

The introduction and subsequent extinction of the camel tick *Hyalomma (Euhyalomma) dromedarii* (Acari, Ixodidae) in Australia, with a review of the introduction of foreign ticks to Australia

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Abstract Historically, several tick taxonomists have reported *Hyalomma aegyptium* within Australia due to misidentifications. This has resulted in confusion relating to the occurrence of the genus *Hyalomma* within Australia. Based on the recent discovery of museum specimens of *Hyalomma dromedarii*, misidentified as *H. aegyptium*, the historical occurrence of *H. dromedarii* is reported for the first time within Australia, along with its apparent subsequent extinction. The introduction and naturalisation of foreign tick species into Australia is also reviewed.

Keywords Exotic tick · *Hyalomma dromedarii* · Livestock · Imported · Extinction

Introduction

Hyalomma dromedarii is a widely distributed tick species found through North Africa, much of Asia, and the Middle East (Apanaskevich et al. 2008). Although primarily a parasite of camels it has been recorded from a wide range of domestic species and wildlife (Apanaskevich et al. 2008). *Hyalomma dromedarii* is also considered to be of significant medical interest due to its ability to act as a vector of the Crimean–Congo haemorrhagic fever virus, *Theileria annulata*, *Theileria camelensis*, and *Coxiella burnetii* (Hoogstraal et al. 1981).

Records of the genus *Hyalomma* in Australia have been reported by both Cleland (1910) and Taylor (1946). Later efforts by Roberts (1953) to authenticate these claims resulted in the author determining that these prior claims were based on incorrectly identified specimens of *Rhipicephalus sanguineus* and the misunderstanding of past literature. Therefore up until now, it has been unclear whether the genus *Hyalomma* has ever been collected in Australia.

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Methods

Three engorged adult female tick specimens marked as *Hyalomma aegyptium*, collected by Cleland and Giles in 1908 from along the Strelley River in Western Australia were discovered in the tick collection of Museum Victoria (NMV). Specimens were examined using a LEICA M205 C light microscope and their identity was established based on taxonomic keys and descriptions in Geevarghese and Dhanda (1987) and Apanaskovich et al. (2008).

Results

The three engorged female specimens were identified as *H. dromedarii* based on a combination of deep cervical grooves and eyes on the scutum, ivory coloured bands encircling the distal portion of each leg segment, a broad and blunt posteromedian spur on coxa I, a long tapering posterolateral spur on coxa I, and a 'v' shaped genital operculum (Figs. 1, 2). The past occurrence of the genus *Hyalomma* within Australia is therefore confirmed. However, as the only known specimens of *Hyalomma* ticks collected within Australia have been shown to represent *H. dromedarii* instead of *H. aegyptium*, previous reports of the occurrence of *H. aegyptium* within Australia are likely to be misidentifications.

A review of the published Australian tick literature revealed no records of the genus *Hyalomma* collected in Australia during or after the extensive study of the Australian tick fauna by Roberts (1970). More recent surveys of the parasites of Australian camels also revealed no tick species (Spratt 1984; Brown 2004; Barton 2008). It was also found that no specimens of *Hyalomma* collected in Australia have been deposited in the tick collection housed at the Australian National Insect Collection (ANIC), Canberra. As more than a century has elapsed during which time no records of *Hyalomma* have been reported despite numerous surveys of Australian ticks, the author concluded that *H. dromedarii* has become extinct within Australia.



Figs. 1, 2 Morphological features distinguishing *Hyalomma dromedarii*

Discussion

The first report of a *Hyalomma* tick within Australia was that of *H. dromedarii* which was misidentified as *Hyalomma aegyptium*, at the time referred to as *Amblyomma aegyptium* by Cleland (1910). These reports were based on ticks imported to northern Western Australia on camels (*Camelus dromedarius*) originating from India. These ticks then apparently spread “temporarily through the country” on camels, cattle, and horses (Cleland 1910). However, all specimens collected by Cleland were apparently lost and could not be examined by later researchers to confirm the identity of these ticks until the author of this research paper discovered three specimen in a museum collection. *Hyalomma aegyptium* was subsequently reported by Taylor (1946) from the sheep, cow, horse, dog, cat and human in eastern Australia. However, later examination of some of these specimens by Roberts (1953) indicated that they were actually those of *Rhipicephalus sanguineus*. Roberts (1953) also attributed other records by Taylor (1946) to a misunderstanding of the outline by Fielding (1926) of host species from which *H. aegyptium* has been taken outside of Australia. Roberts (1953) reported specimens of *H. aegyptium* in the tick collection housed at the former animal health station in Yeerongpilly, Queensland, Australia. However, he noted that these specimens did not have locality records. Although having not viewed any specimens of *Hyalomma* known to have been collected in Australia, Roberts (1970) suggested that *Hyalomma* may still be present on camels in Australia. However, the genus *Hyalomma* has not been confirmed within Australia since the collection of the original specimens report by Cleland (1910). Host records of supposed *Hyalomma* from Australia are presented in Table 1.

While examination of the recently discovered historical specimens from Australia indicated the past occurrence of the *H. dromedarii* within Australia, the continued existence of this species is doubtful. As no evidence to support the occurrence of *H. dromedarii* in Australia has been published over the past century the author believes the species to be extinct within Australia.

Since the time of European colonisation, many different domestic animals have been brought to Australia along with their associated tick species, of which some have become naturalised. To date, five non-native tick species representing two families and four genera have become naturalised within Australia (Table 2).

Two non-native soft tick (Argasidae) species have become established in Australia, namely the poultry tick (*Argas persicus*) and more recently the spinose ear tick (*Otobius megnini*) (Roberts 1970; Mayberry 2003). *Argas persicus* is a widely distributed

Table 1 Host records of ‘*Hyalomma aegyptium*’ from Australia

Host species	Australian host-tick record	Record accuracy	Record correction
Camel (<i>Camelus dromedarius</i>)	Cleland (1910)	Unknown	–
Horse (<i>Equus caballus</i>)	Cleland (1910)	Unknown	–
Cow (<i>Bos taurus</i>)	Cleland (1910)	Unknown	–
Sheep (<i>Ovis aries</i>)	Taylor (1946)	Incorrect	Roberts (1953)
Dog (<i>Canis lupus familiaris</i>)	Taylor (1946)	Incorrect	Roberts (1953)
Cat (<i>Felis catus</i>)	Taylor (1946)	Incorrect	Roberts (1953)
Human (<i>Homo sapiens</i>)	Taylor (1946)	Incorrect	Roberts (1953)

References by Cleland (1910) to *H. aegyptium* likely refer to *H. dromedarii*

Table 2 Introduced tick species naturalised in Australia

Tick species	Australian common name	Main Australian host(s)	References
<i>Argas persicus</i>	Poultry tick	Poultry	Roberts (1970)
<i>Otobius megnini</i>	Spinose ear tick	Horses	Mayberry (2003)
<i>Haemaphysalis longicornis</i>	Bush tick	Cattle	Roberts (1970)
<i>Rhipicephalus australis</i>	Cattle tick	Cattle	Estrada-Peña et al. (2012)
<i>Rhipicephalus sanguineus</i>	Brown dog tick	Dogs	Roberts (1970)

tick species which has been suggested to have originated in central Asia and become a cosmopolitan species on domestic poultry as humans spread them throughout the globe (Barker and Walker 2014). The first record of *A. persicus* within Australia dates from 1887 (Barker and Walker 2014). While it remains unclear when and from where *A. persicus* was introduced to Australia it is possible that the species was carried on one or more of the approximately 200 domestic fowl which were brought to Australia with the first fleet in 1788 (Fisher 1994). In the time that *A. persicus* has inhabited Australia, it has become widespread and is now found in every state and territory of mainland Australia, and is believed to be absent only from Tasmania and Australia's small offshore islands (Barker and Walker 2014). Information surrounding the introduction and distribution of *O. megnini* within Australia is far more limited due to the cryptic nature of most infestations of this species. *Otobius megnini* derives its common name from its peculiar habit of infesting the ear canals of its host which makes detection difficult (Nava et al. 2009). To date, the species is known in Australia only from the state of Western Australia on horses where it was recorded only relatively recently (Mayberry 2003). It is possible that this species is far more widely distributed within Australia than what is presently recognised. However, extensive monitoring is required to determine this.

Three non-native hard tick (Ixodidae) species have become established in Australia, namely the bush tick (*Haemaphysalis longicornis*), cattle tick (*Rhipicephalus australis*) and the brown dog tick (*Rhipicephalus sanguineus*). *Haemaphysalis longicornis* is primarily a parasite of cattle and is distributed through much of East Asia (Barker and Walker 2014). It has been proposed that *H. longicornis* was originally introduced into Australia from Japan during the 1800s (Hoogstraal et al. 1968). Since then the species has become widespread in Australia and is considered to be a pest by the cattle industry (Barker and Walker 2014). However, of the introduced ticks, *R. australis* is perhaps the most nationally important tick pest on cattle. The evolutionary origin of *R. australis* is unclear but it is certainly not native to Australia as might be assumed based on its bionomial. Barker and Walker (2014) noted that this species is also found in Cambodia and is likely distributed in numerous other South East Asian countries. Its preference for cattle as hosts, coupled with its occurrence in South East Asia suggests that this may be where it evolved before later spreading into Australia with the introduction of cattle, which do not naturally occur in Australia. *Rhipicephalus sanguineus* is chiefly a parasite of dogs (*Canis lupus familiaris*) in Australia (Roberts 1970). The fact that it has not been recorded from the dingo (*Canis lupus dingo*) suggests that this species was likely introduced into Australia with Europeans rather than aboriginal people when they introduced the dingo. Intriguingly this species has been suggested to be most common on dogs in aboriginal communities (Barker and Walker 2014). This may reflect the susceptibility of these ticks to modern hygiene practices used

by dog owners in higher socioeconomic regions of Australia, namely the use of broad spectrum parasiticides for the control of heartworm (*Dirofilaria immitis*) and fleas.

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