Fourie, L.J., Horak, I.G. & Woodall, P.F. 2005. Elephant shrews as hosts of immature ixodid ticks. Onderstepoort J. Vet. Res., 72: 293–301.

Horak, I.G., Fourie, L.J., Heyne, H., Walker, J.B. & Needham, G.R. 2002. Ixodid ticks feeding on humans in South Africa: with notes on preferred hosts, geographic distribution, seasonal occurrence and transmission of pathogens. Exp. Appl. Acarol., 27: 113–136.

Horak, I.G., Fourie, L.J. & Braack, L.E.O. 2005. Small mammals as hosts of immature ixodid ticks. Onderstepoort J. Vet. Res., 72: 255–261.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Tonetti, N. & Walters, M. 2010. Correction for Tonetti et al. 2009. J. Wildl. Dis., 45: 437–446. J. Wildl. Dis., 46: 133.

Tonetti, N., Berggoetz, M., Rühle, C., Pretorius, A.M. & Gern, L. 2009. Ticks and tick-borne pathogens from wildlife in the Free State Province. South Africa. J. Wildl. Dis., 45: 437–446.

Van Niekerk, D.J., Fourie, L.J. & Horak, I.G. 2006. Birds as hosts of immature ixodid ticks in Free State Province, South Africa. Onderstepoort J. Vet. Res., 73: 123–130.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

82 – *R. zambeziensis* Walker, Norval & Corwin, 1981 (Onderstepoort J. Vet. Res., 48: 87–104)

Type depositories: OVI (holotype, paratypes), BMNH, USNTC, VRLH (paratypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae; usual hosts for larvae and nymphs are Artiodactyla: Bovidae and Lagomorpha: Leporidae.
Artiodactyla: Bovidae; Carnivora (several families); Lagomorpha: Leporidae; Rodentia: Sciuridae (ANL)
Artiodactyla: Giraffidae; Rodentia: Hystricidae; Tubulidentata: Orycteropodidae (A)
Artiodactyla: Suidae; Perissodactyla: Equidae (A, N and/or L)
Galliformes: Numididae, Phasianidae (NL)
Perissodactyla: Rhinocerotidae; Rodentia: Pedetidae (N)

Human infestation: yes (Horak et al. 2002)

Remarks: Walker et al. (2000) use the term "immatures" extensively without specifying which immature stages of *R. zambeziensis* were found on hosts. See also *R. appendiculatus.*

References

Horak, I.G., De Vos, V. & De Klerk, B.D. 1984. Parasites of domestic and wild animals in South Africa. XVII. Arthropod parasites of Burchell's zebra *Equus burchelli*, in the Eastern Transvaal Lowveld. Onderstepoort J. Vet. Res., 51: 145–154.

Horak, I.G., Boomker, J., De Vos, V. & Potgieter, F.T. 1988. Parasites of domestic and wild animals in South Africa. XXIII. Helminth and arthropod parasites of warthogs, *Phacochoerus aethiopicus*, in the Eastern Transvaal Lowveld. Onderstepoort J. Vet. Res., 55: 145–152.

Horak, I.G., Spickett, A.M., Braack, L.E.O. & Williams, E.J. 1991. Parasites of domestic and wild animals in South Africa. XXVII. Ticks on helmeted guineafowls in the Eastern Cape Province and Eastern Transvaal lowveld. Onderstepoort J. Vet. Res., 58: 137–143.

Horak, I.G., Boomker, J., Spickett, A.M. & De Vos, V. 1992. Parasites of domestic and wild animals in South Africa. XXX. Ectoparasites of kudus in the Eastern Transvaal Lowveld and the Eastern Cape Province. Onderstepoort J. Vet. Res., 59: 259–273.

Horak, I.G., Spickett, A.M., Braack, L.E.O. & Penzhorn, B.L. 1993. Parasites of domestic and wild animals in South Africa. XXXII. Ixodid ticks on scrub hares in the Transvaal. Onderstepoort J. Vet. Res., 60: 163–174.

Horak, I.G., Braack, L.E.O., Fourie, L.J. & Walker, J.B. 2000. Parasites of domestic and wild animals in South Africa. XXXVIII. Ixodid ticks collected from 23 wild carnivore species. Onderstepoort J. Vet. Res., 67: 239–250.

Horak, I.G., Fourie, L.J., Heyne, H., Walker, J.B. & Needham, G.R. 2002. Ixodid ticks feeding on humans in South Africa: with notes on preferred hosts, geographic distribution, seasonal occurrence and transmission of pathogens. Exp. Appl. Acarol., 27: 113–136.
Horak, I.G., Fourie, L.J. & Braack, L.E.O. 2005. Small mammals as hosts of immature ixodid ticks. Onderstepoort J. Vet. Res., 72: 255–261.
Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

83 – *R. ziemanni* Neumann, 1904 (Arch. Parasitol., 8: 444–464)
See *R. aurantiacus.*

Type depository: BMNH (syntypes) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands; tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Carnivora: Felidae; Rodentia: Hystricidae (AN)
Mammalia (several orders) (A)

Human infestation: yes (Walker et al. 2000)

Remarks: Camicas et al. (1998) report that the nymph of *R. ziemanni* has been described, but we follow Walker et al. (2000), who state that the nymph of this species is known but undescribed. We also follow Walker et al. (2000) in regarding Felidae and Hystricidae as provisional hosts for nymphs.

References

Camicas, J.-L., Hervy, J.P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.
Morel, P.-C. & Mouchet, J. 1958. Les tiques du Cameroun (Ixodidae et Argasidae). Ann. Parasitol., 33: 69–111.
Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

84 – *R. zumpti* Santos Dias, 1950 (Moçambique (61): 113–170)

Type depository: SDC (holotype) (Walker et al. 2000, *op. cit*. under *R. appendiculatus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: southern miombo woodlands; Maputaland coastal forest mosaic; Nama Karoo

Hosts: Mammalia (several orders) (A)

Human infestation: yes (Walker et al. 2000)

Remarks: Walker et al. (2000) state that the hosts of larvae and nymphs of *R. zumpti* are probably Muridae. However, the natural hosts of these stages are unknown because they were described from laboratory-reared specimens (Walker et al. 2000). Consequently, we have excluded Muridae from the host list above.

References

Horak, I.G., Braack, L.E.O., Fourie, L.J. & Walker, J.B. 2000. Parasites of domestic and wild animals in South Africa. XXXVIII. Ixodid ticks collected from 23 wild carnivore species. Onderstepoort J. Vet. Res., 67: 239–250.

Walker, J.B., Keirans, J.E. & Horak, I.G. 2000. The genus *Rhipicephalus* (Acari: Ixodidae): a guide to the brown ticks of the world. Cambridge University Press, Cambridge, 643 pp.

Synopsis of the Genus *Rhipicephalus*

A synopsis of the genus *Rhipicephalus* is presented in Tables 1 and 2. Most species of *Rhipicephalus* are found exclusively in the Afrotropical Region (63 or 75 % of all species), while 7 (8 %) and 3 (4 %) are found exclusively in the Palearctic and Oriental Zoogeographic Regions, respectively. No species of *Rhipicephalus* are present exclusively in the Australasian, Nearctic and Neotropical Regions. The status of *R. sanguineus* and *R. turanicus* is difficult to define; *R. sanguineus* is considered to be cosmopolitan, but the species itself is not morphologically well characterized, and its source is a Palearctic locality. On the other hand, *R. turanicus* is morphologically well defined and there are *bona fide* records for it in the Palearctic Region, but a multitude of records from other zoogeographic regions remain unconfirmed (see *R. sanguineus* and *R. turanicus* above). For the purposes of this review, we consider both species to be established exclusively in the Palearctic Region. Future analyses, however, may overturn this view.

Four *Rhipicephalus* species are widespread, being present in three or more zoogeographic regions: *R. haemaphysaloides* is established in the Australasian, Oriental and Palearctic Regions, *R. annulatus* is present in the Afrotropical, Oriental and Palearctic Regions, *R. australis* is found in the Australasian and Oriental Regions but also on Pacific islands, and *R. microplus* is established in all zoogeographic regions, including some remote islands. Thus, the distribution of the genus *Rhipicephalus* encompasses all zoogeographic regions as well as some remote islands, for a total of ten combinations of land utilization. This genus is absent

Table 1 Numbers and percentages of all species of *Rhipicephalus*, by zoogeographic region(s), number known to feed on humans (% of the total number of species in a particular region), and number of species for which all stages (larva, nymph, male and/or female) are known (% of the total number of species in a particular region)

Regions	No of species	%	No of species on humans	No of species of which all stages are known
Afrotropical	63	75.0	33 (52.4)	42 (66.7)
Palearctic[a]	7	8.4	5 (71.4)	6 (85.7)
Afrotropical-Palearctic	5	6.0	3 (60.0)	5 (100)
Oriental	3	3.6	0	1 (33.3)
Australasian-Oriental	1	1.2	1 (100)	1 (100)
Oriental-Palearctic	1	1.2	1 (100)	1 (100)
Afrotropical-Nearctic-Palearctic	1	1.2	1 (100)	1 (100)
Australasian-Oriental-Palearctic	1	1.2	1 (100)	1 (100)
Australasian-Oriental-Pacific slands	1	1.2	0	1 (100)
All Zoogeographic Regions and several islands around the world	1	1.2	1 (100)	1 (100)
Total	**84**		**46 (54.8)**	**60 (71.4)**

[a]Two Palearctic species (*R. sanguineus* and *R. turanicus*) probably have wider distributions than we have recorded, but we are unable to determine the extent of these. Both species feed on humans and all stages of *R. turanicus* are known, but not those of *R. sanguineus*

Table 2 Numbers and percentages of the 46 species of *Rhipicephalus* whose adult (female and/or male), larval and nymphal stages as well as natural hosts are known, including or excluding exceptional hosts

Hosts	No of species Including exceptional hosts	%	No of species Excluding exceptional hosts	%
Aves + Mammalia	20	43.5	8	17.3
Mammalia	16	34.7	38	82.6
Aves + Mammalia + Squamata	4	8.7	0	0
Aves + Mammalia + Testudines	3	6.5	0	0
Anura + Aves + Mammalia + Squamata	1	2.2	0	0
Aves + Mammalia + Squamata + Testudines	1	2.2	0	0
Mammalia + Squamata	1	2.2	0	0
Total	**46**		**46**	

around the poles, but the earths's islands have been colonized by *R. microplus* and, to a lesser extent, by *R. australis* via settlement of humans and their infested cattle.

Our analyses show that 68 species (81 % of the genus) are found exclusively in regions that constituted the ancient continent Gondwana; 7 species (8 %) are established in regions that formed Laurasia, and 8 species (10 %) are present in regions that were part of both ancient continents.

The larva, nymph and at least one adult stage are known for 60 (71 %) of the 84 species of *Rhipicephalus* that we recognize as valid. Although this is a comparatively high proportion, descriptive and diagnostic problems associated with important ticks belonging to the *R. sanguineus* group of species need to be addressed to better understand the phylogenetic relationships within this genus.

A total of 46 species (55 %) have been recorded as feeding on humans.

Hosts for 46 species (55 % of the total) of *Rhipicephalus* whose adult (female and/or male) and immature stages and natural hosts are known are presented in Table 2, including or excluding exceptional hosts. All parasitic stages of *R. camicasi*, *R. capensis*, *R. carnivoralis*, *R. humeralis*, *R. hurti*, *R. kochi*, *R. lounsburyi*, *R. moucheti*, *R. neumanni*, *R. sculptus*, *R. sulcatus*, *R. tricuspis* and *R. zumpti* are known, but one or both immature stages are known only from laboratory-reared specimens. Therefore, these species have been excluded from our host analysis.

When exceptional hosts are included in the analysis, ticks of the genus *Rhipicephalus* are recorded from seven different categories of hosts (Table 2). However, the only exclusive hosts for *Rhipicephalus* are Mammalia (16 species or 35 % of the total taxa analyzed), while all the remaining species have also been collected from Mammalia. The most common combination of hosts for this genus is Mammalia + Aves (20 species, 43 %), and Aves are also non-exclusive hosts of 29 species (63 %). Squamata are non-exclusive hosts of seven species (15 %) of *Rhipicephalus.* The contribution of Testudines and Anura as hosts for ticks of this genus is meager. Testudines are exceptional hosts of four species (*R. appendiculatus*, *R. decoloratus*, *R. evertsi* and *R. gertrudae*), while Anura are a rare host for a single species, *R. microplus*. No *Rhipicephalus* ticks have been collected from Crocodilia.

The above situation changes dramatically when exceptional hosts are excluded from the analysis. No *Rhipicephalus* species are now associated with Anura, Squamata and Testudines, and the categories of host utilization decrease from seven to just two (Mammalia and, Aves + Mammalia). Aves are recognized as non-exclusive but relevant hosts for eight species (17 % of the total of species analyzed), while the role of Mammalia as exclusively relevant hosts is further consolidated, with all parasitic stages of 38 *Rhipicephalus* species (83 % of the total) feeding on this class of vertebrates.

Part V
The Genus *Dermacentor*

General Comment and Remarks on an Invalid Name

The genus *Dermacentor* is under revision by one of us (DAA). Therefore, several changes in the taxonomy and nomenclature of this genus are expected in the near future.

Dermacentor rosmari Ass, 1935 was described from two specimens collected from a walrus, *Odobenus rosmarus* (Carnivora: Odobenidae), in the Kara Sea, but it is impossible to determine the tick in question based on the description and figures in Ass (1935). Clearly, these specimens are not *Dermacentor* because eyes are lacking. We tried to locate the types of *D. rosmari* but were unsuccessful. Pomerantzev (1950) regards *D. rosmari* as a synonym of *Hyalomma aegyptium*, while Camicas et al. (1998) treat it as a synonym of *Ixodes uriae.* We find these decisions unjustifiable and consider *D. rosmari* a *nomen nudum.* Still, some authors, such as Raga et al. (2008), regard *D. rosmari* as valid.

References

Ass, M.I. 1935. Zur Kenntnis der Ektoparasiten der Flossenfüssler (Pinnipedia). Eine neue Zeckenart auf dem Walross. Z. Parasitenkd., 7: 601–607. Spanish translation by Dreher, N.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Pomerantzev, B.I. 1950. Ixodid ticks (Ixodidae). Fauna of USSR, Zool. Inst. Acad. Sci. USSR New Ser. (41), 224 pp. In Russian.

Raga, J.A., Fernández, M., Balbuena, J.A. & Aznar, F.J. 2008. Parasites. *In* W.F. Perrin, B. Wursig & J.G.M. Thewissen (editors), Encyclopedia of marine mammals, 2nd edition. Academic Press, pp. 821–830.

DOI 10.1007/978-94-007-7497-1_10,

Individual Species Accounts

1 – *D. abaensis* Teng, 1963 (Acta Entomol. Sin., 12: 225–228. In Chinese)
This species is close to *D. everestianus*, but we follow Guglielmone, A.A., Robbins, R.G., Apanaskevich, D.A., Petney, T.N., Estrada-Peña, A. & Horak, I.G. (2009. Comments on controversial tick (Acari: Ixodida) species names and species described or resurrected from 2003 to 2008. Exp. Appl. Acarol., 48: 311–327), who treat *D. abaensis* as provisionally valid pending type comparison with *D. everestianus*. One of us (DAA) is currently comparing the types of *D. abaensis*, *D. everestianus* and *D. birulai* Olenev, 1927; the last taxon is listed as valid in Kolonin, G.V. (2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/) but considered a synonym of *D. everestianus* by most tick workers, and we provisionally agree with this opinion.

Type depository: IZAS (holotype, paratypes) (Teng, K.-F. 1963. A new species of the genus *Dermacentor* (Ixodidae). Acta Entomol. Sin., 12: 225–228. In Chinese, NAMRU-3 translation 446.)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: southeast Tibet shrublands and meadows

Hosts: Artiodactyla: Bovidae, Moschidae; Carnivora: Ursidae (A)
Lagomorpha: Ochotonidae; Rodentia: Muridae (NL)

Human infestation: no

Remarks: Camicas et al. (1998) indicate that the nymph of *D. abaensis* is undescribed, but this stage was described by Jiang and Li (1989). Teng (1982) provides records of this species from Guinan, Jianzha, and Mangya, all in Qinghai Province.

DOI 10.1007/978-94-007-7497-1_11, © Springer Science+Business Media Dordrecht 2014

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Jiang, Z.-T. & Li, G.-M. 1989. The nymphs of 3 species of *Dermacentor* and key to the nymphs of Chinese common species of *Dermacentor*. Acta Zootax. Sin., 14: 427–432.

Teng, K.-F. 1982. The geographic distribution of the genus *Dermacentor* in China. Sinozoologia (2): 211–216. In Chinese, NAMRU-3 translation 1790.

Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect of fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.

2 – *D. albipictus* (Packard, 1869) (First Annual Report of the Trustees of the Peabody Academy of Sciences, Appendix, pp. 56–69)

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. (1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.) treat *D. nigrolineatus* (Packard, 1869) as a valid species, but, like most authors, we follow Ernst, S.E. & Gladney, W.J. (1975. *Dermacentor albipictus*: hybridization of the two forms of the winter ticks. Ann. Entomol. Soc. Am., 68: 63–67), who determined that *D. nigrolineatus* is a synonym of *D. albipictus.* Dana, A.N. (2009. Diagnosis and treatment of tick infestation and tick-borne diseases with cutaneous manifestations. Dermatol. Ther., 22: 293–326) referred to this species as *D. albopictus.*

Type depository: MCZ (syntypes) (online at http://mczbase.mcz.harvard.edu/ accessed April 4, 2013) as *Ixodes albipictus*

Known stages: male, female, nymph, larva

Zoogeographic Regions: Nearctic, Neotropical

Ecoregions: many Nearctic and Neotropical ecoregions

Hosts: usual hosts for this tick are Artiodactyla: Bovidae and Cervidae; and Perissodactyla: Equidae. Aves are exceptional hosts.
Mammalia (several orders); Charadriiformes: Scolopacidae; Falconiformes: Accipitridae

Human infestation: yes (Heath and Hardwick 2011 among others)

Remarks: because this is a one-host tick, we do not separately record the various life stages associated with particular hosts. Crosbie et al. (1998) analyzed sequences of 16S rDNA of *D. albipictus* and suggested that this name may represent a species complex, but a recent mitochondrial DNA study by Leo et al. (2010) does not validate that hypothesis. There are several records of *D. albipictus* having been introduced into other zoogeographic regions, *e.g.*, Joyce (1959), Lillehaug et al. (2002)

and Heath and Hardwick (2011), but there is no evidence that it has become established outside the Nearctic and Neotropical Regions. Other records, as in Kishida (1936) for the Palearctic Region (under the name *D. variegatus* Marx and Neumann, 1897) and Chhetri and Shrestha (2011), are considered misidentifications. Kolonin (2009) limits the range of hosts of *D. albipictus* to ungulates, but the references cited below reveal a wider spectrum of hosts for this tick. Romero-Castañón et al. (2008) state that their record of *D. albipictus* is the first for Mexico, but the first record for this country is that of Chavarría (1941). Peters (1936) refers to this tick as *D. nigrolineatus*. Aves are not included as hosts for *D. albipictus* in Kolonin (2009); this host-parasite relationship, unusual for a species of *Dermacentor*, is recorded in Furman and Loomis (1984), among others. See also *D. kamshadalus.*

References

Chavarría, C. M. 1941. Garrapatas determinadas en México. Caracteres genéricos de las más comunes. Rev. Inst. Pecu., 1: 18–24.

Chhetri, K.R.B. & Shrestha, S.P. 2011. Study of tick fauna in bovine, caprine and canine of Kathmandu Valley. Nepalese Vet. J., 30: 151–153.

Crosbie, P.R., Boyce, W.M. & Rodwell, T.C. 1998. DNA sequence variation in *Dermacentor hunteri* and estimated phylogenies of *Dermacentor* spp. (Acari: Ixodidae) in the New World. J. Med. Entomol., 35: 277–288.

Furman, D.P. & Loomis, E.C. 1984. The ticks of California (Acari: Ixodida). Bull. Calif. Insect Surv., 25: 1–239.

Gregson, J.D. 1956. The Ixodoidea of Canada. Can. Dept. Agric. Sci. Serv. Entomol. Div. Publ. (930), 92 pp.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Heath, A.C.G. & Hardwick, S. 2011. The role of humans in the importation of ticks to New Zealand: a threat to public health and biosecurity. N. Zeal. Med. J., 124: 67–82.

Joyce, C.R. 1959. Notes and exhibitions. Proc. Hawaiian Entomol. Soc., 17: 15.

Kishida, K. 1936. Notes on the Acarina – mite and tick, from the Peninsula of Corea and the island of Quelpart collected in August, 1936. Lansania, 8: 131–144. In Japanese.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Leo, S.S.T., Pybus, M.J. & Sperling, F.A.H. 2010. Deep mitochondrial DNA lineage divergences within Alberta populations of *Dermacentor albipictus* (Acari: Ixodidae) do not indicate distinct species. J. Med. Entomol., 47: 565–574.

Lillehaug, A., Mehl, R. & Gjerde, B. 2002. Importation of *Dermacentor albipictus* into Europe. Vet. Rec., 115: 94–95.

Peters, H.S. 1936. A list of external parasites from birds of the eastern part of the United States. Bird-Banding, 7: 9–27.

Romero-Castañón, S., Ferguson, B.G., Güiris, D., González, D., López, S., Paredes, A. & Webber, M. 2008. Comparative parasitology of wild and domestic ungulates in the Selva Lacandona, Chiapas, México. Comp. Parasitol., 75: 115–126.

Tijerina-Medina, G., Torres, J.M., Rodríguez-Castro, V.A., Quiroz-Martínez, H. & González-Rojas, J.I. 2006. Fleas (Siphonaptera) and ticks (Arachnida: Acari: Ixodida) parasitizing small mammals in the Sierra San Antonio Peña Nevada, State of Nuevo León, México. Entomol. News, 117: 95–100.
Yunker, C.E., Keirans, J.E., Clifford, C.M. & Easton, E.R. 1986. *Dermacentor* ticks (Acari: Ixodidae) of the New World: a scanning electron microscope atlas. Proc. Entomol. Soc. Wash., 88: 609–627.

3 – *D. andersoni* Stiles, 1908 (Publ. Health Rep. U.S. Publ. Health Mar. Hosp. Serv., 23: 949)

Type depository: USNTC (type) [sic] (Keirans, J.E. & Clifford, C.M. 1984. A checklist of types of Ixodoidea (Acari) in the collection of the Rocky Mountain Laboratories. J. Med. Entomol., 21: 310–320) as *Dermacentor venustus* Marx, Ms. in Neumann, 1897. This name was suppressed to conserve the name *andersoni*, as detailed in Keirans, J.E. (1976. *Dermacentor venustus* Marx Ms. in Neumann, 1897: proposed suppression under the plenary powers so as to conserve *Dermacentor andersoni* Stiles, 1908 (Acarina: Ixodidae). Bull. Zool. Nomencl., 32: 261–264)

Known stages: male, female, nymph, larva

Zoogeographic Region: Nearctic

Ecoregions: xeric shrublands; temperate conifer forests

Hosts: usual hosts for adult ticks are Artiodactyla (several families); Carnivora (several families); Lagomorpha: Leporidae and Perissodactyla: Equidae. Usual hosts for larvae and nymphs are Lagomorpha: Leporidae and Rodentia (several families). Aves are considered exceptional hosts for this tick.
Mammalia (several orders) (ANL)
Galliformes: Phasianidae (AN)
Falconiformes: Accipitridae (stage unknown)

Human infestation: yes (Heath and Hardwick 2011)

Remarks: a Neotropical record of *D. andersoni* (under the name *Dermacentor venustus*) by Barroso (1922) is considered a misidentification by Guglielmone et al. (2003). This tick species has been introduced into the Palearctic (Okino et al. 2007) and Australasian Regions (Heath and Hardwick 2011) but there is no evidence that it has become established in either of those regions. Ekanem et al. (2012) reported a natural population of *D. andersoni* in the Afrotropical Region, but this is regarded as a diagnostic error.

References

Barroso, S.M. 1922. O que todo devemos saber os parasitas vegetaes e animaes que se implantam no nosso corpo e os males que nos causam. Meios de os evitar. Bahia, 230 pp.
Bishopp, F.C. & Trembley, H.L. 1945. Distribution and hosts of certain North American ticks. J. Parasitol., 31: 1–54.

Cooley, R.A. 1938. The genera *Dermacentor* and *Otocentor* (Ixodidae) in the United States, with studies in variation. Natl. Inst. Health Bull. (171), 89 pp.
Ekanem, M.S., Opara, K.N., Bennie, D.P. & Udo, I.O. 2012. Ectoparasites [sic] of goats in Etinan, Akwa Ibom State, Nigeria. J. Agric. Biol. Sci., 2: 108–113.
Gregson, J.D. 1956. The Ixodoidea of Canada. Canad. Dept. Agric. Sci. Serv. Entomol. Div. Publ. (930), 92 pp.
Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.
Hearle, E. 1938. The ticks of British Columbia. Sci. Agric., 18: 341–354.
Heath, A.C.G. & Hardwick, S. 2011. The role of humans in the importation of ticks to New Zealand: a threat to public health and biosecurity. N. Zeal. Med. J., 124: 67–82.
Okino, T. Ushirogawa, H., Matoba, K. & Hatsushika, R. 2007. A bibliographical study of human cases of hard tick (Acarina: Ixodidae) bites received abroad and found in Japan. Kawasaki Med. J., 33: 189–194.

4 – *D. asper* Arthur, 1960 (Ticks. A monograph of the Ixodoidea. Part V. On the genera *Dermacentor*, *Anocentor*, *Cosmiomma*, *Boophilus* & *Margaropus*. Cambridge University Press, London, 251 pp.)
Kolonin G.V. (2009, *op. cit.* under *D. abaensis*) treats *D. asper* as a probable synonym of *D. sinicus* without presenting evidence for this conclusion. We consider *D. asper* provisionally valid.

Type depository: BMNH (syntypes) (Keirans, J.E. & Hillyard, P.D. 2001. A catalogue of the type specimens of Ixodida (Acari: Argasidae, Ixodidae) deposited in The Natural History Museum, London. Occ. Pap. Syst. Entomol. (13), 74 pp.)

Known stages: male

Zoogeographic Region: Palearctic

Ecoregion: temperate broadleaf and mixed forests

Hosts: Erinaceomorpha: Erinaceidae (A)

Human infestation: no

Reference

Keirans, J.E. & Hillyard, P.D. 2001. A catalogue of the type specimens of Ixodida (Acari: Argasidae, Ixodidae) deposited in The Natural History Museum, London. Occ. Pap. Syst. Entomol., (13), 74 pp.

5 – *D. atrosignatus* Neumann, 1906 (Arch. Parasitol., 10: 195–219)

Type depository: BMNH (holotype) (Keirans and Hillyard 2001, *op. cit*. under *D. asper*)

Known stages: male, female

Zoogeographic Regions: Australasian, Oriental

Ecoregions: peninsular Malaysian rain forests

Hosts: usual hosts for adult ticks are Artiodactyla: Suidae.
Artiodactyla: Bovidae (AL)
Artiodactyla: Suidae (A, N and/or L)
Carnivora: Canidae, Ursidae; Pholidota: Manidae; Squamata: Elapidae, Varanidae (A)
Rodentia: Muridae; Soricomorpha: Soricidae (NL)
Chiroptera: Pteropodidae (N)

Human infestation: yes (Durden et al. 2008)

Remarks: Hoogstraal and Wassef (1985) explain the confusion attending the identity of this species; accordingly, we have not included host records published prior to their work. These authors also use the term "immatures" without specifying which sub-adult stage (both undescribed) of *D. atrosignatus* was found on a given host. Durden et al. (2008) regard as tentative their diagnoses of larvae and nymphs of *D. atrosignatus* on Bovidae, Muridae, Pteropodidae and Soricidae because there are no formal descriptions of these stages of *D. atrosignatus*. However, we have provisionally excluded their records in our host list for this tick.

References

Durden, L.A., Merker, S. & Beati, L. 2008. The tick fauna of Sulawesi, Indonesia (Acari: Ixodoidea: Argasidae and Ixodidae). Exp. App. Acarol., 45: 85–110.

Hoogstraal, H. & Wassef, H. 1985. *Dermacentor* (*Indocentor*) *atrosignatus* (Acari: Ixodoidea: Ixodidae): hosts and distribution in the Malay Peninsula, Indonesia, Borneo, and southern Philippines. J. Med. Entomol., 22: 644–647.

6 – *D. auratus* Supino, 1897 (Atti. Soc. Veneto-Trentina Sci. Nat. Residente Padova Ser. 2, 3: 230–238)
See remarks below.

Type depositories: GM, BMNH (syntypes) (Keirans and Hillyard 2001, *op. cit*. under *D. asper*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregion: moist broadleaf forests

Hosts: usual hosts for adult ticks are Artiodactyla: Suidae, while Aves and Squamata are considered exceptional hosts.
Artiodactyla: Cervidae; Rodentia: Sciuridae (ANL)
Artiodactyla: Suidae; Carnivora: Felidae, Mustelidae, Ursidae; Perissodactyla: Rhinocerotidae (AN)
Carnivora: Canidae; Squamata: Boidae (A)

Artiodactyla: Tragulidae; Primates: Cercopithecidae; Rodentia: Hystricidae, Muridae (NL)
Mammalia (several orders); Galliformes: Phasianidae (N)

Human infestation: yes (Burridge 2011)

Remarks: Hoogstraal and Wassef (1985) explain the confusion attending the identity of this species; accordingly, we have excluded records published prior to their work. We believe that there are no *bona fide* records of *D. auratus* from the Australasian Region, although Teng (1982) states that this species is established there. Teng (1982) also apparently considers *D. steini* (an Australasian and Oriental species) a synonym of *D. auratus*, as stated in Teng and Jiang (1991), but we feel that this synonymy is unproved. Based on Hoogstraal and Wassef (1985), Burridge (2011) lists Soricomorpha as hosts for larvae, nymphs and adults of *D. auratus*, but the former authors recognize only nymphs as being found on this type of host. Keirans and Durden (2001) and Burridge (2011) record the introduction of *D. auratus* into the Nearctic Region, but there is no evidence of it having become established there. Kolonin (2009) ignores the Hoogstraal and Wassef (1985) records of Squamata and Aves as hosts for *D. auratus*, probably because such parasitism appears to be rare.

References

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Hoogstraal, H. & Wassef, H. 1985. *Dermacentor* (*Indocentor*) *auratus* (Acari: Ixodoidea: Ixodidae): hosts, distribution and medical importance in tropical Asia. J. Med. Entomol., 22: 170–177.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Parola, P., Cornet, J.-P., Sanogo, Y.O., Miller, R.S., Thien, H.V., González, J.-P., Raoult, D., Telford, S.R. & Wongsrichanalai, C. 2003. Detection of *Ehrlichia* spp., *Anaplasma* spp., *Rickettsia* spp., and other eubacteria in ticks from the Thai-Myanmar border and Vietnam. J. Clin. Microbiol., 41: 1600–1608.

Teng, K.-F. 1982. The geographic distribution of the genus *Dermacentor* in China. Sinozoologia, (2): 211–216. In Chinese, NAMRU-3 translation 1790.

Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect of fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.

7 – *D. circumguttatus* Neumann, 1897 (Mém. Soc. Zool. Fr., 10: 324–420)

Type depository: MNHN (syntypes) (Neumann, L.G. 1897. Revision de la famille des ixodidés. Mém. Soc. Zool. Fr., 10: 324–420)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical moist broadleaf forests; tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for adult ticks are Proboscidea: Elephantidae.
Artiodactyla: Bovidae, Suidae; Proboscidea: Elephantidae (A)

Human infestation: yes (Ntiamoa-Baidu et al. 2004)

Remarks: Kolonin (2009) limits the range of hosts for adult *D. circumguttatus* to Proboscidea, but we accept the records from other hosts included in Elbl and Anastos (1966). Camicas et al. (1998) list Aves and pholeophilic (burrowing) mammals as hosts for the undescribed immature stages of *D. circumguttatus*, but we have been unable to confirm this. According to Mihalca et al. (2011), this species is at risk of extinction.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Elbl, A. & Anastos, G. 1966. Ixodid ticks (Acarina, Ixodidae) of Central Africa. Vol. IV. Genera *Aponomma* Neumann, 1899, *Boophilus* Curtice, 1891, *Dermacentor* Koch, 1844, *Haemaphysalis* Koch, 1844, *Hyalomma* Koch, 1844 and *Rhipicentor* Nuttall and Warburton, 1908. Ann. Mus. R. Centr. Afr., Ser. 8º Sci. Zool. (148), 412 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

Ntiamoa-Baidu, Y., Carr-Saunders, C., Matthews, B.E., Preston, P.M. & Walker, A.R. 2004. An updated list of the ticks of Ghana and an assessment of the distribution of the ticks of Ghanaian wild mammals in different vegetation zones. Bull. Entomol. Res., 94: 245–260.

8 – *D. compactus* Neumann, 1901 (Mém. Soc. Zool. Fr., 14: 249–372)

Type depositories: ENV (lectotype, paralectoypes), ZMB (paralectotypes) Moritz, M. & Fischer, S.C. (1981. Die Typen der Arachniden-Sammlung des Zoologischen Museums Berlin. Mitt. Zool. Mus. Berlin, 57: 341–364) include syntypes in ZMB, but Wassef & Hoogstraal (1983. *Dermacentor* (*Indocentor*) *compactus* (Acari: Ixodoidea: Ixodidae): identity of male and female. J. Med. Entomol., 20: 648–652) designated lectotype and paralectotypes from specimens in the Neumann tick collection at ENV.

Known stages: male, female

Zoogeographic Region: Oriental

Ecoregions: montane rain forests

Hosts: usual hosts for adult ticks are Artiodactyla: Suidae, while Squamata are considered exceptional hosts.
Mammalia (several orders); Squamata: Boidae (A)

Human infestation: yes (Hoogstraal and Wassef 1984)

Remarks: Wassef and Hoogstraal (1983) explain the confusion attending the identity of this species; accordingly, we have not included host records prior to their work. Camicas et al. (1998) list pholeophilic (burrowing) mammals as hosts of the undescribed larva and nymph of *D. compactus*, but we have found no *bona fide* records supporting this.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Hoogstraal, H. & Wassef, H. 1984. *Dermacentor* (*Indocentor*) *compactus* (Acari: Ixodoidea: Ixodidae): wild pigs and other hosts and distribution in Malaysia, Indonesia, and Borneo. J. Med. Entomol., 22: 644–647.

Wassef, H.Y. & Hoogstraal, H. 1983. *Dermacentor* (*Indocentor*) *compactus* (Acari: Ixodoidea: Ixodidae): identity of male and female. J. Med. Entomol., 21: 174–178.

9 – *D. confragus* (Schulze, 1933) (Z. Parasitenkd., 6: 416–431)
Kolonin (2009, *op. cit*. under *D. abaensis*) excludes *D. confragus* from his list of *Dermacentor* of the world, but we follow Guglielmone et al. (2009, *op. cit.* under *D. abaensis*), who treat this species as provisionally valid pending the results of current studies of the type material by one of us (TNP). Camicas et al. (1998, *op. cit.* under *D. albipictus*) regard this species as valid under the name *D. confractus* (Schulze, 1933), but this name was corrected to *D. confragus*, as explained in Guglielmone et al. (2009, *op. cit.* under *D. abaensis*).

Type depository: ZMB (syntypes) (Moritz and Fischer 1981, *op. cit*. under *D. compactus*) as *Indocentor confractus*. The specific name *confractus* is a *lapsus* in the original description of *D. confragus*, as stated in Schulze, P. (1935. Zur Zeckenfauna Formosas. Zool. Anz., 112, 233–237.)

Known stages: male, female

Zoogeographic Region: Oriental

Ecoregion: eastern Java-Bali rain forests

Hosts: unknown

Human infestation: no

Remarks: Camicas et al. (1998) state that the hosts of *D. confragus* (under the name *D. confractus*) are ungulates, but we have not found records supporting this statement.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Schulze, P. 1933. Die Arten der Zeckengattung *Dermacentor* s. l. aus Europa, Asien und Neu-Guinea. Z. Parasitenkd., 6: 416–431.

10 – *D. dispar* Cooley, 1937 (J. Parasitol., 23: 259–264)

Type depository: USNTC (holotype, paratype) (Cooley, R.A. 1937. Two new dermacentors [sic] from Central America. J. Parasitol., 23: 259–264), but not listed in Keirans and Clifford (1984, *op. cit*. under *D. andersoni*).

Known stages: male, female

Zoogeographic Region: Neotropical

Ecoregion: Central American pine-oak forests

Hosts: Artiodactyla: Tayassuidae, Cervidae; Cingulata: Dasypodidae (A)

Human infestation: no

Reference

Yunker, C.E., Keirans, J.E., Clifford, C.M. & Easton, E.R. 1986. *Dermacentor* ticks (Acari: Ixodidae) of the New World: a scanning electron microscope atlas. Proc. Entomol. Soc. Wash., 88: 609–627.

11 – *D. dissimilis* Cooley, 1947 (Am. Mus. Novitates 1332: 1–3)

Type depository: USNTC (holotype, paratypes) (Keirans and Clifford 1984, *op. cit*. under *D. andersoni*)

Known stages: male, female, nymph

Zoogeographic Region: Neotropical

Ecoregion: Central American pine-oak forests

Hosts: Artiodactyla: Bovidae; Perissodactyla: Equidae (ANL)

Human infestation: no

Remarks: Kohls and Dalmat (1952) noted that larvae (no formal description of this stage is available), nymphs and adults of *D. dissimilis* were found simultaneously on the same hosts; they considered this a strong indication that *D. dissimilis* is a one-host tick.

References

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Kohls, G.M. & Dalmat, H.T. 1952. The male of *Dermacentor dissimilis* Cooley (Acarina: Ixodidae). J. Parasitol., 38: 140–142.

12 – *D. everestianus* Hirst, 1926 (Ann. Mag. Nat. Hist. Ser. 9, 17: 671)
See *D. abaensis.*

Type depository: BMNH (holotype) (Keirans and Hillyard 2001, *op. cit*. under *D. asper*)

Known stages: male, female

Zoogeographic Region: Palearctic

Ecoregion: Himalayan alpine shrubs and meadows

Hosts: Artiodactyla: Bovidae; Lagomorpha: Leporidae; Perissodactyla: Equidae (A)
Rodentia (unknown family) (NL)
Rodentia: Muridae

Human infestation: no

Remarks: Camicas et al. (1998) state that *D. everestianus* is an Oriental and Palearctic species, but we were unable to find Oriental localities for this tick. We consider tentatively valid Teng and Jiang's (1991) records of larvae and nymphs (both stages remain undescribed) from Rodentia. Teng (1982) provides records of this species from Kangma, Dingri, and the Himalayas, stating that this species occurs from 3,500 to 5,000 m above sea level on the Xizang Plateau.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Jiang, Z.-T. & Li, G.-M. 1989. The nymphs of 3 species of *Dermacentor* and key to the nymphs of Chinese common species of *Dermacentor.* Acta Zootax. Sin., 14: 427–432.

Mitchell, R.M. 1979. A list of ectoparasites from Nepalese mammals, collected during the Nepal ectoparasite program. J. Med. Entomol., 16: 227–233.

Teng, K.-F. 1982. The geographic distribution of the genus *Dermacentor* in China. Sinozoologia, (2): 211–216. In Chinese. NAMRU-3 translation 1790.
Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect of fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.

13 – *D. halli* McIntosh, 1931 (J. Parasitol., 18: 124)
See remarks below.

Type depositories: USNPC (holotype, paratypes), USNTC (paratypes) (Salley, E.J., Lichtenfels, J.R. & Shaw, J.H. 1978. Index-catalogue of medical and veterinary zoology. Special publication 3. Checklist of types in the U.S. National Parasite Collection. U. S. Department of Agriculture, U. S. Government Printing Office, Washington D.C. 230 pp.; Keirans and Clifford 1984, *op. cit*. under *D. andersoni*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Nearctic, Neotropical

Ecoregions: Tamaulipan thorn scrub; Tehuacan Valley; Central Mexican matorral (shrubland that consists of short trees and is usually fairly open, enabling grasses and other short plants to grow between the trees)

Hosts: Rodentia: Erethizontidae (AN)
Artiodactyla: Bovidae, Tayassuidae; Carnivora: Canidae, Mephitidae; Perissodactyla: Equidae, Tapiridae (A)
Chiroptera: Vespertilionidae; Rodentia (unknown family) (N)

Human infestation: yes (Hoffmann and López-Campos 2000)

Remarks: Fairchild et al. (1966) stated that specimens of *D. halli* from the Neotropical Region differ somewhat from Nearctic specimens, leaving open the possibility that more than one taxon is included under this name. These authors consider a nymph of *D. halli* collected from Chiroptera to have been a "stray." Natural hosts for the larvae of *D. halli* are unknown.

References

Cooley, R.A. 1938. The genera *Dermacentor* and *Otocentor* (Ixodidae) in the United States, with studies in variation. Natl. Inst. Health Bull. (171), 89 pp.
Cruz Aldán, E., Torres, I.L., Güiris Andrade, D.M., Osorio Sarabia, D., & Quintero, M.T. 2006. Parásitos del tapir centroamericano *Tapirus bairdii* (Perissodactyla: Tapiridae) en Chiapas, México. Rev. Biol. Trop., 54: 445–450.
Fairchild, G.B., Kohls, G.M. & Tipton, V.J. 1966. The ticks of Panama (Acarina: Ixodoidea). *In* W.R. Wenzel & V.J. Tipton (editors), Ectoparasites of Panama. Field Museum of Natural History, Chicago, pp. 167–219.
Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.
Hoffmann, A. & López-Campos, G. 2000. Biodiversidad de los ácaros en México. Jiménez Editores e Impresores. México D.F., 230 pp.

14 – *D. hunteri* Bishopp, 1912 (Proc. Biol. Soc. Wash., 25: 29–38)

Typ.e depository: USNTC (syntypes) (Keirans and Clifford 1984, *op. cit*. under *D. andersoni*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Nearctic

Ecoregions: Sierra Nevada; Modoc Plateau

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Artiodactyla: Bovidae, Cervidae; Lagomorpha: Leporidae (A)
Rodentia: Cricetidae (NL)

Human infestation: yes (Merten and Durden 2000)

Remarks: Camicas et al. (1998) state that *D. hunteri* is found in the Nearctic and Neotropical Regions, but we were unable to find any Neotropical record for this species. Crosbie and Boyce (1998) list *bona fide* records of larvae and nymphs of *D. hunteri* from Cricetidae, but these hosts were not included in Kolonin (2009).

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Crosbie, P.R. & Boyce, W.M. 1998. *Dermacentor hunteri* (Acari: Ixodidae): seasonal variation in questing adults and on-host juvenile stages, and host associations and feeding behavior of larvae and nymphs. J. Med. Entomol., 35: 1034–1043.

Crosbie, P.R., Goff, W.L., Stiller, D., Jessup, D.A. & Boyce, W.M. 1997. The distribution of *Dermacentor hunteri* and *Anaplasma* sp. in desert bighorn sheep (*Ovis canadensis*). J. Parasitol., 83: 31–37.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Merten, H.A. & Durden, L.A. 2000. A state-by-state survey of ticks recorded from humans in the United States. J. Vector Ecol., 25: 102–113.

15 – *D. imitans* Warburton, 1933 (Parasitology, 24: 558–568)

Type depository: BMNH (lectotype, paralectotypes) (Keirans and Hillyard 2001, *op. cit*. under *D. asper*)

Known stages: male, female

Zoogeographic Region: Neotropical

Ecoregions: Central American pine-oak forests; few ticks in moist forests

Hosts: usual hosts for adult ticks are Artiodactyla: Tayassuidae.
Artiodactyla: Cervidae, Tayassuidae (A)

Human infestation: yes (Guglielmone et al. 2006)

Remarks: Camicas et al. (1998) list pholeophilic (burrowing) mammals as hosts for the undescribed nymph and larva of *D. imitans*, but we have found no records supporting this.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Fairchild, G.B., Kohls, G.M. & Tipton, V.J. 1966. The ticks of Panama (Acarina: Ixodoidea). *In* W.R. Wenzel & V.J. Tipton (editors), Ectoparasites of Panama. Field Museum of Natural History, Chicago, pp. 167–219.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Guglielmone, A.A., Beati, L., Barros-Battesti, D.M., Labruna, M.B., Nava, S., Venzal, J.M., Mangold, A.J., Szabó, M.P.J., Martins, J.R., González-Acuña, D. & Estrada-Peña, A. 2006. Ticks (Ixodoidea) on humans in South America. Exp. Appl. Acarol., 40: 83–100.

16 – *D. kamshadalus* Neumann, 1908 (Notes Leyden Mus., 30: 73–91)
This species was considered a synonym of *D. albipictus* but was reinstated by Apanaskevich, D.A. (2013. Reinstatement of *Dermacentor kamshadalus* Neumann (Acari: Ixodidae), as a valid species parasitzing mountain goats and sheep in the United States, Canada and Russia. J. Med. Entomol., 50: 691–700); originally named *D. variegatus kamshadalus.*

Type depository: LMNH (holotype) but not found there (Apanaskevich 2013, *op. cit.* above)

Known stages: male, female, nymph

Zoogeographic Regions: Nearctic, Palearctic

Ecoregions: temperate conifer forests; Kamchatka forest tundra

Hosts: Artiodactyla: Bovidae (AN)

Human infestation: no

Remarks: some of the illustrations in Cooley (1938) are in fact *D. kamshadalus*, as stated in Apanskevich (2013).

References

Apanaskevich, D.A. 2013. Reinstatement of *Dermacentor kamshadalus* Neumann (Acari: Ixodidae), as a valid species parasitzing mountain goats and sheep in the United States, Canada and Russia. J. Med. Entomol., 50: 691–700.

Cooley, R.A. 1938. The genera *Dermacentor* and *Otocentor* (Ixodidae) in the United States, with studies in variation. Natl. Inst. Health Bull. (171), 89 pp.

17 – *D. latus* Cooley, 1937 (J. Parasitol., 23: 259–264)

Type depository: USNTC (holotype) (Keirans and Clifford 1984, *op. cit*. under *D. andersoni*)

Known stages: male, female

Zoogeographic Region: Neotropical

Ecoregions: Isthmian-Atlantic and Isthmian-Pacific moist forests

Hosts: usual hosts for adult ticks are Perissodactyla: Tapiridae.
Carnivora: Canidae; Perissodactyla: Tapiridae (A)

Human infestation: yes (Fairchild et al. 1966)

Remarks: Mihalca et al. (2011) list *Dermacentor latus* as an endangered species.

References

Fairchild, G.B., Kohls, G.M. & Tipton, V.J. 1966. The ticks of Panama (Acarina: Ixodoidea). *In* W.R. Wenzel & V.J. Tipton (editors), Ectoparasites of Panama. Field Museum of Natural History, Chicago, pp. 167–219.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

18 – *D. marginatus* (Sulzer, 1776) (*In* Abgekürzte Geschichte der Insecten nach dem Linnaeischen System. H. Steiner, Winterthur, Zurich, 274 pp.)
See below, and *D. niveus* and *D. ushakovae.*

Type depository: unknown, as *Acarus marginata*

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: several ecoregions within the Palearctic Region

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae and Suidae, and Perissodactyla: Equidae. Usual hosts for larvae and nymphs are Erinaceomorpha: Erinaceidae; Lagomorpha: Leporidae and Rodentia (several families). Anura, Aves and Squamata are exceptional hosts.
Mammalia (several orders) (ANL)
Passeriformes: Corvidae (AN)
Falconiformes: Accipitridae; Passeriformes: Laniidae, Muscicapidae (A)
Passeriformes: Passeridae; Squamata: Lacertidae; Anura: Ranidae (NL)
Galliformes: Phasianidae (A, N and/or L)
Passeriformes: Sturnidae, Turdidae (N)
Passeriformes: Hirundinidae, Motacillidae (L)

Coraciiformes: Upupidae; Strigiformes: Strigidae (N and/or L)
Charadriiformes: Burinhidae; Columbiformes: Columbidae; Coraciiformes: Coraciidae, Meropidae; Passeriformes (several families) (stages unknown)

Human infestation: yes (Filippova 1997; Bursali et al. 2012 among others)

Remarks: Filippova and Plaksina (2005) stress the difficulties involved in differentiating species of the *D. marginatus* complex, which includes *D. marginatus*, *D. niveus*, *D. nuttalli*, *D. silvarum* and *D. ushakovae*. In China, Teng (1982) states that *D. marginatus* occurs only in Xinjiang Uygur Autonomous Region. Hoogstraal (1979) does not specify whether larvae, nymphs or both stages of *D. marginatus* were found on the hosts that he discusses. Fedorov (1970) considers his records of *D. marginatus* nymphs and larvae from Squamata and Anura to be rare, as in the case of records from Aves in Gusev et al. (1962). Kolonin (2009) limits the hosts of larval and nymphal *D. marginatus* to "small rodents."

References

Akimov, I.A. & Nebogatkin, I.V. 2011. Distribution of ticks of the genus *Dermacentor* (Acari, Ixodidae) in Ukraine. Vest. Zool., 45: 35–40.

Arthur, D.R. 1960. Ticks. A monograph of the Ixodoidea. Part V. On the genera *Dermacentor*, *Anocentor*, *Cosmiomma*, *Boophilus* & *Margaropus*. Cambridge University Press, London, 251 pp.

Bailly-Choumara, H., Morel, P.-C. & Pérez, C.L. 1980. Deuxième contribution au catalogue des tiques du Maroc (Acari, Ixodoidea). Bull. Inst. Sci. (4): 1–12.

Bursali, A., Keskin, A. & Tekin, S. 2012. A review of the ticks (Acari: Ixodida) of Turkey: species diversity, hosts and geographical distribution. Exp. Appl. Acarol., 57: 91–104.

Černý, V. 1972. The tick fauna of Czechoslovakia. Folia Parasitol., 19: 87–92.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Dzhaparidze, N.I. 1960. Ixodid ticks of Georgian SSR. Akad. Nauk Gruz. SSR, Inst. Zool., Tbilisi, 295 pp. In Russian.

Fedorov, V.G. 1970. Bloodsucking ticks on amphibians and reptiles in western Siberia. Tezisy Dokl. 2. Akarol. Sovesch. (2): 185–186. In Russian, NAMRU-3 translation 1493.

Fedorov, V.G. 1972. Ticks of the superfamily Ixodoidea of birds and their nests in western Siberia. *In* A. Cherepanov and L.A. Mater (editors), Transcontinental associations of migratory birds and their role in distribution of arboviruses. 5. Simp. Isuch. Roli Pereletn. Ptits Rasp. Arbovirus, Novosibirsk, Jul. 1969, pp. 384–388. In Russian, NAMRU-3 translation 1494.

Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian.

Filippova, N.A. & Panova, I.V. 1989. Revision of the genus *Dermacentor* Koch of the fauna of the USSR and adjoining territories (Ixodoidea, Ixodidae). Parazitol. Sborn. Zool. Inst. Akad. Nauk SSSR, 35: 49–55. In Russian, NIH Library translation by Crump, T.

Filippova, N.A. & Plaksina, M.A. 2005. Some aspects of intraspecific variability of the closely related species of the *Dermacentor marginatus* complex (Acari: Ixodidae) as demonstration of microevolution process. Parazitologiya, 39: 337–364. In Russian.
Filippova, N.A., Neronov, V.M., & Farhang-Azad, A. 1976. Materials on the fauna of ixodids (Acarina, Ixodidae) of small mammals in Iran. Entomol. Obozr., 55: 467–478. In Russian.
Filippova, N.A., Panova, I.V. & Grebenjuk, R.V. 1986. Diagnostics of species of the genus *Dermacentor* Koch from Central Asia on their larval phase (Ixodidae). Parazitologiya, 20: 89–98. In Russian.
Grebenyuk, R.V. 1966. Ixodid ticks (Parasitiformes, Ixodidae) of Kirgizia. Akademii Nauk Kirgizkoy SSR, Instituta Biologii, Frunze, 328 pp. In Russian.
Gusev, V.M., Bednyy, S.N., Guseva, A.A., Labunets, N.F. & Bakeyev, N.N. 1961. The ecological groups of birds on the Caucasus and their role in the life cycle of ticks and fleas. Trudy Nauch.-Issled. Protiv. Inst. Kavk. Zakav. (5): 217–267. In Russian.
Gusev, V.M., Guseva, A.A., Petrosyan, E.A. & Eygelis, Yu. K. 1962. The role of birds in the spread of ticks and fleas (material collected in Azerbaijan SSR). Zool. Zh., 41: 905–912. In Russian, NAMRU-3 translation 83.
Hoogstraal, H. 1979. The epidemiology of tick-borne Crimean-Congo hemorrhagic fever in Asia, Europe, and Africa. J. Med. Entomol., 15: 307–417.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Manilla, G. & Sobrero, L. 1982. Zecche ed uccelli in Italia. Nota I: lista delle specie. Riv. Parassitol., 43: 241–252.
Nosek, J., Lichard, M. & Sztankay, M. 1967. The ecology of ticks in the Tribeč and Hronský Inovec Mountains. Bull. World Health Org., 36 (Suppl. 1): 49–59.
Pomerantzev, B.I. 1950. Ixodid ticks (Ixodidae). Fauna of USSR, Zool. Inst. Acad. Sci. USSR New Ser. (41), 224 pp. In Russian.
Teng, K.-F. 1982. The geographic distribution of the genus *Dermacentor* in China. Sinozoologia (2): 211–216. In Chinese. NAMRU-3 translation 1790.

19 – *D. montanus* Filippova & Panova, 1974 (Entomol. Obozr. 53: 470–476. In Russian)

Type depository: ZIAC (holotype, paratypes) (Filippova, N.A. 2008. Type specimens of argasid and ixodid ticks (Ixodoidea: Argasidae, Ixodidae) in the collection of the Zoological Institute, Russian Academy of Sciences (St. Petersburg). Entomol. Rev., 88: 1002–1011.)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: alpine steppes; xeric shrublands

Hosts: Artiodactyla: Bovidae (A)
Lagomorpha: Ochotonidae; Rodentia: Cricetidae, Muridae, Sciuridae (NL)

Human infestation: no

Remarks: we feel that Filippova's (1997) records of adults of *D. montanus* from Rodentia (Cricetidae and Sciuridae) require confirmation and we have therefore tentatively excluded them from our list of hosts of this species.

References

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian.

Filippova, N.A. & Panova, I.V. 1974. The systematics of the genus *Dermacentor* Koch (Ixodoidea: Ixodidae) Communication 1. A new species, *D. montanus*, sp. n., from the Peter the First ridge [= Range] and description of a new subgenus, *Asiacentor*, subgen. n. Entomol. Obozr., 53: 470–476. In Russian, translation in Entomol. Rev. 53: 165–168.

Filippova, N.A. & Panova, I.V. 1989. Revision of the genus *Dermacentor* Koch of the Fauna of the USSR and contiguous territories (Ixodoidea, Ixodidae). Parazitol. Sborn. Zool. Inst. Akad. Nauk SSSR, 35: 49–55. In Russian, NIH Library translation by Crump, T.

Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect of fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.

20 – *D. nitens* Neumann, 1897 (Mém. Soc. Zool. Fr., 10: 324–420)

Type depository: BMNH (syntypes) (Keirans and Hillyard 2001, *op. cit*. under *D. asper*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Nearctic, Neotropical

Ecoregions: many different ecoregions in the Nearctic and Neotropical Zoogeographic Regions

Hosts: usual hosts for adult ticks are Perissodactyla: Equidae, while Anura and Squamata are exceptional hosts.
Mammalia (several orders); Squamata: Boidae; Anura: Bufonidae

Human infestation: yes (Guglielmone et al. 2006)

Remarks: because this is a one-host tick, we do not separately record the various life stages associated with particular hosts. Černý (1966) found a specimen on Strigiformes: Strigidae, but it was not actually feeding and we therefore have not included Strigidae in our list of hosts of *D. nitens.* Infestations of Squamata and Anura with *D. nitens* are infrequent, and these hosts, cited in Pérez Vigueras (1934) and Morel (1966), are not included in Kolonin (2009). Vogelsang and Santos Dias (1953), Černý (1966), Morel (1966), López and Parra (1985), Guglielmone et al. (2003), and Cruz Aldán et al. (2006) refer to this tick as *Anocentor nitens*.

References

Bishopp, F.C. & Trembley, H.L. 1945. Distribution and hosts of certain North American ticks. J. Parasitol., 31: 1–54.

Černý, V. 1966. Nuevas garrapatas (Ixodoidea) en aves y reptiles de Cuba. Poeyana Ser. A (26) 10 pp.

Cruz Aldán, E., Torres, I.L., Güiris Andrade, D.M., Osorio Sarabia, D., & Quintero, M.T. 2006. Parásitos del tapir centroamericano *Tapirus bairdii* (Perissodactyla: Tapiridae) en Chiapas, México. Rev. Biol. Trop., 54: 445–450.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Guglielmone, A.A., Beati, L., Barros-Battesti, D.M., Labruna, M.B., Nava, S., Venzal, J.M., Mangold, A.J., Szabó, M.P.J., Martins, J.R., González-Acuña, D. & Estrada-Peña, A. 2006. Ticks (Ixodoidea) on humans in South America. Exp. Appl. Acarol., 40: 83–100.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Labruna, M.B., Jorge, R.S.P., Sana, D.A., Jácomo, A.T.A., Kashivakura, C.K., Furtado, M.M., Ferro, C., Perez, S.A., Silveira, L., Santos, T.S., Marques, S.R., Morato, R.G., Nava, A., Adania, C.H., Teixeira, R.H.F., Gomes, A.A.B., Conforti, V.A., Azevedo, F.C.C., Prada, C.S., Silva, J.C.R., Batista, A.F., Marvulo, M.F.V., Morato, R.L.G., Alho, C.J.R., Pinter, A., Ferreira, P.M., Ferreira, F. & Barros-Battesti, D.M. 2005. Ticks (Acari: Ixodida) on wild carnivores in Brazil. Exp. Appl. Acarol., 36: 149–163.

López, G. & Parra, D. 1985. *Amblyomma neumanni,* Ribaga 1902. Primera comprobación en Colombia y claves para las especies de *Amblyomma*. Rev. Inst. Colombiano Agropec., 20: 152–162.

Morel, P.-C. 1966. Étude sur les tiques du bétail en Guadeloupe et Martinique. I. Les tiques et leur distribution (Acariens, Ixodoidea). Rev. Élev. Méd. Vét. Pays Trop., 19: 307–321.

Pérez Vigueras, J. 1934. On the ticks of Cuba, with description of a new species, *Amblyomma torrei*, from *Cyclura macleayi* Gray. Psyche, 41: 13–18.

Valdés, J.M. & Cordovés, C.O. 1987. Infestación por *Dermacentor* (*Anocentor*) *nitens* Neumann, 1897 (Acarina: Ixodidae) en un perro. Rev. Cubana Cienc. Vet., 18: 181–182.

Vogelsang, E.G. & Santos Dias, J.A. 1953. Nueva contribución al estudio de la fauna ixodológica en Venezuela. Rev. Med. Vet. Parasitol., 12: 63–89.

21 – *D. niveus* Neumann, 1897 (Mém. Soc. Zool. Fr., 10: 324–420)

Kolonin (2009, *op. cit*. under *D. abaensis*) treats *D. niveus* as a synonym of *D. daghestanicus* Olenev, 1929, but we follow Guglielmone et al. (2009, *op. cit.* under *D. abaensis*), who consider *D. niveus* a valid species and *D. daghestanicus* its junior synonym, as asserted in Filippova, N.A. (1997. Ixodid tick of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian). Camicas et al. (1998, *op. cit.* under *D. albipictus*) and Tekin, S., Bursali, A., Mutluay, N., Keskin, A. & Dundar, E. (2012. Crimean-Congo hemorrhagic fever virus in various ixodid tick species from a highly endemic area. Vet. Parasitol., 186: 546–552) list both *D. daghestanicus* and *D. niveus* as valid but we do not share this opinion. One of us (AEP) examined syntypes of *D. niveus* and considers this species conspecific with *D. marginatus*, a view shared by Moshaverinia, A., Shayan, P., Nabian, S. & Rahbari, S. (2009. Genetic evidence for

conspecificity between *Dermacentor marginatus* and *Dermacentor niveus*. Parasitol. Res., 105: 1125–1132). AEP stresses that the types and sub-adult stages of *D. marginatus*, *D. niveus* and *D. ushakovae* will need to be compared in order to determine the validity of these taxa. We consider *D. niveus* provisionally valid and are awaiting the results of such a comparison. See also *D. nuttalli*, *D. ushakovae* and remarks below.

Type depository: MNHN (syntypes) (Neumann, 1897, *op. cit*. under *D. circumguttatus*) as *D. reticulatus niveus*

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: xeric steppes; alpine brushlands

Hosts: usual hosts for adult ticks are Artiodactyla (several families). Usual hosts for larvae and nymphs are Rodentia (several families); Lagomorpha: Leporidae; and Erinaceomorpha: Erinaceidae. Aves and Testudines are exceptional hosts.
Erinaceomorpha: Erinaceidae (ANL)
Carnivora: Canidae (AN)
Mammalia (several orders) (A)
Passeriformes: Corvidae, Emberizidae, Muscicapidae (L)
Lagomorpha: Leporidae; Rodentia (several families) (NL)
Coraciiformes: Coraciidae; Falconiformes: Accipitridae; Passeriformes: Laniidae; Testudines: Testudinidae (stages unknown)

Human infestation: yes (Filippova 1997; Bursali et al. 2012 among others)

Remarks: Ushakova (1958, 1960), Serdjukova (1956), Gusev et al. (1961), Pomerantzev (1950) and Kolonin (2009) refer to this tick as *D. daghestanicus.* Records published prior to the redescription of *D. niveus* by Pomerantzev (1950), who named this tick *D. daghestanicus*, have been excluded from this review because of difficulties in determining which species is being discussed. Bursali et al. (2010) treated *D. daghestanicus* and *D. niveus* as different species. In China, Teng (1982) states that this species appears to be restricted to Xinjiang but is widespread there, with records from Aksu, Chabuzhar, Hutubi, Jinghe, Korla, Manas, Moyu, Qiemo, Shihezi, Sufu, Tacheng and Tulufan, among other locations. Infestation by *D. niveus* of hosts other than Mammalia is uncommon, and such records are ignored by Kolonin (2009). See above and *D. marginatus*.

References

Arthur, D.R. 1960. Ticks. A monograph of the Ixodoidea. Part V. On the genera *Dermacentor*, *Anocentor*, *Cosmiomma*, *Boophilus* & *Margaropus*. Cambridge University Press, London, 251 pp.

Bursali, A., Tekin, S., Orhan, M., Keskin, A. & Ozkan, M. 2010. Ixodid ticks (Acari: Ixodidae) infesting humans in Tokat Province of Turkey: species diversity and seasonal activity. J. Vector Ecol., 35: 180–186.

Bursali, A., Keskin, A. & Tekin, S. 2012. A review of the ticks (Acari: Ixodida) of Turkey: species diversity, hosts and geographical distribution. Exp. Appl. Acarol., 57: 91–104.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian.

Filippova, N.A., Neronov, V.M., & Farhang-Azad, A. 1976. Materials on the fauna of ixodids (Acarina, Ixodidae) of small mammals in Iran. Entomol. Obozr., 55: 467–478. In Russian.

Filippova, N.A. & Panova, I.V. 1989. Revision of the genus *Dermacento*r Koch of the fauna of the USSR and contiguous territories (Ixodoidea, Ixodidae). Parazitol. Sborn. Zool. Inst. Akad. Nauk SSSR, 35: 49–55. In Russian, NIH Library translation by Crump, T.

Gusev, V.M., Bednyy, S.N., Guseva, A.A., Labunets, N.F. & Bakeyev, N.N. 1961. The ecological groups of birds on the Caucasus and their role in the life cycle of ticks and fleas. Trudy Nauch.-Issled. Protiv. Inst. Kavk. Zakav. (5): 217–267. In Russian.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Moshaverinia, A., Shayan, P., Nabian, S. & Rahbari, S. 2009. Genetic evidence for conspecificity between *Dermacentor marginatus* and *Dermacentor niveus*. Parasitol. Res., 105: 1125–1132.

Pomerantzev, B.I. 1950. Ixodid ticks (Ixodidae). Fauna of USSR, Zool. Inst. Acad. Sci. USSR New Ser. (41), 224 pp. In Russian.

Serdjukova, G.V. 1956. Ixodid ticks of the fauna of USSR. Opred. Faune SSSR. Zool. Inst. Akad. Nauk SSSR (64), 121 pp. In Russian.

Teng, K.-F. 1982. The geographic distribution of the genus *Dermacentor* in China. Sinozoologia (2): 211–216. In Chinese. NAMRU-3 translation 1790.

Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect of fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.

Ushakova, G.V. 1958. Ixodoidea parasitic on birds of the lower Ili River. Trudy Inst. Zool. Akad. Nauk Kazakh. SSR, 9: 135–145. In Russian.

Ushakova, G.V. 1960. Ecological-faunistic survey of ticks of the lower Ili River. Trudy Inst. Zool. Akad. Nauk Kazakh. SSR, 14: 148–161. In Russian.

22 – *D. nuttalli* Olenev, 1929 (Ezhegodnik Zool. Muz., 30, 305–314. In Russian)

Doss, M.A. & Anastos, G. (1977. Index-Catalogue of medical and veterinary zoology. special publication Nº. 3. Tick and tickborne diseases. III. Checklist of families, genera, species and subspecies of ticks. United States Government Printing Office, Washington, 97 pp.) and Guglielmone, A.A., Robbins, R.G., Apaneskevich, D.A., Petney, T.N., Estrada-Peña, A., Horak, I.G., Shao, R. & Barker, S. (2010. The Argasidae, Ixodidae and Nuttalliellidae (Acari: Ixodida) of the world: a list of

valid species names. Zootaxa, 2528, 1–28), among others, state that 1928 is the year of description of *D. nuttalli*, but Filippova (2008, *op. cit*. under *D. montanus*) clearly indicates that the year of publication of Olenev's description of *D. nuttalli* was 1929.

Type depository: ZIAC (lectotype) (Filippova 2008, *op. cit*. under *D. montanus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: Altai alpine meadows and tundra; Ordos Plateau steppes; Emin Valley steppes

Hosts: usual hosts for adults are Artiodactyla (several families) and Perissodactyla: Equidae. Usual hosts for larvae and nymphs are Rodentia (several families); Lagomorpha: Leporidae, Ochotonidae; and Erinaceomorpha: Erinaceidae. Mammals from other orders and Aves are considered exceptional hosts.
Mammalia (several orders) (ANL)
Aves (several orders) (NL)

Human infestation: yes (Teng and Jiang 1991; Heath 2013)

Remarks: Teng (1982) states that *D. nuttalli* is one of the most widely distributed species of *Dermacentor* in China, with collections from Beijing, Gansu, Hebei, Heilongjiang, Jilin, Nei Monggol Zizhiqu, Ningxia, Qinghai, Shanxi, and Xinjiang Uygur Zizhiqu, and a range extending from Zhuoni, Gansu Province (34°30′N) in the south to Hailar, Nei Monggol (49°12′N) in the north, and from Anda, Heilongjiang Province (125°36′E) in the east to Chabuzhar, Xinjiang (81°6′E) in the west. Keirans and Durden (2001) and Heath (2013) record introductions of *D. nuttalli* into the Nearctic and Australasian Regions, respectively, but there is no evidence that this species has become established in either of these regions. Kolonin (2009) does not recognize Aves as hosts of *D. nuttalli*. Indeed, infestations of *D. nuttalli* on Aves and Mammalia other than those indicated above are unusual. See *D. marginatus.*

References

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Emel'yanova, N.D. 1950. Fauna of ticks of the family Ixodidae of rodents in southestern Transbaikal. Rep. 1. Izv. Irkutsk. Gos. Nauch. Issled. Protiv. Inst. Sibiri Dal'n. Vost., 8: 64–71. In Russian.

Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian.

Filippova, N.A. & Panova, I.V. 1985. Identification of the species of the genus *Dermacentor* Koch from Siberia and Far East of the USSR on their immature phases (Ixodidae). Parazitologiya, 19: 443–455. In Russian.

Heath, A.C.G. 2013. Implications for New Zealand of potentially invasive ticks sympatric with *Haemaphysalis longicornis* Neumann, 1901 (Acari: Ixodidae). Syst. Appl. Acarol., 18: 1–26.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Petrova-Piontkovskaya, S.P. & Flint, V.E. 1964. On the ecology of juvenile forms of *Dermacentor nuttalli* Olen. and of other ticks of wild rodents in Ubsu Nur hollow of Tuva ASSR. Zool. Zh., 43: 178–184. In Russian.
Pomerantzev, B.I. 1950. Ixodid ticks (Ixodidae). Fauna of USSR, Zool. Inst. Acad. Sci. USSR New Ser. (41), 224 pp. In Russian.
Serdjukova, G.V. 1956. Ixodid ticks of the fauna of USSR. Opred. Faune SSSR. Zool. Inst. Akad. Nauk SSSR (64), 121 pp. In Russian.
Teng, K.-F. 1982. The geographic distribution of the genus *Dermacentor* in China. Sinozoologia (2): 211–216. In Chinese. NAMRU-3 translation 1790.
Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect of fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.

23 – *D. occidentalis* Marx, 1892 (*In* Curtice, J. Comp. Med. Vet. Arch., 13: 223–236)

Type depository: unknown

Known stages: male, female, nymph, larva

Zoogeographic Region: Nearctic

Ecoregions: Great Central Valley; Klamath Mountains; Sierra Nevada; coast of California

Hosts: usual hosts for adult ticks are Artiodactyla: Cervidae. Usual hosts for larvae and nymphs are Lagomorpha: Leporidae and Rodentia (several families). Mammalia (several orders) (ANL)

Human infestation: yes (Heath and Hardwick 2011)

Remarks: Heath and Hardwick (2011) cite a record of *D. occidentalis* introduced into the Australasian Region, but there is no indication that this species has become established there. In Chamberlin (1937) there is a record of *D. occidentalis* (no developmental stage provided) from Squamata that requires confirmation and consequently has not been included in the host list above. Kolonin (2009) limits the hosts of larvae and nymphs of *D. occidentalis* to rodents and lagomorphs, but the references cited below contain data showing that larvae and nymphs of this species feed on other types of hosts.

References

Chamberlin, W.J. 1937. The ticks of Oregon. Agric. Exp. Stn. Bull. (349), 34 pp.
Furman, D.P. & Loomis, E.C. 1984. The ticks of California (Acari: Ixodida). Bull. Calif. Insect Surv., 25: 1–239.

Heath, A.C.G. & Hardwick, S. 2011. The role of humans in the importation of ticks to New Zealand: a threat to public health and biosecurity. N. Zeal. Med. J., 124: 67–82.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Lang, J.D. 1999. Ixodid ticks (Acari, Ixodidae) found in San Diego County, California. J. Vector Ecol., 24: 61–69.

24 – *D. parumapertus* Neumann, 1901 (Mém. Soc. Zool. Fr., 14: 249–372)

Type depository: USNTC (syntypes) (Arthur, D.R. 1960. Ticks. A monograph of the Ixodoidea. Part V. On the genera *Dermacentor*, *Anocentor*, *Cosmiomma*, *Boophilus* & *Margaropus*. Cambridge University Press, London, 251 pp.), but not listed in Keirans & Clifford (1984, *op. cit*. under *D. andersoni*). Hooker, W.A. (1909. The geographical distribution of American ticks. J. Econ. Entomol., 2: 403–429) states that a "cotype" is in the MC.

Known stages: male, female, nymph, larva

Zoogeographic Region: Nearctic

Ecoregions: mediterranean forests, woodlands, scrub and xeric shrublands

Hosts: usual hosts for adult ticks are Lagomorpha: Leporidae. Usual hosts for larvae and nymphs are Lagomorpha: Leporidae, and Rodentia: Cricetidae and Heteromyidae. Aves are exceptional hosts.
Lagomorpha: Leporidae; Rodentia: Heteromyidae, Sciuridae (ANL)
Artiodactyla: Bovidae, Cervidae; Carnivora: Canidae; Falconiformes: Accipitridae (A)
Rodentia: Cricetidae (NL)

Human infestation: yes (Furman and Loomis 1984)

Remarks: Camicas et al. (1998) state that *D. parumapertus* is found in the Nearctic and Neotropical Regions, but Guglielmone et al. (2003) believe that its presence in the Neotropics requires confirmation. We provisionally limit this species to the Nearctic Region. Kolonin (2009) does not include Aves as hosts for *D. parumapertus*; this host association appears to be infrequent, but *bona fide* records for it may be found in Beck et al. (1963).

References

Beck, D.E., Allred, D.M. & Brinton, E.P. 1963. Ticks of the Nevada Test Site. Brigham Young Univ. Sci. Bull. Biol. Ser., 4 (1), 11 pp.
Bishopp, F.C. & Trembley, H.L. 1945. Distribution and hosts of certain North American ticks. J. Parasitol., 31: 1–54.
Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.
Cooley, R.A. 1938. The genera *Dermacentor* and *Otocentor* (Ixodidae) in the United States, with studies in variation. Natl. Inst. Health Bull. (171), 89 pp.

Furman, D.P. & Loomis, E.C. 1984. The ticks of California (Acari: Ixodida). Bull. Calif. Insect Surv., 25: 1–239.
Gastfriend, A. 1955. New host records for the immature stages of the tick *Dermacentor parumapertus.* J. Parasitol., 41: 63–65.
Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Thorpe, B.D., Sidwell, R.W., Johnson, D.E., Smart, K.L. & Parker, D.D. 1965. Tularemia in the wildlife and livestock of the Great Salt Lake desert region, 1951 through 1964. Am. J. Trop. Med. Hyg., 14: 622–637.

25 – *D. pavlovskyi* Olenev, 1927 (Parasitology, 19: 84–85)

Type depository: ZIAC (lectotype, paralectotype) (Filippova 2008, *op. cit*. under *D. montanus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregion: montane forests

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae. Usual hosts for larvae and nymphs are Lagomorpha: Leporidae and Ochotonidae, and Rodentia (several families).
Rodentia: Sciuridae (ANL)
Artiodactyla: Bovidae, Camelidae; Perissodactyla: Equidae (A)
Lagomorpha: Leporidae, Ochotonidae; Rodentia (several families) (NL)

Human infestation: no

Remarks: Teng (1982) cites just two records of this species in China, from Baicheng and Manas in Xinjiang Autonomous Region, but Wang et al. (2012) cite several records for *D. pavlovskyi* in mountain grasslands of Xinjiang.

References

Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian.
Filippova, N.A. & Panova, I.V. 1984. Contributions to diagnosis of subgenera of the genus *Dermacentor* Koch from larvae and nymphs and new data on distribution of the subgenus *Asiacentor* (Ixodidae). Parazitologiya, 18: 135–139. In Russian, NAMRU-3 translation 1748.
Grebenyuk, R.B., Klassovsky, L.N., Sartbayev S.K., Shwartz, E.A. & Polulyakh, P.A. 1956. Possible role of ixodid ticks as reservoirs and vectors of plague. Akad. Nauk Kirgiz. SSR (4): 117–119. In Russian.
Teng, K.-F. 1982. The geographic distribution of the genus *Dermacentor* in China. Sinozoologia (2): 211–216. In Chinese, NAMRU-3 translation T1790.

Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect of fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.
Wang, Z., Cao, W.L., Liu, Q.S., Yan, S., Chen, L. & Bayinchahan [sic] 2011. Infection survey of the ticks on yak of mountain grasslands in Xinjiang. Xinjiang Agric. Sci., 48: 1514–1519. In Chinese.

26 – *D. pomerantzevi* Serdjukova, 1951 (Dokl. Akad. Nauk SSSR, 79: 909–912. In Russian)

Type depository: ZIAC (holotype) (Filippova 2008, *op. cit*. under *D. montanus*)

Known stages: female

Zoogeographic Region: Palearctic

Ecoregion: Sarmatic mixed forests

Hosts: Erinaceomorpha: Erinaceidae (A)

Human infestation: no

Reference

Arthur, D.R. 1960. Ticks. A monograph of the Ixodoidea. Part V. On the genera *Dermacentor*, *Anocentor*, *Cosmiomma*, *Boophilus* & *Margaropus*. Cambridge University Press, London, 251 pp.

27 – *D. raskemensis* Pomerantzev, 1946 (Faune SSSR Zool. Inst. Akad. Nauk SSSR (26), 28 pp. In Russian)

Type depository: ZIAC (holotype) (Filippova 2008, *op. cit*. under *D. montanus*)

Known stages: male, female

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: montane and forest steppes

Hosts: usual hosts of adult ticks are Artiodactyla: Bovidae.
Artiodactyla: Bovidae (A, N and/or L)
Carnivora: Canidae (A)
Lagomorpha: Ochotonidae (N)
Rodentia: Calomyscidae (N and/or L)

Human infestation: yes (Filippova 1983)

Remarks: Camicas et al. (1998) state that *D. raskemensis* is found only in the Palearctic Region, but Dhanda et al. (1971) record this tick in the District of Chamba, in northern India, which is within the Oriental Region. Hoogstraal and Valdez (1980) use the term “immature ticks” without specifying whether the larva, nymph or both of these undescribed stages were found on hosts. We consider a male of *D. raskemensis* found in a pika nest by Hoogstraal and Valdez (1980) a consequence of nymphs probably feeding on Ochotonidae.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Dhanda, V., Kulkarni, S.M. & Pratt, P. 1971. *Dermacentor raskemensis* (Ixodoidea: Ixodidae), redescription and notes on ecology. J. Parasitol., 57: 1324–1329.

Filippova, N.A. 1983. Redescription of *Dermacentor rasckemensis* [sic] Pomerantzev, 1946 (Ixodidae), representative of the mountain fauna of southern regions of USSR and adjacent territories. Parazitologiya, 17: 283–292. In Russian, NAMRU-3 translation 1694.

Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian.

Hoogstraal, H. & Valdez, R. 1980. Ticks (Ixodoidea) from wild sheep and goats in Iran and medical and veterinary implications. Fieldiana Zool. New Ser. (6), 16 pp.

28 – *D. reticulatus* (Fabricius, 1794) (*Entomologia sistematica emendata et aucta, secundum classes, ordines, genera, species adjectis synonimis, loci, observationibus, descriptionibus.* Hafniae, 4, 472 pp.)

Type depository: ZMUC, but lost (Scharff, N. personal communication to Guglielmone, A.A.) This species was originally described as *Acarus reticulatus.*

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: Atlantic, Cantabrian, Western and Central European mixed forests

Hosts: usual hosts for adult ticks are Carnivora: Canidae and Artiodactyla: Bovidae, Cervidae and Suidae, and Perissodactyla: Equidae. Usual hosts for nymphs and larvae are Rodentia (several families), Erinaceomorpha: Erinaceidae and Lagomorpha: Leporidae. Anura, Aves and Squamata are considered exceptional hosts for this species.
Mammalia (several orders) (ANL)
Squamata: Lacertidae (AL)
Passeriformes (several families) (NL)
Charadriiformes: Scolopacidae; Anura: Ranidae (N)
Charadriiformes: Charadriidae (L)
Columbiformes: Columbidae; Gruiformes: Otidae (stages unknown)

Human infestation: yes (Burridge 2011)

Remarks: Emchuk (1960) and Fedorov (1970) refer to this tick as *D. pictus* (Hermann, 1804). In China, Teng (1982) records this species only from Xinjiang Autonomous Region. There are several records of *D. reticulatus* outside the Palearctic Region, *e.g.*, Theiler (1962), Guglielmone et al. (2003) and Keirans and Durden (2001), that are considered misidentifications or unsuccessful introductions. Kolonin (2009) and Burridge (2011) do not provide the full range of hosts of *D. reticulatus* listed above.

References

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Černý, V. 1972. The tick fauna of Czechoslovakia. Folia Parasitol., 19: 87–92.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Emchuk, E.M. 1960. Ixodid ticks. 1. External and internal structure, ecology, systematics, distribution and economic importance of ixodid ticks. Fauna Ukrayiny, 25: 1–163. In Russian.

Fedorov, V.G. 1970. Bloodsucking ticks on amphibians and reptiles in western Siberia. Tezisy Dokl. 2. Akarol. Sovesch. (2): 185–186. In Russian, NAMRU-3 translation 1493.

Fedorov, V.G. 1972. Ticks of the superfamily Ixodoidea of birds and their nests in western Siberia. *In* A. Cherepanov and L.A. Mater (editors), Transcontinental associations of migratory birds and their role in distribution of arboviruses. 5. Simp. Isuch. Roli Pereletn. Ptits Rasp. Arbovirus, Novosibirsk, Jul. 1969, pp. 384–388. In Russian, NAMRU-3 translation 1494.

Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian.

Guglielmone, A.A., Estrada-Peña, A., Keirans, J.E. & Robbins, R.G. 2003. Ticks (Acari: Ixodida) of the Neotropical Zoogeographic Region. Special Publication of the International Consortium on Ticks and Tick-borne Diseases-2, Atalanta, Houten, The Netherlands, 173 pp.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Panas, E., Léger, N., Kretz, J.-L. & Dumesnil, C. 1976. Les Ixodidae de la région Champagne-Ardennes. Étude préliminaire. Acarologia, 18: 51–55.

Szymański, S. 1987. Seasonal activity of *Dermacentor reticulatus* (Fabricius, 1794) (Ixodidae) in Poland. III. Larvae and nymphs. Acta Parasitol. Polonica, 32: 265–280.

Teng, K.-F. 1982. The geographic distribution of the genus *Dermacentor* in China. Sinozoologia (2): 211–216. In Chinese, NAMRU-3 translation 1790.

Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect of fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

29 – *D. rhinocerinus* (Denny, 1843) (Ann. Mag. Nat. Hist., 12: 312–316)

Type depository: not stated in Denny, H. (1843. Description of six supposed new species of parasites. Ann. Mag. Nat. Hist., 12: 312–316) as *Ixodes rhinocerinus*

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for adult ticks are Perissodactyla: Rhinocerotidae. Squamata are exceptional hosts for this tick.
Mammalia (several orders); Squamata: Varanidae (A)
Rodentia: Muridae (NL)

Human infestation: yes (Walker 1974)

Remarks: Keirans and Durden (2001) record an introduction of *D. rhinocerinus* into the Nearctic Region, but there is no evidence of its subsequent establishment there. Kolonin (2009) ignores Squamata as hosts for *D. rhinocerinus*, but we regard Theiler's (1962) record from this type of host as valid, although this host-parasite relationship appears to be quite unusual. Mihalca et al. (2011) list this species as endangered.

References

Horak, I.G. & Cohen, M. 2001. Hosts of the immature stages of the rhinoceros tick, *Dermacentor rhinocerinus* (Acari: Ixodidae). Onderstepoort J. Vet. Res., 68: 75–77.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

Walker, J.B. 1974. The ixodid ticks of Kenya. A review of present knowledge of their hosts and distribution. Commonwealth Institute of Entomology, London, 220 pp.

Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.

30 – *D. silvarum* Olenev, 1931 (*In* Parasitic ticks (Ixodoidea) of USSR. Opredeliteli po Faune SSSR, Izdavaemye Zoologischeskim Muzeem Akademii Nauk, (4), 125 pp. In Russian)

Type depository: ZIAC (holotype) (Filippova 2008, *op. cit*. under *D. montanus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: temperate broadleaf and mixed forests; boreal forests, including those in mountainous areas

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae, Cervidae and Suidae, and Perissodactyla: Equidae. Usual hosts for larvae and nymphs are Rodentia (several families); Erinaceomorpha: Erinaceidae and Lagomorpha: Leporidae. Squamata are exceptional hosts for this tick.
Lagomorpha: Leporidae (ANL)
Artiodactyla: Bovidae (AN)
Artiodactyla: Cervidae, Suidae; Carnivora: Canidae, Felidae; Perissodactyla: Equidae (A);
Erinaceomorpha: Erinaceidae; Rodentia (several families); Galliformes: Phasianidae; Passeriformes: Emberizidae, Sylviidae (NL)
Squamata: Lacertidae (N)
Passeriformes: Motacillidae, Passeridae (L)
Carnivora: Mustelidae; Soricomorpha: Soricidae; Charadriiformes: Scolopacidae; Passeriformes: Motacillidae, Sittidae; Piciformes: Picidae (stages unknown).

Human infestation: yes (Heath and Hardwick 2011, among others)

Remarks: records published prior to the redescription of this species by Pomerantzev (1950) have been excluded from this review because of difficulties in determining which species is being discussed. According to Teng (1982), *D. silvarum* is the most common and widespread member of its genus in northeast China, with records from Beijing, Hebei, Heilongjiang, Jilin, Liaoning, Nei Monggol Zizhiqu, Shanxi and Xinjiang Uygur Zizhiqu, and a range extending south to Taiyuan, Shanxi Province (37°48′N), east to Huachuan, Heilongjiang (130°36′E), and west to Suiding, Xinjiang (80° 54′E). Loth (2005) and Heath and Hardwick (2011) record the introduction of *D. silvarum* into the Australasian Region, but there is no evidence that this species has become established there. Kolonin (2009) lists only mammals as hosts of *D. silvarum*, but the references below provide a broader spectrum of hosts for this species. See also *D. marginatus.*

References

Arthur, D.R. 1960. Ticks. A monograph of the Ixodoidea. Part V. On the genera *Dermacentor*, *Anocentor*, *Cosmiomma*, *Boophilus* & *Margaropus*. Cambridge University Press, London, 251 pp.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Fedorov, V.G. 1970. Bloodsucking ticks on amphibians and reptiles in western Siberia. Tezisy Dokl. 2. Akarol. Sovesch. (2): 185–186. In Russian, NAMRU-3 translation 1493.

Fedorov, V.G. 1972. Ticks of the superfamily Ixodoidea of birds and their nests in western Siberia. *In* A. Cherepanov and L.A. Mater (editors), Transcontinental associations of migratory birds and their role in distribution of arboviruses. 5. Simp. Isuch. Roli Pereletn. Ptits Rasp. Arbovirus, Novosibirsk, Jul. 1969, pp. 384–388. In Russian, NAMRU-3 translation 1494.

Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian.
Heath, A.C.G. & Hardwick, S. 2011. The role of humans in the importation of ticks to New Zealand: a threat to public health and biosecurity. N. Zeal. Med. J., 124: 67–82.
Kislenko, G.S. & Koneva, I.V. 1965. Infestations of birds by ixodid ticks in secondary forests in lower reaches of the Usuri River. Mater. 4. Vses. Orinthol. Konf., Alma-Ata, Sep. 1965, pp. 160–163. In Russian, NAMRU-3 translation 408.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Loth, L. 2005. Review of exotic tick interceptions in New Zealand since 1980. Surveillance, 32 (3): 7–9.
Pomerantzev, B.I. 1950. Ixodid ticks (Ixodidae). Fauna of U.S.S.R. Zool. Inst. Acad. Sci. USSR New Ser. (41), 224 pp. In Russian.
Serdjukova, G.V. 1956. Ixodid ticks of the fauna of USSR. Opred. Faune SSSR. Zool. Inst. Akad. Nauk SSSR (64), 121 pp. In Russian.
Teng, K.-F. 1982. The geographic distribution of the genus *Dermacentor* in China. Sinozoologia (2): 211–216. In Chinese, NAMRU-3 translation 1790.
Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect of fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.
Yu, Z., Zheng, H., Yang, X., Chen, Z., Wang, D., Hao, M., Yang, Y. & Liu, J. 2011. Seasonal abundance and activity of *Dermacentor silvarum* Olenev (Acari: Ixodidae) in northern China. Med. Vet. Entomol., 25: 25–31.

31 – *D. sinicus* Schulze, 1932 (Sber. Abh. Naturf. Ges. Rostock (1930–1932), 3: 49–54)
See *D. asper.*

Type depository: ZMB (syntypes) (Moritz and Fischer 1981, *op. cit*. under *D. compactus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: Mongolian-Manchurian grasslands; Central China loess plateau mixed forests; Huang He Plain mixed forests

Hosts: Erinaceomorpha: Erinaceidae (ANL)
Mammalia (several orders) (A)
Rodentia (unknown family) (NL)

Human infestation: no

Remarks: Teng (1982) cites collections from Beijing, Hebei, Heilongjiang, Jilin, Nei Monggol, Shandong and Xinjiang and describes the range of this species as extending south to Qingdao, Shandong Province (36°6′N), north and east to Sartu, Heilongjiang (46°36′N, 125°E), and west to Chabuzhar, Xinjiang Uygur (81°6′E).

References

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.

Teng, K.-F. 1982. The geographic distribution of the genus *Dermacentor* in China. Sinozoologia (2): 211–216. In Chinese, NAMRU-3 T1790.

Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect of fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.

32 – *D. steini* Schulze, 1933 (Z. Parasitenkd., 6: 416–431)

Type depository: USNTC (lectotype, paralectotypes) (Wassef, H.Y. & Hoogstraal, H. 1986. *Dermacentor* (*Indocentor steini*) (Acari: Ixodoidea: Ixodidae): identity of male and female. J. Med. Entomol., 23: 532-537)

Known stages: male, female

Zoogeographic Regions: Australasian, Oriental

Ecoregions: rain forests of the Australasian and Oriental Regions

Hosts: usual hosts for adult ticks are Artiodactyla: Suidae.
Rodentia: Muridae (AN)
Mammalia: (several orders); Squamata: Boidae, Elapidae, Varanidae (A)

Human infestation: yes (Durden et al. 2008)

Remarks: nymphs of *D. steini* were collected from Muridae, and the diagnosis is certain because the nymphs molted to adults of this species (Wassef and Hoogstraal 1988).

References

Durden, L.A., Merker, S. & Beati, L. 2008. The tick fauna of Sulawesi, Indonesia (Acari: Ixodoidea: Argasidae and Ixodidae). Exp. App. Acarol., 45: 85–110.

Parola, P., Cornet, J.-P., Sanogo, Y.O., Miller, R.S., Thien, H.V., González, J.-P., Raoult, D., Telford, S.R. & Wongsrichanalai, C. 2003. Detection of *Ehrlichia* spp., *Anaplasma* spp., *Rickettsia* spp., and other eubacteria in ticks from the Thai-Myanmar border and Vietnam. J. Clin. Microbiol., 41: 1600–1608.

Wassef, H.Y. & Hoogstraal, H. 1988. *Dermacentor* (*Indocentor*) *steini* (Acari: Ixodoidea: Ixodidae): hosts, distribution in the Malay Peninsula, Indonesia, Borneo, Thailand, the Philippines, and New Guinea. J. Med. Entomol., 25: 315–320.

33 – *D. taiwanensis* Sugimoto, 1935 (Taiwan Hakubutsu Gakkai Kaiho, 3: 5–7. In Japanese)

Type depository: unknown.

Known stages: male, female, nymph, larva

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: Taiheiyo evergreen forests; Taiwan subtropical evergreen forests

Hosts: usual hosts for adult ticks are Artiodactyla: Suidae. Aves are exceptional hosts for this tick.
Artiodactyla: Suidae; Carnivora: Ursidae (A)
Carnivora: Mustelidae; Lagomorpha: Leporidae; Rodentia: Muridae (NL)
Carnivora: Viverridae; Galliformes: Phasianidae (L)

Human infestation: yes (Petney and Keirans 1996)

Remarks: Camicas et al. (1998) consider this species strictly Oriental, but Kitaoka and Suzuki (1981), Teng and Jiang (1991), Nakao and Takada (1997) and Yamauchi et al. (2013) present *bona fide* Palearctic records. Aves are ignored as hosts for *D. taiwanensis* in Kolonin (2009), but Hoogstraal et al. (1986) present sound records for these unusual hosts. Heath (2013) lists dogs as hosts of *D. taiwanensis* as a result of a transcription error (Heath, A.C.G., personal communication to Guglielmone, A.A.).

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Heath, A.C.G. 2013. Implications for New Zealand of potentially invasive ticks sympatric with *Haemaphysalis longicornis* Neumann, 1901 (Acari: Ixodidae). Syst. Appl. Acarol., 18: 1–26.

Hoogstraal, H., Wassef, H.Y., Santana, F.J. & Kuntz, R.E. 1986. *Dermacentor* (*Indocentor*) *taiwanensis* (Acari: Ixodoidea: Ixodidae): hosts and distribution in Taiwan and southern Japan. J. Med. Entomol., 23: 286–288.

Kitaoka, S. & Suzuki, H. 1981. *Dermacentor taiwanensis* Sugimoto, 1935 (Acarina: Ixodidae): the immature stages and notes on hosts and distribution in Japan. Trop. Med., 23: 205–211.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Nakao, M. & Takada, N. 1997. Survey of tick fauna in the Kyushu mainland, Japan. Med. Entomol. Zool., 48: 39–44. In Japanese.

Petney, T.N. & Keirans, J.E. 1996. Ticks of the genera *Boophilus*, *Dermacentor*, *Nosomma* and *Rhipicephalus* (Acari: Ixodidae) in South-east Asia. Trop. Biomed., 13: 73–84.

Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect of fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.

Yamauchi, T., Yano, S., Yamamoto, T., Yamamoto, E. & Miyamoto, T. 2013. Ticks (Acari: Ixodidae) from medium-sized to large mammals in Ehime Prefecture, Japan. Exp. Appl. Acarol., 60: 263–270.

34 – *D. ushakovae* Filippova & Panova, 1987 (Parazitologiya, 21: 450–458. In Russian) Guglielmone et al. (2009, *op. cit.* under *D. abaensis*) note that *D. ushakovae* is sometimes treated as a synonym of either *D. niveus* or *D. marginatus* but have maintained the validity of this species, pending type comparison and clarification of its status. One of us (AEP) considers *D. ushakovae* a synonym of *D. marginatus*.

Type depository: ZIAC (holotype, paratypes) (Filippova 2008, *op. cit*. under *D. montanus*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: Kopet Dag woodlands and forest steppes; alpine meadows

Hosts: Artiodactyla: Bovidae (A)
Lagomorpha: Leporidae; Rodentia: Cricetidae, Dipodidae, Muridae (NL)

Human infestation: no

Remarks: see *D. marginatus.*

References

Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian.

Filippova, N.A. & Panova, I.V. 1987. A new species of ticks, *Dermacentor ushakovae* sp. n., (Ixodoidea, Ixodidae) from Kazakhstan and Central Asia. Parazitologiya, 21: 450–458. In Russian.

35 – *D. variabilis* (Say, 1821) (J. Acad. Natl. Sci. Philadelphia, 2: 59–82)

Type depository: lost (Cooley, R.A. 1938. The genera *Dermacentor* and *Otocentor* (Ixodidae) in the United States, with studies in variation. Natl. Inst. Health Bull. (171), 89 pp.), as *Ixodes variabilis*

Known stages: male, female, nymph, larva

Zoogeographic Regions: Nearctic, Neotropical

Ecoregions: many ecoregions in the Nearctic and Neotropical Regions

Hosts: usual hosts for adult ticks are Artiodactyla (several families), Perissodactyla: Equidae, and Carnivora (several families). Usual hosts for nymphs and larvae are Rodentia (several families). Aves, Mammalia (Phocidae) and Squamata are exceptional hosts for this tick.
Mammalia (several orders); Galliformes: Phasianidae (ANL)
Passeriformes: Emberizidae; Squamata: Agamidae (NL)
Passeriformes: Cardinalidae, Icteridae, Sturnidae (N)
Apodiformes: Apodidae; Passeriformes: Mimidae, Troglodytidae (L)
Carnívora: Phocidae; Passeriformes: Corvidae, Parulidae (stages unknown)

Human infestation: yes (Furman and Loomis 1984 among others)

Remarks: Davis (1964), Halliday and Sutherst (1990) and Jameson et al. (2010), among others, report collections of *D. variabilis* in remote Pacific islands and the Australasian and Palearctic Regions, respectively, and warn of the prospects of range extension. The wide host range of *D. variabilis* includes a rare finding on Carnivora:

Phocidae (no developmental stage stated) in Rand et al. (2007). Kolonin (2009) restricts the hosts of *D. variabilis* larvae and nymphs to rodents and lagomorphs, but the references cited below provide a broader range of hosts for these stages. Goddard and Bircham (2010) report a curious finding of larvae of *D. variabilis* on *Xylocopa virginica* (Hymenoptera: Apidae), but it is unclear whether they fed on the insect.

References

Battaly, G.R., Fish, D. & Dowler, R.C. 1987. The seasonal occurrence of *Ixodes dammini* and *Ixodes dentatus* (Acari: Ixodidae) on birds in a Lyme disease endemic area of southeastern New York State. J. New York Entomol. Soc., 95: 461–468.

Bishopp, F.C. & Trembley, H.L. 1945. Distribution and hosts of certain North American ticks. J. Parasitol., 31: 1–54.

Cooley, R.A. 1938. The genera *Dermacentor* and *Otocentor* (Ixodidae) in the United States, with studies in variation. Natl. Inst. Health Bull. (171), 89 pp.

Davis, C.J. 1964. Notes and exhibitions. Proc. Hawaiian Entomol. Soc., 18: 343.

Furman, D.P. & Loomis, E.C. 1984. The ticks of California (Acari: Ixodida). Bull. Calif. Insect Surv., 25: 1–239.

Goddard, J. & Bircham, L. 2010. Parasitism of the carpenter bee, *Xylocopa virginica* (L.) (Hymenoptera: Apidae), by larval *Dermacentor variabilis* (Say) (Acari: Ixodidae). Syst. Appl. Acarol., 15: 195–196.

Halliday, R.B. & Sutherst, R.W. 1990. An Australian record of the American dog tick *Dermacentor variabilis*, and the risk of its establishment outside North America. Exp. Appl. Acarol., 8: 65–70.

Harman, D.M., Willner, G.R. & Chapman, J.A. 1984. Frequency and distribution of the American dog tick on the nutria in Maryland. Am. Midl. Nat., 111: 81–85.

Jameson, L.J., Phipps, L.P. & Medlock, J.M. 2010. Surveillance for exotic ticks on companion animals in the UK. Vet. Rec., 166: 202–203.

Kollars, T.M., Oliver, J.H., Masters, E.J., Kollars, P.G. & Durden, L.A. 2000. Host utilization and seasonal occurrence of *Dermacentor* species (Acari: Ixodidae) in Missouri, USA. Exp. Appl. Acarol., 24: 631–643.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Lancaster, J.L. 1973. A guide to the ticks of Arkansas. Bull. Agric. Exp. Stn. Univ. Arkansas (779), 39 pp.

Nicholls, T.H. & Callister, S.M. 1996. Lyme disease spirochetes in ticks collected from birds in midwestern United States. J. Med. Entomol., 33: 379–384.

Rand, P.W., Lacombe, E.H., Dearborn, R., Cahill, B., Elias, S., Lubelczyk, C.B., Beckett, G.A. & Smith, R.P. 2007. Passive surveillance in Maine, an area emergent for tick-borne diseases. J. Med. Entomol., 44: 1118–1129.

Reeves, W., Durden, L. & Wills, W. 2002. New records of ticks (Acari: Argasidae, Ixodidae) from South Carolina. J. Agric. Urban Entomol., 19: 197–204.

Zimmerman, R.H., McWherter, G.R. & Bloemer, S.R. 1988. Medium-sized mammal hosts of *Amblyomma americanum* and *Dermacentor variabilis* (Acari: Ixodidae) at Land Between The Lakes, Tennessee, and effects of integrated tick management on host infestations. J. Med. Entomol., 25: 461–466.

Synopsis of the Genus *Dermacentor*

A synopsis of the genus *Dermacentor* is presented in Tables 1 and 2. The Palearctic Region contains the greatest number of species found exclusively in one region (13, or 37 % of the total), while the Afrotropical Region contains the least number of species confined to a single region (two species, *D. circumguttatus* and *D. rhinocerinus*). No species are found exclusively in the Australasian Zoogeographic Region, and no species are widely distributed (established in three or more zoogeographic regions). All species are confined to one or two of the six zoogeographic regions (Table 1), and no species occurs near the poles or on remote islands.

Our overall analyses indicate that 11 species (31 %) of *Dermacentor* occur exclusively in regions that constituted Gondwanaland, 18 species (51 %) are found in regions derived from Laurasia, and the remaining six species (17 %) occur in lands that were part of both ancient continents. No other numerically significant tick genus has such a preponderance of Laurasian species.

The larva, nymph and at least one adult stage are known for 21 (60 %) of the 35 species of *Dermacentor*. However, in none of the Neotropical species and just one of the Oriental species have all the parasitic stages been described.

Notably, 23 (66 %) of the world's *Dermacentor* species have been recorded feeding on humans.

Host usage by the 20 species whose adult (female and/or male) and sub-adult stages are known, along with their natural hosts, is presented in Table 2, first including exceptional hosts, and then excluding these hosts. All parasitic stages of the Nearctic and Neotropical *D. halli* are known, but there is uncertainty concerning the larval hosts of this species, which has therefore been excluded from our analysis.

Dermacentor ticks fall into seven categories of host utilization (Table 2) when exceptional hosts are included. The only exclusive host for this genus is Mammalia (seven species, 35 % of the total), but Mammalia are exclusive or non-exclusive hosts for all species. The most common combination of hosts is Mammalia + Aves (five species, 25 %), but Aves are non-exclusive hosts for 11 (55 %) species. Squamata have been found to be non-exclusive hosts for seven species (35 %). Anura are non-exclusive exceptional hosts for the Palearctic species *D. marginatus* and *D. reticulatus*, and the Nearctic and Neotropical *D. nitens.* Testudines are rare hosts for the Palearctic *D. niveus.* The share of Crocodilia as *Dermacentor* hosts is nil.

The situation changes dramatically when exceptional hosts are excluded from the analysis. No longer does any species of *Dermacentor* show a relevant relationship with Anura, Squamata and Testudines. The seven categories of host usage when exceptional hosts are excluded are reduced to two. However, the most important observation to emerge from this analysis is that 19 species (95 %) are found exclusively on Mammalia. The remaining species, the Palearctic *Dermacentor silvarum*, has both Mammalia + Aves as major hosts.

Table 1 Numbers and percentages of all species of *Dermacentor*, by zoogeographic region(s), number known to feed on humans (% of the total number of species in a particular region) and number of species for which all stages (larva, nymph, male and/or female) are known (% of the total number of species in a particular region)

Regions	No. of species	%	No. of species on humans	No. of species of which all stages are known
Palearctic	13	37.1	5 (38.5)	10 (76.9)
Nearctic	4	11.4	4 (100)	4 (100)
Neotropical	4	11.4	2 (50.0)	0
Nearctic-Neotropical	4	11.4	4 (100)	4 (100)
Oriental	3	8.6	2 (66.7)	1 (33.3)
Afrotropical	2	5.7	2 (100)	1 (50.0)
Australasian-Oriental	2	5.7	2 (100)	0
Oriental-Palearctic	2	5.7	2 (100)	1 (50.0)
Nearctic-Palearctic	1	2.9	0	0
Total	**35**		**23 (65.7)**	**21 (60.0)**

Table 2 Numbers and percentages of the 20 species of *Dermacentor* whose adult (female and/or male), larval and nymphal stages as well as natural hosts are known, including or excluding exceptional hosts

Hosts	No. of species Including exceptional hosts	%	No. of species Excluding exceptional hosts	%
Mammalia	7	35.0	19	95.0
Aves + Mammalia	5	25.0	1	5.0
Aves + Mammalia + Squamata	3	15.0	0	0
Anura + Aves + Mammalia + Squamata	2	10.0	0	0
Mammalia + Squamata	1	5.0	0	
Anura + Mammalia + Squamata	1	5.0	0	0
Aves + Mammalia + Testudines	1	5.0	0	0
Total	**20**		**20**	

Part VI
The Genus *Hyalomma*

General Comment and Remarks on Some Invalid Names

Romero-Castañon et al. (2008) record the presence of *Hyalomma* sp. in the Neotropical Zoogeographic Region and, by implication, the Americas. However, their paper contains gross errors in literature interpretation (see the remarks on *Amblyomma cajennense* in our *Amblyomma* chapter for just one example), and we consider their diagnosis erroneous.

Hyalomma bubi Sharma, 1993 is a name assigned to nymphs of an alleged new species of *Hyalomma* that parasitizes Strigiformes: Strigidae in the Poonch Valley, Kashmir. We are unaware of any formal description of this species and treat this epithet as a *nomen nudum.*

Hyalomma brevipunctata Sharif, 1928 is a widely used name but is a Latin misspelling of *brevipunctatum*; therefore, the correct name for this taxon is *H. brevipunctatum.*

Hyalomma erythraeum Tonelli Rondelli, 1932 is considered a valid name in Kolonin (2009), but Guglielmone et al. (2010) follow Apanaskevich and Horak (2009), who present sound arguments supporting the view that *H. erythraeum* is a synonym of *H. impeltatum* Schulze & Schlottke, 1929.

Hyalomma sinaii Feldman-Muhsam, 1960 is treated as a valid species in Kolonin (2009) and also in earlier lists of the Ixodidae, but has been excluded from the list compiled by Guglielmone et al. (2010), who follow Apanaskevich and Horak (2009) in relegating *H. sinaii* to the synonymy of *H. impeltatum.*

References

Apanaskevich, D.A. & Horak, I.G. 2009. The genus *Hyalomma* Koch, 1844. IX. Redescription of all parasitic stages of *H.* (*Euhyalomma*) *impeltatum* Schulze & Schlottke, 1930 and *H.* (*E.*) *somalicum* Tonelli Rondelli, 1935 (Acari: Ixodidae). Syst. Parasitol., 73: 199–218.

Guglielmone, A.A., Robbins, R.G., Apanaskevich, D.A., Petney, T.N., Estrada-Peña, A., Horak, I.G., Shao, R. & Barker, S.C. 2010. The Argasidae, Ixodidae and Nuttalliellidae (Acari: Ixodida) of the world: a list of valid species names. Zootaxa, 2528: 1–28.

DOI 10.1007/978-94-007-7497-1_12,

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Romero-Castañon, S., Ferguson, B.G., Güiris, D., González, D., López, S., Paredes, A. & Webber, M. 2008. Comparative parasitology of wild and domestic ungulates in the Selva Lacandona, Chiapas, México. Comp. Parasitol., 75: 115–126.
Sharma, B.D. 1993. Medical & veterinary arthropod-disease ecology. Ashish Publishing House, New Delhi, 335 pp.

Individual Species Accounts

1 – *H. aegyptium* (Linnaeus, 1758) (*In Systema naturae per regna tria naturae, secundum classes, ordines, genera, species cum characteribus, differentiis, synonymis, locis*. Editio decima, reformata. Holmiae, 1, 823 pp.)

Type depository: LC (holotype) (Wallin, L. 1991. Catalogue of type specimens. 4. Linnaean specimens. Uppsala University, Museum of Evolution, Zoology section, 128 pp.), as *Acarus aegyptius.*

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: mediterranean forests, woodlands and scrub; desert and xeric shrublands

Hosts: usual hosts for larvae, nymphs and adults are Testudines: Testudinidae.
Testudines: Testudinidae; Erinaceomorpha: Erinaceidae; Lagomorpha: Leporidae; Rodentia: Cricetidae, Muridae; Galliformes: Phasianidae (ANL)
Squamata: Agamidae (AN)
Artiodactyla: Bovidae, Cervidae, Suidae; Carnivora: Canidae; Ciconiiformes: Ardeidae (A)
Falconiformes: Falconidae; Passeriformes (several families); Strigiformes: Strigidae (NL)
Columbiformes: Columbidae; Coraciiformes: Coraciidae, Upupidae (N)
Lagomorpha: Ochotonidae (L)
Artiodactyla: Camelidae; Perissodactyla: Equidae; Testudines: Emyididae (stages unknown)

Human infestation: yes (Burridge 2011)

Remarks: according to Hoogstraal (1956), many early records of *H. aegyptium* are erroneous because the name was used for a number of different tick species. Camicas et al. (1998) state that *H. aegyptium* occurs within the Oriental and Palearctic Zoogeographic Regions, but we have been unable to locate *bona fide* Oriental localities for this species. Arthur (1963) lists Afrotropical localities for *H. aegyptium* that

DOI 10.1007/978-94-007-7497-1_13,

we consider doubtful; consequently, this region is not included in the distribution of this tick. Our summary of the hosts of *H. aegyptium* is based on the data of Burridge (2011) and Apanaskevich (2003). Burridge (2011) records several introductions of this tick into the Nearctic Zoogeographic Region, but there is no evidence of it having become established there. Lahille (1914) claimed that *H. aegyptium* was introduced into the Neotropical Region with camels, but it is uncertain whether his species diagnoses were correct. Camicas et al. (1998) ignore Mammalia and Aves as hosts of *H. aegyptium.* Mihalca et al. (2011) list this species as endangered.

References

Apanaskevich, D.A. 2003. To diagnostics of *Hyalomma* (*Hyalomma*) *aegyptium* (Acari: Ixodidae). Parazitologiya, 37: 47–59. In Russian.

Arthur, D.R. 1963. British ticks. Butterworths, London, 213 pp.

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Hoogstraal, H. 1956. African Ixodoidea. I. Ticks of the Sudan (with special reference to Equatoria Province and with preliminary reviews of the genera *Boophilus*, *Margaropus* and *Hyalomma*). Research Report NM 005 050.29.07, Department of the Navy Bureau of Medicine and Surgery, Washington D.C., 1101 pp.

Lahille, F. 1914. Nota sobre la presencia accidental en Buenos Aires de unas garrapatas del camello. Bol. Minist. Agric. Arg., 17: 289–293.

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.

2 – *H. albiparmatum* Schulze, 1920 (Sber. Ges. Naturf. Freunde Berl., 5: 189–196) The year of description of this species is generally considered to be 1919, the date that appears in Guglielmone, A.A., Robbins, R.G., Apanaskevich, D.A., Petney, T.N., Estrada-Peña, A., Horak, I.G., Shao, R. & Barker, S.C. (2010. The Argasidae, Ixodidae and Nuttalliellidae (Acari: Ixodida) of the world: a list of valid species names. Zootaxa, 2528: 1–28); however, the publication containing the original description bears wording clearly stating that it was printed in 1920. Apanaskevich, D.A. & Horak, I.G. (2008a. The genus *Hyalomma.* VI. Systematics of *H.* (*Euhyalomma*) *truncatum* and the closely related species, *H.* (*E.*) *albiparmatum* and *H.* (*E.*) *nitidum* (Acari: Ixodidae). Exp. Appl. Acarol., 44: 115–136) treat *H. albiparmatum* as a valid species, but leave open the possibility that it is conspecific with *H. truncatum*.

Type depository: ZMB (syntypes) (Moritz, M. & Fischer, S.C. 1981. Die Typen der Arachniden-Sammlung des Zoologischen Museums Berlin. Mitt. Zool. Mus. Berlin, 57: 341–364), as *Hyalomma aegyptium albiparmatum.*

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: *Acacia-Commiphora* bushlands and thickets

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae. Aves are considered exceptional hosts for this species.
Artiodactyla: Bovidae, Giraffidae, Suidae; Carnivora: Canidae, Felidae; Perissodactyla: Equidae, Rhinocerotidae; Struthioniformes: Struthionidae (A) Lagomorpha: Leporidae (N)

Human infestation: yes (Apanaskevich and Horak 2008)

Remarks: Camicas et al. (1998) indicate that the larva and nymph of *H. albiparmatum* are undescribed, but these stages were subsequently described by Apanaskevich and Horak (2008). Burridge (2011) records this tick as having been introduced into the Nearctic Region, but there is no evidence that it has become established there. Morel (2003) lists Leporidae as hosts for adults of *H. albiparmatum* in Kenya, but Walker (1974) states that it was nymphs collected from Cape hares in Kenya that later molted into adults of this species. Thus, we have not included Leporidae as hosts for *H. albiparmatum* adults. The natural hosts of the larva of *H. albiparmatum* are unknown (Apanaskevich and Horak 2008). Our host profile for *H. albiparmartum* chiefly follows Apanaskevich and Horak (2008). See also *H. nitidum*.

References

Apanaskevich, D.A. & Horak, I.G. 2008. The genus *Hyalomma.* VI. Systematics of *H.* (*Euhyalomma*) *truncatum* and the closely related species, *H.* (*E.*) *albiparmatum* and *H.* (*E.*) *nitidum* (Acari: Ixodidae). Exp. Appl. Acarol., 44: 115–136.

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Walker, J.B. 1974. The ixodid ticks of Kenya. A review of present knowledge of their hosts and distribution. Commonwealth Institute of Entomology, London, 220 pp.

Yeoman, G.H. & Walker, J.B. 1967. The ixodid ticks of Tanzania. A study of the zoogeography of the Ixodidae of an East African country. Commonwealth Institute of Entomology, London, 215 pp.

3 – *H. anatolicum* Koch, 1844 (Arch. Naturgesch., 10: 217–239)
See *H. excavatum* and remarks below.

Type depository: USNTC (neotype) (Apanaskevich, D.A. & Horak, I.G. 2005. The genus *Hyalomma* Koch, 1844. II. Taxonomic status of *H.* (*Euhyalomma*) *anatolicum* Koch, 1844 and *H.* (*E.*) *excavatum* Koch, 1844 (Acari, Ixodidae)

with redescriptions of all stages. Acarina, 13: 181–197). However, a recent search of the USNTC by one of us (DAA) failed to locate the neotype of *H. anatolicum*.

Known stages: male, female, nymph, larva

Zoogeographic Regions: Afrotropical, Oriental, Palearctic

Ecoregions: several ecoregions

Hosts: usual hosts for larvae, nymphs and adults are Artiodactyla: Bovidae; Aves are considered exceptional hosts for this tick.
Artiodactyla: Bovidae, Camelidae; Lagomorpha: Leporidae (ANL)
Carnivora: Canidae (AN)
Erinaceomorpha: Erinaceidae (AL)
Artiodactyla: Suidae; Carnivora: Felidae; Perissodactyla: Equidae (A)
Rodentia: Dipodidae (NL)
Lagomorpha: Ochotonidae; Rodentia: Muridae; Passeriformes: Muscicapidae; Squamata: Lacertidae (N)
Galliformes: Phasianidae (N and/or L)

Human infestation: yes (Hoogstraal et al. 1981, see also below)

Remarks: considerable difficulties may be encountered in distinguishing *H. anatolicum* from *H. excavatum*, as detailed in Apanaskevich (2003) and Apanaskevich and Horak (2005). We relied on the data in both of these papers, as well as that in Hoogstraal (1956) (who referred to this species as *H. excavatum*) (Hoogstraal et al. 1964, 1981), and Wassef et al. (1997) (who referred to this species as *H. anatolicum anatolicum*), for profiles of hosts and distribution. Hoogstraal et al. (1964) used the term "immatures" without specifying whether larvae or nymphs of *H. anatolicum* were present on Galliformes. Camicas et al. (1998) consider *H. anatolicum* (under the name *H. anatolicum anatolicum*) an Oriental and Palearctic species, but there are *bona fide* records for the Afrotropical Region in the references below. Kolonin (2009) ignores hosts of *H. anatolicum* other than Bovidae and Equidae. See also *H. excavatum.*

References

Apanaskevich, D.A. 2003. Differentiation of closely related species *Hyalomma anatolicum* and *H. excavatum* (Acari: Ixodidae) based on a study of all life cycle stages, throughout entire geographic range. Parazitologiya, 37: 259–280. In Russian.

Apanaskevich, D.A. & Horak, I.G. 2005. The genus *Hyalomma* Koch, 1844. II. Taxonomic status of *H.* (*Euhyalomma*) *anatolicum* Koch, 1844 and *H.* (*E.*) *excavatum* Koch, 1844 (Acari, Ixodidae) with redescriptions of all stages. Acarina, 13: 181–197.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Hoogstraal, H. 1956. African Ixodoidea. I. Ticks of the Sudan (with special reference to Equatoria Province and with preliminary reviews of the genera *Boophilus*, *Margaropus* and *Hyalomma*). Research Report NM 005 050.29.07, Department of the Navy Bureau of Medicine and Surgery, Washington D.C. 1101 pp.
Hoogstraal, H., Traylor, M.A., Gaber, S., Malakatis, G., Guindy, E. & Helmy, I. 1964. Ticks (Ixodidae) on migrating birds in Egypt, spring and fall 1962. Bull. World Health Org., 30: 355–367.
Hoogstraal, H., Wassef, H.Y. & Büttiker, W. 1981. Ticks (Acarina) of Saudi Arabia Fam. Argasidae, Ixodidae. Fauna Saudi Arabia, 3: 25–110.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Wassef, H.I., Büttiker, W. & Gallagher, M.D. 1997. Further records of ticks (Acari: Argasidae and Ixodidae) from the Arabian Peninsula. Fauna Saudi Arabia, 16: 63–88.

4 – *H. arabica* Pegram, Hoogstraal & Wassef, 1982 (J. Parasitol., 68: 150–156)

Type depositories: USNTC (holotype, paratypes), BMNH, DB, HH (paratypes) (Keirans, J.E. & Hillyard, P.D. 2001. A catalogue of the type specimens of Ixodida (Acari: Argasidae, Ixodidae) deposited in The Natural History Museum, London. Occ. Pap. Syst. Entomol. (13), 74 pp.)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregion: southwestern Arabian montane woodlands

Hosts: Artiodactyla: Bovidae (A)
Rodentia: Muridae (NL)

Human infestation: no

References

Al-Khalifa, M.S., Al-Asgah, N.A. & Diab, F.M. 1986. *Hyalomma* (*Hyalommina*) *arabica*, the Arabian goat and sheep tick: distribution and abundance in Saudi Arabia. J. Med. Entomol., 23: 220–221.
Papadopoulos, B., Büttiker, W., Morel, P.-C. & Aeschlimann, A. 1991. Ticks (Acarina, Fam. Argasidae & Ixodidae) of Oman. Fauna Saudi Arabia, 12: 200–208.

5 – *H. asiaticum* Schulze & Schlottke, 1929 (Sber. Abh. Naturf. Ges. Rostock 1927–1929, 2: 32–46)

There is disagreement concerning the year of description of *H. asiaticum*; some authors argue that it is 1930, while others claim that it is 1929. Guglielmone et al. (2010, *op. cit.* under *H. albiparmatum*) consider 1930 to be the correct date, but recently one of us (TNP) observed that the publication date of the reprint that contains the description of *H. asiaticum* is January 12, 1929. Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. (1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes,

répartition. ORSTOM, Paris, 233 pp.) and other authors support the existence of three subspecies of *H. asiaticum.*

Type depository: ZMB (syntype from the series of *H. dromedarii*) (Moritz and Fischer, 1981, *op. cit.* under *H. albiparmatum*) as *Hyalomma dromedarii asiaticum.*

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: several ecoregions

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae and Camelidae; usual hosts for nymphs and larvae are Erinaceomorpha: Erinaceidae, Lagomorpha: Leporidae, and Rodentia (several families). Aves and Squamata are considered exceptional hosts for this tick.
Several orders (Mammalia) (ANL)
Columbiformes: Columbidae; Strigiformes: Strigidae (A)
Passeriformes (several families) (N)
Falconiformes: Falconidae; Squamata: Gekkonidae (N and/or L)

Human infestation: yes (Apanaskevich and Horak 2010)

Remarks: Apanaskevich and Horak (2010) redescribed all parasitic stages of *H. asiaticum.* Kolonin (2009) does not recognize hosts of *H. asiaticum* other than Mammalia, but there are *bona fide* records of such hosts in the references below. Filippova et al. (1995) and Apanaskevich and Horak (2010) use the term "immatures" without specifying whether larvae, nymphs or both stages of *H. asiaticum* were found on Falconiformes and Squamata. Apanaskevich and Horak (2010) do not include Passeriformes in their list of *H. asiaticum* hosts, but we provisionally accept Morel's (2003) compilation of passeriform records. We feel that a recent record of a female of *H. asiaticum* on *Alectoris chukar* (Phasianidae) by Al-Barwari and Saeed (2012) requires confirmation, and it was therefore not included in the host list above.

References

Al-Barwari, S. & Saeed, I. 2012. Parasitosis of the chukar partridge, *Alectoris chukar* in north Irak. Turk. Parazitol. Derg., 36: 240–246.

Apanaskevich, D.A. 2002. Identification of species of *Hyalomma asiaticum* group (Ixodidae) in areas of their sympatry based on immature stages. Parazitologiya, 36: 271–279. In Russian.

Apanaskevich, D.A. & Horak, I.G. 2010. The genus *Hyalomma.* XI. Redescription of all parasitic stages of *H.* (*Euhyalomma*) *asiaticum* (Acari: Ixodidae) and notes on its biology. Exp. Appl. Acarol., 52: 207–220.

Filippova, N.A., Musatov, S.A., Panova, I.V. & Lobanov, A.L. 1995. The taxonomic pattern of the polytypic species *Hyalomma asiaticum* (Ixodidae). First experience of morphometric data bases application. Parazitologiya, 29: 65–82. In Russian.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

6 – *H. brevipunctatum* Sharif, 1928 (Rec. Ind. Mus., 30: 217–344)
See "remarks on same invalid names" at the beginning of this chapter for the correct spelling of the name of this tick species, which is usually spelled *H. brevipunctata.*

Type depository: IM (syntypes) (Sharif, M. 1928. A revision of the Indian Ixodidae with special reference to the collection in the Indian Museum. Rec. Ind. Mus., 30: 217–344), as *Hyalomma hussaini brevipunctata*

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregions: deserts and xeric shrublands

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae; usual hosts for nymphs and larvae are Rodentia: Muridae and Sciuridae. Aves are considered exceptional hosts for this tick.
Rodentia: Muridae, Sciuridae (ANL)
Artiodactyla: Bovidae, Camelidae, Cervidae; Carnivora: Canidae, Felidae; Perissodactyla: Equidae (A)
Soricomorpha: Soricidae (NL)
Cuculiformes: Cuculidae (N and/or L)

Human infestation: yes (Apanaskevich et al. 2009)

Remarks: Camicas et al. (1998) indicate that the larva and nymph of *H. brevipunctatum* are undescribed, but these stages were described by Singh and Dhanda (1965) and recently redescribed by Apanaskevich et al. (2009). It is unclear whether the larva, nymph or both stages of *H. brevipunctatum* were found by Geevarghese and Dhanda (1995) on Cuculidae. Kolonin (2009) recognizes only Mammalia as hosts of *H. brevipunctatum*, probably because records of this tick on other hosts are unusual.

References

Apanaskevich, D.A., Horak, I.G. & Geevarghese, G. 2009. The genus *Hyalomma* Koch, 1844. VIII. Redescription of three *Hyalommina* Schulze, 1919 species (Acari: Ixodidae) from South Asia with notes on their biology. Zootaxa, 2050: 31–55.
Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.
Geevarghese, G. & Dhanda, V. 1995. Ixodid ticks of Maharashtra State, India. Acarologia, 36: 309–313.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Rebello, M.J. & Reuben, R. 1967. A report on ticks collected from birds and small mammals in North Arcot and Chittoor Districts, South India. J. Bombay Nat. Hist. Soc., 68: 283–289.
Singh, K.R.P. & Dhanda, V. 1965. Descriptions and keys of immature stages of some species of Indian *Hyalomma* Koch, 1844 (Ixodoidea, Ixodidae). Acarologia, 7: 636–651.

7 – *H. dromedarii* Koch, 1844 (Arch. Naturgesch., 10: 217–239)

Type depository: ZMB (syntypes) (Moritz and Fischer, 1981, *op. cit.* under *H. albiparmatum*), but Apanaskevich, D.A., Schuster, A.L. & Horak, I.G. (2008b. The genus *Hyalomma*: VII. Redescription of all parasitic stages of *H.* (*Euhyalomma*) *dromedarii* and *H.* (*E.*) *schulzei* (Acari: Ixodidae). J. Med. Entomol., 45: 817–831) were unable to find any syntypes of *H. dromedarii* in ZMB.

Known stages: male, female, nymph, larva

Zoogeographic Regions: Afrotropical, Oriental, Palearctic

Ecoregions: several ecoregions

Hosts: usual hosts for larvae, nymphs and adults are Artiodactyla: Camelidae.
Mammalia (several orders); Squamata: Lacertidae (ANL)
Struthioniformes: Struthionidae (A)
Rodentia: Muridae; Falconiformes: Falconidae; Galliformes: Phasianidae (NL)
Charadriiformes: Charadriidae (stage unknown)

Human infestation: yes (Burridge 2011)

Remarks: in nature *H. dromedarii* can be a one-host, two-host or three-host tick. Burridge (2011) and Keirans (1985) record this tick as having been introduced into the Nearctic Region, while Lahille (1914), among others, recorded its introduction into the Neotropical Region, but there is no evidence that it has become established in either region. Kolonin (2009) recognizes only Mammalia as hosts of *H. dromedarii*, but Hoogstraal et al. (1981) state that the sub-adults of *H. dromedarii* are fairly common on Squamata and Aves.

References

Apanaskevich, D.A., Schuster, A.L. & Horak, I.G. 2008. The genus *Hyalomma*: VII. Redescription of all parasitic stages of *H.* (*Euhyalomma*) *dromedarii* and *H.* (*E.*) *schulzei* (Acari: Ixodidae). J. Med. Entomol., 45: 817–831.
Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.
Hoogstraal, H., Wassef, H.Y. & Büttiker, W. 1981. Ticks (Acarina) of Saudi Arabia Fam. Argasidae, Ixodidae. Fauna Saudi Arabia, 3: 25–110.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Lahille, F. 1914. Nota sobre la presencia accidental en Buenos Aires de unas garrapatas del camello. Bol. Minist. Agric. Arg., 17: 289–293.

8 – *H. excavatum* Koch, 1844 (Arch. Naturgesch., 10: 217–239)
This species was until recently regarded as a subspecies of *H. anatolicum*, as discussed in Guglielmone, A.A., Robbins, R.G., Apanaskevich, D.A., Petney, T.N., Estrada-Peña, A. & Horak, I.G. (2009. Comments on controversial tick (Acari: Ixodida) species names and species described or resurrected from 2003 to 2008. Exp. Appl. Acarol., 48: 311–327).

Type depository: ZMB (holotype). The holotype was redescribed by Feldman-Muhsam, B. (1954. Revision of the genus *Hyalomma.* I. Description of Koch's types. Bull. Res. Counc. Israel, 4: 150–170). It should be in the ZMB, according to Moritz and Fischer (1981, *op. cit.* under *H. albiparmatum*), but they and also Apanaskevich and Horak (2005, *op. cit.* under *H. anatolicum*) state that the depository of the holotype of *H. excavatum* is currently unknown.

Known stages: male, female, nymph, larva

Zoogeographic Regions: Afrotropical, Palearctic

Ecoregions: several ecoregions

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae and Camelidae; usual hosts for larvae and nymphs are Erinaceomorpha: Erinaceidae; Lagomorpha: Leporidae; Rodentia: Dipodidae, Muridae and Sciuridae. Aves and Squamata are considered exceptional hosts.
Lagomorpha: Leporidae (ANL)
Artiodactyla: Bovidae, Camelidae; Carnivora: Canidae; Perissodactyla: Equidae (A)
Galliformes: Phasianidae (A and N and/or L)
Carnivora: Mustelidae; Erinaceomorpha: Erinaceidae; Rodentia: Dipodidae, Muridae, Sciuridae (NL)
Squamata: Lacertidae (N)
Lagomorpha: Ochotonidae (L)

Human infestation: yes (Hoogstraal et al. 1981; see also below)

Remarks: Camicas et al. (1998) indicate that the nymph of *H. excavatum* is undescribed, but it was subsequently described by Apanaskevich (2003) and redescribed by Apanaskevich and Horak (2005). Considerable difficulties may be encountered in distinguishing between *H. anatolicum* and *H. excavatum*, as detailed in Apanaskevich (2003) and Apanaskevich and Horak (2005). We relied on the data in both of these papers, as well as that in Hoogstraal et al. (1964, 1981) (who referred to this species as *H. anatolicum excavatum*), for profiles of hosts

and distribution. Hoogstraal et al. (1964) used the term "immatures" without specifying whether larvae or nymphs of *H. excavatum* were present on Phasianidae. Loftis et al. (2006) apparently found adults of *H. excavatum* (named *H. anatolicum excavatum*) on Erinaceidae, but this record needs to be confirmed and it is not included in the host list above. Kolonin (2009) recognizes only Mammalia as hosts of *H. excavatum*. See also *H. anatolicum.*

References

Apanaskevich, D.A. 2003. Differentiation of closely related species *Hyalomma anatolicum* and *H. excavatum* (Acari: Ixodidae) based on a study of all life cycle stages, throughout entire geographic range. Parazitologiya, 37: 259–280. In Russian.

Apanaskevich, D.A. & Horak, I.G. 2005. The genus *Hyalomma* Koch, 1844. II. Taxonomic status of *H.* (*Euhyalomma*) *anatolicum* Koch, 1844 and *H.* (*E.*) *excavatum* Koch, 1844 (Acari, Ixodidae) with redescriptions of all stages. Acarina, 13: 181–197.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Hoogstraal, H., Traylor, M.A., Gaber, S., Malakatis, G., Guindy, E. & Helmy, I. 1964. Ticks (Ixodidae) on migrating birds in Egypt, spring and fall 1962. Bull. World Health Org., 30: 355–367.

Hoogstraal, H., Wassef, H.Y. & Büttiker, W. 1981. Ticks (Acarina) of Saudi Arabia Fam. Argasidae, Ixodidae. Fauna Saudi Arabia, 3: 25–110.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Loftis, A.D., Reeves, W.K., Szumlas, D.E., Abbasy, M.M., Helmy, I.H., Moriarity, J.R. & Dasch, G.A. 2006. Rickettsial agents in Egyptian ticks collected from domestic animals. Exp. Appl. Acarol., 40: 67–81.

9 – *H. franchinii* Tonelli Rondelli, 1932 (Atti Soc. Ital. Sci. Nat., 71: 119–125)

Type depository: MSNM (syntypes) as *H. tunesiacum franchinii.* Hoogstraal, H. & Kaiser, M.N. (1958. Observations on Egyptian *Hyalomma* ticks (Ixodoidea, Ixodidae). 4. Identity, distribution, and hosts of *H. franchinii* Tonelli-Rondelli (new combination). Systematic status of *H. tunesiacum* Sc. & Sc. and its subspecies. Ann. Entomol. Soc. Am., 51: 397–400) affirm that the deposition of type specimens is unknown, but Kratz, W. (1940. Die Zeckengattung *Hyalomma* Koch. Z. Parasitenkd., 11: 510–562) states that the "type" is in the Zoological Museum of Milan, probably meaning MSNM.

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: north Saharan steppes and woodlands

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae and Camelidae; usual hosts for nymphs and larvae are Squamata: Lacertidae.
Artiodactyla: Bovidae, Camelidae; Perissodactyla: Equidae; Testudines: Testudinidae (A)
Squamata: Lacertidae (NL)
Squamata: Agamidae; Rodentia: Muridae (N)

Human infestation: no

Remarks: Camicas et al. (1998) indicate that the nymph and larva of *H. franchinii* are undescribed, but both immature stages were subsequently described by Apanaskevich et al. (2008). Bursali et al. (2011) reported several records of *Hyalomma franchinii* from humans, but these records were corrected in Bursali et al. (2012).

References

Apanaskevich, D.A., Santos-Silva, M.M. & Horak, I.G. 2008. The genus *Hyalomma* Koch, 1844. IV. Redescription of all parasitic stages of *H.* (*Euhyalomma*) *lusitanicum* Koch, 1844 and the adults of *H.* (*E.*) *franchinii* Tonelli Rondelli, 1932 (Acari: Ixodidae) with a first description of its immature stages. Folia Parasitol., 55: 61–74

Bursali, A., Tekin, S., Keskin, A., Ekici, M. & Dundar, E. 2011. Species diversity of ixodid ticks feeding on humans in Amasya, Turkey: seasonal abundance and presence of Crimean-Congo hemorrhagic fever virus. J. Med. Entomol., 48: 85–93.

Bursali, A., Keskin, A. & Tekin, S. 2012. A review of the ticks (Acari: Ixodida) of Turkey: species diversity, hosts and geographical distribution. Exp. Appl. Acarol., 57: 91–104.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

10 – *H. glabrum* Delpy, 1949 (Ann. Parasitol. Hum. Comp., 24: 97–109)
As reported in Guglielmone et al. (2009, *op. cit.* under *H. excavatum*), this name was until recently considered a synonym of *H. turanicum.*

Type depository: probably in OVI (syntypes) (Apanaskevich, D.A. & Horak, I.G. 2006. The genus *Hyalomma* Koch, 1844. I. Reinstatement of *Hyalomma* (*Euhyalomma*) *glabrum* Delpy, 1949 (Acari, Ixodidae) as a valid species with a redescription of the adults, the first description of its immature stages and notes on its biology. Onderstepoort J. Vet. Res., 73: 1–12) as *Hyalomma rufipes glabrum.*

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: Nama Karoo; few ticks in Succulent Karoo.

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Artiodactyla: Bovidae; Carnivora: Canidae; Perissodactyla: Equidae (A)
Lagomorpha: Leporidae; Rodentia: Pedetidae; Galliformes: Numididae; Passeriformes (several families) (NL)
Hyracoidea: Procaviidae (L)

Human infestation: yes (Apanaskevich and Horak 2006)

Remarks: because *H. glabrum* is a two-host tick, we do not separately record subadult ticks present on hosts. Horak and MacIvor (1987) and Horak et al. (1991) refer to this tick as *H. marginatum turanicum*, while *H. turanicum* in Hoogstraal (1956) in part represents *Hyalomma glabrum.*

References

Apanaskevich, D.A. & Horak, I.G. 2006. The genus *Hyalomma* Koch, 1844. I. Reinstatement of *Hyalomma* (*Euhyalomma*) *glabrum* Delpy, 1949 (Acari, Ixodidae) as a valid species with a redescription of the adults, the first description of its immature stages and notes on its biology. Onderstepoort J. Vet. Res., 73: 1–12.

Hasle, G., Horak, I.G., Grieve, G., Leinaas, H.P. & Clarke, F. 2009. Ticks collected from birds in the northern provinces of South Africa, 2004–2006. Onderstepoort J. Vet. Res., 76: 167–175.

Hoogstraal, H. 1956. African Ixodoidea. I. Ticks of the Sudan (with special reference to Equatoria Province and with preliminary reviews of the genera *Boophilus*, *Margaropus* and *Hyalomma*). Research Report NM 005 050.29.07, Department of the Navy Bureau of Medicine and Surgery, Washington D.C. 1101 pp.

Horak, I.G. & MacIvor, K.M. de F. 1987. The scrub hare, a reliable indicator of the presence of *Hyalomma* ticks in the Cape Province. J. S. Afr. Vet. Assoc., 58: 15–19.

Horak, I.G., Fourie, L.J., Novellie, P.A. & Williams, E.J. 1991. Parasites of domestic and wild animals in South Africa. XXVI. The mosaic of ixodid tick infestations on birds and mammals in the Mountain Zebra National Park. Onderstepoort J. Vet. Res., 58: 125–136.

Matthee, S., Lovely, C., Gaugler, A., Beeker, R., Venter, H.R. & Horak, I.G. 2010. Ixodid ticks on domestic dogs in the Northern Cape Province of South Africa and in Namibia. J. S. Afr. Vet. Assoc., 81: 126–128.

11 – *H. hussaini* Sharif, 1928 (Rec. Ind. Mus., 30: 217–344)

Type depository: IM (syntypes) (Sharif, 1928, *op. cit.* under *H. brevipunctatum*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

Ecoregions: several ecoregions

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Artiodactyla: Bovidae, Camelidae, Suidae; Carnivora: Canidae, Ursidae; Perissodactyla: Equidae (A)
Rodentia: Muridae; Soricomorpha: Soricidae (NL)

Human infestation: yes (Apanaskevich et al. 2009)

Remarks: Camicas et al. (1998) indicate that the larva and nymph of *H. hussaini* are undescribed, but they were described by Singh and Dhanda (1965) and were recently redescribed by Apanaskevich et al. (2009). Kolonin (2009) states that the hosts of the larvae and nymphs of *H. hussaini* are unknown, but we believe that the hosts of these stages contained in the references below are correct.

References

Apanaskevich, D.A., Horak, I.G. & Geevarghese, G. 2009. The genus *Hyalomma* Koch, 1844. VIII. Redescription of three *Hyalommina* Schulze, 1919 species (Acari: Ixodidae) from South Asia with notes on their biology. Zootaxa, 2050: 31–55.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Singh, K.R.P. & Dhanda, V. 1965. Description and keys of immature stages of some species of Indian *Hyalomma* Koch, 1844 (Ixodoidea, Ixodidae). Acarologia, 7: 636–651.

12 – *H. hystricis* Dhanda & Raja, 1974 (Oriental Insects, 8: 531–536)

Type depositories: VRC (holotype, paratypes), CR, ZSI (paratypes) (Dhanda, V. & Raja, E.E. 1974. A new species of *Hyalomma* (Acarina: Ixodidae) from porcupine in South India. Oriental Insects, 8: 531–536), stated that some paratypes are deposited in BMNH. However, Keirans and Hillyard (2001, *op. cit.* under *H. arabica*) attested that no paratypes of *H. hystricis* were received by BMNH.

Known stages: male, female

Zoogeographic Region: Oriental

Ecoregion: Deccan thorn scrub forests

Hosts: Rodentia: Hystricidae (A)

Human infestation: no

Remarks: Camicas et al. (1998) include ungulates as hosts of *H. hystricis*, but we have been unable to confirm this.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Dhanda, V. & Raja, E.E. 1974. A new species of *Hyalomma* (Acarina: Ixodidae) from porcupine in South India. Oriental Insects, 8: 531–536.

13 – *H. impeltatum* Schulze & Schlottke, 1929 (Sber. Abh. Naturf. Ges. Rostock 1927–1929, 2: 32–46)

There is disagreement concerning the year of description of *H. impeltatum*; some authors argue that it is 1930, while others claim that it is 1929. Guglielmone et al. (2010, *op. cit.* under *H. albiparmatum*) considered 1930 to be the correct date, but recently one of us (TNP) observed that the publication date of the reprint that contains the description of *H. impeltatum* is January 12, 1929. See the introduction to this chapter for arguments justifying the classification of *H. erythraeum* and *H. sinaii* as junior synonyms of *H. impeltatum.* See also *H. somalicum.*

Type depository: USNTC (neotype) (Apanaskevich, D.A. & Horak, I.G. 2009. The genus *Hyalomma* Koch, 1844. IX. Redescription of all parasitic stages of *H.* (*Euhyalomma*) *impeltatum* Schulze & Schlottke, 1930 and *H.* (*E.*) *somalicum* Tonelli Rondelli, 1935 (Acari: Ixodidae). Syst. Parasitol., 73: 199–218) as *H. savignyi impeltatum*

Known stages: male, female, nymph, larva

Zoogeographic Regions: Afrotropical, Palearctic

Ecoregions: several ecoregions

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae and Camelidae; usual hosts for larvae and nymphs are Lagomorpha: Leporidae and Rodentia: Muridae.
Erinaceomorpha: Erinaceidae (ANL)
Lagomorpha: Leporidae; Passeriformes: Muscicapidae (AN)
Artiodactyla: Bovidae, Camelidae (AL)
Artiodactyla: Suidae; Perissodactyla: Equidae, Rhinocerotidae; Carnivora: Canidae, Felidae; Struthioniformes: Struthionidae (A)
Rodentia: Muridae (NL)
Rodentia: Dipodidae; Squamata: Lacertidae (N)

Human infestation: yes (Apanaskevich and Horak 2009)

Remarks: Wassef et al. (1997) present an extensive list of host records for *H. impeltatum*, but there are discrepancies between the hosts listed in the text and the tables. Consequently, the data of Wassef et al. (1997) are not included in our list of hosts of *H. impeltatum*. Al-Ghamdi et al. (2011) found *Hyalomma impeltatum* (tick stages not specified) in burrows of *Scincus hemprichii*, but we feel that this host requires confirmation and it is not included in the host list above.

References

Al-Ghamdi, A., Morsy, K., Bashtar, A.-R. Abdel-Ghaffar, F., Al-Rasheid, K., Al-Quraishy, S. & Mehlhorn, H. 2011. Developmental stages of *Hepatozoon hemprichii* sp. nov. infecting the skink *Scincus hemprichii* and the tick *Hyalomma impeltatum* from Saudi Arabia. J. Parasitol., 97: 878–888.

Apanaskevich, D.A. & Horak, I.G. 2009. The genus *Hyalomma* Koch, 1844. IX. Redescription of all parasitic stages of *H.* (*Euhyalomma*) *impeltatum* Schulze & Schlottke, 1930 and *H.* (*E.*) *somalicum* Tonelli Rondelli, 1935 (Acari: Ixodidae). Syst. Parasitol., 73: 199–218.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Hoogstraal, H. 1956. African Ixodoidea. I. Ticks of the Sudan (with special reference to Equatoria Province and with preliminary reviews of the genera *Boophilus*, *Margaropus* and *Hyalomma*). Research Report NM 005 050.29.07, Department of the Navy Bureau of Medicine and Surgery, Washington D.C., 1101 pp.

Hoogstraal, H., Wassef, H.Y. & Büttiker, W. 1981. Ticks (Acarina) of Saudi Arabia Fam. Argasidae, Ixodidae. Fauna Saudi Arabia, 3: 25–110.

Kaiser, M.N. & Hoogstraal, H. 1964. The *Hyalomma* ticks (Ixodoidea, Ixodidae) of Pakistan, India, and Ceylon, with keys to subgenera and species. Acarologia, 6: 257–286.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Wassef, H.I., Büttiker, W. & Gallagher, M.D. 1997. Further records of ticks (Acari: Argasidae and Ixodidae) from the Arab Peninsula. Fauna Saudi Arabia, 16: 63–88.

14 – *H. impressum* Koch, 1844 (Arch. Naturgesch., 10: 217–239)

Type depository: ZMB (holotype) (Moritz and Fischer, 1981, *op. cit.* under *H. albiparmatum*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: west Sudan savanna; few ticks in Guinean forest-savanna mosaic

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae and Camelidae. Aves are exceptional hosts for this tick.
Artiodactyla: Bovidae, Camelidae, Suidae; Carnivora: Canidae, Felidae; Perissodactyla: Equidae, Rhinocerotidae; Struthioniformes: Struthionidae (A)
Rodentia: Muridae (NL)
Lagomorpha: Leporidae (N)
Erinaceomorpha: Erinaceidae (L)
Tubulidentata: Orycteropodidae (stage unknown)

Human infestation: no

Remarks: Camicas et al. (1998) indicate that the nymph of *H. impressum* is undescribed, but the nymph was subsequently described by Apanaskevich and Horak (2007). Apanaskevich and Horak (2007) and Burridge (2011) mention this tick as having been introduced into the Palearctic and Nearctic Zoogeographic Regions, but there is no evidence that it has become established there. Recently, Abdel-Shafy et al. (2011) found *H. impressum* females on Camelidae in Sinai, Egypt (Palearctic Region), but this diagnosis appears to be incorrect. We consider tentatively valid the records of *H. impressum* from Rhinocerotidae and Orycteropodidae and the odd record from Aves in Burridge (2011), as well as the record of nymphs of *H. impressum* on Muridae in Morel (2003), collections that are not included in Apanaskevich and Horak (2007).

References

Abdel-Shafy, S., El Namaky, A. & Khalil, F.H.M. 2011. Scanning electron microscopy and morphometrics of nymph and larva of the tick *Hyalomma impressum* (Acari: Ixodidae). Parasitol. Res., 109: 1509–1518.

Apanaskevich, D.A. & Horak, I.G. 2007. The genus *Hyalomma* Koch, 1844. III. Redescription of the adults and larva of *H.* (*Euhyalomma*) *impressum* Koch, 1844 (Acari: Ixodidae) with a first description of its nymph and notes on its biology. Folia Parasitol., 54: 51–58.

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

15 – *H. isaaci* Sharif, 1928 (Rec. Ind. Mus., 30: 217–344)
As reported in Guglielmone et al. (2009, *op. cit.* under *H. excavatum*), many authors previously considered this tick a subspecies of *H. marginatum.*

Type depository: IM, BMNH (syntypes) (Keirans and Hillyard, 2001, *op. cit.* under *H. arabica*) as *H. aegyptium isaaci.*

Known stages: male, female, nymph, larva

Zoogeographic Regions: Oriental, Palearctic

Ecoregion: several ecoregions

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae; usual hosts for larvae and nymphs are Lagomorpha: Leporidae, Cuculiformes: Cuculidae, and Passeriformes (several families).
Carnivora: Herpestidae; Lagomorpha: Leporidae (ANL)
Mammalia (several orders) (A)
Cuculiformes: Cuculidae; Passeriformes (several families) (NL)

Human infestation: yes (Kaiser and Hoogstraal 1964)

Remarks: because *H. isaaci* is a two-host tick, we do not separately record sub-adult ticks present on hosts. Camicas et al. (1998) state that *H. isaaci* is found only in the Oriental Region, but Kaiser and Hoogstraal (1963, 1964) present records from Afghanistan and Pakistan in the Palearctic Region. All authors cited below, except Apanaskevich and Horak (2008), refer to this tick as *H. marginatum isaaci*. Sharma (1993) and Dilrukshi (2006) present records of sub-adult *H. isaaci* on Bovidae and Tragulidae, respectively, but we believe that these determinations require confirmation and have therefore not included them in our list of hosts for this tick.

References

Apanaskevich, D.A. & Horak, I.G. 2008. The genus *Hyalomma* Koch, 1844: V. Re-evaluation of the taxonomic rank of taxa comprising the *H.* (*Euhyalomma*) *marginatum* Koch complex of species (Acari: Ixodidae) with redescription of all parasitic stages and notes on biology. Int. J. Acarol., 34: 13–42.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Dilrukshi, P.R.M.P. 2006. Taxonomic status of ticks in Sri Lanka. *In* C.N.B. Bambaradeniya (editor), The fauna of Sri Lanka: status of taxonomy, research and conservation. The World Conservation Union, Colombo, Sri Lanka, pp. 65–69.

Kaiser, M.N. & Hoogstraal, H. 1963. The *Hyalomma* ticks (Ixodoidea, Ixodidae) of Afghanistan. J. Parasitol., 49: 130–139.

Kaiser, M.N. & Hoogstraal, H. 1964. The *Hyalomma* ticks (Ixodoidea, Ixodidae) of Pakistan, India, and Ceylon, with keys to subgenera and species. Acarologia, 6: 257–286.

Kaul, H.N., Dhanda, V. & Mishra, A.C. 1979. A survey of ixodid ticks in Orissa State, India. Ind. J. Anim. Sci., 49: 707–712.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Rajagopalan, P.K. 1972. Ixodid ticks (Acarina: Ixodidae) parasitizing wild birds in the Kyasanur Forest disease area of Shimoga District, Mysore State, India. J. Bombay Nat. Hist. Soc., 69: 55–78.

Rebello, M.J. & Reuben, R. 1967. A report on ticks collected from birds and small mammals in North Arcot and Chittoor Districts, South India. J. Bombay Nat. Hist. Soc., 63: 283–289.

Seneviratna, P. 1965. The Ixodoidea (ticks) of Ceylon. Parts II and III. Ceylon Vet. J., 13: 28–54.

Sharma, B.D. 1993. Medical & veterinary arthropod-disease ecology. Ashish Publishing House, New Delhi, 335 pp.

Singh, K.R.P. & Dhanda, V. 1965. Description and keys of immature stages of some species of Indian *Hyalomma* Koch, 1844 (Ixodoidea, Ixodidae). Acarologia, 7: 636–651.

Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.
Wattal, B.L. & Srivastva, S.P. 1969. Ectoparasite fauna of small mammals and domestic animals in the neighbourhood of Alwar City (Rajasthan). Bull. Ind. Soc. Malaria Commun. Dis., 4: 191–202.

16 – *H. kumari* Sharif, 1928 (Rec. Ind. Mus., 30: 217–344)

Type depository: IM, BMNH (syntypes) (Keirans and Hillyard, 2001, *op. cit.* under *H. arabica*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: several ecoregions

Hosts: Aves are exceptional hosts for this tick.
Artiodactyla: Bovidae, Camelidae, Cervidae; Carnivora: Canidae, Felidae; Perissodactyla: Equidae (A)
Soricomorpha: Soricidae; Rodentia: Muridae (NL)
Passeriformes: Estrildidae (L)

Human infestation: no

Remarks: Camicas et al. (1998) consider *H. kumari* to be an Oriental tick, but there are several *bona fide* records for the Palearctic Region in Apanaskevich et al. (2009). Records of larvae and nymphs of *H. kumari* on Bovidae and Canidae (Chaudhuri 1970; Gill and Gill 1977; Khan 1996) require confirmation according to Apanaskevich et al. (2009), and these hosts are provisionally excluded from our list above.

References

Apanaskevich, D.A., Horak, I.G. & Geevarghese, G. 2009. The genus *Hyalomma* Koch, 1844. VIII. Redescription of three *Hyalommina* Schulze, 1919 species (Acari: Ixodidae) from South Asia with notes on their biology. Zootaxa, 2050: 31–55.
Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.
Chaudhuri, R.P. 1970. Description of the immature stages of *Hyalomma* (*Hyalommina*) *kumari* Sharif, 1928 (Acarina: Ixodidae) and redescription of the adults, with notes on its hosts and distribution. Parasitology, 61: 43–53.
Gill, H.S. & Gill, B.S. 1977. Ixodid ticks of domestic animals in the Punjab State. Punjab Agricultural University, Ludhiana, India, 69 pp.
Khan, M.H. 1996. Studies on *Hyalomma* (*Hyalommina*) *kumari* Sharif, 1928 (Acarina: Ixodidae) on goats. J. Vet. Parasitol., 10: 165–169

17 – *H. lusitanicum* Koch, 1844 (Arch. Naturgesch., 10: 217–239)

Type depository: ZMB (syntypes, but lost) (Apanaskevich et al. 2008, *op. cit.* under *H. franchinii*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: mediterranean forests, woodlands and scrub

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae; usual hosts for larvae and nymphs are Lagomorpha: Leporidae. Aves are exceptional hosts for this tick.
Lagomorpha: Leporidae (ANL)
Mammalia (several Orders); Galliformes: Phasianidae (AN)
Passeriformes: Fringillidae; Strigiformes: Strigidae; Struthioniformes: Struthionidae (A)
Passeriformes: Turdidae (NL)

Human infestation: yes (Apanaskevich et al. 2008a)

Remarks: Apanaskevich et al. (2008a) maintain that the records of nymphs of *H. lusitanicum* on Bovidae (García Fernández and Hueli 1984) and on Aves (Pérez-Eid and Cabrita 2003) require confirmation. We have therefore tentatively excluded these records from the host list of *H. lusitanicum*. Mertins and Schlater (1991) record this tick as having been introduced into the Nearctic Region with Afrotropical hosts reared in Portugal (Palearctic), but there is no evidence that it has become established in the Nearctic. Kolonin (2009) does not recognize the few non-mammalian hosts of *H. lusitanicum*.

References

Apanaskevich, D.A., Santos-Silva, M.M. & Horak, I.G. 2008. The genus *Hyalomma* Koch, 1844. IV. Redescription of all parasitic stages of *H.* (*Euhyalomma*) *lusitanicum* Koch, 1844 and the adults of *H.* (*E.*) *franchinii* Tonelli Rondelli, 1932 (Acari: Ixodidae) with a first description of its immature stages. Folia Parasitol., 55: 61–74.

Bailly-Choumara, H., Morel, P.-C. & Pérez, C.L. 1980. Deuxième contributuion au catalogue de tiques du Maroc (Acari, Ixodoidea). Bull. Inst. Sci. (4): 1–12.

Calvete, C., Estrada, R., Lucientes, J. & Estrada, A. 2003. Ectoparasite ticks and chewing lice of red-legged partridge, *Alectoris rufa*, in Spain. Med. Vet. Entomol., 17: 33–37.

García Fernández, P. & Hueli, L.E. 1984. Garrapatas (Acarina, Ixodidae) parásitas del ganado bovino en el sur de España. Identificación, distribución geográfica y estacional. Rev. Ibér. Parasitol., 44: 129–138.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Mertins, J.W. & Schlater, J.L. 1991. Exotic ectoparasites of ostriches recently imported into the United States. J. Wildl. Dis., 27: 180–182.

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

Norte, A.C., Ramos, J.A., Gern, L., Núncio, M.S. & Carvalho, I.L. 2013. Birds as reservoirs for *Borrelia burgdorferi* s.l. in Western Europe: circulation of *B. turdi* and other genospecies in bird-tick cycles in Portugal. Environ. Microbiol., 15: 386–397.

Pérez-Eid, C. & Cabrita, J. 2003. La larve et la nymphe de *Hyalomma* (*Hyalomma*) *lusitanicum* Koch, 1844 (Acari: Ixodida): description morphologique, habitats, hôtes. Acarologia, 43: 327–335.

Santos Dias, J.A.T. 1994. As carraças (Acarina: Ixodoidea) da península ibérica. Algumas considerações sobre a sua biogeografá e relacionamento com a ixodofauna afropaleártica e afrotropical. Estud. Ens. Doc. (158), 163 pp.

Santos-Silva, M.M., Beati, L., Santos, A.S., Sousa de, R., Núncio, M.S., Melo, P., Santos-Reis, M., Fonseca, C., Formosinho, P., Vilela, C. & Bacellar, F. 2011. The hard-tick fauna of mainland Portugal (Acari: Ixodidae): an update on geographical distribution and known associations with hosts and pathogens. Exp. Appl. Acarol., 55: 85–121.

18 – *H. marginatum* Koch, 1844 (Arch. Naturgesch., 10: 217–239)
See *H. isaaci*, *H. rufipes* and *H. turanicum*.

Type depository: lost (Apanaskevich, D.A. & Horak, I.G. 2008b. The genus *Hyalomma* Koch, 1844: V. Re-evaluation of the taxonomic rank of taxa comprising the *H.* (*Euhyalomma*) *marginatum* Koch complex of species (Acari: Ixodidae) with redescription of all parasitic stages and notes on biology. Int. J. Acarol., 34: 13–42)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: several ecoregions

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae; usual hosts for nymphs and larvae are Lagomorpha: Leporidae and Aves (several orders).
Mammalia (several orders); Aves (several orders) (ANL)

Human infestation: yes (Apanaskevich and Horak 2008)

Remarks: because *H. marginatum* is a two-host tick, we do not separately record subadult ticks present on hosts. According to Apanaskevich and Horak (2008), records of *H. marginatum* from the Afrotropical Region are probably a consequence of ticks having been transported there by migratory birds, but this tick is not established in the Afrotropics. Therefore, recent records of *H. marginatum* on cattle in Ethiopia in Kebede and Fetene (2012) require confirmation and are not included in the range of this species. Labruna et al. (2001) and Burridge (2011) record this tick as having been introduced into the Neotropical and Nearctic Regions, respectively, but again there is no evidence that it has become established there. Hoogstraal (1979)

classified this tick as *H. marginatum marginatum*, and Morel (2003) uses the name *H. plumbeum plumbeum* (Panzer 1795). Hoogstraal (1956) listed hedgehogs, various rodents and lizards as hosts of immature stages, but later he excluded rodents as hosts of this tick (Hoogstraal 1979). Burridge (2011) lists Testudines as hosts for the *H. marginatum* group but does not provide information on the tick life history stage(s) involved, while Mihalca et al. (2012) list Squamata as hosts for larvae and nymphs of this tick. These records and those of nymphs and larvae on animals other than Leporidae and Aves require confirmation and accordingly are not included in our host list above. Kolonin (2009) does not recognize hosts other than Mammalia for adults of *H. marginatum*.

References

Akimov, I.A. & Nebogatkin, I.V. 2011. Distribution of the ixodid tick *Hyalomma marginatum* (Ixodoidea, Ixodidae) in Ukraine. Vest. Zool., 45: 371–374.

Apanaskevich, D.A. & Horak, I.G. 2008. The genus *Hyalomma* Koch, 1844: V. Re-evaluation of the taxonomic rank of taxa comprising the *H.* (*Euhyalomma*) *marginatum* Koch complex of species (Acari: Ixodidae) with redescription of all parasitic stages and notes on biology. Int. J. Acarol., 34: 13–42.

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Hoogstraal, H. 1956. African Ixodoidea. I. Ticks of the Sudan (with special reference to Equatoria Province and with preliminary reviews of the genera *Boophilus*, *Margaropus* and *Hyalomma*). Research Report NM 005 050.29.07, Department of the Navy Bureau of Medicine and Surgery, Washington D.C., 1101 pp.

Hoogstraal, H. 1979. The epidemiology of tick-borne Crimean-Congo hemorrhagic fever in Asia, Europe, and Africa. J. Med. Entomol., 15: 307–417.

Jameson, L.J., Morgan, P.J., Medlock, J.M., Watola, G. & Vaux, A.G.C. 2012. Importation of *Hyalomma marginatum*, vector of Crimean-Congo haemorrhagic fever, into the United Kingdom by migratory birds. Tick Tick-borne Dis., 3: 95–99.

Kebede, N. & Fetene, T. 2012. Population dynamics of cattle ectoparasites in Western Amhara National Regional State, Ethiopia. J. Vet. Med. Anim. Health, 4: 22–26.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Labruna, M.B., Pinter, A., Roncati, N.V., Pereira, M.C. & Faccini, J.L.H. 2001. Exotic ticks on horses imported from Portugal to Brazil. Arq. Bras. Med. Vet. Zoot., 53: 179–182.

Mihalca, A.D., Dumitrache, M.O., Magdaş, C., Gherman, C.M., Domşa, C., Mircean, V., Ghira, I.V., Pocora, V., Ionescu, D.T., Sikó Barabási, S., Cozma, V. & Sandor, A.D. 2012. Synopsis of the hard ticks (Acari: Ixodidae) of Romania with update on host associations and geographical distribution. Exp. Appl. Acarol., 58: 183–206.

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.

19 – *H. nitidum* Schulze, 1920 (Sber. Ges. Naturf. Freunde Berl., 5: 189–196)
The year of description of this species is generally considered to be 1919, the date that appears in Guglielmone et al. (2010, *op. cit.* under *H. albiparmatum*); however, the publication containing the original description bears wording clearly stating that it was printed in 1920. Apanaskevich and Horak (2008a, *op. cit*. under *H. albiparmatum*) treat *H. nitidum* as a valid species but leave open the possibility that it is conspecific with *H. truncatum*.

Type depository: ZMB (syntypes) (Moritz and Fischer, 1981, *op. cit.* under *H. albiparmatum*), as *H. impressum nitidum.*

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Lagomorpha: Leporidae (ANL)
Artiodactyla: Bovidae, Suidae; Carnivora: Canidae; Perissodactyla: Equidae (A)
Rodentia: Muridae (NL)

Human infestation: no

Remarks: Camicas et al. (1998) indicate that the larva and nymph of *H. nitidum* are undescribed, but these stages were subsequently described by Apanaskevich and Horak (2008). The latter authors consider humans to be hosts for *H. nitidum*, but Tomassone et al. (2005) noted that the only record of this tick from humans is that of an unattached male specimen. Consequently, we do not include humans in our host list. The difficulties involved in morphologically separating *H. nitidum* from *H. albiparmatum* and *H. truncatum* have been discussed by Apanaskevich and Horak (2008).

References

Apanaskevich, D.A. & Horak, I.G. 2008. The genus *Hyalomma*. VI. Systematics of *H.* (*Euhyalomma*) *truncatum* and the closely related species, *H.* (*E.*) *albiparmatum* and *H.* (*E*) *nitidum* (Acari: Ixodidae). Exp. Appl. Acarol., 44: 115–136.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Cornet, J.-P. 1995. Contribution à l'étude des tiques (Acarina: Ixodina) de la République Centrafricaine 4. Inventaire et répartition. Acarologia, 36: 203–212.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Tomassone, L., Camicas, J.-L., De Meneghi, D., Di Giulio, A. & Uilenberg, G. 2005. A note on *Hyalomma nitidum*, its distribution and its hosts. Exp. Appl. Acarol., 35: 341–355.

20 – *H. punt* Hoogstraal, Kaiser & Pedersen, 1969 (Ann. Entomol. Soc. Am., 62: 415–419)

Type depositories: USNTC (holotype, paratypes), OVI (paratypes) (Hoogstraal, H., Kaiser, M.N. & Pedersen, E.C. 1969. *Hyalomma* (*Hyalommina*) *punt*, n. sp. (Ixodoidea, Ixodidae), a relict parasite of domestic animals and gazelles in arid areas of northern Somali Republic. Ann. Entomol. Soc. Am., 62: 415–419). A recent search of the OVI tick collection by one of us (DAA) failed to locate the paratypes of *H. punt*.

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregions: Somali *Acacia-Commiphora* bushlands and thickets

Hosts: Artiodactyla: Bovidae, Camelidae (A)

Human infestation: no

Reference

Hoogstraal, H., Kaiser, M.N. & Pedersen, E.C. 1969. *Hyalomma* (*Hyalommina*), *punt* n. sp. (Ixodoidea, Ixodidae), a relict parasite of domestic animals and gazelles in arid areas of northern Somali Republic. Ann. Entomol. Soc. Am., 62: 415–419.

21 – *H. rhipicephaloides* Neumann, 1901 (Mém. Soc. Zool. Fr., 14: 249–372)

Type depository: ZMB (syntypes) (Moritz and Fischer, 1981, *op. cit.* under *H. albiparmatum*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: mediterranean forests, woodlands and scrub; desert and xeric shrublands

Hosts: Rodentia are considered exceptional hosts for adults of this tick.
Rodentia: Muridae (ANL)
Artiodactyla: Bovidae (A)

Human infestation: no

Remarks: the record of adult ticks on Muridae is that of a single male tick. Mihalca et al. (2011) list *H. rhipicephaloides* as an endangered species.

References

Hoogstraal, H., Kaiser, M.N., Ormsbee, R.A., Osborn, D.J., Helmy, I. & Gaber, S. 1967. *Hyalomma* (*Hyalommina*) *rhipicephaloides* Neumann (Ixodoidea: Ixodidae): its identity, hosts, and ecology, and *Rickettsia conori*, *R. prowazeki*, and *Coxiella burneti* infection in rodent hosts in Egypt. J. Med. Entomol., 4: 391–400.

Mihalca, A.D., Gherman, C.M. & Cozma, V. 2011. Coendangered hard-ticks: threatened or threatening? Parasit. Vectors, 4 (71), 7 pp.
Theodor, O. & Costa, M. 1967. A survey of the parasites of wild mammals and birds in Israel. Part One. Ectoparasites. The Israel Academy of Sciences and Humanities, Jerusalem, 119 pp.

22 – *H. rufipes* Koch, 1844 (Arch. Naturgesch., 10: 217–239)
As reported in Guglielmone et al. (2009, *op. cit.* under *H. excavatum*), this species was previously classified as a subspecies of *H. marginatum.*

Type depository: ZMB (lectotype, paralectotypes) (Moritz and Fischer, 1981, *op. cit.* under *H. albiparmatum*). Apanaskevich and Horak (2008b, *op. cit.* under *H. marginatum*) determined that the female paralectotype is in fact a specimen of *H. truncatum.*

Known stages: male, female, nymph, larva

Zoogeographic Regions: Afrotropical, Palearctic

Ecoregions: several ecoregions

Hosts: usual hosts for larvae and nymphs are Lagomorpha: Leporidae, and Aves (several orders), while Macroscelidea: Macroscelididae are considered exceptional hosts for larvae and nymphs.
Lagomorpha: Leporidae; Aves (several orders) (ANL)
Carnivora: Canidae (AN)
Artiodactyla (several families); Carnivora: Felidae; Perissodactyla: Equidae, Rhinocerotidae (A)
Macroscelidea: Macroscelididae (NL)

Human infestation: yes (Apanaskevich and Horak 2008)

Remarks: because we consider *H. rufipes* to be a two-host tick, we do not separately record subadult ticks present on hosts. Camicas et al. (1998) believe that records of *H. rufipes* from the Palearctic Region are instances of importation, but this tick is naturally established in the Palearctic. Keirans (1985) provides a record of adult *H. rufipes* from an unknown host in the Oriental Region, but we consider this unlikely and have tentatively excluded this region from our summary of this species' distribution. Walker (1991) questions the determination of "immature" stages of *H. rufipes* from Muridae and Herpestidae in Theiler (1962), and we have therefore not included these records in our list of hosts of this species. Moreover, we feel that the records of sub-adult *H. rufipes* from Bovidae, Cercopithecidae, Erinaceidae, Herpestidae, Macroscelididae, Muridae and Sciuridae listed in Camicas (1970) require confirmation and have tentatively excluded these from our host synopsis. Fourie et al. (2005) treat the single larva found on Macroscelididae as a "straggler." Hoogstraal (1956) and Morel (1958) classify this tick as *H. rufipes*, while the other authors cited below refer to it as *H. marginatum rufipes.*

References

Apanaskevich, D.A. & Horak, I.G. 2008. The genus *Hyalomma* Koch, 1844: V. Re-evaluation of the taxonomic rank of taxa comprising the *H.* (*Euhyalomma*) *marginatum* Koch complex of species (Acari: Ixodidae) with redescription of all parasitic stages and notes on biology. Int. J. Acarol., 34: 13–42.

Camicas, J.-L. 1970. Contribution à l'étude des tiques du Senegal (Acarina, Ixodoidea). I. Les larves de'*Amblyomma* Koch et de *Hyalomma* Koch. Acarologia, 12: 71–102.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Fourie, L.J., Horak, I.G. & Woodall, P.F. 2005. Elephant shrews as hosts of immature ixodid ticks. Onderstepoort J. Vet. Res., 72: 293–301.

Hoogstraal, H. 1956. African Ixodoidea. I. Ticks of the Sudan (with special reference to Equatoria Province and with preliminary reviews of the genera *Boophilus*, *Margaropus* and *Hyalomma*). Research Report NM 005 050.29.07, Department of the Navy Bureau of Medicine and Surgery, Washington D.C., 1101 pp.

Hoogstraal, H., Traylor, M.A., Gaber, S., Malakatis, G., Guindy, E. & Helmy, I. 1964. Ticks (Ixodidae) on migrating birds in Egypt, spring and fall 1962. Bull. World Health Org., 30: 355–367.

Kaiser, M.N., Hoogstraal, H. & Watson, G.E. 1974. Ticks (Ixodoidea) on migrating birds in Cyprus, fall 1967 and spring 1968, and epidemiological considerations. Bull. Entomol. Res., 64: 97–110.

Keirans, J.E. 1985. George Henry Falkiner Nuttall and the Nuttall tick catalogue. U. S. Dept. Agric., Agric. Res. Ser. Misc. Pub. (1438), 1785 pp.

Matthee, S., Lovely, C., Gaugler, A., Beeker, R., Venter, H.R. & Horak, I.G. 2010. Ixodid ticks on domestic dogs in the Northern Cape Province of South Africa and in Namibia. J. S. Afr. Vet. Assoc., 81: 126–128.

Morel, P.-C. 1958. Les tiques des animaux domestiques de l'Afrique Occidentale Française. Rev. Élev. Méd. Vét. Pays Trop., 11: 153–189.

Norval, R.A.I. 1982. The ticks of Zimbabwe. IV. The genus *Hyalomma*. Zimbabwe Vet. J., 13: 2–10.

Theiler, G. 1962. The Ixodoidea parasites of vertebrates in Africa south of the Sahara (Ethiopian Region). Report to the Director of Veterinary Services, Onderstepoort, South Africa, Project S.9958, 260 pp.

Van Niekerk, J., Fourie, L.J. & Horak, I.G. 2006. Birds as hosts of immature ixodid ticks in Free State Province, South Africa. Onderstepoort J. Vet. Res., 73: 123–130.

Walker, J.B. 1974. The ixodid ticks of Kenya. A review of present knowledge of their hosts and distribution. Commonwealth Institute of Entomology, London, 220 pp.

Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.

23 – *H. schulzei* Olenev, 1931 (Parazitol. Sborn. Zool. Inst. Akad. Nauk SSSR, 2: 249–261. In Russian)

Type depository: ZIAC (lectotype, paralectotypes) (Filippova, N.A. 2008. Type specimens of argasid and ixodid ticks (Ixodoidea: Argasidae, Ixodidae) in the collection of the Zoological Institute, Russian Academy of Sciences (St. Petersburg). Entomol. Rev., 88: 1002–1011)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: deserts and xeric shrublands

Hosts: usual hosts for adult ticks are Artiodactyla: Camelidae.
Artiodactyla: Bovidae, Camelidae (A)
Erinaceomorpha: Erinaceidae; Lagomorpha: Leporidae; Rodentia: Muridae (NL)

Human infestation: yes (Apanaskevich, D.A., unpublished, see below)

Remarks: because we consider *H. schulzei* to be a two-host tick, we do not separately record subadult ticks present on hosts. Camicas et al. (1998) indicate that the larva and nymph of *H. schulzei* are undescribed, but these stages were subsequently described by Apanaskevich (2002) and then redescribed by Apanaskevich et al. (2008). One of us (DAA) recently discovered *H. schulzei* feeding on a human.

References

Apanaskevich, D.A. 2002. Identification of species of the *Hyalomma asiaticum* group (Ixodidae) in areas of their sympatry, based on immature stages. Parazitologiya, 36: 271–279. In Russian.

Apanaskevich, D.A., Schuster, A.L. & Horak, I.G. 2008. The genus *Hyalomma* VII. Redescription of all parasitic stages of *H.* (*Euhyalomma*) *dromedarii* and *H.* (*E.*) *schulzei* (Acari: Ixodidae). J. Med. Entomol., 45: 817–831.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

24 – *H. scupense* Schulze, 1919 (Sber. Ges. Naturf. Freunde Berlin. (1–2): 61–66)
Until recently, many Western workers recognized this species as *H. detritum* Schulze, 1920 (the year of publication is generally considered 1919, but the description was actually published in 1920). To avoid confusion, Guglielmone et al. (2009, *op. cit.* under *H. excavatum*) proposed that the name be annotated "*H. scupense* (= *H. detritum*)." Apanaskevich, D.A., Filippova, N.A. & Horak, I.G. (2010. The genus *Hyalomma* Koch, 1844. X. Redescription of all parasitic stages of *H.* (*Euhyalomma*) *scupense* Schulze, 1919 (= *H. detritum* Schulze) (Acari: Ixodidae) and notes on its biology. Folia Parasitol., 57: 69–78) present solid evidence to support the validity of the name *H. scupense.* See remarks below.

Type depository: ZMB (syntypes) (Moritz and Fischer, 1981, *op. cit.* under *H. albiparmatum*)

Known stages: male, female, nymph, larva

Zoogeographic Regions: Oriental, Palearctic

Ecoregions: several ecoregions

Hosts: usual hosts for all stages of this tick are Artiodactyla: Bovidae, Camelidae, Suidae.
Artiodactyla (several families); Perissodactyla: Equidae

Human infestation: yes (Apanaskevich et al. 2010)

Remarks: because *H. scupense* is a one-host or two-host tick, we do not separately record the various life stages present on hosts. Hoogstraal (1956) refers to a few collections of *H. scupense* (as *H. detritum*) in Sudan (Afrotropical Region), but there is no certainty that the ticks were local. Burridge (2011) describes several introductions of *H. scupense* (as *H. detritum*) into the Nearctic Region, but there is no evidence that this species has become established there. Our host list is chiefly based on Apanaskevich et al. (2010). Morel (2003) (who uses the name *H. detritum*) recorded *H. scupense* on Canidae, Leporidae, Erinaceidae and an undetermined tortoise, while Bursali et al. (2012) recorded *H. scupense* on Leporidae, but we think that these records require confirmation and have tentatively excluded them from our list. Burridge (2011) provides an extensive list of hosts for *H. scupense* (referred to as *H. detritum*), including numerous birds, but, again, we consider many of these uncertain at best and therefore have not accepted them. Authors such as Teng and Jiang (1991) and Hubálek (2009) regard both *H. detritum* and *H. scupense* as valid.

References

Apanaskevich, D.A., Filippova, N.A. & Horak, I.G. 2010. The genus *Hyalomma* Koch, 1844. X. Redescription of all parasitic stages of *H.* (*Euhyalomma*) *scupense* Schulze, 1919 (= *H. detritum* Schulze) (Acari: Ixodidae) and notes on its biology. Folia Parasitol., 57: 69–78.

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Bursali, A., Keskin, A. & Tekin, S. 2012. A review of the ticks (Acari: Ixodida) of Turkey: species diversity, hosts and geographical distribution. Exp. Appl. Acarol., 57: 91–104.

Hoogstraal, H. 1956. African Ixodoidea. I. Ticks of the Sudan (with special reference to Equatoria Province and with preliminary reviews of the genera *Boophilus*, *Margaropus* and *Hyalomma*). Research Report NM 005 050.29.07, Department of the Navy Bureau of Medicine and Surgery, Washington D.C., 1101 pp.

Hubálek, Z. 2009. Biogeography of tick-borne Bhanja virus (*Bunyaviridae*) in Europe. Interdiscipl. Perspect. Infect. Dis., 2009 (372691), 11 pp

Morel, P.-C. 2003. Les tiques d'Afrique et du Bassin méditerranéen (1965–1995). CIRAD- EMVT, 1342 pp.
Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.

25 – *H. somalicum* Tonelli Rondelli, 1935 (Att. Soc. Ital. Sci. Nat., 74: 239–252)
This species was until recently classified as *H. erythraeum* Tonelli Rondelli 1932, but this epithet is a synonym of *H. impeltatum* and the name *H. somalicum* was resurrected by Apanaskevich and Horak (2009, *op. cit.* under *H. impeltatum*).

Type depository: ICA (lost?) (Tonelli Rondelli, M. 1935. Ixodoidea del Fezzan e della Somalia italiana raccolti dal prof. E. Zavattari e dal prof. C. Tedeschi. Att. Soc. Ital. Sci. Nat., 74: 239–252), but Apanaskevich, D.A. and Horak, I.G. (2009, *op. cit*. under *H. impeltatum*) failed to confirm the presence of types in ICA.

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: xeric grassland and shrublands

Hosts: Artiodactyla: Bovidae, Camelidae; Perissodactyla: Equidae (A)

Human infestation: no

Remarks: although the larva and nymph of *H. somalicum* are known, their natural hosts have not been determined (Apanaskevich and Horak 2009). Kolonin (2009), who refers to this species as *H. erythraeum*, does not regard equids as natural hosts, but we consider the host data in Apanaskevich and Horak (2009) sound.

References

Apanaskevich, D.A. & Horak, I.G. 2009. The genus *Hyalomma* Koch, 1844. IX. Redescription of all parasitic stages of *H.* (*Euhyalomma*) *impeltatum* Schulze & Schlottke, 1930 and *H.* (*E.*) *somalicum* Tonelli Rondelli, 1935 (Acari: Ixodidae). Syst. Parasitol., 73: 199–218.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

26 – *H. truncatum* Koch, 1844 (Arch. Naturgesch., 10: 217–239)
See *H. albiparmatum* and *H. nitidum.*

Type depository: ZMB (holotype) (Moritz and Fischer, 1981, *op. cit.* under *H. albiparmatum*)

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: several ecoregions within the Afrotropical Region

Hosts: usual hosts for adult ticks are Artiodactyla Bovidae; usual hosts for larvae and nymphs are Lagomorpha: Leporidae and Rodentia (several families).

Macroscelidea, Squamata and Testudines are exceptional hosts for this species, while Aves are exceptional hosts for nymphs and larvae.
Mammalia (several orders) (ANL)
Charadriiformes: Burhinidae; Falconiformes: Accipitridae; Struthioniformes: Struthionidae; Testudines: Testudinidae (A)
Galliformes: Numididae, Phasianidae (NL)
Passeriformes: Alaudidae; Squamata: Chamaeleonidae (N)
Aves (several orders) (L)
Columbiformes: Columbidae; Gruiformes: Otidae; Squamata: Agamidae (stages unknown)

Human infestation: yes (Burridge 2011)

Remarks: Camicas et al. (1998) indicate that the nymph of *H. truncatum* is undescribed, but this stage was subsequently described by Apanaskevich and Horak (2008). Burridge (2011) records several introductions of this tick into the Nearctic Region, but there is no evidence that it has become established there. There are also many records of this tick from the Palearctic Region, but it is unclear whether *H. truncatum* occurs there, and we tentatively treat this species as exclusively Afrotropical. Apanaskevich and Horak (2008) believe that most reports of immature stages of *H. truncatum* from Aves are probably misidentifications; therefore, these records are considered tentative, as are the records from Squamata in Burridge (2011). Theiler (1959) lists a number of adult *H. truncatum* specimens from several orders of Aves, most collected by F. Zumpt; however, Zumpt (1958) refers only to sub-adult *H. truncatum* on birds. For this reason, we have excluded the avian records of this tick in Theiler (1959). Kolonin (2009) recognizes only Mammalia as hosts of *H. truncatum.* Fourie et al. (2005) treat the few immature stages of this tick found on Macroscelidea as "stragglers." One of us (DAA) intensively studied collections of *H. truncatum* from various museums and found that many records of this tick (especially larvae and nymphs) must be considered tentative. Therefore, even our own list is tentative because several records, mainly from unusual hosts, require confirmation. See also *H. nitidum.*

References

Apanaskevich, D.A. & Horak, I.G. 2008. The genus *Hyalomma.* VI. Systematics of *H.* (*Euhyalomma*) *truncatum* and the closely related species, *H.* (*E.*) *albiparmatum* and *H.* (*E.*) *nitidum* (Acari: Ixodidae). Exp. Appl. Acarol., 44: 115–136.

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Colbo, M.H. 1973. Ticks of Zambian wild animals: a preliminary checklist. Puku (7): 97–105.

Fourie, L.J., Horak, I.G. & Woodall, P.F. 2005. Elephant shrews as hosts of immature ixodid ticks. Onderstepoort J. Vet. Res., 72: 293–301.
Harrison, A., Robb, G.N., Bennett, N.C. & Horak, I.G. 2012. Differential feeding success of two paralysis-inducing ticks, *Rhipicephalus warburtoni* and *Ixodes rubicundus* on sympatric small mammal species, *Elephantulus myurus* and *Micaelamys namaquensis.* Vet. Parasitol., 188: 346–354.
Hoogstraal, H. 1956. African Ixodoidea. I. Ticks of the Sudan (with special reference to Equatoria Province and with preliminary reviews of the genera *Boophilus*, *Margaropus* and *Hyalomma*). Research Report NM 005 050.29.07, Department of the Navy Bureau of Medicine and Surgery, Washington D.C., 1101 pp.
Horak, I.G. & MacIvor, K.M. de F. 1987. The scrub hare, a reliable indicator of the presence of *Hyalomma* ticks in the Cape Province. J. S. Afr. Vet. Assoc., 58: 15–19.
Horak, I.G., Braack, L.E.O., Fourie, L.J. & Walker, J.B. 2000. Parasites of domestic and wild animals in South Africa. XXXVIII. Ixodid ticks collected from 23 wild carnivore species. Onderstepoort J. Vet. Res., 67: 239–250.
Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/
Morel, P.-C. 1958. Les tiques des animaux domestiques de l'Afrique Occidentale Française. Rev. Élev. Méd. Vét. Pays Trop., 11: 153–189.
Norval, R.A.I. 1982. The ticks of Zimbabwe. IV. The genus *Hyalomma*. Zimbabwe Vet. J., 13: 2–10.
Theiler, G. 1959. African ticks and birds. Ostrich (Suppl. 3), 3: 353–378.
Zumpt, F. 1958. A preliminary survey of the distribution and host-specificity of ticks (Ixodoidea) in the Bechuanaland Protectorate. Bull. Entomol. Res., 49: 201–223.

27 – *H. turanicum* Pomerantzev, 1946 (Ticks (Family Ixodidae) of the USSR and adjacent countries. Nauka, Moscow, 28 pp. In Russian)
As reported in Guglielmone et al. (2009, *op. cit.* under *H. excavatum*), this tick was previously considered a subspecies of *H. marginatum*, a view shared by Kolonin, G.V. (2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/). See also *H. glabrum.*

Type depository: ZIAC (lectotype, paralectotypes) (Filippova, 2008, *op. cit.* under *H. schulzei*) as *H. marginatum turanicum.*

Known stages: male, female, nymph, larva

Zoogeographic Regions: Afrotropical, Oriental, Palearctic

Ecoregions: several ecoregions

Hosts: usual hosts of adult ticks are Artiodactyla: Bovidae and Camelidae; usual hosts of nymphs and larvae are Lagomorpha: Leporidae, and Aves (several orders).
Lagomorpha: Leporidae (ANL)
Artiodactyla: Bovidae, Camelidae, Suidae; Perissodactyla: Equidae (A)
Aves (several orders) (NL)

Human infestation: yes (Apanaskevich and Horak 2008)

Remarks: because we consider *H. turanicum* to be a two-host tick, we do not separately record subadult ticks present on hosts. Camicas et al. (1998) indicate that the nymph and larva of *H. turanicum* are undescribed, but they were subsequently described by Apanaskevich (2003) (as subspecies *H. marginatum turanicum*) and redescribed by Apanaskevich and Horak (2008) as *H. turanicum.* Theiler (1959) includes several records of *H. turanicum* adults from various orders of Aves; most of these records are based on Hoogstraal (1956). However, Hoogstraal (1956) discusses sub-adults rather than adult *H. turanicum*. Consequently, we have excluded the avian records of this tick in Theiler (1959).

References

Apanaskevich, D.A. 2003. Discrimination of subspecies in a polymorphic species *Hyalomma marginatum* (Acari, Ixodidae) based on immature stages. Parazitologiya, 37: 462–472. In Russian.

Apanaskevich, D.A. & Horak, I.G. 2008. The genus *Hyalomma* Koch, 1844: V. Re-evaluation of the taxonomic rank of taxa comprising the *H.* (*Euhyalomma*) *marginatum* Koch complex of species (Acari: Ixodidae) with redescription of all parasitic stages and notes on biology. Int. J. Acarol., 34: 13–42.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Hoogstraal, H. 1956. African Ixodoidea. I. Ticks of the Sudan (with special reference to Equatoria Province and with preliminary reviews of the genera *Boophilus*, *Margaropus* and *Hyalomma*). Research Report NM 005 050.29.07, Department of the Navy Bureau of Medicine and Surgery, Washington D.C., 1101 pp.

Hoogstraal, H., Wassef, H.Y. & Büttiker, W. 1981. Ticks (Acarina) of Saudi Arabia. Fam. Argasidae, Ixodidae. Fauna Saudi Arabia, 3: 25–110.

Theiler, G. 1959. African ticks and birds. Ostrich (Suppl. 3), 3: 353–378.

Synopsis of the Genus *Hyalomma*

A synopsis of the genus *Hyalomma* is presented in Tables 1 and 2. The Afrotropical Region contains the greatest number of species found exclusively in one region (eight), while the Oriental Region contains the least number of species confined to a single region (three). The genus *Hyalomma* is absent from the Australasian, Nearctic and Neotropical Zoogeographic Regions. Three species – *H. anatolicum*, *H. dromedarii* and *H. turanicum* – are widely distributed, occurring in the Afrotropical, Oriental and Palearctic Regions, but as a genus hyalommines are confined to six combinations of these regions (Table 1).

Our overall analyses indicate that 11 species (41 %) occur in regions that constituted Gondwanaland, seven species (26 %) are found in the Palearctic

Table 1 Numbers and percentages of all species of *Hyalomma*, by zoogeographic region(s), number known to feed on humans (% of the total number of species in a particular region) and number of species for which all stages (larva, nymph, male and/or female) are known (% of the total number of species in a particular region)

Regions	No. of species	%	No. of species on humans	No. of species of which all stages are known
Afrotropical	8	29.6	3 (37.5)	7 (87.5)
Palearctic	7	25.9	5 (71.4)	7 (100)
Oriental	3	11.1	2 (66.7)	2 (66.7)
Afrotropical-Palearctic	3	11.1	3 (100)	3 (100)
Oriental-Palearctic	3	11.1	2 (66.7)	3 (100)
Afrotropical-Oriental-Palearctic	3	11.1	3 (100)	3 (100)
Total	**27**		**18 (66.7)**	**25 (92.6)**

Table 2 Numbers and percentages of the 23 species of *Hyalomma* whose adult (female and/or male), larval and nymphal stages as well as natural hosts are known, including or excluding exceptional hosts

	No. of species	%	No. of species	%
Hosts	Including exceptional hosts		Excluding exceptional hosts	
Aves + Mammalia	9	39.1	7	30.4
Mammalia	6	26.1	12	52.2
Aves + Mammalia + Squamata	5	21.7	1	4.3
Aves + Mammalia + Squamata + Testudines	2	8.7	0	0
Mammalia + Squamata + Testudines	1	4.3	0	0
Mammalia + Squamata	0	0	2	8.7
Testudines	0	0	1	4.3
Total	**23**		**23**	

portion of Laurasia, and the remaining nine species occur in lands that were part of both ancient continents.

The larva, nymph and at least one adult stage are known for 25 (93 %) of the 27 species of *Hyalomma*. The larva and nymph of the Oriental *H. hystricis* and the Afrotropical *H. punt* remain unknown.

A total of 18 species (67 %) have been recorded as feeding on humans.

Host usage by the 23 species of *Hyalomma* whose adult (female and/or male) and sub-adult stages are known, along with their natural hosts, is presented in Table 2, first including exceptional hosts, and then excluding these hosts. All parasitic stages of the Afrotropical species *H. albiparmatum* and *H. somalicum* are known, but there is uncertainty concerning the larval and nymphal hosts of these species, which have therefore been excluded from our analysis.

Hyalomma ticks fall into five categories of host utilization (Table 2) when exceptional hosts are included. The only exclusive host for this genus is

Mammalia (six species, 26 % of the total), but Mammalia are exclusive or non-exclusive hosts for all species. The most common combination of hosts is Aves + Mammalia (nine species, 39 %) followed by Aves + Mammalia + Squamata (five species, 22 %), and Aves + Mammalia + Squamata + Testudines (two species, 9 %). The combination Mammalia + Squamata + Testudines applies only to the Palearctic *H. franchinii*. Aves are non-exclusive hosts for 16 species (70 % of the total). The contributions of Squamata and Testudines as non-exclusive of hosts of *Hyalomma* ticks are eight (35 %) and three (13 %), respectively, of the 23 species included in the analysis. The share of Anura and Crocodilia as *Hyalomma* hosts is nil.

The situation changes, but not drastically, when exceptional hosts are excluded from the analysis. Again, five categories of host utilization are revealed (Table 2) because the combinations Mammalia + Squamata + Testudines, and Aves + Mammal ia + Squamata + Testudines drop out, but the categories Mammalia + Squamata, and Testudines now appear. Mammalia increases its share as exclusive hosts for 12 species (52 %), Aves are now non-exclusive hosts for eight species (35 %), and Squamata and Testudines for three (13 %) and one species, respectively. Although the contribution of Testudines may seem insignificant, the Palearctic *H. aegyptium* is dependent on this type of parasitism for its survival.

Part VII
The Genera *Anomalohimalaya*, *Bothriocroton*, *Cosmiomma*, *Compluriscutula*, *Cornupalpatum*, *Margaropus*, *Nosomma* and *Rhipicentor*

The Genus *Anomalohimalaya*

1 – *A. cricetuli* Teng & Huang, 1981 (Acta Entomol. Sin., 24: 99–102. In Chinese) Deng, G.L., Jiang, W., Ye, R.Y. et al. [sic] (1999. The fauna of ticks and mites in the Yeerqiang River Valley in Xinjiang, China. Endemic Dis. Bull., 14: 55–57. In Chinese) consider *A. cricetuli* a synonym of *A. lotozkyi*, but Guglielmone, A.A., Robbins, R.G., Apanaskevich, D.A., Petney, T.N., Estrada-Peña, A., Horak, I.G., Shao, R. & Barker, S.C. (2010. The Argasidae, Ixodidae and Nuttalliellidae (Acari: Ixodida) of the world: a list of valid species names. Zootaxa, 2528: 1–28) treat *A. cricetuli* as a valid species because no evidence has been provided to support its synonymy. Nevertheless, Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. (2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404) did not list *A. cricetuli* as part of the ixodid fauna of China, and, again, no reason for its exclusion is given.

Type depository: IZAS (holotype, paratypes) (Teng, K.-F. & Huang, C.-A. 1981. A new species of tick of the genus *Anomalohimalaya* from China (Acarina: Ixodidae). Acta Entomol. Sin., 24: 99–102. In Chinese)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregions: montane grasslands and shrublands

Hosts: Rodentia: Cricetidae (ANL)

Rodentia: Muridae (NL)

Human infestation: no

Remarks: Camicas et al. (1998) list only the male and female of *A. cricetuli* as having been described, but we regard the description of the larva and nymph in Filippova and Bardzimashvily (1992) as valid. In their redescription of the larva, these authors also emphasize that this stage lacks eyes, in contrast to the original description of

DOI 10.1007/978-94-007-7497-1_14,

Teng and Huang (1981) and the later description of Teng and Jiang (1991). Durden and Keirans (1996) list *A. cricetuli* as an endangered species.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition (Acarida, Ixodida). ORSTOM, Paris, 233 pp.

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91

Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian.

Filippova, N.A. & Bardzimashvily, E.A. 1992. *Anomalohimalaya cricetuli* (Ixodoidea: Ixodidae) in the mountains of Central Asia and differential diagnosis of female and nymph. Parazitologiya, 26: 403–408. In Russian.

Teng, K.-F. & Huang, C.-A. 1981. A new species of tick of the genus *Anomalohimalaya* from China (Acarina: Ixodidae). Acta Entomol. Sin., 24: 99–102. In Chinese.

Teng, K.-F. & Jiang, Z.-J. 1991. Economic insect of fauna of China. Fasc. 39, Acari: Ixodidae. Science Press, Beijing, 355 pp. In Chinese.

2 – *A. lamai* Hoogstraal, Kaiser & Mitchell, 1970 (Ann. Entomol. Soc. Wash., 63: 1576–1585)

Type depositories: USNTC (holotype, paratypes), BMNH, FMNH, VRC, ZIAC (paratypes) (Keirans, J.E. & Hillyard, P.D. 2001. A catalogue of the type specimens of Ixodida (Acari: Argasidae, Ixodidae) deposited in The Natural History Museum, London. Occ. Pap. Syst. Entomol. (13), 74 pp.), originally named *A. lama*

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic

Ecoregion: eastern Himalayan broadleaf forests

Hosts: Rodentia: Cricetidae (ANL)
Rodentia: Muridae; Soricomorpha: Soricidae (NL)
Lagomorpha: Leporidae (N)

Human infestation: no

Remarks: Camicas et al. (1998) state that *A. lamai* occurs within the Oriental and Palearctic Zoogeographic Regions, but we have been unable to locate Oriental collections of this species. Durden and Keirans (1996) list *A. lamai* as an endangered species.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature,stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.
Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.
Hoogstraal, H., Kaiser, M.N. & Mitchell, R.M. 1970. *Anomalohimalya lama*, new genus and new species (Ixodoidea: Ixodidae), a tick parasitizing rodents, shrews, and hares in the Tibetan highland of Nepal. Ann. Entomol. Soc. Am., 63: 1576–1585.

3 – *A. lotozkyi* Filippova & Panova, 1978 (Parazitologiya, 12: 391–399. In Russian) See *A. cricetuli.*

Type depository: ZIAC (holotype, paratypes) (Filippova, N.A. 2008. Type specimens of argasid and ixodid ticks (Ixodoidea: Argasidae, Ixodidae) in the collection of the Zoological Institute, Russian Academy of Sciences (St. Petersburg). Entomol. Rev., 88: 1002–1011)

Known stages: male, female, nymph, larva

Zoogeographic Region: Palearctic.

Ecoregions: temperate grasslands, savannas and shrublands

Hosts: Rodentia: Cricetidae (NL)

Human infestation: no

Remarks: male and female *A. lotozkyi* are only known from laboratory-reared specimens (Filippova 1997). Durden and Keirans (1996) list *A. lotozkyi* as an endangered species.

References

Chen, Z., Yang, X., Bu, F., Yang, X., Yang, X. & Liu, J. 2010. Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of China. Exp. Appl. Acarol., 51: 393–404.
Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.
Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka, St. Petersburg, 436 pp. In Russian.

Comments on the Genus *Anomalohimalaya*

All species of *Anomalohimalaya* are found only in the Palearctic Region, where they feed only on mammals. All parasitic stages are known for the three species in the genus, but the natural hosts of adults of *A. lotozkyi* are unknown.

The Genus *Bothriocroton*

Kolonin, G.V. (2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/) does not consider this genus valid and includes all seven species below in the genus *Aponomma.* See also the first paragraph in the chapter on *Amblyomma.*

1 – *B. auruginans* Schulze, 1936 (Z. Parasitenkd., 8: 619–637)

Type depository: ZSH (holotype) (Kaufman, T.S. 1972. A revision of the genus *Aponomma* Neumann, 1899 (Acarina: Ixodidae). Ph.D. Dissertation, University of Maryland, 390 pp.) as *Aponomma auruginans*.

Known stages: male, female, nymph, larva

Zoogeographic Region: Australasian

Ecoregions: temperate grasslands, savannas and shrublands

Hosts: usual hosts for larvae, nymphs and adults are Diprotodontia: Vombatidae. Carnivora: Canidae are considered exceptional hosts for this tick.
Diprotodontia: Vombatidae (ANL)
Carnivora: Canidae (N)

Human infestation: yes (Stewart 1991)

Remarks: the authors listed below consider this species a member of the genus *Aponomma*.

References

Kaufman, T.S. 1972. A revision of the genus *Aponomma* Neumann, 1899 (Acarina: Ixodidae). Ph.D. Dissertation, University of Maryland, 390 pp.

Stewart, R.S. 1991. Flinders Island spotted fever: newly recognized endemic focus of tick typhus in Bass Strait. Part 1. Clinical and epidemiological features. Med. J. Austr., 154: 94–99.

DOI 10.1007/978-94-007-7497-1_15,

2 – *B. concolor* Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294)
See *B. oudemansi*.

Type depository: ZMB (holotype) (Moritz, M. & Fischer, S.C. 1981. Die Typen der Arachniden-Sammlung des Zoologischen Museums Berlin. Mitt. Zool. Mus. Berlin, 57: 341–364) as *Aponomma concolor*.

Known stages: male, female, nymph, larva

Zoogeographic Region: Australasian

Ecoregions: eastern and southeastern Australasian temperate forests; Murray-Darling woodlands and mallee

Hosts: usual hosts for larvae, nymphs and adults are Monotremata: Tachyglossidae.
Monotremata: Tachyglossidae (ANL)
Diprotodontia: Macropodidae (AN)

Human infestation: no

Remarks: records of *B. concolor* on cattle, horses and Peramelidae are considered doubtful by Roberts (1970) and are not included in our list of hosts for this species. Burridge (2011) lists Varanidae as hosts of *A. concolor*, but we have been unable to confirm this finding. There is a United States Department of Agriculture (1974) record of the introduction of *B. concolor* into the Nearctic Region, but it has not become established there. With the exception of Oorebeek and Rismiller (2007) and Beati et al. (2008), the authors listed below consider this species a member of the genus *Aponomma*. Kolonin (2009) reduces the references for *B. concolor* to Roberts (1970) and Kaufman (1972). See also *B. hydrosauri*.

References

Beati, L., Keirans, J.E., Durden, L.A. & Opiang, M.D. 2008. *Bothriocroton oudemansi* (Neumann, 1910) n. comb. (Acari: Ixodida: Ixodidae), an ectoparasite of the western long-beaked echidna in Papua New Guinea: redescription of the male and first description of the female and nymph. Syst. Parasitol., 69: 185–200.

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Kaufman, T.S. 1972. A revision of the genus *Aponomma* Neumann, 1899 (Acarina: Ixodidae). Ph.D. Dissertation, University of Maryland, 390 pp.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Oorebeek, M. & Rismiller, P. 2007. *Bothriocroton concolor* (Acari: Ixodidae) on the Kangaroo Island. Kangaroo: a new host-parasite relationship. J. Med. Entomol., 44: 901–902.

Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.

United States Department of Agriculture. 1974. National tick surveillance program, calendar year 1973. Animal & Plant Health Inspection Service, U. S. Department of Agriculture, Hyattsville, Maryland. APHIS 91–22, 15 pp.

3 – *B. glebopalma* Keirans, King & Sharrad, 1994 (J. Med. Entomol., 31: 132–147)

Type depositories: WAM (holotype, paratypes), BMNH, NTMD, USNTC (paratypes) (Keirans and Hillyard 2001, *op. cit*. under *Anomalohimalaya lamai*) as *Aponomma glebopalma*

Known stages: male, female, nymph, larva

Zoogeographic Region: Australasian

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: Squamata: Varanidae (ANL)

Human infestation: no

Reference

Keirans, J.E., King, D.R. & Sharrad, R.D. 1994. *Aponomma* (*Bothriocroton*) *glebopalma*, n. subgen., and *Amblyomma glauerti* n. sp. (Acari: Ixodida: Ixodidae), parasites of monitor lizards (Varanidae) in Australia. J. Med. Entomol., 31: 132–147.

4 – *B. hydrosauri* Denny, 1843 (Ann. Mag. Nat. Hist., 12: 312–316)

Type depository: not stated in Denny, H. (1843. Description of six supposed new species of parasites. Ann. Mag. Nat. Hist., 12: 312–316) as *Ixodes hydrosauri*

Known stages: male, female, nymph, larva

Zoogeographic Region: Australasian

Ecoregions: mediterranean forests, woodlands and scrub; temperate broadleaf and mixed forests

Hosts: usual hosts for larvae, nymphs and adults are Squamata: Scincidae, while Mammalia and Testudines are considered exceptional hosts for this tick.
Squamata: Elapidae, Scincidae; Monotremata: Tachyglossidae (ANL)
Squamata: Agamidae (AL)
Artiodactyla: Bovidae; Squamata: Varanidae (A)
Testudines: Chelidae (N)
Perissodactyla: Equidae? (N)
Rodentia: Muridae (stage(s) unknown)

Human infestation: yes (Graves et al. 1993)

Remarks: records of *B. hydrosauri* on Monotremata are considered tentative since most of the ticks involved were found to be either *B. tachyglossi* or *B. concolor* by Andrews et al. (2006), who classified these species in the genus *Aponomma.* These authors also think it probable that the record of a nymph of *B. hydrosauri* on Equidae was actually *B. tachyglossi*. Keirans and Durden (2001) record a single introduction of *B. hydrosauri* (then named *A. hydrosauri*) into the Nearctic Region, but there is

no evidence that it has become established there. Beati et al. (2008) examined specimens of *B. hydrosauri* from Muridae (stage of development not given), but this record, which we consider valid, is not included in Kolonin (2009) or Burridge (2011). See also *B. tachyglossi.*

References

Andrews, R.H., Beveridge, I., Bull, C.M., Chilton, N.B., Dixon, B. & Petney, T.N. 2006. Systematic status of *Aponomma tachyglossi* Roberts (Acari: Ixodidae) from echidnas, *Tachyglossus aculeatus*, from Queensland, Australia. Syst. Appl. Acarol., 11: 23–39.

Beati, L., Keirans, J.E., Durden, L.A. & Opiang, M.D. 2008. *Bothriocroton oudemansi* (Neumann, 1910) n. comb. (Acari: Ixodida: Ixodidae), an ectoparasite of the western long-beaked echidna in Papua New Guinea: redescription of the male and first description of the female and nymph. Syst. Parasitol., 69: 185–200.

Burridge, M.J. 2011. Non-native and invasive ticks. Threats to human and animal health in the United States. University of Florida Press, Gainesville, 448 pp.

Graves, S.R., Stewart, L., Stenos, J., Stewart, R.S., Schmidt, E., Hudson, S., Banks, J., Huang, Z. & Dwyer, B. 1993. Spotted fever group rickettsial infection in south-eastern Australia: isolation of Rickettsiae. Comp. Immunol. Micriobiol. Inf. Dis., 16: 223–233.

Kaufman, T.S. 1972. A revision of the genus *Aponomma* Neumann, 1899 (Acarina: Ixodidae). Ph.D. Dissertation, University of Maryland, 390 pp.

Keirans, J.E. & Durden, L.A. 2001. Invasion: exotic ticks (Acari: Argasidae, Ixodidae) imported into the United States. A review and new records. J. Med. Entomol., 38: 850–861.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

5 – *B. oudemansi* Neumann, 1910 (Tijdschr. Entomol., 53: 11–17)
This species was considered a synonym of *B. concolor*, but Beati, L., Keirans, J.E., Durden, L.A. & Opiang, M.D. (2008. *Bothriocroton oudemansi* (Neumann, 1910) n. comb. (Acari: Ixodida: Ixodidae), an ectoparasite of the western long-beaked echidna in Papua New Guinea: redescription of the male and first description of the female and nymph. Syst. Parasitol., 69: 185–200) present solid evidence for its validity.

Type depositories: ZMA (lectotype, paralectotypes), BMNH (paralectotype) (Santos Dias, J.A.T. 1993. Contribuição para o estudo da sistemática e taxonomia das espécies do género *Aponomma* Neumann, 1899 (Acarina-Ixodoidea). Estud. Ens. Doc. (157), 204 pp.; Keirans and Hillyard, 2001, *op. cit*. under *Anomalohimalaya lamai*) as *Aponomma oudemansi*.

Known stages: male, female, nymph

Zoogeographic Region: Australasian

Ecoregions: tropical and subtropical moist broadleaf forests

Hosts: Monotremata: Tachyglossidae (AN)

Human infestation: no

Remarks: Beati et al. (2008) consider *B. oudemansi* an endangered species.

Reference

Beati, L., Keirans, J.E., Durden, L.A. & Opiang, M.D. 2008. *Bothriocroton oudemansi* (Neumann, 1910) n. comb. (Acari: Ixodida: Ixodidae), an ectoparasite of the western long-beaked echidna in Papua New Guinea: redescription of the male and first description of the female and nymph. Syst. Parasitol., 69: 185–200.

6 – *B. tachyglossi* Roberts, 1953 (Aust. J. Zool., 1: 111–161)
This species was considered a synonym of *B. hydrosauri*, but Andrews, R.H., Beveridge, I., Bull, C.M., Chilton, N.B., Dixon, B. & Petney, T.N. (2006. Systematic status of *Aponomma tachyglossi* Roberts (Acari: Ixodidae) from echidnas, *Tachyglossus aculeatus*, from Queensland, Australia. Syst. Appl. Acarol., 11: 23–39) present sound scientific evidence for the validity of *B. tachyglossi* and retain it in the genus *Aponomma.*

Type depositories: QM (holotype, paratypes), ANIC (paratypes) (Roberts, F.H.S. 1953. The Australian species of *Aponomma* and *Amblyomma* (Ixodoidea). Aust. J. Zool., 1: 111–161) as *Aponomma tachyglossi*

Known stages: male, female, nymph, larva

Zoogeographic Region: Australasian

Ecoregion: eastern Australasian temperate forests

Hosts: usual hosts for all parasitic stages are Monotremata: Tachyglossidae.
Monotremata: Tachyglossidae (ANL)
Artiodactyla: Bovidae (A)
Perissodactyla: Equidae? (N)

Human infestation: no

Remarks: Andrews et al. (2006) reexamined specimens of *B. hydrosauri* collected from Monotremata and found them to be *B. tachyglossi.* The same results were obtained with most specimens collected from Bovidae. There is a record of a *B. hydrosauri* nymph from Equidae, but these authors think it is probably *B. tachyglossi* because the locality corresponds to the known distribution of this species.

Reference

Andrews, R.H., Beveridge, I., Bull, C.M., Chilton, N.B., Dixon, B. & Petney, T.N. 2006. Systematic status of *Aponomma tachyglossi* Roberts (Acari: Ixodidae) from echidnas, *Tachyglossus aculeatus*, from Queensland, Australia. Syst. Appl. Acarol., 11: 23–39.

7 – *B. undatum* Fabricius, 1775 (*In Systema entomologiae, sistens insectorum classes, ordines, genera, species, adiectis synonymis, locos, descriptionibus, observationibus.* Kortim Flensburgi et Lipsiae, 832 pp.)
Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. (1998. Les tiques du monde. Nomenclature (Acarida, Ixodida), stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.) consider this species a synonym of *Aponomma decorosum* (Koch, 1867), while Kolonin, G.V. (2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/) lists this species as "?*A. undatum*" below the name *A. decorosum*, implying that the former name is a synonym of the latter. This is incorrect because the name *undatum* has priority over *decorosum.* Moreover, Roberts, F.H.S. (1964. Further observations on the Australian species of *Aponomma* and *Amblyomma* with descriptions of the nymphs of *Amblyomma moreliae* (L. Koch) and *Amb. loculosum* Neumann (Acarina: Ixodidae). Aust. J. Zool., 12: 288–313) was able to identify the male of *B. undatum* (then named *Aponomma undatum*) using characters cited in the original description. Santos Dias (1993, *op. cit.* under *Bothriocroton oudemansi*) explains the problems related to the identification of tick specimens belonging to this species, of which the synonyms include *B. decorosum* (all these species are included in *Aponomma*). We consequently follow this author and Guglielmone et al. (2010, *op. cit.* under *Anomalohimalaya cricetuli*).

Type depository: probably ZMUC, but lost (Scharf, N. personal communication to Guglielmone, A.A.). This species was originally named *Acarus undatus*.

Known stages: male, female, nymph

Zoogeographic Region: Australasian

Ecoregions: temperate, tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for adult ticks are Squamata: Varanidae.
Squamata: Varanidae (AN)
Squamata: Boidae, Scincidae; Monotremata: Tachyglossidae (A)

Human infestation: no

Remarks: Dantas-Torres et al. (2009) report the introduction of *B. undatum* into the Neotropical Region, but there is no evidence that it has become established there. Kaufman (1972) refers to this tick as *Aponomma decorosum*, and Roberts (1970) refers to it as *Aponomma undatum.*

References

Dantas-Torres, F., Onofrio, V.C. & Barros-Battesti, D.M. 2009. The ticks (Acari: Ixodidae: Argasidae, Ixodidae) of Brazil. Syst. Appl. Acarol., 14: 30–46.
Kaufman, T.S. 1972. A revision of the genus *Aponomma* Neumann, 1899 (Acarina: Ixodidae). Ph.D. Dissertation, University of Maryland, 390 pp.
Roberts, F.H.S. 1970. Australian ticks. CSIRO, Melbourne, 267 pp.

Comments on the Genus *Bothriocroton*

All seven species in this genus are found exclusively in the Australasian Region, and with the exception of *B. oudemansi* and *B. undatum*, where the larval stage is unknown, all parasitic stages of each species have been described. Three species whose larva, nymph and adult stages are known feed exclusively on Mammalia, while *B. glebopalma* has been found only on Squamata. *Bothriocroton hydrosauri* has been collected on Squamata and Mammalia, but mammals are considered exceptional hosts for this tick.

The Genus *Cosmiomma*

1 – *C. hippopotamensis* Denny, 1843 (Ann. Mag. Nat. Hist., 12: 312–316)
The female and male of this species were described as *Ixodes bimaculatus* on page 312 and *Ixodes hippopotamensis* on page 313, respectively, by Denny, H. (1843, *op. cit*. under *Bothriocroton hydrosauri*), although Walker, J.B. (1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in Southern Africa. Onderstepoort J. Vet. Res., 58: 81–105) states the opposite. Santos Dias, J.A.T. (1958. Notes on various ticks (Acarina-Ixodoidea) in collection at some entomological institutes in Paris and London. An. Inst. Med. Trop., 15: 459–563) states that the name *bimaculatus* has page priority; therefore, he considers this name valid for the species. However, Koch, C.L. (1844. Systematische Übersicht über die Ordnung der Zecken. Arch. Naturgesch., 10: 217–239) reclassified this species within the genus *Amblyomma* and was the first to treat both names as synonyms with *A. hippopotamensis* (named as *A. hippopotami*) the senior synonym and *A. bimaculatum* the junior synonym. This act is in accord with article 24 of the International Code of Zoological Nomenclature (1999, 4th edition, The International Trust for Zoological Nomenclature, London, 306 pp.) under provision 24.4.2. "Determination of precedence of names or acts by the First Reviser", and the name *hippopotamensis* should thus be considered valid.

Type depository: not stated in Denny, H. (1843, *op. cit*. under *Bothriocroton hydrosauri*). Santos Dias (1958, *op. cit.* above) examined the syntype series of *I. bimaculatus* and *I. hippopotamensis* deposited in BMNH, although Keirans and Hillyard (2001, *op. cit.* under *Anomalohimalaya lamai*) do not record them as being deposited in BMNH.

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregion: Zambezian flooded grasslands

Hosts: Artiodactyla: Hippopotamidae; Perissodactyla: Rhinocerotidae (A)

A.A. Guglielmone et al., *The Hard Ticks of the World: (Acari: Ixodida: Ixodidae)*,
DOI 10.1007/978-94-007-7497-1_16, © Springer Science+Business Media Dordrecht 2014

Human infestation: no

Remarks: Walker (1991) states that a record on Bovidae is probably incorrect and did not include it in her list of hosts of *C. hippopotamensis*. Cumming (1998) includes this record but ignores *bona fide* records from Perissodactyla. Bovidae are not included in our list of hosts for this tick. Durden and Keirans (1996) list this tick as endangered.

References

Cumming, G.S. 1998. Host preference in African ticks (Acari: Ixodida): a quantitative data set. Bull. Entomol. Res., 88: 379–406.

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.

Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.

The Genus *Compluriscutula* (Fossil)

Kolonin, G.V. (2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/) ignores this genus. It is unclear whether he considers it invalid or whether he regards fossil genera as outside his frame of reference.

1 – *C. vetulum* Poinar & Buckley, 2008 (Proc. Entomol. Soc. Wash., 110: 445–450)

Type depository: BAC (holotype) (Poinar, G.O. & Buckley, R. 2008. *Compluriscutula vetulum* (Acari: Ixodida: Ixodidae), a new genus and species of hard tick from lower Cretaceous Burmese amber. Proc. Entomol. Soc. Wash., 110: 445–450)

Known stages: larva

Zoogeographic Region: undetermined

Ecoregion: undetermined

Hosts: unknown

Human infestation: no

Remarks: this species is of great phylogenetic importance because it is one of the oldest fossil Ixodidae (section Metastriata), dating from 100 mya. See also *Cornupalpatum burmanicum.*

Reference

Poinar, G.O. & Buckley, R. 2008. *Compluriscutula vetulum* (Acari: Ixodida: Ixodidae), a new genus and species of hard tick from lower Cretaceous Burmese amber. Proc. Entomol. Soc. Wash., 110: 445–450.

A.A. Guglielmone et al., *The Hard Ticks of the World: (Acari: Ixodida: Ixodidae)*,
DOI 10.1007/978-94-007-7497-1_17,

The Genus *Cornupalpatum* (Fossil)

Kolonin, G.V. (2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/) ignores this genus. It is unclear whether he considers it invalid or whether he regards fossil genera as outside his frame of reference.

1 – *C. burmanicum* Poinar & Brown, 2003 (Syst. Parasitol., 54: 199–205)

Type depository: OSU? CAS? (holotype, paratype) (Poinar, G. & Brown, A.E. 2003. A new genus of hard ticks in Cretaceous Burmese amber (Acari: Ixodida: Ixodidae). Syst. Parasitol., 54: 199–205) state that the types, which were maintained at OSU, would be deposited in CAS; however, as of March 2013, they were not listed in the CAS fossil collection. (http//:researcharchive.calacademy.org/research/izg/fossil/index.asp/ accessed March 10, 2013)

Known stages: larva

Zoogeographic Region: undetermined

Ecoregion: undetermined

Hosts: unknown

Human infestation: no

Remarks: this species is of great phylogenetic importance because it is one of the oldest fossil Ixodidae (section Metastriata), dating from 100 mya. See also *Compluriscutula vetulum.*

Reference

Poinar, G. & Brown, A.E. 2003. A new genus of hard ticks in Cretaceous Burmese amber (Acari: Ixodida: Ixodiae). Syst. Parasitol., 54: 199–205.

DOI 10.1007/978-94-007-7497-1_18,

The Genus *Margaropus*

1 – *M. reidi* Hoogstraal, 1956 (*In* African Ixodoidea. I. Ticks of the Sudan (with special reference to Equatoria Province and with preliminary reviews of the genera *Boophilus*, *Margaropus* and *Hyalomma*). Research Report NM 005050.29.07, Department of the Navy Bureau of Medicine and Surgery, Washington D.C. 1101 pp.)

Type depositories: USNTC (holotype, paratypes), BMNH, EAVRO, FMNH, HH, OVI (paratypes) (Keirans and Hillyard, 2001, *op. cit*. under *Anomalohimalaya lamai*)

Known stages: male, female, nymph

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: Artiodactyla: Giraffidae

Human infestation: no

Remarks: because this is presumably a one-host tick, we do not separately record the various life stages present on hosts. Durden and Keirans (1996) list *M. reidi* as an endangered species.

References

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.

Hoogstraal, H. 1956. African Ixodoidea. I. Ticks of the Sudan (with special reference to Equatoria Province and with preliminary reviews of the genera *Boophilus*, *Margaropus* and *Hyalomma*). Research Report NM 005050.29.07, Department of the Navy Bureau of Medicine and Surgery, Washington D.C. 1101 pp.

A.A. Guglielmone et al., *The Hard Ticks of the World: (Acari: Ixodida: Ixodidae)*,
DOI 10.1007/978-94-007-7497-1_19,

2 – *M. wileyi* Walker & Laurence, 1973 (Onderstepoort J. Vet. Res., 40: 13–21)

Type depositories: BMNH (holotype, paratypes), HH, LSHTM, OVI, SAIMR, USNTC, VRLKK (paratypes) (Keirans and Hillyard, 2001, *op. cit*. under *Anomalohimalaya lamai*)

Known stages: male, female

Zoogeographic Region: Afrotropical

Ecoregions: Masai xeric grasslands and shrublands

Hosts: Artiodactyla: Giraffidae

Human infestation: no

Remarks: because this is presumably a one-host tick, we do not separately record the various life stages present on hosts. Durden and Keirans (1996) list *M. wileyi* as endangered.

References

Durden, L.A. & Keirans, J.E. 1996. Host-parasite coextinction and the plight of tick conservation. Am. Entomol., 42: 87–91.

Walker, J.B. & Laurence, B.R. 1973. *Margaropus wileyi* sp. nov. (Ixodoidea, Ixodidae), a new species of tick from the reticulated giraffe. Onderstepoort J. Vet. Res., 40: 13–21.

3 – *M. winthemi* Karsch, 1879 (Mitt. Munch. Entomol. Ver., 3: 95–96)

Type depository: ZMB (holotype) (Moritz and Fischer, 1981, *op. cit.* under *Bothriocroton concolor*)

Hosts: usual hosts for larvae, nymphs and adults are Artiodactyla: Bovidae and Perissodactyla: Equidae. Aves are considered exceptional hosts for this tick.
Mammalia (several orders); Galliformes: Numididae.

Known stages: male, female, nymph, larva

Zoogeographic Region: Afrotropical

Ecoregions: montane grasslands and shrublands, desert and xeric shrublands

Human infestation: no

Remarks: because this is a one-host tick, we do not separately record the various life stages present on hosts. The original description was apparently based on mislabeled ticks allegedly collected in the southern Neotropics. This error was repeated by subsequent authors, such as Pinto (1945). Bedford (1920) stated that one common name for *M. winthemi* in South Africa was “Argentine tick” because it was thought to have been imported with Argentinean equids during the Boer War. Kolonin (2009) recognizes only Equidae and Bovidae as hosts for *M. winthemi*, but there are *bona fide* records of other hosts in the references below.

References

Bedford, G.A.H. 1920. Ticks found on man and his domestic animals and poultry in South Africa. J. Dept. Agric., 1: 317–340.

Fourie, L.J., Vrahimis, S., Horak, I.G., Terblanche, H.J. & Kok, O.B. 1991. Ecto- and endoparasites of introduced gemsbok in the Orange Free State. S. Afr. J. Wildl. Res., 21: 82–87.

Horak, I.G. & Williams, E.J. 1986. Parasites of domestic and wild animals in South Africa. XVIII. The crowned guinea fowl (*Numida meleagris*), an important host of immature ixodid ticks. Onderstepoort J. Vet. Res., 53: 119–122.

Horak, I.G., Fourie, L.J., Novellie, P.A. & Williams, E.J. 1991. Parasites of domestic and wild animals in South Africa. XXVI. The mosaic of ixodid tick infestations on birds and mammals in the Mountain Zebra National Park. Onderstepoort J. Vet. Res., 58: 125–136.

Horak, I.G., Fourie, L.J. & Braack, L.E.O. 2005. Small mammals as hosts of immature ixodid ticks. Onderstepoort J. Vet. Res., 72: 255–261.

Kolonin, G.V. 2009. Fauna of ixodid ticks of the world. http://www.kolonin.org/

Pinto, C. 1945. Zoo – parásitos de interêsse médico e veterinario. 2nd edition, Editora Científica, Rio de Janeiro, 461 pp.

Comments on the Genus *Margaropus*

The three species of *Margaropus* occur only in the Afrotropical Region where they feed almost exclusively on mammals. All parasitic stages are known only for *M. winthemi*.

The Genus *Nosomma*

1 – *N. keralensis* Prakasan & Ramani, 2007 (Int. J. Zool. Res., 3: 169–177)
Guglielmone et al. (2010, *op. cit.* under *Anomalohimalaya cricetuli*) regard this species as only tentatively valid because its description is very poor, and the characters used to differentiate *N. keralensis* from *N. monstrosum* are highly variable.

Type depository: DA (holotype, paratypes) (Prakasan, K. & Ramani, M. 2007. Two new species of ixodid ticks (Acarina: Ixodida) from Kerala, India. Int. J. Zool. Res., 3: 169–177)

Known stages: male

Zoogeographic Region: Oriental

Ecoregion: North Western Ghats montane rain forests

Hosts: Artiodactyla: Bovidae (A)

Human infestation: no

Reference

Prakasan, K. & Ramani, N. 2007. Two new species of ixodid ticks (Acarina: Ixodida) from Kerala, India. Int. J. Zool. Res., 3: 169–177.

2 – *N. monstrosum* Nuttall & Warburton, 1908 (Proc. Cambr. Phil. Soc., 14: 392–416)

Type depository: BMNH (holotype) (Keirans and Hillyard, 2001, *op. cit*. under *Anomalohimalaya lamai*) as *Hyalomma monstrosum*

Known stages: male, female, nymph, larva

Zoogeographic Region: Oriental

A.A. Guglielmone et al., *The Hard Ticks of the World: (Acari: Ixodida: Ixodidae)*,
DOI 10.1007/978-94-007-7497-1_20,

Ecoregions: several ecoregions within the Oriental Region

Hosts: usual hosts for adult ticks are Artiodactyla: Bovidae.
Artiodactyla: Bovidae, Suidae; Carnivora: Canidae, Ursidae; Perissodactyla: Equidae (A)
Rodentia: Muridae (NL)
Soricomorpha: Soricidae (N and/or L)

Human infestation: yes (Hoogstraal 1970)

Remarks: in Geevarghese and Dhanda (1995) it is unclear whether larvae, nymphs or both sub-adult stages of *N. monstrosum* were found on Soricomorpha.

References

Geevarghese, G. & Dhanda, V. 1995. Ixodid ticks of Maharashtra State, India. Acarologia, 36: 309–313.

Hoogstraal, H. 1970. Human infestation by ticks (Ixodidae) in the Himalaya. *In* K.S. Sing & B.K. Tandan (editors), H.D. Srivastava commemoration volume. Division of Parasitology of the Indian Veterinary Research Institute, Izatnagar, pp. 75–89.

Kaul, H.N., Dhanda, V. & Mishra, A.C. 1979. A survey of ixodid ticks in Orissa State, India. Ind. J. Anim. Sci., 49: 707–712.

Petney, T.N. & Keirans, J.E. 1996. Ticks of the genera *Boophilus*, *Dermacentor*, *Nosomma* and *Rhipicephalus* (Acari: Ixodidae) in south-east Asia. Trop. Biomed., 13: 73–84.

Sharif, M. 1928. A revision of the Indian Ixodidae with special reference to the collection in the Indian Museum. Rec. Ind. Mus., 30: 217–344.

Singh, K.R.P. 1968. Description of the nymph and the larva of *Nosomma monstrosum* (Nuttall & Warburton, 1908). Parasitology, 58: 461–463.

The Genus *Rhipicentor*

1 – *R. bicornis* Nuttall & Warburton, 1908 (Proc. Cambr. Phil. Soc., 14: 392–416)

Type depository: BMNH (lectotype, paralectotypes) (Keirans and Hillyard, 2001, *op. cit*. under *Anomalohimalaya lamai*)

Known stages: male, female, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for adult ticks are Carnivora: Canidae, Felidae and Viverridae. Artiodactyla: Bovidae; Carnivora: Canidae, Felidae, Viverridae; Perissodactyla: Equidae (A)

Human infestation: no

Remarks: Camicas et al. (1998) state that the larva of *R. bicornis* is unknown, but it is described in Theiler (Theiler 1961). Hosts for this stage are unknown.

References

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1998. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Horak, I.G., Heyne, H. & Donkin, E.F. 2010. Parasites of domestic and wild animals in South Africa. XLVIII. Ticks (Acari: Ixodidae) infesting domestic cats and wild felids in southern Africa. Onderstepoort J. Vet. Res., 77: doi:10.4102/ojvr.v77i1.3

Theiler, G. 1961. A contribution to the knowldedge of African Ixodidae. The genus *Rhipicentor*. Rev. Zool. Bot. Afr., 64: 297–308. Volume 64 of this journal is often cited as volume 66.

Walker, J.B. 1991. A review of the ixodid ticks (Acari, Ixodidae) occurring in southern Africa. Onderstepoort J. Vet. Res., 58: 81–105.

DOI 10.1007/978-94-007-7497-1_21,

2 – *R. nuttalli* Cooper & Robinson, 1908 (Proc. Cambr. Phil. Soc., 14: 457–470)

Type depository: not stated in Cooper, W.F. & Robinson, L.E. (1908. On six new species of Ixodidae including a second species of the new genus *Rhipicentor* N. and W. Proc. Cambr. Phil. Soc., 14: 457–470)

Known stages: male, female, larva

Zoogeographic Region: Afrotropical

Ecoregions: tropical and subtropical grasslands, savannas and shrublands

Hosts: usual hosts for adult ticks are Carnivora (several families).
Mammalia (several orders) (A)
Macroscelidea: Macroscelididae (NL)

Human infestation: no

Remarks: although the nymph of *R. nuttalli* has not been described, Fourie et al. (2002) have collected nymphs from Macroscelididae.

References

Fourie, L.J., Horak, I.G., Kok, D.J. & Van Zyl, W. 2002. Hosts, seasonal occurrence and life cycle of *Rhipicentor nuttalli* (Acari: Ixodidae). Onderstepoort J. Vet. Res., 69: 177–187.

Horak, I.G., Heyne, H. & Donkin, E.F. 2010. Parasites of domestic and wild animals in South Africa. XLVIII. Ticks (Acari: Ixodidae) infesting domestic cats and wild felids in southern Africa. Onderstepoort J. Vet. Res., 77: doi:10.4102/ojvr.v77i1.3

Norval, R.A.I. & Colborne, J. 1985. The ticks of Zimbabwe. X. The genera *Dermacentor* and *Rhipicentor.* Zimbabwe Vet. J., 16: 1–4.

Theiler, G. 1961. A contribution to the knowldedge of African Ixodidae. The genus *Rhipicentor*. Rev. Zool. Bot. Afr., 64: 297–308. The volume for this paper is often erroneously cited as volume 66.

Comments of the Genus *Rhipicentor*

The two species of *Rhipicentor* are exclusively Afrotropical and feed only on mammalian hosts.

Part VIII
Synopsis

Worldwide, the number of ixodid tick species that we consider valid stood at 707 as of May 2013. The largest genus is *Ixodes*, with 244 species, followed by *Haemaphysalis* (167 species), *Amblyomma* (130), *Rhipicephalus* (84), *Dermacentor* (35), *Hyalomma* (27), *Bothriocroton* (7), *Anomalohimalaya* (3), *Margaropus* (3), *Nosomma* (2), *Rhipicentor* (2) and *Cosmiomma* (1). The fossil genera *Compluriscutula* and *Cornupalpatum* contain one species each. However, descriptions of new hard tick taxa are expected to soon increase these totals (see Addenda).

Addenda

Amblyomma multipunctum Neumann, 1899 (Mém. Soc. Zool. Fr., 12: 107–294). The nymph of *A. multipunctum* has recently been described from specimens collected on vegetation in Ecuador (Neotropical) by Labruna, M.B., Martins, T.F., Nunes, P.B., Borges, F.C., Portero, F. & Venzal, J.M. 2013. New records of *Amblyomma multipunctum* and *Amblyomma naponense* from Ecuador, with the description of the nymph of *A. multipunctum.* J. Parasitol., doi:10.1645/13-254.1; these authors state that *A. multipunctum* in Boero, J.J. & Prosen. 1959. Ixodideos de "anta" II. *Amblyomma multipunctum* Neuman, 1899. An. Inst. Med. Reg., 5: 95–97, is probably *A. scalpturatum.*

Cosmiomma hippopotamensis Denny, 1843 (Ann. Mag. Nat. Hist., 12: 312–316). The larva and nymph of *C. hippopotamensis* were recently described from laboratory-reared material in Apanaskevich, D.A., Walker, J.B., Heyne, H., Bezuidenhout, J.D. & Horak, I.G. 2013. First description of the immature stages and redescription of the adults of *Cosmiomma hippopotamensis* (Acari: Ixodidae) with notes on its bionomics. J. Med. Entomol., 50: 709–722.

Dermacentor raskemensis Pomerantzev, 1946 (Faune SSSR Zool. Inst. Akad. Nauk SSSR (26), 28 pp. In Russian). The larva and nymph of *D. raskemensis* were recently described by Apanaskevich, D.A. 2013. First description of the nymph and

larva of *Dermacentor raskemensis* Pomerantzev (Acari: Ixodidae), parasites of pikas and other small mammals in central Asia. J. Med. Entomol., 50: 959–964. Larvae and nymphs were found on Lagomorpha: Ochotonidae; Rodentia: Cricetidae, Muridae; while only larvae were found on Lagomorpha: Leporidae; Rodentia: Calomyscidae, Gliridae.

Rhipicephalus rossicus Yakimov & Kohl-Yakimova, 1911 (Arch. Parasitol., 14: 416–425). Recently, Akimov, I.A. & Nebogatkin, I.V. 2013. Ticks of the genus *Rhipicephalus* (Acari, Ixodidae) and their distribution in Ukraine. Vest. Zool., 47: e28-e24, reported the parasitism of Amphibia: Ranidae by adults of *R. rossicus*.

Rhipicephalus walkerae Horak, Apanaskevich and Kariuki, 2013 (J. Med. Entomol., 50: 685–690). This species is Afrotropical and is known from male and female specimens collected from Artiodactyla: Giraffidae, as detailed in Horak, I.G., Apanaskevich, D.A. and Kariuki, E.K. 2013. A new species of *Rhipicephalus* (Acari: Ixodidae), a parasite of giraffes in Kenya. J. Med. Entomol., 50: 685–690.

Ticks Feeding on Humans

With the exception of ticks in the genera *Anomalohimalaya*, *Cosmiomma*, *Margaropus*, *Rhipicentor* and the two fossil genera, at least one member of each ixodid genus has been observed feeding on humans. Table 1 below shows the numbers and percentages of species in each genus that have been found feeding on humans alongside the corresponding numbers and percentages of species in all genera of the Ixodidae. Over a third (38 % or 267 species) feed on humans, although many of these are not known to transmit pathogens. The genera *Rhipicephalus*, *Dermacentor* and *Hyalomma* are particularly important because more than 50 % of their members have been found attached to humans. The maximum percentages are *Hyalomma* (18 taxa or 67 %) followed by *Dermacentor* (23 species or 66 %). However, in absolute terms the genus *Ixodes* contributes the highest number of species (63 species, 26 % of the total), followed by *Amblyomma* (58 species, 45 % of the total), *Haemaphysalis* (56 species, 33 % of the total) and *Rhipicephalus* (46 species, 55 % of the total). Over the last two decades, the known number and significance of tick-borne diseases have markedly increased. This tendency is likely to continue, and ticks will remain a group of interest to researchers as more species are collected from humans and consequently viewed as potential disease vectors.

A.A. Guglielmone et al., *The Hard Ticks of the World: (Acari: Ixodida: Ixodidae)*,
DOI 10.1007/978-94-007-7497-1_22, © Springer Science+Business Media Dordrecht 2014

Table 1 Numbers and percentages of species in each genus of the Ixodidae, and numbers and percentages of species feeding on humans

Genera	Total no. of species (%)	No. of species feeding on humans (% of each genus)
Ixodes	244 (34.5)	63 (25.8)
Haemaphysalis	167 (23.6)	56 (33.5)
Amblyomma	130 (18.4)	58 (44.6)
Rhipicephalus	84 (11.9)	46 (54.8)
Dermacentor	35 (5.0)	23 (65.7)
Hyalomma	27 (3.8)	18 (66.7)
Bothriocroton	7 (1.0)	2 (28.6)
Anomalohimalaya	3 (0.4)	0 (0.0)
Margaropus	3 (0.4)	0 (0.0)
Nosomma	2 (0.3)	1 (50.0)
Rhipicentor	2 (0.3)	0 (0.0)
Compluriscutula	1 (0.1)	0 (0.0)
Cornupalpatum	1 (0.1)	0 (0.0)
Cosmiomma	1 (0.1)	0 (0.0)
Total	**707**	**267 (37.8)**

Distribution

Hard ticks are found in all six zoogeographic regions, but the distribution of the species in different genera is not uniform. The genus *Ixodes* has the widest distribution, occurring across the six zoogeographic regions; 32 species (13 %) occur in more than one zoogeographic region. Seven species of *Ixodes* have a broad distribution because they are established in three or more zoogeographic regions or, in the case of *I. kerguelenensis*, in the Australasian Region and on islands in the Atlantic, Indian and Pacific Oceans, while *I. uriae* has a circumpolar distribution, including adjacent islands and continental lands. Members of this genus are remarkable for parasitizing Aves on remote islands and around the poles. The Afrotropical Region contains the greatest number of *Ixodes* (63 species or 26 % of the total for the genus), followed by the Palearctic Region with 44 (18 %) found exclusively there. A total of 138 species (57 %) are currently known only from lands that constituted the ancient continent of Gondwana; this percentage increases to 69 % for the 169 species established exclusively and non-exclusively in these lands. On the other hand, 74 species (30 %) are exclusively found in lands derived from the ancient continent of Laurasia.

Endemic species of *Haemaphysalis* occur in all six zoogeographic regions. The representation of this genus in the Nearctic and Neotropical Regions is poor, with one species exclusive to each region, namely *H. chordeilis* in the Nearctic and *H. cinnabarina* in the Neotropics. The latter is known only from its holotype and the holotype of *H. sanguinolenta* (a synonym of *H. cinnabarina*), collected more than 160 years ago. The focus of *Haemaphysalis* is the Oriental Region, with 64 species (38 % of the total) found only there, followed by the Afrotropical Region, with 38 endemic species (23 %). Six species occur in three zoogeographic regions. A total of 118 species (71 %) occur exclusively in lands that constituted the ancient continent of Gondwana. This increases to 88 % for the 146 species established exclusively and non-exclusively in lands derived from Gondwana. Twenty taxa (12 %) are established in lands derived from Laurasia.

Amblyomma species are found in all six zoogeographic regions but there are no species of this genus exclusive to the Palearctic Region. Twenty-five species occur in more than one zoogeographic region and two of these (*A. loculosum* and

A.A. Guglielmone et al., *The Hard Ticks of the World: (Acari: Ixodida: Ixodidae)*,
DOI 10.1007/978-94-007-7497-1_23, © Springer Science+Business Media Dordrecht 2014

A. testudinarium) occur in three regions. The Neotropical Region contains the largest number of species (46 or 35 %) endemic to one region, followed by the Afrotropical Region (26 species or 20 %), while 112 species (86 %) of *Amblyomma* are found exclusively in areas that have been derived from Gondwana. A total of 98 % of *Amblyomma* (127 species) currently occur exclusively or non-exclusively in lands that constituted Gondwana. Only three species are found exclusively in the Nearctic Region, which was originally part of Laurasia.

Rhipicephalus is basically an Afrotropical genus (*i.e.*, Gondwanan), with 63 species (75 % of the total) endemic to the Afrotropical Region, 68 species (81 %) found exclusively in areas that constituted the ancient continent of Gondwana, and 78 species (93 %) exclusive and non-exclusive to that ancient continent. Seven species (8 %) are found only in the Palearctic Region (Laurasian origin). The genus is represented in all six zoogeographic regions but there are no *Rhipicephalus* exclusive to the Nearctic and Neotropical Regions. Eleven species are found in two or more regions. The status of two important taxa (*R. sanguineus* and *R. turanicus*) should be reevaluated to determine how many species are included under these names and the extent of their distributions. Current data indicate that *R. annulatus*, *R. australis* and *R. haemaphysaloides* occur in three regions, while *R. microplus* occurs in all six zoogeographic regions and on some remote islands.

Dermacentor species are found in all zoogeographic regions but there is no species exclusive to the Australasian Region. The genus is best represented in the Palearctic (13 species or 38 % of the total), followed by the Nearctic and Neotropical Regions with 12 % of the species (4 endemics in each region). This is a Laurasian genus, with 18 species (51.4 %) exclusive to the Nearctic and Palearctic. Nine species occur in two regions and none in three or more regions.

The genus *Hyalomma* is absent from the Australasian, Nearctic and Neotropical Regions but is well represented in the Afrotropical Region, with eight species (30 % of the total) exclusive to the Afrotropics, followed by the Palearctic Region, with seven endemic species (26 %). Eleven species (41 %) are exclusively Gondwanan and seven (26 %) are exclusively Laurasian, while the rest are found in the lands derived from Gondwana and Laurasia. Nine species are established in two or more zoogeographic regions, with three of these species established in three regions.

The 18 species in the extant genera *Anomalohimalaya*, *Bothriocroton*, *Cosmiomma*, *Margaropus*, *Nosomma* and *Rhipicentor* are mostly found only in the Australasian (7 species, all *Bothriocroton*) and Afrotropical (6 species representing all taxa in the genera *Cosmiomma*, *Margaropus* and *Rhipicentor*) Regions. The three species of *Anomalohimalaya* are exclusive to the Palearctic Region, while *Nosomma* (two species) are exclusively Oriental. No species is found in two or more zoogeographic regions and none are established in the Nearctic and Neotropical Regions. The species in these genera are almost exclusively found in regions that constituted Gondwana (15 species or 83 % of the total), while the remaining three species (17 %, all from the genus *Anomalohimalaya*) are only found in lands that constituted Laurasia.

Table 1 Distribution of species in the genera of Ixodidae in relation to the zoogeographic regions that constituted the ancient continent of Gondwana (Afrotropical, Australasian, Neotropical and Oriental Regions)

Genus of ticks (No. of species)	Exclusive Gondwanian distribution	% of total for corresponding genus	Exclusive and non-exclusive Gondwanian distribution	% of total for corresponding genus
Ixodes (243)	138	56.8	169	69.5
Haemaphysalis (166)	118	71.1	146	88.0
Amblyomma (130)	112	86.2	127	97.7
Rhipicephalus (84)	68	80.9	78[a]	92.8
Dermacentor (35)	11	31.4	17	48.6
Hyalomma (27)	11	40.7	20	74.1
Rest of genera (18)	15	83.3	15	83.3
Total[b] (703)	**473**	**67.2**	**572**	**81.4**

[a]Two Palearctic species (*R. sanguineus* and *R. turanicus*) probably have a wider distribution that includes areas that constituted Gondwana

[b]Two extinct genera (*Compluriscutula* and *Cornupalpatum*), *Haemaphysalis kumaonensis* and the fossil *Ixodes succineus* are excluded from this analysis

The percentages of species of extant genera of Ixodidae established exclusively and non-exclusively in the regions derived from Gondwana appear in Table 1. The regions that constituted Gondwana were of great importance in determining the current distribution of ixodid genera, with the exception of *Dermacentor* and *Anomalohimalaya.* A total of 473 (67 %) of the 703 known ixodid species are exclusively Gondwanan (see footnotes in Table 1 for the number of species used in this analysis); this figure increases to 572 species (81 %) for species occurring exclusively and non-exclusively in lands derived from Gondwana. Conversely, just 19 % of the species of Ixodidae are found only in lands derived from Laurasia; this figure increases modestly to 34 % for both exclusive and non-exclusive species. Such observations are remarkable in light of the fact that current Laurasian landmasses are more extensive than Gondwanan landmasses. The genus *Ixodes* is of particular relevance here because it is the only genus containing species that occur exclusively in all six regions as well as on remote islands and around the poles (Table 2). Even so, species of *Ixodes* predominate in lands of Gondwanan origin. The genus *Haemaphysalis* is also represented in the six zoogeographic regions but is not known to be present on remote islands, and its representation in the Nearctic and Neotropical Regions is very poor in comparison to *Ixodes* (Table 2).

Table 2 provides details of the distributions of the genera constituting the Ixodidae. Again, a notable difference is seen when comparing where the species of *Ixodes* are established in relation to other genera. *Ixodes* is established in 20 of the defined areas, followed by *Amblyomma* (13), *Haemaphysalis* (12), *Rhipicephalus* (10), *Dermacentor* (8), *Hyalomma* (6) and the remaining genera (4). Part of this difference can be attributed to the colonization of remote islands in the world's oceans and lands around the poles, features that are peculiar to *Ixodes*, as explained above.

Table 2 Distribution of species in extant genera of Ixodidae by zoogeographic region(s), remote island group, polar area (circumpolar) and combinations of these categories

	Ixodes	*Haemaphysalis*	*Amblyomma*	*Rhipicephalus*[a]	*Dermacentor*	*Hyalomma*	Rest of genera	**Total (%)**
Afrotropical	63	38	26	63	2	8	6	**206 (29.2)**
Australasian	24	8	19				7	**58 (8.2)**
Nearctic	28	1	3		4			**36 (5.0)**
Neotropical	38	1	46		4			**89 (12.6)**
Oriental	10	64	11	3	3	3	2	**96 (13.6)**
Palearctic	44	19		7	13	7	3	**93 (13.2)**
Afrotropical-Neotropical			1					**1 (0.1)**
Afrotropical-Oriental			1					**1 (0.1)**
Afrotropical-Palearctic		1	1	5		3		**10 (1.4)**
Australasian-Oriental	2	7	7	1	2			**19 (2.7)**
Nearctic-Neotropical	10	2	12		4			**28 (4.0)**
Nearctic-Palearctic	2				1			**3 (0.4)**
Oriental-Palearctic	11	19	1	1	2	3		**37 (5.2)**
Afrotropical-Australasian-Oriental	1		1					**1 (0.1)**
Afrotropical-Nearctic-Palearctic				1				**2 (0.3)**
Afrotropical-Oriental-Palearctic	1	2				3		**6 (0.9)**
Australasian-Oriental-Palearctic	1	4	1	1				**7 (1.0)**
Australasian-Oriental-Pacific islands				1				**1 (0.1)**

Afrotropical-Australasian-Nearctic-Neotropical	1							**1 (0.1)**
Afrotropical-Australasian-Oriental-Palearctic	1							**1 (0.1)**
Afrotropical-Australasian-Nearctic-Neotropical-Oriental- several islands around the world				1				**1 (0.1)**
Islands in Atlantic and Indian Oceans	1							**1 (0.1)**
Australasian- islands in Atlantic, Pacific & Indian Oceans	1							**1 (0.1)**
Circumpolar	1							**1 (0.1)**
Islands in the Atlantic Ocean	1							**1 (0.1)**
Islands in the Central Pacific Ocean	2							**2 (0.3)**
Unknown	1	1						**2 (0.3)**
Total categories	**20**	**12**	**13**	**10**	**8**	**6**	**4**	
Total of species per extant genus	**244**	**167**	**130**	**84**	**35**	**27**	**18**	**705**

[a]*Rhipicephalus sanguineus* and *R. turanicus* may be established in several zoogeographic regions, but determinations of specimens from these regions require confirmation

Hosts

As explained in the introduction to this work, host analyses were performed using data for tick species where the natural hosts of larvae, nymphs and adults (either or both sexes), as well as descriptions of these stages, are known. Species whose larvae and/or nymphs are known only from laboratory-reared specimens, as well as species whose adults are known only from molted nymphs, were excluded from our analysis. Provisionally valid hosts were also excluded. A first analysis scored host utilization in absolute terms; that is, just one collection from an identified host was sufficient to include that host in the range of hosts for a particular species. A second analysis was performed excluding these exceptional hosts.

The most frequent host groups for hard ticks are the Mammalia and, to a lesser extent, Aves. However, several species are also found on Squamata and Testudines, some parasitize Anura, and very few are known from Crocodilia. *Amblyomma sphenodonti* is almost exclusive to the Rhynchocephalia. Our descriptive analysis is thus based on six host categories: Anura, Aves, Crocodilia, Mammalia, Squamata and Testudines.

Ixodes (analysis of 132 of the 244 species whose stages and natural hosts for larvae, nymphs and adults are known) were not found on Crocodilia, while Anura and Testudines do not appear to be relevant for the maintenance of this genus in nature because Anura are non-exclusive hosts for just one species (*I. persulcatus*) and Testudines for three species. Both categories of hosts are exceptional for the species of *Ixodes* found on them. Fourteen species were found on Squamata, but none are exclusive to this category of hosts when exceptional hosts are included in the analysis. *Ixodes* species chiefly parasitize Mammalia – 61 species or 46 % are exclusive to mammals. To a lesser extent, Aves are also parasitized (19 species or 15 % of *Ixodes* are exclusive to Aves), while 38 species (29 %) utilize both Aves + Mammalia as hosts. Seven categories of host usage were found when exceptional hosts were included in the analysis. When exceptional hosts were excluded, the role of Mammalia as exclusive hosts for *Ixodes* increased to 76 species (57 %), while Aves increased their share as exclusive hosts to 25 species (19 %). Squamata were found to be exclusive for one species (*I. asanumai*).

A.A. Guglielmone et al., *The Hard Ticks of the World: (Acari: Ixodida: Ixodidae)*,
DOI 10.1007/978-94-007-7497-1_24, © Springer Science+Business Media Dordrecht 2014

Figures for host combinations were low: 24 species (18 %) feed on Aves + Mammalia, five species feed on Aves + Mammalia + Squamata and one species (*I. vestitus*) is known from Mammalia + Squamata, for a total usage of six categories.

Haemaphysalis (analysis of 85 of the 167 species whose stages and natural hosts for larvae, nymphs and adults are known) were not found on Anura and Crocodilia. Seven categories of host usage were found when exceptional hosts were included in the analysis. The contributions of Squamata and Testudines were relatively minor, being non-exclusive hosts of eight (9 %) and six (7 %) species, respectively. Mammalia are of major importance for *Haemaphysalis* because 29 (34 %) of the species were found exclusively on this host group, a contribution that increased to 83 (98 %) species when considering those that feed non-exclusively on Mammalia. Aves are parasitized exclusively by one species (*H. megalaimae*) and non-exclusively by 54 species (64 %). The most common host combination was Mammalia + Aves (45 species or 53 % of the total). The contribution of Mammalia and Aves as exclusive hosts of *Haemaphysalis* increased to 41 (48 %) and five (6 %) species, respectively, when exceptional hosts were excluded from the analysis. Aves + Mammalia was the commonest combination of hosts for 34 (40 %) species excluding exceptional hosts. Squamata were found to be non-exclusive hosts of five (6 %) species and Testudines of just one species (*H. sulcata*), for a total of six categories of host usage.

Amblyomma (analysis of 63 of the 130 species whose larvae, nymphs and adult stages and natural hosts are known) were found on all principal categories of hosts when exceptional hosts were included in the analysis, plus the Rhynchocephalia, which is parasitized only by *A. sphenodonti*. The contribution of Anura and Crocodilia was rather poor because they were found to be non-exclusive hosts for only eight (13 %) and two (3 %) species, respectively. Squamata, Mammalia and Testudines are exclusive hosts for six (10 %), three (5 %) and three (5 %) taxa, respectively; therefore, this genus is the only one in which Mammalia are not the predominant exclusive hosts when exceptional hosts are included in the analysis. No *Amblyomma* were found exclusively on Aves. Mammalia, Squamata, Aves and Testudines are of relevance because they were found to be hosts (exclusive and non-exclusive) for 49 (78 %), 37 (59 %), 35 (56 %) and 26 (41 %) species of *Amblyomma*, respectively. There is no other genus of Ixodidae that shows as wide a range of hosts as *Amblyomma*, especially considering its utilization of Squamata and Testudines as principal hosts for several species. A total of 18 categories of host usage were determined for species of *Amblyomma* when exceptional hosts were included in the analysis. The categories of host usage dropped to 12 when exceptional hosts were excluded. Crocodilia is then no longer a host group for any species, and Mammalia is found to be the most important category of exclusive hosts with 15 (24 %) species, followed by Squamata with 13 (21 %) species, and Testudines, which are exclusive hosts for three species. One species (*A. loculosum*) is now an exclusive host of Aves. Anura are a non-exclusive host group for three species of *Amblyomma*; however, anurans are important for the maintenance of two species of Nearctic and Neotropical *Amblyomma* (*A. dissimile* and *A. rotundatum*). The commonest combination of host usage is Aves + Mammalia, with 14 (22 %) species. Mammalia, Squamata, Aves and Testudines are exclusive and non-exclusive hosts for 39 (62 %), 27 (43 %), 21

(33 %) and 18 (29 %) species, respectively. The unique importance of Squamata and Testudines (and to a lesser extent Anura) is confirmed when exceptional hosts are not included in the study.

Rhipicephalus (analysis of 46 of a total of 84 species whose larvae, nymphs and adults and natural hosts are known) were not found on Crocodilia. The contribution of Anura and Testudines was minor because they were found to be exceptional hosts for just one (*R. microplus*) and four species, respectively. Squamata are non-exclusive hosts for seven (15 %) species, while Aves are non-exclusive hosts for 29 (63 %) species. The major host group for this genus is Mammalia, which are exclusive hosts for 16 (35 %) species of *Rhipicephalus*, and non-exclusive hosts for the remaining 46 species. Seven categories of host usage were revealed when exceptional hosts are considered, but this picture changes dramatically when such hosts are removed from the analysis, leaving two categories of host usage: Mammalia with 38 (83 %) species, and the combination Mammalia + Aves that includes the remaining eight species.

Dermacentor (analysis of 20 of the 35 species whose larvae, nymphs and adults and natural hosts are known) were not found on Crocodilia. Analysis including exceptional hosts reveals a small contribution by Anura and Testudines, which are exceptional hosts for three (15 %) and one (*D. niveus*) species, respectively. Aves and Squamata were found to be non-exclusive hosts for 11 (55 %) and seven (35 %) species, respectively. The role of Mammalia is of major importance because seven (35 %) of the species were found exclusively on this category of hosts; Mammalia are non-exclusive hosts for the remaining 13 species. A total of seven categories of host usage were determined when exceptional hosts were included in the analysis. This figure abruptly changes when exceptional hosts are excluded from the analysis, leaving only two categories: Mammalia as exclusive hosts for 19 (95 %) species, and the combination Aves + Mammalia for the remaining species (*D. silvarum*).

Hyalomma (analysis of 23 of the 27 species whose larvae, nymphs and adults and natural hosts are known) were not found infesting Anura and Crocodilia. Analysis including exceptional hosts reveals a relatively minor contribution by Testudines, with three (13 %) species of *Hyalomma* found non-exclusively on this type of host. Squamata are non-exclusive hosts for eight (35 %) species. The role of Aves is greater, with 16 (70 %) species found non-exclusively on this group. However, the chief host category is Mammalia with six (26 %) tick species that feed exclusively on this group, although all species (exclusive and non-exclusive) feed on mammals. Five categories of host usage were seen when exceptional hosts were included. These figures changed when exceptional hosts were excluded from the analysis because Testudines remains as an important but not exclusive host category for *H. aegyptium*. Squamata diminished in importance as non-exclusive hosts for three (13 %) species, and Aves were found to be non-exclusive hosts for eight (35 %) species. The Mammalia increased their participation as exclusive hosts for 12 (52 %) species and are non-exclusive hosts for the remaining 12 species, for a total of five categories of host usage when exceptional hosts are excluded from the analysis.

Anomalohimalaya, *Bothriocroton*, *Margaropus* and *Nosomma* (analysis of nine species whose stages and natural hosts for larvae, nymphs and adults are known) were not found on Anura and Crocodilia. Analysis including exceptional hosts shows that the contributions of Aves and Testudines are minor because they are exceptional hosts for one species each, *M. winthemi* and *B. hydrosauri*, respectively. The only exclusive hosts for these genera are Mammalia (6 species, 2 *Anomalohimalaya*, 3 *Bothriocroton* and *Nosomma monstrosum*) and Squamata (1 species, *B. glebopalma*). Squamata and Mammalia are exclusive and non-exclusive hosts for two and eight species, respectively, for a total of five categories of host usage when exceptional hosts are included in the study. However, only two categories of host usage remain when exceptional hosts are excluded from the analysis: seven species feed exclusively on Mammalia, and the remaining two species (*B. glebopalma* and *B. hydrosauri*) are exclusive parasites of Squamata.

Tables 1 and 2 show host utilization categories of the 377 species representing different ixodid genera whose adults, nymphs and larvae are known, as well as their natural hosts, including or excluding exceptional hosts for each species. Twenty categories of host usage are seen when exceptional hosts are included, versus 13 when such hosts are excluded. Crocodilia are considered non-exclusive hosts when exceptional hosts are included, but this category disappears when exceptional hosts are excluded. In brief, Anura, Aves, Mammalia, Squamata and Testudines (plus Rhynchocephalia, the host of *Amblyomma sphenodonti*) each represent the main blood source for at least one species of Ixodidae.

The most obvious result of our analysis of host usage is that members of the genus *Amblyomma* are highly versatile in terms of host selection, being the only ixodid genus with species that feed exclusively on Squamata and Testudines. This genus also contains species that feed on the combinations Squamata + Testudines, and Anura + Squamata + Testudines, each a unique combination of host categories. While no *Amblyomma* species feed exclusively on Anura, in the case of two species – *A. dissimile* and *A. rotundatum* – this group contains important hosts, a situation not seen in other ixodid genera.

Mammalia are of paramount importance as hosts of the Ixodidae, being the principal exclusive hosts for all genera. More than half of the species (208 or 55 %) feed exclusively on mammals (Table 2, excluding exceptional hosts). Their singular importance is enhanced by the fact that the most common combination of host categories is Aves + Mammalia with 87 species (23 %). Notably, most species of *Haemaphysalis* and *Hyalomma* feed on Mammalia and/or Mammalia + Aves, and all species of *Rhipicephalus* and *Dermacentor* feed on these categories (Table 2). It is therefore highly likely that the Ixodidae took advantage of the strong radiation of the Mammalia during the Cenozoic Era and many Mammalia-tick relationships may be relatively new. Indeed, this appears to be true for South American (Neotropical) tick species that feed on Rodentia: Caviidae and Cricetidae, and Carnivora: Canidae because these relationships cannot be older than *circa* 6 mya for Neotropical ticks that feed on Rodentia and considerably less (*circa* 3 mya) for ticks that feed on Canidae (Guglielmone and Nava 2010). A similar situation is seen among South American species like *Ixodes loricatus*, whose adults feed on ancestral hosts (Didelphidae) but whose larvae and nymphs utilize members of the

Table 1 Host utilization by genera of Ixodidae for species whose larva, nymph, male and/or female are known, including exceptional hosts

	Ixodes	*Haemaphysalis*	*Amblyomma*[a]	*Rhipicephalus*	*Dermacentor*	*Hyalomma*	Rest of genera	**Total (%)**
Aves	19	1						**20 (5.3)**
Mammalia	61	29	**3**	16	7	6	6	**128 (33.9)**
Squamata			6				1	**7 (1.9)**
Testudines			3					**3 (0.8)**
Anura + Squamata			1					**1 (0.3)**
Aves + Mammalia	38	45	14	20	5	9	1	**132 (34.9)**
Mammalia + Squamata	4	1	5	1	1			**12 (3.2)**
Squamata + Testudines			2					**2 (0.5)**
Anura + Mammalia + Squamata					1			**1 (0.3)**
Aves + Mammalia + Squamata	6	3	6	4	3	5		**27 (7.1)**
Aves + Mammalia + Testudines		2	2	3	1			**8 (2.1)**
Mammalia + Squamata + Testudines			5			1	1	**7 (1.9)**
Anura + Aves + Mammalia + Squamata	1			1	2			**4 (1.1)**
Anura + Aves + Mammalia + Testudines			1					**1 (0.3)**
Anura + Aves + Squamata + Testudines			1					**1 (0.3)**
Anura + Mammalia + Squamata + Testudines			1					**1 (0.3)**
Aves + Mammalia + Squamata + Testudines	3	4	8	1		2		**18 (4.8)**
Anura + Aves + Mammalia + Squamata + Testudines			2					**2 (0.5)**
Anura + Crocodilia + Mammalia + Squamata-Testudines			1					**1 (0.3)**
Anura + Aves + Crocodilia + Mammalia + Squamata + Testudines			1					**1 (0.3)**
Total host categories	**7**	**7**	**17**	**7**	**7**	**5**	**4**	
Total of species per extant genus	**131**	**85**	**63**[a]	**46**	**20**	**23**	**9**	**377**

[a]One species, *Amblyomma sphenodonti*, is found almost exclusively on Rhynchocephalia

Table 2 Host utilization by genera of the Ixodidae for species whose larva, nymph, male and/or female are known, excluding exceptional hosts

	Ixodes	*Haemaphysalis*	*Amblyomma*[a]	*Rhipicephalus*	*Dermacentor*	*Hyalomma*	Rest of genera	**Total (%)**
Aves	25	5	1					**31 (8.2)**
Mammalia	76	41	15	38	19	12	7	**208 (55.0)**
Squamata	1		13				2	**16 (4.2)**
Testudines			3			1		**4 (1.1)**
Aves + Mammalia	24	34	14	8	1	7		**88 (23.3)**
Mammalia + Squamata	1	1	1			2		**5 (1.3)**
Squamata + Testudines			2					**2 (0.5)**
Anura + Squamata + Testudines			3					**3 (0.8)**
Aves + Mammalia + Squamata	5	3				1		**9 (2.4)**
Aves + Mammalia + Testudines			2					**2 (0.5)**
Mammalia + Squamata + Testudines			3					**3 (0.8)**
Aves + Mammalia + Squamata + Testudines		1	5					**6 (1.6)**
Total host categories	**6**	**6**	**11**	**2**	**2**	**5**	**2**	
Total of species per extant genus	**131**	**85**	**63**[a]	**46**	**20**	**23**	**9**	**377**

[a]One species, *Amblyomma sphenodonti*, is found exclusively on Rhynchocephalia

Table 3 Distribution of the 31 species of Ixodidae that feed exclusively on Aves (exceptional hosts excluded)

Tick species	Distribution
Ixodes anatis	Australasian
Ixodes arboricola[a]	Oriental-Palearctic
Ixodes auritulus[a]	Afrotropical-Australasian-Nearctic-Neotropical
Ixodes baergi	Nearctic
Ixodes berlesei	Palearctic
Ixodes brunneus	Nearctic-Neotropical
Ixodes caledonicus	Palearctic
Ixodes collocaliae	Australasian-Oriental
Ixodes eudyptidis	Australasian
Ixodes frontalis	Palearctic
Ixodes howelli	Nearctic
Ixodes jacksoni	Australasian
Ixodes kerguelenensis	Australasian-Islands in Atlantic, Indian and Pacific Oceans
Ixodes kohlsi	Australasian
Ixodes laysanensis	Central Pacific islands
Ixodes lividus	Palearctic
Ixodes mitchelli	Palearctic
Ixodes paranaensis	Neotropical
Ixodes percavatus	Islands in Atlantic and Indian Oceans
Ixodes rothschildi	Palearctic
Ixodes signatus	Nearctic-Palearctic
Ixodes subterraneus	Palearctic
Ixodes turdus	Palearctic
Ixodes unicavatus	Palearctic
Ixodes uriae[a]	Circumpolar
Haemaphysalis chordeilis	Nearctic
Haemaphysalis doenitzi[a]	Australasian-Oriental-Palearctic
Haemaphysalis hoodi	Afrotropical
Haemaphysalis megalaimae	Oriental
Haemaphysalis minuta	Oriental
Amblyomma loculosum	Afrotropical-Australasian-Oriental

[a]More than one species may be included under these names

Sigmodontinae as their principal hosts. *Ixodes neuquenensis*, a parasite of *Dromiciops gliroides* (the South American ancestor of Australian marsupials), provides evidence of a host-tick relationship that developed at the time of the great American interchange (*circa* 2.5 mya) when Central America collided with South America and the Sigmodontinae rapidly colonized new lands (Guglielmone et al. 2011; Pardiñas et al. 2002).

The phenomenon of ticks feeding on Aves merits some discussion. There are 31 species of Ixodidae that feed exclusively on Aves, but most of these are members of the genera *Ixodes*, with 25 (81 %), *Haemaphysalis* with five (16 %); and *Amblyomma* with one (3 %) (Table 2, excluding exceptional hosts). The names of these species and their distributions are presented in Table 3. Tick species considered basal for

Ixodes (*I. jacksoni* and *I. uriae*) (Filippova 1977; Balashov 1994), which are included in the genus *Ceratixodes* by Camicas et al. (1998) or in the subgenus *Ceratixodes* by Clifford et al. (1973), are found exclusively on marine Aves. This host-parasite relationship was considered of evolutionary significance by Morel (1969), but his view has been largely ignored.

Two highlights of host utilization by the Ixodidae concern the genera *Amblyomma* and *Ixodes.* In contrast to other genera, species of *Amblyomma* feed on various categories of hosts, engaging in a survival strategy not seen elsewhere in the Ixodidae. The host relationships of *Amblyomma* thus differ markedly from those seen in *Ixodes*, although the latter genus is the most speciose and widely distributed of all ixodid genera. However, host usage in *Ixodes* is conservative. This dichotomy between *Ixodes* and *Amblyomma* may be evidence of an important evolutionary step that would have occurred during the Mesozoic.

Species with Broad Distributions

Data for broadly distributed species of Ixodidae appear in Table 1. There are 22 hard tick species with broad distributions, defined here as tick species that are found in three or more zoogeographic regions, lands around the poles, remote islands, and combinations of these categories. There are also three species that have attained their current broad distribution due to human activities (*Rhipicephalus annulatus*, *R. australis*, and *R. microplus*). Another species with an allegedly broad distribution is *Haemaphysalis cornigera*, but we feel that this species has been inadequately defined and have therefore excluded it from Table 1. Similarly, *Rhipicephalus sanguineus* and *R. turanicus* require further taxonomic investigation before we can say whether their distributions are broad. Our analysis yields 18 species whose broad distribution is not obviously related directly to human activities and whose identity can be ascertained, although some of these may yet represent species groups. *Ixodes* is again the predominant genus, with seven species in this category, followed by *Haemaphysalis* with five of the 18 species, *Hyalomma* with three, *Amblyomma* with two and *Rhipicephalus* with one species.

A.A. Guglielmone et al., *The Hard Ticks of the World: (Acari: Ixodida: Ixodidae)*,
DOI 10.1007/978-94-007-7497-1_25, © Springer Science+Business Media Dordrecht 2014

Table 1 Species of Ixodidae with naturally broad distributions

Tick species	Principal hosts	Distribution
H. indica[a]	Mammalia (Carnivora)	Afrotropical-Oriental-Palearctic
H. sulcata	Mammalia and to a lesser extent Aves	*Ibidem*
Hy. anatolicum	Mammalia (Artiodactyla)	*Ibidem*
Hy. dromedarii	Mammalia (Artiodactyla)	*Ibidem*
Hy. turanicum	Mammalia and Aves	*Ibidem*
I. vespertilionis	Mammalia (Chiroptera)	*Ibidem*
A. testudinarium	Mammalia and to a lesser extent Aves and Squamata	Australasian-Oriental-Palearctic
H. doenitzi[a]	Aves	*Ibidem*
H. hystricis	Mammalia	*Ibidem*
H. longicornis	Mammalia	*Ibidem*
I. granulatus	Mammalia and to a lesser extent Aves	*Ibidem*
R. haemaphysaloides	Mammalia	*Ibidem*
A. loculosum	Aves	Afrotropical-Australasian-Oriental
I. kopsteini	Mammalia (Chiroptera)	*Ibidem*
I. simplex	Mammalia (Chiroptera)	Afrotropical-Australasian-Oriental-Palearctic
I. auritulus[a]	Aves	Afrotropical-Australasian-Nearctic-Neotropical
I. kerguelenensis	Aves	Australasian-Islands in Atlantic, Indian and Pacific Oceans
I. uriae[a]	Aves	Circumpolar

A. Amblyomma, *H. Haemaphysalis*, *Hy. Hyalomma*, *I. Ixodes*, *R. Rhipicephalus*
[a]More than one species may be included under these names

References

Balashov, Y.S. 1994. Importance of continental drift in the distribution and evolution of ixodid ticks. Entomol. Rev., 73 (8): 42–50.

Camicas, J.-L., Hervy, J.-P., Adam, F. & Morel, P.-C. 1988. Les tiques du monde (Acarida, Ixodida). Nomenclature, stades décrits, hôtes, répartition. ORSTOM, Paris, 233 pp.

Clifford, C.M., Sonenshine, D.E., Keirans, J.E. & Kohls, G.M. 1973. Systematics of the subfamily Ixodinae (Acarina: Ixodidae). 1. The subgenera of *Ixodes*. Ann. Entomol. Soc. Am., 66: 489–500.

Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4), Nauka, Moscow, Leningrad, 316 pp. In Russian.

Guglielmone, A.A. Nava, S. 2010. Rodents of the subfamily Caviinae (Hystricognathi, Caviidae) as hosts for hard ticks (Acari: Ixodidae). Mastozool. Neotr., 17: 279–286.

Guglielmone, A.A., Nava, S. & Díaz, M.M. 2011. Relationships of South American marsupials (Didelphimorphia, Microbiotheria and Paucituberculata) and hard ticks (Acari: Ixodidae) with distribution of four species of *Ixodes*. Zootaxa, 3086: 1–30.

Morel, P.-C. 1969. Contribution à la connaissance de la distribution des tiques (Acariens, Ixodidae et Amblyommidae) en Afrique éthiopienne continentale. Thèse de Doctoratdes Sciences Naturelles. Université de París, 398 pp.

Pardiñas, U.F.J., D'Elía G. & Ortiz, P.E. 2002. Sigmodontinos fósiles (Rodentia, Muroidea, Sigmodontinae) de América del Sur: estado actual de su conocimiento y prospectiva. Mastozool. Neotr., 9: 209–252.

Type Depository Acronyms

Type depositories are included for all taxa and are referenced using the acronyms listed below. Some collections in the USA have been merged and new names have been given to them. For example, the former Rocky Mountain Laboratories and Harry Hoogstraal collections are now in the U.S. National Tick Collection. Throughout, we have used the current acronym, even when the original description states otherwise.

AI:	Agriculture Institute N 1, Hanoi, Vietnam
AMNH:	American Museum of Natural History, New York, USA
AM:	Australian Museum, Sydney, Australia
ANIC:	Australian National Insect Collection, CSIRO, Canberra, Australia The F.H.S. Roberts Australian tick collection, and most other reference collections of Australian ticks, are now located in the ANIC, CSIRO Entomology, Canberra (Halliday, B., personal communication to Guglielmone, A.A.).
AR:	Arthur's Collection, unknown address
BAC:	Buckley Amber Collection (private), Florence, Kentucky, USA
BM:	B.P. Bishop Museum, Honolulu, USA
BMNH:	The Natural History Museum, London, EnglandStatements concerning types deposited in the British Museum of Natural History, British Museum, Cambridge or London, are considered to refer to BMNH.
CAS:	California Academy of Sciences, San Francisco, USA
CB:	Colección Boero (private), city unknown, Argentina
CDPV:	Colección Departamento de Parasitología Veterinaria, Salto, Uruguay
CDS:	D.C. Swan Collection, city unknown, Australia
CFCV:	Colección Facultad de Ciencias Veterinarias, Esperanza, Argentina
CFMVZ:	Coleção da Faculdade de Medicina Veterinária e Zootecnia, São Paulo, Brazil
CG:	Collection of E.S. Gourlay, city unknown, New Zealand?
CGC:	Collection Gil Collado, city unknown, Spain

A.A. Guglielmone et al., *The Hard Ticks of the World: (Acari: Ixodida: Ixodidae)*,
DOI 10.1007/978-94-007-7497-1_26, © Springer Science+Business Media Dordrecht 2014

CI: Cawthorn Institute, Nelson, New Zealand
CK: Collection Kishida, city unknown, Japan
CL: Colección Lahille, city unknown, Argentina?
CM: Collection P.-C. Morel, Paris, France
CMC: Canterbury Museum, Christchurch, New Zealand
CNC: Canadian National Collection of Insects and Arachnids, Agriculture and Agri-Food, Canada, Ottawa
CNHM: Chicago Natural History Museum, Chicago, USA. Now known as the Field Museum of Natural History
CR: Collection Raja, Vepery, India
CS: Collection Saito, Niigata, Japan
CT: Colección Tovar, México D.F., Mexico
CZIICT: Centro de Zoología do Instituto de Investigãçao Científica Tropical, Lisbon, Portugal
DA: Division of Acarology, Department of Zoology, University of Calicut, Kerala, India
DB: Department of Biology, Faculty of Science, King Abdel Aziz University, Jidda, Saudi Arabia
DEEZ: Division of Entomology and Economic Zoology, University of Minnesota, St. Paul, USA
DEP: Division of Entomology and Parasitology, University of California, Berkeley, USA
DPFV: Departamento de Parasitología, Facultad de Veterinaria, Zaragoza, Spain
EAVRO: East African Veterinary Research Organization, Kikuyu, Kenya
EC: Evans Collection in Edinburgh Museum, Scotland
EMV: Escuela de Medicina Veterinaria, Santiago, Chile
ENV: École Nationale Vétérinaire, Toulouse, FranceStatements concerning types deposited in Toulouse are considered to refer to ENV.
FCM: Field Columbia Museum, Chicago, USA. Now known as the Field Museum of Natural History
FF: Facultad de Farmacia, Universidad de Madrid, Madrid, Spain
FMC: Feldman-Muhsam collection, city unknown, Israel
FMNH: Field Museum of Natural History, Chicago, USA
FMS: Fukui Medical School, Laboratory of Ohara General Hospital, Omachi, Fukushima, Japan
GM: Museo Civico di Storia Naturale di Genova Giacomo Doria, Genoa, Italy. Statements concerning types deposited in Genoa are considered to refer to GM.
GML: Gorgas Memorial Laboratory, Panama City, Panama
HH: Harry Hoogstraal Collection, United States Naval Medical Research Unit Nº 3, Cairo, Egypt
IAHVS: Institute of Animal Husbandry and Veterinary Science, Yang-xi County, Hubei Province People's Republic of China
IBAC: Instituto de Biología, Academia de Ciencias de Cuba, Havana
IBU: Instituto Butantan, São Paulo, Brazil

ICA: Institute of Comparative Anatomy, University of Pavia, Pavia, Italy
IEMVPT: Institut d'Élevage et de Médecine Vétérinaire des Pays Tropicaux, Tananarive, Madagascar
IGHTC: Ivan G. Horak Tick Collection, Faculty of Veterinary Science, University of Pretoria Onderstepoort, South Africa
IM: Indian Museum, Calcutta
IME: Institute of Microbiology and Epidemiology, Academy of Military Medical Sciences, Beijing People's Republic of China
IMRKL: Institute for Medical Research, Kuala Lumpur, Malaysia
INTA: Instituto Nacional de Tecnología Agropecuaria, Rafaela, Argentina
IOC: Instituto Oswaldo Cruz, Rio de Janeiro, Brazil
IP: Institut de Parasitologie (sometimes referred to as Laboratoire de Parasitologie), Faculté de Médecine de Paris, France
IPCAS: Institute of Parasitology, Czech (formerly Czechoslovak) Academy of Sciences, Prague, Czech Republic
IPG: Institut Pasteur, Guyane et du Territoire de l'Inini, Cayenne, French Guiana
IPT: Institut Pasteur, Tananarive, Madagascar
IPP: Institut Pasteur, Paris, France
ISET: Instituto de Salubridad y Enfermedades Tropicales, México D.F., Mexico
ISM: Institut Scientifique de Madagascar, Tananarive, Madagascar
ITS: Institut Tropical Suisse, Bâle, Switzerland
IZAS: Institute of Zoology, Academia Sinica, Beijing, People's Republic of China
IZG: Institute of Zoology of Georgia, Tbilisi, Georgia
KC: Kolonin Collection, Moscow, Russia
LACM: Los Angeles County Museum, Los Angeles, California, USA
LC: Linnaeus Collection, Upsala, Sweden
LFE: Laboratoire Federal de l'Élevage, Dakar, Senegal
LMNH: Rijksmuseum van Natuurlijke Historie, Leiden, The Netherlands. Statements concerning types deposited in Leiden are considered to refer to LMNH.
LP: Laboratorio de Parasitología, Facultad de Medicina Veterinaria, Maracay, Venezuela
LPFMR: Laboratoire de Parasitologie, Faculté de Médecine de Rennes, Rennes, France
LSHTM: London School of Hygiene and Tropical Medicine, London, England
MC: Marx's Collection, city unknown, USAAccording to Keirans, J.E. (personal communication to Guglielmone, A.A.), most specimens from this collection are now in the USNM, while some are in the USNTC.
MCN: Museo de Ciencias Naturales Bernardino Rivadavia, Buenos Aires, Argentina
MCNB: Museo de Ciencias Naturales, Barcelona, Spain
MCZ: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA

MHNLS: Museo de Historia Natural La Salle, Caracas, Venezuela
MHNCI: Museu de Historia Natural Capão da Imbuia, Curitiba, Brazil
MHNM: Museu de Historia Natural, Maputo, Mozambique
MHO: Hope Museum, Oxford, England
MNHN: Museum National d'Histoire Naturelle, Paris, France. Statements concerning types deposited in Paris are considered to refer to MNHN.
MPAS: Museum of the Peabody Academy of Science, Salem, Massachusetts, USA
MRCB: Musée Royal du Congo Belge, Tervuren, Belgium
MRSN: Musei Regionale di Scienze Naturali, Turin, Italy. This museum contains specimens maintained previously in the Musei di Zoologia, Instituto de Zoologia e Anatomia Comparata Universitá degli Studi di Torino, Turin, Italy.
MSNM: Museo Civico di Storia Naturale di Milano, Milan, Italy
MZB: Museum Zoologicum Bogoriense, Bogor, Indonesia
MZD: Medical Zoology Department, Niigata University School of Medicine, Niigata, Japan
MZNH: Museum of Zoology and Natural History La Specola, Florence, Italy
NC: Nemenz Collection, private, Vienna? Austria?
NRS: Naturhistoriska Ricksmuseet, Stockholm, Sweden
NIAH: National Institute of Animal Health, Kodaira, Tokyo, Japan
NM: National Museum, Melbourne, Australia
NSM: National Science Museum, Natural History Institute, Shinjuku, Tokyo, Japan
NTMD: Northern Territory Museum, Darwin, Australia
NWC: Nixon Wilson's Collection (private), Cedar Falls, Iowa, USA
OMB: Überseemuseum Bremen, Bremen, Germany
OSU: Oregon State University, Corvallis, USA
OVI: Onderstepoort Veterinary Research Institute, Onderstepoort, South Africa. Types said to have been deposited in Pretoria are considered to be maintained at OVI.
ORSTOM: Office de la Recherche Scientifique et Technique Outre-Mer, Bondy, France
PNM: Philippine National Museum, Manila, Republic of the Philippines
PRUL: Pest Research Unit Laboratory, National Council for Scientific Research, Chilanga, Lusaka, Zambia
QM: Queensland Museum, Brisbane, Australia
SAM: South Australia Museum, Adelaide, Australia
SAIMR: South African Institute for Medical Research, Johannesburg, Republic of South Africa, sometimes cited as Institute of Medical Research, Johannesburg. This institute is now known as the National Institute for Communicable Diseases.
SDC: Santos Dias's Collection, city unknown, Portugal
SEATO: SEATO Medical Research Laboratory, Bangkok, Thailand

SFCST: Service de Faunistique du Centre Scientifique et Technique, Bondy, France
SM: Science Museum, Golden Gate Park, San Francisco, USA
TAU: Tokyo Agricultural University, Tokyo, Japan. We were unable to locate a current institution with this name.
TM: Tasmania Museum, Hobart, Australia
TTU: Texas Tech University, Lubbock, USA
UC: Gerrit Uilenberg's Collection, Cargèse, France
UM: University of Maryland, College Park, USA
USNPC: United States National Parasite Collection, Beltsville, Maryland, USA The USNPC contains specimens in the following collections: Bureau of Animal Industry, United States National Museum of Helminthology, Zoological Division Parasite Collection, United States Department of Agriculture Parasite Collection, Beltsville Parasite Collection and Animal Parasite Collection (Salley et al. 1978).
USNTC: United States National Tick Collection, Statesboro, Georgia, USA This is the largest and most comprehensive tick collection in the world. It includes the Rocky Mountain Laboratories tick collection (Durden et al. 1996) and the tick collection of the U.S. National Museum of Natural History (Smithsonian Institution), whose usual acronym is USNM, although others have been used (Keirans and Hillyard 2001). Part of the Schulze tick collection is also deposited in the USNTC (Keirans J.E., personal communication to Guglielmone, A.A.).
VLM: Veterinary Laboratory, Maputo, Mozambique. The VLM Collection is now located at the Faculdade de Veterinária, Universidade Eduardo Mondlane, Maputo, Mozambique (information provided by one of the authors, IGH)
VRC: Virus Research Centre, Poona, India
VRLH: Veterinary Research Laboratory, Harare, Zimbabwe
VRLKK: Veterinary Laboratory Research, Kabete, Kenya
WAM: Western Australia Museum, Perth, Australia
WC: Jane Walker's southern Africa Collection, OVI, Onderstepoort, South Africa
WUM: Worclaw University Museum of Natural History, Worclaw, Poland Formerly known as the Breslau Museum.
ZIAC: Zoological Institute of the Russian Academy of Sciences, St. Petersburg
ZMA: Zoological Museum, Amsterdam, The Netherlands
ZMB: Zoologischen Museums Berlin, Berlin, Germany Statements concerning types deposited in Berlin are considered to refer to ZMB.
ZMM: Zoologischen Museum München, Munich, Germany
ZMMO: Zoological Museum of Moscow University, Moscow, Russia
ZMUC: Zoological Museum of the University of Copenhagen, Copenhagen, Denmark
ZSH: Zoologischen Staatsmuseum Hamburg, Hamburg, Germany

Statements concerning types deposited in Hamburg are considered to refer to ZSH.

ZSI: Zoological Survey of India, Calcutta, India

References

Durden, L.A., Keirans, J.E. & Oliver, J.H. 1996. The U.S. National Tick Collection. Am. Entomol., 42: 239–243.

Keirans, J.E. & Hillyard, P.D. 2001. A catalogue of the type specimens of Ixodida (Acari: Argasidae, Ixodidae) deposited in The Natural History Museum, London. Occ. Pap. Syst. Entomol. (13), 74 pp.

Salley, E.J., Lichtenfels, J.R. & Shaw, J.H. 1978. Index-catalogue of medical and veterinary zoology. Special publication 3. Checklist of types in the U.S. National Parasite Collection, United States Department of Agriculture, U. S. Government Printing Office, Washington., 230 pp.