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Ticks (Acari: Ixodoidea: Argasidae, Ixodidae) of Chile

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Abstract. The tick species recorded from Chile can be listed under the following headings: (1) endemic or established: *Argas keiransi* Estrada-Peña, Venzal and Gonzalez-Acuña, *A. neghmei* Kohls and Hoogstraal; *Ornithodoros amblus* Chamberlin; *Otobius megnini* (Dugès); *Amblyomma parvitarsum* Neumann; *A. tigrinum* Koch; *Ixodes auritulus* Neumann; *I. chilensis* Kohls; *I. cornuae* Arthur, *I. sigelos* Keirans, Clifford and Corwin; *I. stilesi* Neumann; *I. uriae* White; *Rhipicephalus sanguineus* Koch. (2) Probably established or endemic: *Argas miniatus* Koch; *Ornithodoros spheniscus* Hoogstraal, Wassef, Hays and Keirans; *Ixodes abrocomae* Lahille; *I. neuquenensis* Ringuelet; *I. pararicinus* Keirans and Clifford. (3) Doubtfully established: *Argas reflexus* Fabricius; *Ornithodoros talaje* (Guérin-Méneville). (4) Exotic: *Amblyomma argentinae* Neumann; *A. latum* Koch, *Rhipicephalus* (= *Boophilus*) *microplus* (Canestrini). (5) Erroneously identified as present in Chile: *Amblyomma americanum* (Linnaeus); *A. maculatum* Koch; *A. varium* Koch; *Ixodes conepati* Cooley and Kohls; *I. frontalis* (Panzer); *I. ricinus* (Linnaeus); *Margaropus winthemi* Karsch. (6) Nomina nuda: *Argas reticulatus* Gervais; *Amblyomma inflatum* Neumann; *Ixodes lagotis* Gervais. Hosts and localities (including new records) are presented. *Argas neghmei*, *O. amblus*, *O. megnini*, *I. uriae* and *R. sanguineus* may cause severe injury to their hosts, including humans. The Chilean *Ixodes* fauna is unique to the Neotropical Zoogeographic Region, and additional research is needed in order to understand the biological importance of these species.

Introduction

Ticks (Ixodoidea) are obligatory hematophagous ectoparasites in some or all postembryonic stages. Several species are vectors of agents that may cause disease and even kill their vertebrate hosts; ticks may also cause dermatoses and loss of blood, and they can inoculate toxins.

The tick fauna of Chile is peculiar for the Neotropical Zoogeographic Region, especially with respect to the unique species of *Ixodes* found in this country. The last review of Chilean ticks was that of Tagle (1971). Alcaino and Gorman (1999) published a list of ticks found on Chilean domestic animals, and González-Acuña et al. (2003a, 2004a) revised the genera *Amblyomma* and *Ixodes*. Herein we present a critical review of the Ixodoidea of Chile, as well as new information on tick species, hosts and distribution, with the hope that this material may prove useful in assessing the impact that these parasites have on health.

Materials and methods

The phylogeny proposed by Barker and Murrell (2002) for the Ixodidae and the classification of the Argasidae by Hoogstraal's (1985) have been adopted throughout this work. We do not apply the argasid phylogeny of Klompen and Oliver (1993) because it is based almost entirely on morphological characters, with few data on biology and no considerations about hosts, distribution, and molecular systematics.

This work is mainly a review of the literature, but new tick records obtained by one of us (DGA) are also included; these specimens have been deposited in the collection of the Departamento de Ciencias Pecuarias, Laboratorio de Zoología, Universidad de Concepción, Chile. Localities and the political regions (R) in which each tick species occurs are discussed in the text, while Table 1 provides the geographic coordinates for each locality. Figure 1 shows the administrative divisions of Chile.

We describe the ticks of Chile under six headings: (1) Endemic or established tick species. (2) Tick species probably established or endemic. (3) Tick species

Table 1. Coordinates of the localities where Chilean ticks have been collected.

Localities	S	W	Localities	S	W
Region I			*Region IX*		
Arica	18° 29′	70° 19′	Angol	37° 47′	72° 42′
Surire National Park	18° 51′	69° 30′	Nahuelbuta National Park	37° 47′	73° 02′
Iquique	20° 13′	70° 09′	Arauco	37° 50′	72° 58′
Region II			Callumapu	39° 41′	73° 13′
Chuquicamata	22° 18′	68° 56′	Valdivia	39° 48′	73° 12′
Chiu Chiu	22° 20′	68° 39′	Santo Domingo	39° 53′	73° 08′
Calama	22° 27′	68° 56′	*Region X*		
San Pedro de Atacama	22° 54′	68° 13′	Chiloé National Park	42° 30′	74° 00′
Toconao	23° 11′	68° 00′	*Region XII*		
Region III			Punta Arenas	53° 08′	70° 56′
Isla Pan de Azucar	26° 09′	70° 35′	Puerto Williams	54° 56′	67° 37′
Vallenar	28° 34′	70° 45′	Isla Navarino	55° 05′	67° 40′
Region V			Cabo de Hornos	55° 50′	67° 18′
Los Andes	32° 49′	70° 35′	Isla Diego Ramírez	56° 30′	68° 44′
Viña del Mar	32° 59′	71° 33′	*Region Metropolitana*		
Valparaíso	33° 02′	71° 38′	North East Cerro Manqueheu	32° 20′	70° 33′
West of Til Til	33° 04′	71° 04′	Santiago	33° 27′	70° 38′
Santo Domingo	33° 37′	71° 37′	San Bernardo	33° 35′	70° 41′
Region VII			Puente Alto	33° 36′	70° 34′
Talca	35° 25′	71° 39′	Pirque	33° 37′	70° 33′
Vilches Altos	35° 35′	71° 04′			
Region VIII					
Chillán	36° 36′	72° 02′			
Bío Bío	36° 49′	73° 03′			
Concepción	36° 50′	73° 03′			
Ñuble	36° 51′	72° 52′			
Arauco	37° 19′	73° 19′			

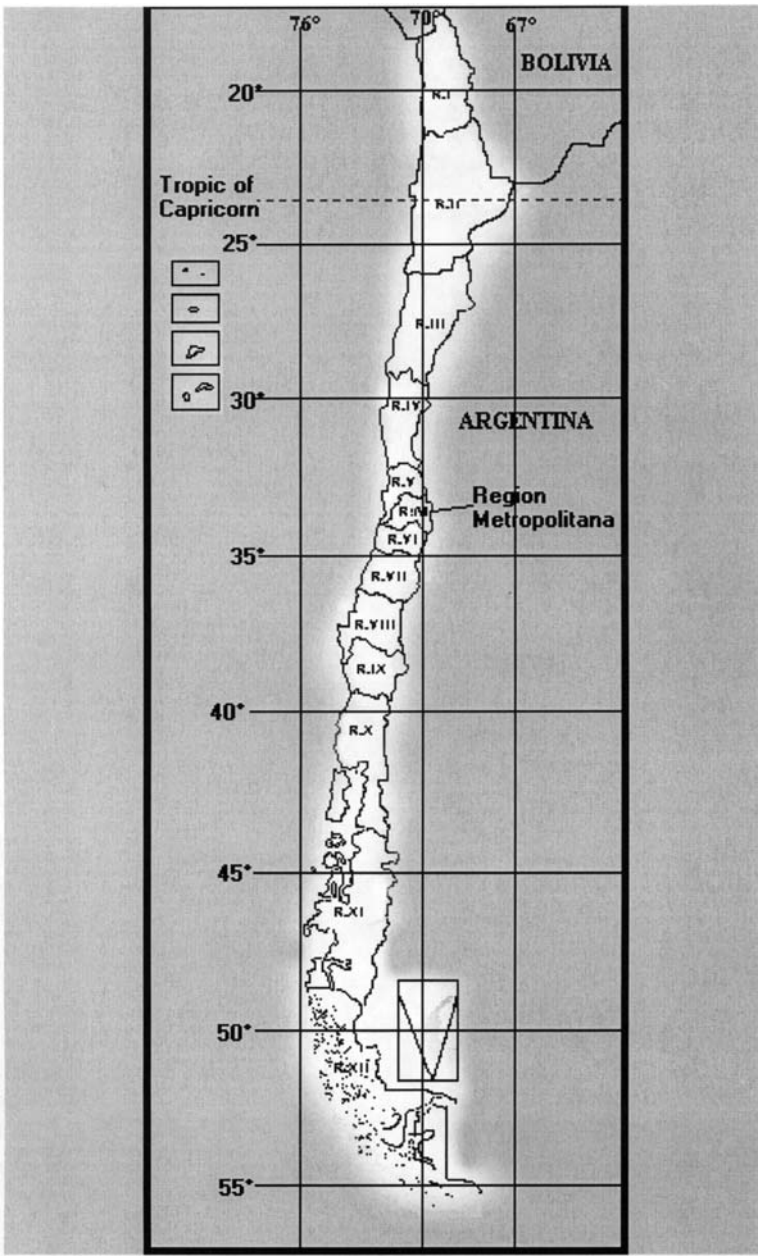

Figure 1. Political division of Chile showing administrative regions.

doubtfully established. (4) Exotic tick species. (5) Species erroneously identified as present in Chile. (6) Species of uncertain status. Some general remarks on families and genera are included the first time that they are mentioned. The

wond distribution of each species is also included, along with biological data when appropriate. Finally, we discuss the importance of some species in animal and human health and in the context of regional biodiversity.

Results

(1) Endemic or established tick species

Argasidae Canestrini, 1890. Argasid ticks are found mainly in deserts or semi-arid areas, where they are capable of surviving for long periods in the absence of hosts (Hoogstraal 1985).

Argas Latreille, 1796. The genus *Argas* contains about 60 species worldwide, of which 2 occur in Chile.

Argas keiransi Estrada-Peña, Venzal and González-Acuna, 2003. This species was described from larvae collected in Chillán (R VIII) on *Milvago chimango* (Aves, Falconiformes) (Estrada-Peña et al. 2003). Recently, nymphs and adults belonging to this species were found on a wall in the type locality. Olalquiaga Faure (1951) allegedly found *A. persicus* (Oken, 1818) under debris at a site frequented by *M. chimango* in Los Andes (R V). Confirmed records of *A. persicus* are lacking for Chile, but it has not been possible to determine whether the specimens found by Olalquiaga Faure (1951) were *A. keiransi* because they were not available for examination.

Argas neghmei Kohls and Hoogstraal, 1961. In 1950, Neghme collected argasids in chicken in Chile of houses, dovecotes, and human houses in Chuquicamata and Calama (R II). These specimens were later described by Kohls and Hoogstraal (1961) as *A. neghmei*. Other collections were made from chickens (locality unknown), chicken houses in Calama and Chiu Chiu, and in human dwellings in San Pedro de Atacama, Toconao and Chiu Chiu (Tagle 1966; Reyes 1971; Burchard 1985). Burchard stated that up to 24% of houses were infested with *A. neghmei* in northern Chile. All records of this species are from R II. The *A. persicus* recorded from man in Calama by Porter (1928) are probably *A. neghmei*. This species has also been found in Argentina (Aguirre et al. 1997) and is probably present in Perú (Kohls and Hoogstraal 1961). Like other Neotropical argasids, *A. neghmei* has been misidentified as *A. persicus* and also as the Palearctic *A. reflexus* (Latreille 1794) (Guglielmone et al. 2003). Although the female of *A. neghmei* somewhat resembles *A. reflexus*, the larvae of the two species differ greatly (Kohls and Hoogstraal 1961).

Ornithodoros Koch, 1844. The genus *Ornithodoros* comprises about 100 species worldwide (Hoogstraal 1985) but only one species has been confirmed for Chile. All stages are generally parasitic, though in some species the first nymphal stage can moult to the second stage without feeding, while in other species unfed larvae moult to first nymphs. With one exception, *Ornithodoros* ticks use a different host for each feeding instar (Hoogstraal 1985).

Ornithodoros amblus Chamberlin, 1920. *Ornithodoros amblus* was collected by Olalquiaga Fauré (1951) on the Guanay cormorant, *Phalacrocorax bouganville*, in Iquique (R I), and Schumaker et al. (1997) found this tick on sea gulls (*Larus* spp.) in Isla Pan de Azucar (R II). *Ornithodoros amblus* has been also found in Perú (Clifford et al. 1980). Biological differences among strains of *O. amblus* may indicate that more than one species is included under this name (Guglielmone et al. 2003).

Otobius Banks, 1912. There are two known species of *Otobius*, one of which occurs in Chile and elsewhere. Adults of this genus are nonparasitic and have nonfunctional mouthparts; females lay eggs autogenously (Hoogstraal 1985).

Otobius megnini (Dugés, 1883). This tick was reported by Descazeux (1925) as *Ornithodoros megnini* (Dugiés, 1883) on cattle and dogs in north and central Chile, and Donoso (1953) added horses, dogs and humans as hosts in the same areas. Porter (1937) reported the same species on horses near Santiago (R Metropolitana). Mucher1 (1952) and Tagle (1966) reported this tick on cattle, dogs, horses, donkeys, and humans in Calama (R II). Tagle (1966) recorded this tick on horses and cattle from Arica (R I), Puente Alto (R Metropolitana) and Talca (R VII), Keirans (1985) reported one nymph from cattle from an unknown locality. This species is also found in Argentina, Bolivia, Chile, Mexico, Perú, Venezuela and Guatemala. Its presence in Brazil and Cuba is doubtful (Guglielmone et al. 2003). *Otobius megnini* has been also found in the Afrotropical, Nearctic, Oriental (Keirans 1992) and Palearctic Zoogeographic Regions (Ozer and Aydin 1996). *Otobius megnini* is a specialized tick whose larvae and nymphs feed inside the ears of its hosts (primarily large wandering ungulates) in a modified one-host life cycle (Keirans and Pound 2003).

Ixodidae Murray, 1877. Members of this family are characterized by obvious sexual dimorphism, one nymphal instar, and females that take a single blood meal, followed by oviposition and death.

Amblyomma Koch, 1844. All members of this genus are three-host ticks, though two species are able to switch to a two-host life cycle (Dunn 1918; Oliver 1989). Of about 125 *Amblyomma* species worldwide, only two have been confinned as occurring in Chile.

Amblyomma parvitarsum Neumann, 1901. Adults of this species were reported by Donoso (1953), Tagle (1971) and Alcaíno and Gorma (1999) on vicuña (*Vicugna vicugna*), alpaca (*Lama pacos*), guanaco (*Lama guanicoe*) and llama (*Lama glama*) without precise localities. Recently, larvae of *A. parvitarsum* were found on lizards in Surire National Park (R I). *Amblyomma parvitarsum* has been also found in Argentina, Bolivia and Perú (Guglielmone et al. 2003); its finding on a penguin, *Spheniscus magellanicus*, by Becker et al. (1997) is considered accidental (Guglielmone et al. 2003).

Amblyomma tigrinum Koch, 1844. Tagle and Alvarez (1957, 1959) and González-Acuña et al. (2003a) reported adult of *A. tigrinum* on foxes (*Pseudalopex griseus*, *P. culpaeus*) and/or dogs in Pirque and Santiago (R Metropolitana), Nahuelbuta National Park: (R IX), Arauco, Concepción

(R VIII), Valparaiso and Santo Domingo (R V). Tagle and Alvarez (1957) identified this tick as *A. maculatum* Koch, 1844 but this diagnosis was later corrected by Tagle and Alvarez (1959). A recent study showed that 39% of the ticks collected on dogs in Concepción were *A. tigrinum* (Muñoz and Casanueva 2002). González-Acuna et al. (2004b) found larvae and nymphs on birds, including the Chilean tinamou (*Nothoprocta perdicaria*), Eared dove (*Zenaida auriculata*) and California quail (*Callipepla californica*) in Ñuble (R VIII). *Amblyomma tigrinum* adults are commonly known in Chile as the 'garrapata de listas blancas del perro' (white-ribbed dog tick). This is a South American species, with confirmed records in Argentina, Bolivia, Brazil, French Guyana, Paraguay, Perú, Uruguay and Venezuela (Guglielmone et al. 2003). *Amblyomma tigrinum* was long confused with *A. maculatum* until the former was validated by Kohls (1956a). Adult ticks generally infest domestic and wild carnivores (Guglielmone et al. 2000), while larvae and nymphs are found on various other hosts (Jones et al. 1972; Guglielmone et al. 2000), with birds being especially preferred (Venzal et al. 2003; González-Acuña et al. 2004b). Laboratory studies also show a preference for birds over mammals as hosts for larvae and nymphs of *A. tigrinum* (Souza et al. 1999). However, Aguirre (personal communication) found that larvae and nymphs of an Argentinian strain of *A. tigrinum* tend to infest rodents rather than birds, both in the laboratory and in nature.

Ixodes Latreille, 1795. Members of this genus are three-host ticks. *Ixodes* is represented by about 240 species worldwide and is the best represented tick genus in Chile.

Ixodes auritulus Neumann, 1904. Females of this species were collected from the passeriforme bird *Cinclodes antarcticus* in Isla Diego Ramirez and on *C. fuscus* in Isla Navarino (Robbins et al. 2001), and on birds in Punta Arenas by Neumann (1899) (who named these specimens *I. thoracicus* Koch, 1844). Nymphs have also been found on *C. fuscus*, and male ticks from an unknown host were collected at Rio el Ganso by Kohls and Clifford (1966). All these localities are in R XII. Recently, one nymph and one female were found on an Austral Blackbird (*Curaeus curaeus*) in Ñuble (R VIII) (González-Acuña et al. 2004a). With few exceptions, *I. auritulus* is a parasite of birds in Argentina, Brazil, Chile, Costa Rica, Guatemala, Peru, Venezuela, Ecuador, Uruguay, and also in the Australian, Ethiopian and Nearctic Zoogeographic Regions (Guglielmone et al. 2003). Arthur (1960) described the difficulties in diagnosing ticks in what he called the *I. auritulus* and *I. percavatus* Neumann, 1906, groups.

Ixodes chilensis Kohls, 1956. Kohls (1956b) described the female of *I. chilensis*, which was taken from an unknown host in Angol (R VIII). Tagle (1971) speculated that the host was a horse. *Ixodes chilensis* is only known from the holotype.

Ixodes cornuae Arthur, 1960. To date, this species has been reported only once from Chile: a single female was collected from an unknown host at Cabo de Homos (R XII) by Arthur (1960). It is also found in Ecuador (Arthur 1960).

Ixodes sigelos, Keirans, Clifford and Corwin, 1976. This species has only been found in Chile. Females, nymphs and larvae were collected on the rodent *Aconaemys fuscus*, west of Angol (R VIII), *Phyllotis* spp. at Vilches Altos (R VII), *Abrocoma bennetti* west of Til Til (R V), and *Octodon degus* northeast of Cerro Manquehue (R Metropolitana) (Keirans et al. 1976). Nymphs and larvae were collected on rodents (probably *Abrothrix longipilus*, *Abrothrix olivaceus* or *Rattus rattus*) at Bio Bio (R VIII) by Osorio (2001). Recently, one nymph and one larva of *I. sigelos* were collected from *Rattus norvegicus* and *Oligoryzomys longicaudatus*, respectively, captured in Chillan (R VIII) (González-Acuña et al. 2004a). Camicas et al. (1998) treated *I. sigelos* as a synonym of *I. abrocomae* Lahille (1916), but no evidence was presented to support their position. *Ixodes sigelos* is considered as a valid species by Horak et al. (2002).

Ixodes stilesi Neumann, 1911 (originally *I. elegans* Neumann (1910), a preoccupied name that Neumann later changed to *I. stilesi*). This species is only known from females collected on deer of the genus *Pudu* in Chile. Neumann (1910) recorded this tick on *Pudu humilis* (a junior synonym of *P. puda*) at an unknown locality; Kohls (1969) identified *I. stilesi* on *P. puda* from Valdivia (R IX), and Osorio (2001) found adult ticks (sex not specified) at Bío Bío (R VIII). Females and nymphs of *I. stilesi*, and a male that probably belongs to this species, were found recently on *P. puda* in Ñuble (R VIII).

Ixodes taglei Kohls, 1969. This species is known only from the males and females that Kohls (1969) used in his original description. The specimens were collected on *Pudu puda* in Santo Domingo (R V) and Callumapu (R X).

Ixodes uriae White, 1852. Lahille (1905) reported this tick as *Ceratixodes putus* (Cambridge, 1876) on the cormorant *Phalacrocorax verrucosus* at Puerto Williams; however, this bird is not present in Chile, so the host diagnosis is probably wrong. Neumann (1907) reported this tick as *Ixodes putus* (Cambridge, 1876) at Cabo de Hornos (without identifying the host). Johnston (1937) stated that Neumann found this species (named *I. putus*) on *Spheniscus magellanicus* (a penguin) and *Phalacrocorax magellanicus* in 'Chilean Tierra del Fuego'. All localities are from R XII. Additionally, Casanueva and Moyano (2000) reported that *I. uriae* was associated with nests of the Papua penguin (*Pygoscelis papua*) on Doumer Island (64 °52′S 63°36′W) in the Antarctic region. This species has a circumpolar distribution in both the southern and northern hemispheres (Wilson 1967).

Rhipicephalus Koch, 1844. Most of the world's approximately 80 species of *Rhipicephalus* have a three-host life cycle, but some members of this genus have one- or two-host cycles (Barker and Murrell 2002). Only one species of *Rhipicephalus* is found in Chile.

Rhipicephalus sanguineus (Latreille, 1806). This species was reported for the first time by Tagle (1976), who found it on dogs in Santiago (R Metropolitana). Numerous findings of *R. sanguineus* were reported from dogs and eventually cats in the R Metropolitana from Buin to Colina by Alcaino (1985) and Alcaino et al. (1990). The range of this tick is from Viña del Mar (R V)

(Alcaino 1985) to Concepción (R VIII) (Muñoz and Casanueva 2002). These last authors reported that 61% of dog ticks in Concepción were *R. sanguineus*. Recently, González-Acuña et al. (2003b) recorded a male *R. sanguineus* on *Rattus norvegicus* in Chillan (R VIII). *Rhipicephalus sanguineus* is an African tick that has been able to spread throughout the world along with humans and their dogs (Keirans 1992).

(2) Tick species probably established or endemic

Argas miniatus Koch, 1844. This species is a common parasite of chickens in Neotropical countries (Guglielmone et al. 2003). Many reports of *A. persicus* (a Palearctic species) on poultry in the Neotropics may actually refer to *A. miniatus* or related species (Kohls et al. 1970). Donoso (1953) found *A. persicus* in chicken houses and dovecotes in central and northern Chile; Tagle (1966) mentions chicken as a host for this tick species, and Porter (1928) stated that ticks found in a hen house in San Bernardo (R Metropolitana) were identified by Lahille as *A. persicus*. Lahille (1915) reported that nymphs and females of *A. persicus* were obtained in Santiago (R Metropolitana). These reports of *A. persicus* in Chile are probably unjustified and may represent records of *A. miniatus*.

Ornithodoros spheniscus Hoogstraal, Wassef, Hays and Keirans, 1985. This species is a parasite of the Humboldt penguin, *Spheniscus humboldti*. All known records of *O. spheniscus* are from Perú (Hoogstraal et al. 1985). However, this penguin breeds on the barren coast and offshore islands of Perú and Chile. The southern distribution limit of *S. humboldti* is R IV in Chile; therefore, we consider it likely that *O. spheniscus* is present in this country.

Ixodes abrocomae Lahille, 1916. This tick species was described from a male found on *Abrocoma murayi* in Vallenar (R III). Camicas et al. (1998) consider *I. sigelos* a synonym of *I. abrocomae*. *Ixodes sigelos* and *I. abrocomae* are considered valid species by Horak et al. (2002).

Lahille (1916) described the male of *I. abrocomae*, and Keirans et al. (1976) described the female, nymph and larva of *I. sigelos*. To our knowledge, no further descriptions of these tick species have been published, and the synonym of Camicas et al. (1998) is therefore unjustified. The description of *I. abrocomae* by Lahille (1916) is brief and without figures, but we consider *I. abrocomae* to probably be a valid species because it is the only *Ixodes* that has ever been collected in the Atacama Desert. Efforts are being made to find the type of *I. abrocomae* in order to confirm its validity.

Ixodes neuquenensis Ringuelet, 1947. This tick is a parasite of the endangered marsupial *Dromiciops gliroides*. All records of *I. neuquenensis* are from Argentina (Guglielmone et al. 2004). However, the host is endemic to the northern portion of the temperate forests of southern Argentina and Chile (Armesto et al. 1998). It seems probable that Chile falls within the range of *I. neuquenensis*.

Ixodes pararicinus Keirans and Clifford, 1985. This species has been found on cattle and horses in Argentina (Keirans et al. 1985). Gervais (1849) found *I. ricinus* (Linnaeus, 1758) (a Palearctic species long confused with *I. pararicinus*) on Chilean cattle. These records could represent *I. pararicinus*.

(3) Tick species doubtfully established in Chile

Argas persicus (Oken, 1818). This tick is a Palearctic species, but it has often been reported as occurring in the Neotropics. Most records have resulted from confusion with the Neotropical fowl tick (*A. miniatus*) and related species (Kohls et al. 1970). However, there exist three records from the Neotropical region that are strongly suggestive of *A. persicus* (Guglielmone et al. 2003), and we therefore cannot rule out the possibility that *A. persicus* occurs in this region. Even so, we consider it unlikely that *A. persicus* is established in Chile.

Argas reflexus Fabricius, 1794. Donoso (1953) and Alcaino and Gorman (1999) reported the Palearctic *A. reflexus* on Chilean domestic pigeons without specifying localities. There are several records of this species from the Neotropical region (Guglielmone et al. 2003), but none have been confirmed. We consider it improbable that *A. reflexus* is established in Chile.

Ornithodoros talaje (Guerin-Méneville, 1849). Cooley (1944) states that several species of *Ornithodoros* as well as species of *Argas* and also *Otobius* have been misidentified as *O. talaje*. Guglielmone et al. (2003) state that its distribution includes Argentina, Brazil, Colombia, Ecuador (Galapagos Islands), Guatemala, Panama and Venezuela. However, differentiating *O. talaje* from *O. puertoricensis* Fox, 1947 is difficult in the absence of larvae (Kohls et al. 1965). Moreover, recent studies in Uruguay showed that ticks that were thought to be *O. talaje* were in fact *O. puertoricensis* (J.M. Venzal, personal communication); therefore, the distribution of *O. talaje* outlined above may require clarification. This species was recorded from an unknown host in Santiago (R Metropolitana) by Neumann (1901). Lahille (1915) allegedly diagnosed this tick on horses (locality unknown) and also synonymized *Argas reticulatus* Gervais, 1849 with *O. talaje*. Porter (1917) mentions its finding on a woman's ear, but this probably reflects the presence of *O. megnini* (Guglielmone et al. 2003). Donoso (1953) allegedly found *O. talaje* on the burrowing owl, *Speotyto cunicularia*. Tagle (1971) doubts about presence in Chile, and Alcaino and Gorma (1999) do not mention *O. talaje* in their list of ticks from Chilean domestic animals. Although Muñoz and Casanueva (2001) consider Chile to be within the range of *O. talaje*, we regard this as unlikely.

(4) Exotic tick species

Amblyomma argentinae Neumann, 1904. This species is usually found on the tortoise *Chelonoidis chilensis* in Argentina (Guglielmone et al. 2001). There are

no tortoises endemic to Chile (Veloso and Navarro 1998), but there are records of *A. argentinae* in Chile, apparently on tortoises imported from Argentina. Olalquiaga Faure (1951) reported this tick species on terrestrial tortoises in Santiago (R Metropolitana), and González-Acuña et al. (2003b) found *A. argentinae* on *C. chilensis* (introduced from Argentina) in San Antonio (R V). Tagle (1971) reported *A. argentinae* on the bird *Turdus falklandii* in the National Park of Chiloé (R X); this finding (two males) was confirmed by González-Acuña et al. (2003b), who considered it an accidental importation on a bird whose distribution also includes Argentina.

Amblyomma latum Koch, 1844. Males of this species have been found recently on *Python regius* imported from Africa via USA to Customs in Santiago (R Metropolitana). Formerly, this tick was included in the genus *Aponomma* (Klompen et al. 2002)

Rhipicephalus (= *Boophilus*) *microplus* (Canestrini, 1887). According to recent progress on tick phylogeny as reviewed by Barker and Murrell (2002) the genus *Boophilus* have been transferred to *Rhipicephalus*. We considered that there is a sound basis for this criterion and, conversely, we follow the proposal of Barker and Murrell (2002).

This species is widely distributed on cattle in the Australian, Afrotropical, Neotropical and Oriental Zoogeographic Regions; however, Chile lies outside the distribution of *R. microplus* (Guglielmone et al. 2003). Hooker (1909) mentions its presence in Chile (locality unknown) under the name *Margaropus annulatus australis* (Fuller, 1899); Tagle (1971) reported this tick as *Boophilus microplus* (Canestrini, 1887) on cattle imported from Argentina and stated that climatic conditions were unfavourable for its maintenance in Chile.

(5) Tick species erroneously identified from Chile

Ornithodoros turicata (Dugas, 1876). Reports of *O. turicata* from Neotropical localities are in error because this is a Nearctic species (Hoogstraal 1985). The listing of *O. turicata* from Chile (host and locality unknown) by Descazeaux (1925) is a misidentification, as are other records from several Neotropical countries.

Amblyomma americanum (Linneus, 1758). This is a Nearctic species. Casanueva (2001) stated that Bishopp and Trembley (1945) reported its presence in Chile; however, these authors do not include Chile in the distribution of *A. americanum*. It appears that Casanueva (2001) confused the distribution of *A. maculatum* presented by Bishopp and Trembley (1945) with that of *A. americanum*.

Amblyomma maculatum Koch, 1844. Tagle and Alvarez (1957) reported this species from a fox (*P. griseus*) in Chile. Later, Tagle and Alvarez (1959) redetermined the tick specimens in their previous report as *A. tigrinum*, according to Kohls (1956a), who resurrected *A. tigrinum* and clarified its distribution as compared with *A. maculatum*. Muñoz and Casanueva (2001)

continue to list *A. maculatum* as occurring in Chile, having apparently relied on references previous to Kohls (1956a).

Amblyomma varium Koch, 1844. Neumann (1899) described *A. varium* (variety *albida*) from an allegedly Chilean specimen. However, Chile is outside the range of the hosts (sloths of the families Bradypodidae and Megalonchydae) of *A. varium* (Marques et al. 2002). We consider this finding a result of mislabelling rather than an indication of the presence of *A. varium* in Chile.

Ixodes conepati Cooley and Kohls, 1943. This species is reported as occurring in Chile by Doss et al. (1978). However, *I. conepati* is a Nearctic tick, and the Chilean collection mentioned by these authors actually applies to *I. auritulus* (Guglielmone et al. 2003).

Ixodes frontalis (Panzer, 1798). Neumann (1911) mentions this species as occurring in Chile; however, *I. frontalis* is a Paleartic tick, and the record from Chile is thought to be a misidentification (Guglielmone et al. 2003).

Ixodes ricinus (Linnaeus, 1758). This is a Palearctic species, and the many reports of its presence in the Neotropics are due to confusion with *I. aragaoi* Fonseca, 1935 or *I. pararicinus* (Guglielmone et al. 2003). Gervais (1849) recorded this tick from Chilean dogs and cattle. Donoso (1953) allegedly found *I. ricinus* on birds in central Chile. It is possible that the *Ixodes* from cattle are *I. pararicinus*, but it is difficult to imagine what species of ticks from dogs and birds have been confused with *I. ricinus* in Chile. Regardless, Chile is outside the range of *I. ricinus*.

Margaropus Karsch, 1879. This genus comprises three African species (Keirans 1992).

Margaropus winthemi Karsch, 1879. Karsch (1879) stated that the holotype of this species was collected in Valparaiso. This error in the distribution of *M. winthemi* was perpetuated for several decades by authors as Pinto (1945). No species of *Margaropus* occurs naturally in Chile or any other Neotropical country. Karsch's (1879) error probably stems from mislabelling.

(6) Species of uncertain status

Argas reticulatus Gervais, 1849. Gervais (1849) described this species from Chilean specimens. Later Neumann (1896) assigned it to the genus *Ornithodoros*, and Lahille (1915) relegated it to the synonymy of *O. talaje*. However, *O. talaje* is not thought to occur in Chile, and the type specimens of *A. reticulatus* are not available. Therefore we consider *A. reticulatus* to be a *nomen nudum*, as suggested by Camicas et al. (1998).

Amblyomma inflatum Neumann, 1901. The name *inflatum* was assigned by Neumann (1901) to a nymphal tick found on an undetermined host in Chile; however, the author was unsure of the genus to which the specimen belonged. This name was rejected by Camicas et al. (1998).

Ixodes lagotis Gervais, 1849. This species was described from specimens found on a rodent Neumann (1901) reclassified it in the genus *Haemaphysalis*.

Tagle (1971) argued that the host of this tick is not endemic to Chile. Anyway the type specimen is not available for examination. Following Camicas et al. (1998), we consider both *I. lagotis* and *H. lagotis* to be *nomina nuda*.

Discussion

Several Chilean tick species are threats to human health. *Argas neghmei* may cause erythema, pruritus and skin discoloration, and *O. amblus* causes severe discomfort (Clifford et al. 1980; Aguirre et al. 1997). Otitis in humans due to infestation with *O. megnini* is common (Burchard et al. 1984), and this tick may also play a role in the maintenance of *Coxiella burneti* (the causative agent of Q fever) in nature (Jellison et al. 1948). *Ixodes uriae* appears capable of transporting *Borrelia* species pathogenic to humans from Northern and Southern Hemispheres via migratory birds (Olsen et al. 1995). *Rhipicephalus sanguineus* has been responsible for 2.2% of the arthropod bites to man in Chile (Schenone 1996), and its bite has been correlated with the transmission of rickettsiae to humans (Burgdorfer 1975). However, no reports of disease transmission by this tick have appeared in Chile. It would be worthwhile to search for *O. spheniscus* in Chile because this tick's bite is known to produce pruritus, inflammation and blisters in both humans and natural vertebrate hosts in Perú (Hoogstraal et al. 1985).

Animal hosts are often adversely affected by tick infestation. Guano birds abandon their nests due to infestations with *O. amblus* (Clifford et al. 1980). Guglielmone et al. (2003) reviewed records of bites by *O. megnini*, which can cause otitis or lead to secondary bacterial infections or screwworm invasion, as well as neurological disorders and muscle spasms in horses and diminished milk production in cows. *Ixodes uriae* may kill its avian hosts (Ballard and Ring 1979), and *R. sanguineus* is known to be a vector of several diseases of dogs, not yet reported from Chile.

Argas miniatus is a vector of chicken borreliosis (*Borrelia anserina*) and *Aegyptionella pullorum* (Hoogstraal 1985) and may cause paralysis (Magalhaes et al. 1987). There is considerable confusion about tick species that feed on chickens in Chile. Therefore, renewed search for argasids in Chilean chicken houses are needed to confirm the presence of *A. miniatus* and to ascertain which species are attacking poultry in this country. Another tick that may be established in Chile is *O. spheniscus*, which produces irritation and may induce penguins to abandon their nests.

A re-examination of alleged specimens of *A. reflexus* from Chile is needed because it is most unlikely that this tick is established in the country. Additional search for pigeon ticks will help to darify this matter. The same applies for *A. persicus*.

Although there are not many species of ticks endemic to Chile, the fauna of *Ixodes* is unique for the Neotropical region. Four of the six Chilean *Ixodes* have not been found elsewhere. Three of these four species are parasites of

mammals, and the fourth parasitizes an unknown host. Some of the presently undescribed stages of these *Ixodes* species will be documented in the near future; however, more intense research is needed to obtain information on their hosts and distribution.

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