

The Ecology, Bionomics, and Behaviour of *Haemaphysalis (Aboimisalis) punctata* Tick in Central Europe

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Summary. 1. *Haemaphysalis (Aboimisalis) punctata* tick is a widely distributed species in palaearctic region. In Slovakia it occurs in region approximately limited with annual isotherms 7–9° C and isohyets 650–1000 mm.

2. It seems that birds and small mammals are very frequent hosts of immature stages of *H. punctata*. For adults very important hosts are grazing domestic animals and free living Artiodactyla. Nymphs and adults only infrequently attach to man.

3. *H. punctata* is known as reservoir and vector of tickborne spotted typhus *Rickettsia siberica*, Q fever and possible vector of Bhanja-virus, Tribeč-virus, and tickborne encephalitis virus. It transmits also *Babesia bigeminum*, *Theileria mutans*, *Brucella melitensis*, and probably louping-ill virus.

Zusammenfassung. 1. Die Zecke *Haemaphysalis punctata* ist eine in der palaarktischen Region weitverbreitete Art. In der Slowakei ist das Auftreten durch die Jahresisotherme von 7–9° C und einen Niederschlag von 650–1000 mm begrenzt.

2. Es scheint, daß Vögel und Kleinsäuger sehr häufig Wirte für unreife Stadien darstellen. Sehr wichtige Wirte für Adulte sind herbivore Haustiere und freilebende Artiodactyla. Nymphen und Adulte saugen gelegentlich an Menschen.

3. *H. punctata* ist als Reservoir und Überträger von *Rickettsia siberica*, Q Fieber und wahrscheinlich als Überträger des Bhanja-Virus, Tribeč-Virus und Zeckenencephalitis-Virus bekannt. Sie überträgt auch *Babesia bigeminum*, *Theileria mutans*, *Brucella melitensis* und wahrscheinlich den louping-ill Erreger.

Introduction

Haemaphysalis (Aboimisalis) punctata Canestrini et Fanzago, 1877 is widely distributed species in palaearctic region from the British Isles to the Japan and from southern Scandinavia to the Mediterranean region, Asia Minor and southern part of U.S.S.R. It occurs chiefly on pastures, forest margins and forest-steppes. Adults and nymphs infrequently parasitize humans.

This paper deals with its distribution, ecology, bionomics, trophic relationship, and behaviour based on our investigations in nature and in laboratory during the years 1955–1970.

Distribution

H. punctata is ecologically very adaptable, tolerating the mild humid Atlantic climate on pastures of England and persisting into karstic region in Slovakia and Hungary and semi-desert zones of Central Asia. It is known from the British Isles, having been recorded from Kent, Gower, Glamorganshire, from Cranborne, Dorset, from Somerset and Devon (Arthur, 1963); Bardsey Island (Hobart and Whalley, 1954), Wheler, 1906, France (Neumann, 1911; Senevet, 1937), Germany (Neumann, 1911; Schulze, 1929), Denmark (Nuttall and Warburton, 1915), Holland (Arthur, 1963), southern Scandinavia and the Baltic islands (Schulze, 1939; Arthur, 1963; Brinck *et al.*, 1965), Poland (Lachmajer, Skierska, Wegner, 1956), Czechoslovakia (Rosický, 1953; Mačička and Rosický, 1956; Mačička and Nosek, 1958; Nosek and Řeháček, 1962; Nosek, Lichard, Sztankay, 1967), Switzerland (Aeschlimann *et al.*, 1965); Hungary (Babos, 1964), Roumania (Feider, 1965), Bulgaria (Sárbova, 1964; Pavlov, 1968), Yugoslavia (Tovornik, 1970), Albania (Rosický *et al.*, 1960), Greece (Neumann, 1911), Spain (Nuttall and Warburton, 1915), Italy (Neumann, 1911; Saccà *et al.*, 1969), the Mediterranean Islands (Corsica, Cypre, Cyclades, Creta), North Africa (Egypt, Algeria), Asia Minor (Hoogstraal, 1959; Merdivenci, 1969), Iran, Japan.

H. punctata has been reported from the following regions in the Soviet Union: Moldavia, southern Ukraine, European part of R.S.F.S.R., Crimea, Lower Volga region (northward to Saratov), Lensk-district, Caucasus and middle Asiatic Republics, Kazakhstan—western (Valley of the Syr-darya) and eastern (Alma-ata, Dzharagent, etc.), Kirghezia (Frunze, Osch, Karakol, etc.), Uzbekistan, Tadzhikistan (Gissar Valley) (Pomerancev, 1950; Skrynnik, 1947; Anastos, 1957; Popov, 1962; Arthur, 1963; Grebenyuk, 1966).

Occurrence in Czechoslovakia

H. punctata in Carpathian foreland occurs prevalently together with *Dermacentor marginatus* tick. It lives in Slovakia at foothill of Hronský Inovec (Čierna dolina), Štiavnické Mountains (Hrončín, Žemberovce), Krupíňská Hillyland (Plášťovce (Fig. 2b), Abelová, Velký Lom, Luboreč), Slovakian Karst (Domica, Ardovo, Silica, Hrhov (Fig. 2c, Jablonov n.T.) (Fig. 1).

Habitats

This chapter briefly describes the characteristics of the locality Domica in Slovakian Karst and Čierna dolina on southern slopes of Hronský Inovec Mountains where research on the ecology of *H. punctata* has been carried out.

The examined locality Domica (Fig. 2d) spreads between the elevations 300–400 m above Sea level. Climatically, this region may be characterized as warm with mild winters. Climate is of Continental character. The annual average air temperature is 8–9° C, the average January temperature is –4° C. The average July temperature is 18° C (19° C). The annual snow cover amounts 20 cm height. The total annual precipitations amount 650–700 mm. Phenologically, the spring begins in the first half of April. The autumn is moderately warm and relatively long.

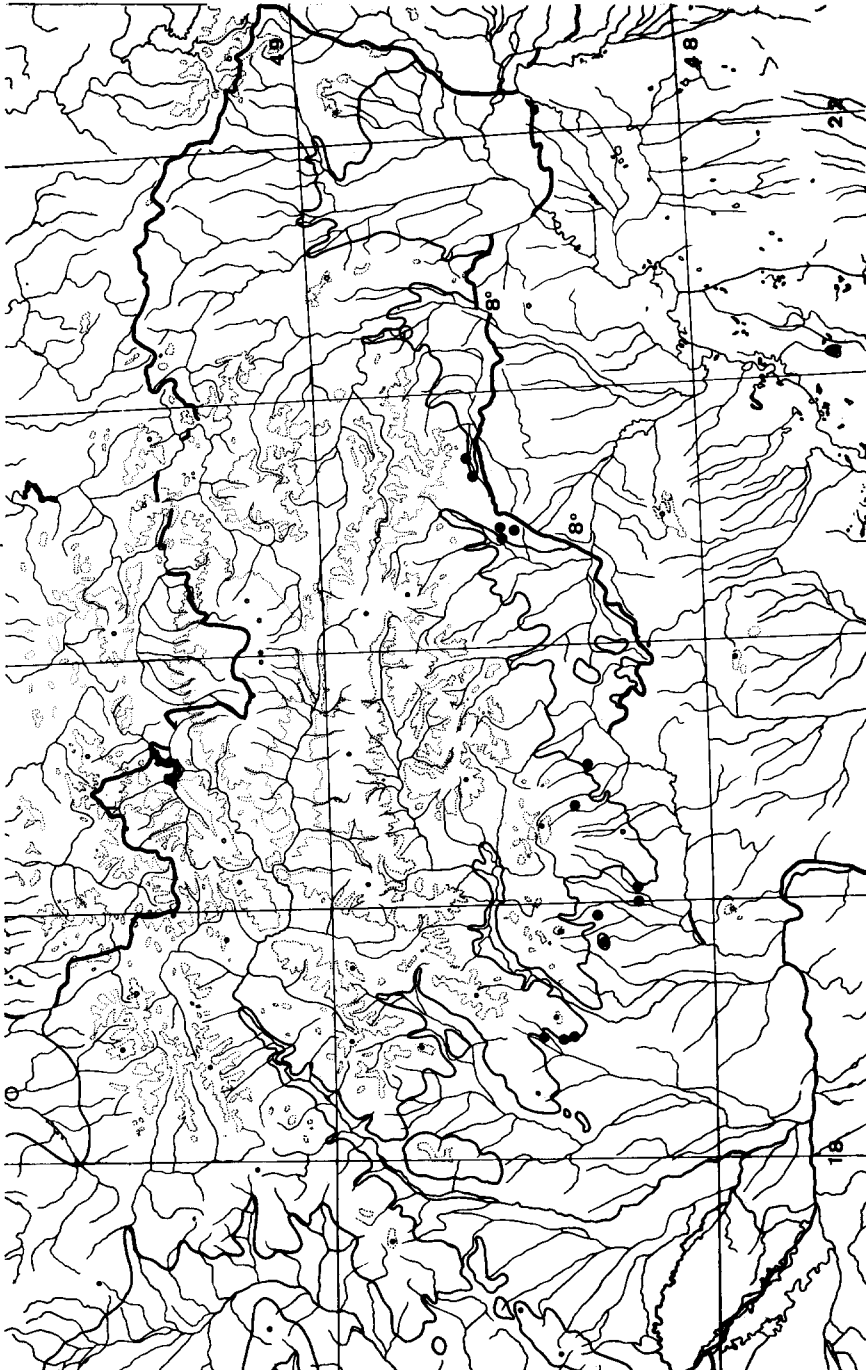


Fig. 1. Distribution of *Haemaphysalis punctata* in Slovakia

Geological formation of the locality is Holocene, Pleistocene, substrate Triassic limestone, grikes.

Geobotanically, this region is characterized as Corneto-Quercetum, vegetation is of thermophilic character.

The tree-communities are composed from the oak-trees (*Quercus cerris*, *Q. pubescens*), *Prunus mahaleb*, *Cornus mas*, *Rosa canina*, *Prunus spinosa*, *Pyrus communis*, *Rosa spinonissima*.

Description of habitat: Slope above Domicia Cave. Altitude: 360 m. Community: *Quercus pubescens* 2, *Q. cerris* 1, *Prunus mahaleb* 3, *Cornus mas* 2, *Rosa canina* +, *Ligustrum vulgare* +, *Prunus spinosa* +, *Evo-ny-mus verrucosa* +. Grassy-herbaceous community: *Festuca duriuscula* 4, *Seseli osseum* 3, *Thymus angustifolius* 2, *Teuricum montanum*, *Potentilla arenaria* 2, *Iris pumila* +, *Achillea nobilis* +, *Verbascum austriacum* +, *Pulsatilla grandis* +, *Hypericum sp.* +, mosses and Cladonias (*Cladonia chlorophaea*) +. Mosses predominate on the stones, under trees and between the boulders.

The second locality Čierna dolina (Fig. 2a) spreads on the southern slope of Hronský Inovec Mountains in altitude about 200 m. Climatically, this region is moderately cool to warm and mild, with mild winters. The annual average air temperature is -8° C, and in the growing season $14-15^{\circ}$ C. The average July temperature is 17° C, the average January temperature is -3° C. The average yearly rainfall is 650–1000 mm, about 400–500 mm falling during the growing season.

This locality spreads on andesite and andesite pyroclasts substrate, in some places eroded and overgrown with shrubs and small groups of trees-residues of a former forest. More exposed and warmer places are overgrown with thermophilic oak forest with *Quercus petraea* and *Q. cerris* and less exposed places with oak-hornbeam forest (*Querco-Carpinetum*). Supplementary grassy communities and shrubs are pastures at the present time and form so-called forest border communities in ecotone pasture-forest. Grassy and shrub communities spread somewhere also in the forest.

The dominant species of grassy communities is *Festuca sulcata*. Other steppe species such as *Botriochloa ischaemum*, *Potentilla heptaphylla*, *Koeleria gracilis*, *Thymus angustifolius*, *Potentilla arenaria*, *P. argentea*, *Agrimonia eupatoria*, *Eryngium campestre*, *Ononis spinosa*, *Seseli osseum* and *Festuca pseudodalmatica* and *Rosa spinonissima* are abundant. The dominant species of shrub is *Prunus spinosa* and there are also *Rosa canina*, *Pyrus communis*, *Malus communis*, *Crataegus sp.*, *Ligustrum vulgare*, *Berberis vulgaris* and *Cornus mas*. Mosses and lichens (*Cladonia mitis*) occur frequently.



a



b

Fig. 2a–d. Habitats of *H. punctata*. a Locality Čierna dolina (Quercu-Carpinetum)—Synusy of *H. inermis*, *H. punctata*, *I. ricinus* and *D. marginatus*, ticks. b Locality Plášťovce (Corneto-Quercetum)—Synusy of *H. inermis*, *H. punctata*, *D. marginatus* and *I. ricinus* ticks. c Locality Hrhov, Slovakian Karst—Synusy of *H. punctata*, *D. marginatus*, and *I. ricinus* ticks. d Locality Domica, Slovakian Karst (Corneto-Quercetum)—Synusy of *H. punctata*, *D. marginatus*, and *I. ricinus* ticks

Seasonal Incidence

Adults appear on the vegetation at the end of March to June and in October. Larvae appear from the end of May to the middle of August. Nymphs are active from the beginning or middle of April to the end of June and again from the beginning of August to the middle of October (sometimes from the beginning of April to the October). Development



Fig. 2c



Fig. 2d

in nature covers three vegetation cycles. The seasonal incidence in southern Slovakia is shown in Fig. 3.

Rearing in Laboratory

The female feeds on the guinea-pig for 10–11 days; preoviposition lasts 12–30 days and from oviposition (number of eggs varies between 3000 and 5000) to hatching of larvae takes 35–43 days. Larvae feed on the white mouse for 3–4 days; the period of pre-ecdysis lasts 25–30 days. Nymphs feed on the white mouse for 3–5 days and pre-ecdysis lasts 28–30 days.

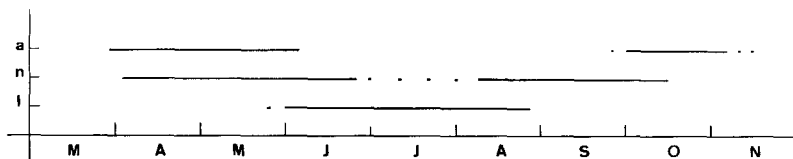


Fig. 3. Seasonal incidence of *H. punctata* tick. *a* adults, *n* nymphs, *l* larvae

Under experimental conditions, development at 20–24° C takes 165–229 days.

Ratio of Sex

Ratio ♂♂: ♀♀ as 1:1.3 was observed as the beginning of incidence (2. April, 1970).

Hosts

Hosts of Adults. Artiodactyla: red deer *Cervus elaphus*, roe deer *Capreolus capreolus*, domestic cattle, goats, sheep, pigs (buffalo, camels):

Perissodactyla: horses (donkeys).

Carnivora: domestic dog *Canis familiaris*, fox *Vulpes vulpes*.

Insectivora: hedgehog *Erinaceus roumanicus*.

Rodentia: brown hare *Lepus europaeus*, rabbit *Oryctolagus cuniculus*.

Aves: pheasant *Phasianus colchicus*.

The adults very rarely attach to man.

Hosts of Nymphs. Artiodactyla: goats, cattle, sheep.

Perissodactyla: horses.

Carnivora: domestic dog *Canis familiaris*, fox *Vulpes vulpes*, polecat *Putorius eversmanni*, weasel *Mustela nivalis*, badger *Meles meles*.

Insectivora: hedgehog *Erinaceus roumanicus*.

Rodentia: brown hare *Lepus europaeus*, rabbit *Oryctolagus cuniculus*, red squirrel *Sciurus vulgaris*, ground squirrel *Citellus citellus*, forest dormouse *Dryomys nitedula*, bank vole *Clethrionomys glareolus*, common vole *Microtus arvalis*, yellownecked mouse *Apodemus flavicollis*, long-tailed fieldmouse *Apodemus sylvaticus*;

Aves: blackbird *Turdus merula*, mistle thrush *Turdus viscivorus*, pheasant *Phasianus colchicus*, European quail *Coturnix coturnix*, corn-crake *Crex crex*, starling *Sturnus vulgaris*, skylark *Alauda arvensis*, crested lark *Galerida cristata*, corn bunting *Emberiza calandra*, tree pipit *Anthus trivialis*, tree sparrow *Passer montanus*, pied wheatear *Oenanthe pleschanka*, common redstart *Phoenicurus phoenicurus*, spotted flycatcher *Muscicapa striata*, willow warbler *Phylloscopus trochilus*, white-throat *Sylvia communis*, thrush nightingale *Luscinia luscinia*.

Hosts of Larvae. Insectivora: hedgehog *Erinaceus roumanicus*, European mole *Talpa europaea*.

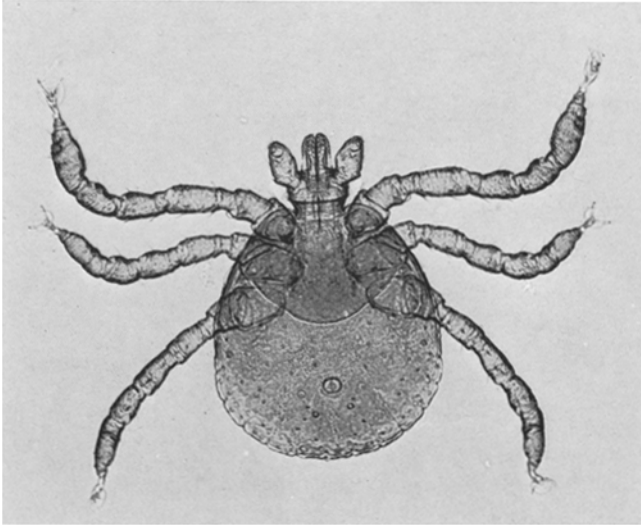


Fig. 4. Larva of *H. punctata*

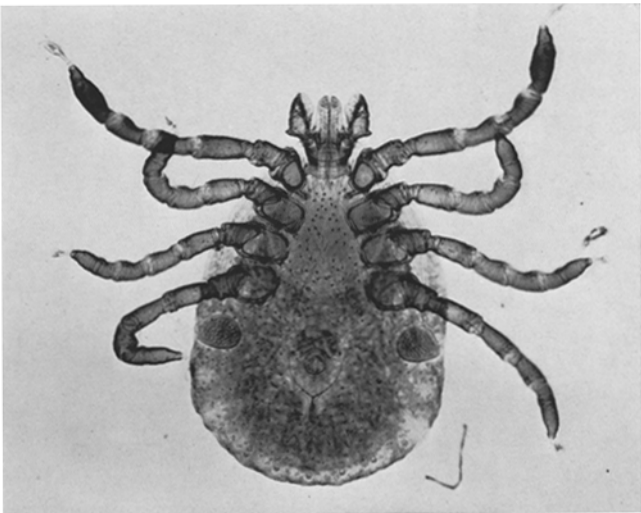


Fig. 5. Nympe of *H. punctata*

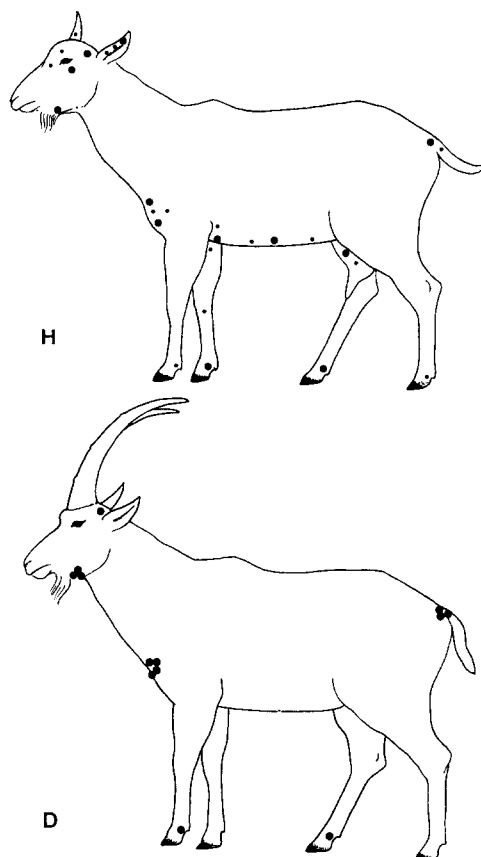


Fig. 6. Repartition of *H. punctata* (H) and *Dermacentor marginatus* (D) on the goat.
 • nymphe, ● adult

Reptilia: lizards *Lacerta viridis* and *L. agilis*.

Aves: blackbird *Turdus merula*, yellowhammer *Emberiza citrinella*, tree pipit *Anthus trivialis*, skylark *Alauda arvensis*, starling *Sturnus vulgaris*, crested lark *Galerida cristata*, corn bunting *Emberiza calandra*, tree sparrow *Passer montanus*, European quail *Coturnix coturnix*, pheasant *Phasianus colchicus*, magpie *Pica pica*, blue rocktrush *Monticola solitarius*, spotted flycatcher *Muscicapa striata*, willow warbler *Phylloscopus trochilus*, thrush nightingale *Luscinia luscinia*.

Larvae and nymphs (Figs. 4, 5) are common on small mammalia and especially on birds.

Table. Infestation of ten grazing goats during April 18-27, 1956, in the locality Pláštovce

| Number of goat | Date | <i>H. punctata</i> | | | <i>I. ricinus</i> | | | <i>D. marginatus</i> | | |
|----------------|-------------|--------------------|----|----|-------------------|----|----|----------------------|----|---|
| | | N | ♀ | ♂ | N | ♀ | ♂ | N | ♀ | ♂ |
| 1. | 18. 4. 1956 | 9 | 33 | 36 | 1 | 3 | 1 | — | — | — |
| 2. | | 6 | 7 | 3 | — | — | — | — | 5 | 7 |
| 3. | | 43 | 41 | 44 | 3 | 7 | 1 | — | 5 | 1 |
| 4. | | 33 | 31 | 49 | — | 8 | 2 | — | 3 | — |
| 5. | | 16 | 21 | 37 | 2 | 1 | 1 | — | 1 | 2 |
| 6. | | — | — | — | — | — | — | — | — | — |
| 7. | | 26 | 41 | 53 | 2 | — | 3 | — | 1 | 2 |
| 8. | | 14 | 43 | 38 | — | 2 | 1 | — | 7 | 1 |
| 9. | | 5 | 32 | 58 | 2 | 15 | 3 | — | — | — |
| 10. | | 32 | 48 | 49 | — | 1 | 1 | — | — | 2 |
| 1. | 22. 4. 1956 | 4 | 2 | 4 | — | 1 | — | — | — | — |
| 2. | | 7 | 9 | 3 | 1 | — | — | — | 2 | 2 |
| 3. | | 3 | 1 | 1 | — | — | — | — | 2 | 2 |
| 4. | | 33 | 31 | 49 | — | 8 | 2 | — | 3 | — |
| 5. | | 3 | — | 1 | — | — | — | — | — | — |
| 6. | | — | 5 | — | — | — | — | — | — | 1 |
| 7. | | — | 33 | 7 | — | 3 | 1 | — | 10 | 1 |
| 8. | | 16 | 5 | 1 | — | 1 | — | — | — | — |
| 9. | | 1 | 1 | — | — | — | — | — | — | — |
| 10. | | 3 | — | — | — | 3 | — | — | — | — |
| 1. | 26. 4. 1956 | — | 14 | 15 | — | 1 | — | — | — | — |
| 2. | | 7 | 38 | 57 | — | 5 | 2 | — | — | 5 |
| 3. | | 9 | 20 | 16 | — | 19 | 9 | — | 1 | — |
| 4. | | 25 | 32 | 17 | 1 | 3 | 1 | — | — | — |
| 5. | | — | 1 | — | 1 | 16 | 23 | — | 3 | 1 |
| 6. | | 17 | 3 | 13 | 13 | 4 | — | — | — | — |
| 7. | | 17 | 11 | 12 | — | 8 | 1 | — | — | — |
| 8. | | 21 | 19 | 21 | — | 8 | 1 | — | — | — |
| 9. | | 3 | 8 | 9 | — | 6 | 1 | — | 1 | — |
| 10. | | 22 | 18 | 4 | — | — | 1 | — | 1 | 1 |
| 1. | 27. 4. 1956 | — | 9 | 4 | — | — | — | — | — | — |
| 2. | | 1 | 4 | 2 | — | 2 | — | — | — | — |
| 3. | | 3 | 1 | 1 | — | — | — | — | 2 | 2 |
| 4. | | 11 | 9 | 3 | — | — | — | — | 2 | — |
| 5. | | 9 | 20 | 14 | — | — | — | — | 1 | — |
| 6. | | 1 | 4 | — | — | — | — | — | — | — |
| 7. | | 1 | 1 | 2 | — | — | — | — | 1 | — |
| 8. | | 2 | 9 | 1 | — | — | — | — | — | — |
| 9. | | 2 | 8 | 4 | — | 1 | — | — | — | 1 |
| 10. | | — | — | 1 | — | 1 | — | — | — | — |

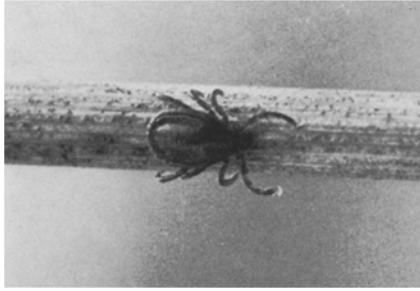


Fig. 7. Female of *H. punctata* waiting for a host

Repartition of Nymphs and Adults on the Host

The nymphae and adults infest Artiodactyla mainly on the places which are in contact with the bushes and grassy vegetation. They were never been found in "nests" as, e.g., *Dermacentor marginatus* (Figs. 6H,D). The infestation of ten goats pastured on the spring (18-27 April) on forest-steppe is summarized in the table.

Behaviour

The places with high density of this species are the margins of forest-steppe oak grazing-woods. Larvae survive the dry period (at the beginning of summer) under stones in bushes, under clusters of *Festuca sulcata* and *pseudodalmatica* etc. The nymphs are less sensitive to dryness. They occur in shade of bushes and on the green grass frequently in open area (Domica, Hrončín, Čierna dolina). Adults await their hosts almost in the upper third of grass-stalk, with palps directing down (Fig. 7).

Disease Relationship

H. punctata tick is known as reservoir and vector of tick spotted typhus *Rickettsia siberica* (Hoogstraal, 1966; Balašov, 1967), Q fever *Coxiella burnetii* (Živković and Petrović, 1970), tick-borne encephalitis virus (Balašov, 1967) possible vector of *Bhanja virus* (Verani *et al.* 1970), *Tribeč virus* (Topcin *et al.*, 1968) and *Babesia bigeminum* (Balašov, 1967). It is a species requiring further investigation in relation to sustaining louping ill and tick-borne encephalitis virus cycles among small vertebrates in nature. Under laboratory conditions it can also transmit *Theileria mutans* and *Brucella melitensis*, when transovarian transmission occurs (Arthur, 1963).

Control

As control measures the limitation of wood grazing and agricultural changes of pastures come in consideration. From natural enemies the common shrew (*Sorex araneus*), ants and *Hunterellus hookeri* may be mentioned.

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