SYSTEMATICS, MORPHOLOGY AND PHYSIOLOGY

Ixodid Ticks (Acari: Ixodidae) Present at Parque Nacional El Rey, Argentina

Pablo M. Beldomenico[1], Cecilia J. Baldi[1], Leandro R. Antoniazzi[1], Guillermina M. Orduna[1], Mariano Mastropaolo[1], Ana C. Macedo[1], Marcelo F. Ruiz[1], Viviana M. Orcellet[1], José L. Peralta[1], José M. Venzal[2], Atilio J. Mangold[3] and Alberto A. Guglielmone[3]

[1]*Facultad de Ciencias Veterinarias,Universidad Nacional del Litoral, P. Kreder 2805 (3080) Esperanza, Santa Fe, Argentina*
[2]*Depto. Parasitología Veterinaria, Facultad de Veterinaria, Alberto Lasplaces 1550, (11600) Montevideo, Uruguay*
[3]*INTA, EEA, CC22 (2300) Rafaela, Santa Fe, Argentina*

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Carrapatos (Acari: Ixodidae) do Parque Nacional El Rey, Argentina

RESUMO - Informações sobre carrapatos autóctones e seus hospedeiros são escassas na América do Sul, especialmente para a Argentina. Com o objetivo de contribuir para o conhecimento dos carrapatos na região, 2094 carrapatos foram coletados da vegetação, de humanos e de animais domésticos e selvagens numa área no norte da Argentina rica em carrapatos e hospedeiros, durante seis viagens de campo conduzidas em 1999 (janeiro e agosto), 2000 (março e novembro) e 2001 (março e junho). Os carrapatos foram identificados como *Amblyomma cajennense* (Fabricius), *A. coelebs* Neumann, *Amblyomma* sp., *Haemaphysalis juxtakochi* Cooley, *H. leporispalustris* (Packard), *Ixodes pararicinus* Keirans & Clifford, *I. loricatus* Neumann, *I. longiscutatum* Boero e *Ixodes* sp. Pequenos mamíferos foram principalmente parasitados por estágios imaturos de *Ixodes*; humanos e animais domésticos, predominantemente por *Amblyomma* spp., e pássaros, principalmente por ninfas e larvas de *Haemaphysalis* spp.

PALAVRAS-CHAVE: *Amblyomma*, *Ixodes*, *Haemaphysalis*

ABSTRACT - Information on autochthonous ticks and their hosts is scarce in South America, especially in Argentina. To contribute to tick knowledge in the region, 2094 ticks were collected from the vegetation, humans, domestic and wild animals at a host-and-tick rich area of northern Argentina during six field trips conducted in 1999 (January and August), 2000 (March and November), and 2001 (March and June). The ticks were identified as *Amblyomma cajennense* (Fabricius), *Amblyomma coelebs* Neumann, *Amblyomma* sp., *Haemaphysalis juxtakochi* Cooley, *H. leporispalustris* (Packard), *Ixodes pararicinus* Keirans & Clifford, *I. loricatus* Neumann, *I. longiscutatum* Boero and *Ixodes* sp. Small mammals were mainly parasitized by immature stages of *Ixodes*; humans and domestic animals, predominantly by *Amblyomma* spp., and birds, mainly by nymphs and larvae of *Haemaphysalis* spp.

KEY WORDS: *Amblyomma, Ixodes, Haemaphysalis*

Ticks (Acari: Ixodoidea) are highly specialized blood-feeding arthropods that parasitize vertebrates and may act as biological vectors for many pathogens of man and animals (Balashov 1972). Most information presently available on Argentinean ticks arises from findings from domestic animals. Around forty tick species are reported for Argentina, with the greatest diversity and abundance in the subtropical northern part of the country (Boero 1957, Guglielmone & Viñabal 1994). Thirty-four of these species belong to the family Ixodidae, and are represented by the genera *Amblyomma* (22 species), *Ixodes* (7 species), *Haemaphysalis* (2 species), *Anocentor* (1 species), *Boophilus* (1 species), and *Rhipicephalus* (presumably 1 species) (Boero 1957, Mangold *et al.* 1983, Keirans *et al.* 1985). The last two genera, represented by single species each, are the cattle tick (*Boophilus microplus* [Canestirini]) and the dog brown tick (*Rhipicephalus sanguineus* [Latreille]), both introduced to the continent along with their hosts. The rest consist of autochthonous species that, with variable distribution ranges, belong to the Neotropical zoogeographic region. Host-specificity is variable among these ticks, but some tick species adapted well to feed on man and/or his domestic animals, parasitizing them while in some stages, like *Amblyomma neumanni* Ribaga, *Amblyomma cajennense* (Fabricius) and

Ixodes parariciinus Keirans & Clifford (Keirans *et al.* 1985; Guglielmone *et al.* 1990, 1991).

The objective of the present study was to identify the tick species present at the host-and-tick rich Parque Nacional El Rey, Anta Department, Salta Province, as well as the hosts they were feeding on.

Materials and Methods

The Parque Nacional El Rey (24º 15' S 64º 40' W) is a 44,162-ha reserve located in the northwestern Argentina. This park consists of environmental settings of Chaco and Cloudforest biomes, with altitudes ranging from 600 m to 2300 m. The climate is subtropical and most of the 1500 mm annual rainfall occurs in spring and summer.

Ticks were collected from humans, domestic and wild animals, and from the vegetation (using the dragging technique with pieces of white flannel as described by Sonenshine *et al.* [1966], or by hand collection) in six 13-day field trips conducted in 1999 (January and August), 2000 (March and November), and 2001 (March and June). Small mammals and birds (the latter were individuals that accidentally fell in the traps) were captured in the last three field trips, with official permission of Administración de Parques Nacionales. For such collection, Tomahawk (1620 trap-days total) and Sherman (2160 trap-days total) traps were evenly placed at three environmental settings of the park (mountainous Chaco, transitional forest and mountain forests [the last belongs to the Cloudforest]). Table 1 shows the number and species of wild animals examined. Park personnel contributed with tick collection during the inter-trip periods. Mouse genus and species identification were conducted by one of the authors (PMB) and confirmed by Carlos Galliari (Universidad Nacional de La Plata). Birds were identified using the descriptions provided by de la Peña & Rumboldt (1998).

Ticks were identified following the keys provided by Clifford *et al.* (1961), Guglielmone & Viñabal (1994), Jones *et al.* (1972) and Kohls (1960). The description by Kohls & Clifford (1967) for *Ixodes longiscutatum* Boero (named as *Ixodes* [*Haemixodes*] *uruguayensis* Kohls & Clifford) was also used. Larvae and nymphs of *Ixodes parariciinus* Keirans & Clifford and *Ixodes loricatus* Neumann were identified and confirmed by comparing with material obtained at the laboratory from adults collected by one of the authors (JMV). Ticks were stored at the Universidad Nacional del Litoral Ixodoidea Collection (accession numbers SAER001-SAER200).

Results and Discussion

A total of 2094 ticks belonging to eight species were collected. Table 2 shows numbers and sources of the tick species collected.

Parasitism. Six hundred and sixty six ticks were collected from humans at the following proportions: 69.2% *Amblyomma* sp. larvae; 19.5% *Amblyomma* sp. nymphs; 9.3% *A. cajennense* adults; 1.7% *Amblyomma coelebs* Neumann adults; 0.33% *Haemaphysalis juxtakochi* Cooley nymphs. Only 19 ticks (2.9%) were attached: *Amblyomma* sp. (10 nymphs and 2 larvae), *A. cajennense* (5 adult females), *A. coelebs* (1 adult female) and *H. juxtakochi* (1 nymph).

Two hundred and three sigmodontin mice of the genera *Akodon, Calomys, Oligoryzomys, Oryzomys,* and *Oxymycterus*, in order of abundance, were captured. Not all of them could be identified to the species level, but the majority identified were *Akodon simulator* Thomas, *A. spegazzini* Thomas, *Calomys venustus* Thomas,

Table 1. Number of wild animals examined for ticks at Parque Nacional El Rey in November 2000, February and June 2001.

Class or Family	Species	Number examined	Number infested
Aves	*Arremon flavirostris* Swainson[a]	1	1
	Buteo magnirostris (Gmelin)	1	0
	Cyanocorax chrysops (Vieillot)[a]	13	10
	Turdus nigriceps Cabanis	1	0
Total		16	11
Caviidae	*Cavia tschudii* Fitzinger[a]	4	3
Total		4	3
Didelphidae	*Lutreolina crassicaudata* (Desmarest)	1	0
	Thylamys venusta (Thomas)[a]	2	1
Total		3	1
Muridae Subfam. Sigmodontinae	*Akodon* spp.[a] *Oryzomys* spp.[a] *Oligoryzomys* spp.[a] *Oxymycterus* spp. *Calomys* spp.[a]	203	57
Total		203	57

[a]Species infested with ticks

Table 2. Number of specimens sorted by tick species and host group collected at Parque Nacional El Rey in sampling conducted in 1999, 2000 and 2001.

Tick species/host	Bird	Muridae	Caviidae	Opossum	Equine	Canine	Bovine	Human detached	Human attached	Questing	Total
Number of individuals examined	16	203	4	3	120[b]	12[b]	2	-	-	-	-
A. cajennense	-	-	-	-	338	2	3	57	5	87	492
A. coelebs	-	-	-	-	2	-	-	10	1	52	65
Amblyomma sp.	10	9[a]	-	-	76	77	19	579	12	370	1152
H. juxtakochi	25	-	-	-	69	1	-	1	1	16	113
H. leporispalustris	18	-	-	-	-	-	-	-		-	18
Ixodes sp.	16	1	-	-	-	-	-	-		-	17
I. longiscutatum	-	3	12	-	-	-	-	-		-	15
I. loricatus	-	20	-	-	-	-	-	-		-	20
I. pararicinus	2	193	-	1	1	-	2	-		3	202
Total	71	226	12	1	486	80	24	647	19	528	2094

[a] Unfed specimens only on one individual.
[b] Each domestic animal was counted every trip examined as an independent individual.

Oligoryzomys chacoensis Myers & Carlenton, *Oryzomys legatus* Thomas, *Oxymycterus paramensis* Thomas. A total of 226 ticks were found on 28.1% of those hosts. All ticks found on mice were immatures. The species *I. pararicinus* was the dominant one, present in 91.2% of the parasitized mice. Less frequent were *I. loricatus* (17 larvae and 1 nymph) and *I. longiscutatum* (3 larvae on 1 *Akodon* sp.). Nine unfed larvae of *Amblyomma* sp. were found on one mouse.

A total of 486 ticks were collected from 20 horses present at the park. Males and females of *A. cajennense* were the dominant ticks on horses, accounting for 69.4% of the findings. They were found year-round, more abundantly in spring and summer. Two females of *A. coelebs* were found on horses. *Amblyomma* sp. nymphs (9.2%) were found year round, and larvae (6.4%) were only present in fall (22 larvae) and winter (9 larvae). The species *H. juxtakochi* was the second most frequent tick species on horses (14.4%). Adults of *H. juxtakochi* were present in every season, but were more abundant in fall (25 females and 9 males), and least frequently found in summer (2 adults or less per sampling trip). Five nymphs of this species were found in winter, spring and summer. Larvae were not found. One male of *I. pararicinus* was found in March 2001.

Eighty ticks were recovered from the three dogs present at the park. The majority (96.3%) corresponded to immature stages of *Amblyomma* (56 larvae and 21 nymphs). Two males of *A. cajennense* and a single male of *H. juxtakochi* were also collected.

Individuals belonging to two bird species were found harboring ticks. Ticks were collected in June, in mountainous Chaco, where the majority (87.5%) of the birds were captured. All ixodids found on them were immatures. Ten out of 13 plush-crested jay (*Cyanocorax chrysops* [Vieillot]) (Passeriformes: Corvidae) were found infested with *Amblyomma* sp. (2 nymphs and 8 larvae), *H. juxtakochi* (3 nymphs and 21 larvae), *Haemaphysalis leporispalustris* (Packard) (1 larvae), *I. pararicinus* (2 larvae), and *Ixodes* sp. (15 larvae). The single captured saffron-billed sparrow (*Arremon flavirostris* Swainson) (Passeriformes: Emberizidae) had *H. leporispalustris* (17 engorged larvae), *H. juxtakochi* (1 larvae) and *Ixodes* sp. (1 larvae).

Four cavies (*Cavia tschudii* Fitzinger [Rodentia: Caviidae]) were captured in mountainous Chaco during spring. The only tick species found on three of them was *I. longiscutatum* (2 females, 1 nymph, 9 larvae).

Three opossums (Didephimorphia: Didelphidae), two *Thylamys venusta* (Thomas) and one *Lutreolina crassicaudatta* (Desmarest), were examined for ticks. One larva of *I. pararicinus* on a *T. venusta* was the only finding.

The species *A. cajennense* (2 females and 1 male), *Amblyomma* sp. (19 nymphs), and *I. pararicinus* (2 females) were found on two sacrificed feral bovines.

Questing Stages. A total of 528 ticks were collected from vegetation. Most specimens (99%) were found in forested areas. A small proportion (1%) of *Amblyomma* sp. nymphs and *A. cajennense* adults were found in open areas. *Amblyomma* was the genus most frequently collected (98.4%). Other species found were *H. juxtakochi* (2 females, 2 males, 8 nymphs and 2 larvae) and *I. pararicinus* (2 females and 1 male).

The genus most commonly found in humans and domestic animals was *Amblyomma*. This correlates with other studies in the region (Guglielmone *et al*. 1990, 1991). Only a small proportion of the ticks found on humans were attached. However, this proportion may be underestimated, because most of the non-attached ticks were *Amblyomma* spp. that could have bitten humans if they were left on, but were removed as soon as noticed to prevent tick borne diseases. Nymphs and larvae of *Amblyomma* were not identified to species level, because currently there is no key to immature *Ammblyomma* of the Neotropical region, but we assumed

that they were either *A. cajennense* or *A. coelebs*, on the basis of not finding any other adult *Amblyomma* species, and also because only two types of different *Amblyomma* nymphs were identified. Rodents did not appear to be important in the maintenance of *A. cajennense* and *A. coelebs* at the park. Instead, larvae and nymphs of *Amblyomma* seemed to prefer larger mammals and birds. Very little is known about the biology of *Amblyomma coelebs*, but the adult stage is commonly found on *Tapirus terrestris* (L.) (Peryssodactyla: Tapiridae), of which large populations are found in the study area (Heinonen & Chebez 1997). Fifty-two of the 65 adults of *A. coelebs* collected were questing. They were found in every season, but more frequently in summer (mean 2 ticks/day), remaining lower the rest of the year (mean 0.4 ticks/day). The rest were found on horses (2 female ticks) and humans (11 specimens, 1 female attached). This constitutes the first record of this species with confirmation of attachment to a human, and the first record on horses in Argentina.

Adults of *H. juxtakochi* are known to prefer cervid hosts and they adapt well to cattle (Boero 1957, Kohls 1960), but they where mostly found on horses. Birds appeared to be important hosts for immature stages of *H. juxtakochi*, particularly for larvae.

The species *H. leporispalustris* was last reported in Argentina in 1954 (Boero 1954). This species' preferred hosts are lagomorphs of the genus *Silvilagus* (Lagomorpha: Leporidae) (Kohls 1960). Parque Nacional El Rey hosts populations of *Silvilagus brasiliensis* (L.) (Chebez & Heinonen 1997), but no rabbit was available for tick examination. Larvae of *H. leporispalustris* were only found on birds, 17 on *A. flavirostris*, and 1 on *C. chrysops*. It is noteworthy that the *H. juxtakochi* : *H. leporispalustris* ratio was 24:1 for *C. chrysops* and 1:17 for *A. flavirostris*.

Horses did not appear as important hosts for *I. pararicinus*, but mice seemed to be very important for their maintenance at the park, as larvae and nymphs of this species frequently parasitized them. A few larvae were also found on *C. chrysops* and *T. venusta.* Both questing females of this tick species responded very apprehensively to human proximity, retracting completely their limbs and remaining immobile, as opposed to what was seen for species of *Amblyomma*, which always showed a reaching out attitude whenever human skin was approached.

The species *I. loricatus* was absent on the three opossums captured, but their immature stages were found on mice.

Immature stages of *I. longiscutatum* were unknown until recently, when Venzal *et al*. (2001) found that the immatures described as *I. uruguayensis* were in fact *I. longiscutatum.* This species was found mainly on *C. tschudii* captured during spring in mountainous Chaco. These cavies were found to harbor every known stage of *I. longiscutatum* (2 females, 1 nymph, 9 larvae). Three larvae of this species were found on a mouse that was captured in the same area and time as the cavies, but the species was absent on the remaining 202 mice examined, suggesting that the occurrence of immature stages of this species on mice is associated with the concurrent presence of cavies in the area, from which that tick could occasionally move onto mice.

Sixteen larvae that resembled *I. pararicinus*, but with shorter palpi, were collected from birds; one such larva was found on a mouse.

Small mammals at the park appeared to harbor principally *Ixodes* spp., whereas domestic animals and humans were principally parasitized by *Amblyomma* spp. This might indicate that direct pathogen transmission from rodents to humans or domestic animals by a single tick species, as for Lyme disease, human granulocitic ehrlichiosis and babesiosis, transmitted by *Ixodes scapularis* Say, 1821 in the eastern United States (Chang *et al*. 1998, Kjemtrup & Conrad 2000), would be rather unusual in the park's ecosystems.

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Literature Cited

Balashov, Y.S. 1972. Bloodsucking ticks (Ixodoidea) - Vectors of diseases of man and animals. Misc. Publ. Entomol. Soc. Am. 8: 161-376.

Boero, J.J. 1954. Los ixodideos de la República Argentina y sus huéspedes. Rev. Fac. Agron. Vet. 13: 505-514.

Boero, J.J. 1957. Las garrapatas de la República Argentina (Acarina –Ixodidae). Buenos Aires, Universidad de Buenos Aires, Depto. Editorial, 113p.

Chang, Y.F., V. Novosel, C.F. Chang, J.B. Kim, S.J. Shin & D.H. Lein. 1998. Detection of human granulocytic ehrlichiosis agent and *Borrelia burgdorferi* in ticks by polymerase chain reaction. J. Vet. Diag. Invest. 10: 56-59.

Chebez, J.C. & S. Heinonen. 1997. Los mamíferos de los Parques Nacionales de Argentina. Buenos Aires, Literature of Latin America, 70p.

Clifford, C.M., G. Anastos & A. Elbl. 1961. The larval ixodid ticks of Eastern United States (Acarina : Ixodidae). Misc. Publ. Entomol. Soc. Am. 1: 213-237.

Guglielmone, A.A. & A.E. Viñabal. 1994. Claves morfológicas dicotómicas e información ecológica para la identificación de las garrapatas del género *Amblyomma* de la Argentina. Rev. Inv. Agropec., INTA, 25: 39-67.

Guglielmone, A.A., A.J. Mangold & A.E. Viñabal. 1991. Ticks (Ixodidae) parasitizing humans in four provinces of north-western Argentina. Ann. Trop. Med. Parasitol. 85: 539-542.

Guglielmone, A.A., A.J. Mangold, D.H. Aguirre & A.B. Gaido. 1990. Ecological aspects of four species of ticks found on cattle in Salta, Northwest Argentina. Vet. Parasitol. 35: 93-101.

Jones, E.K., C.M. Clifford, J.E. Keirans & G.M. Kohls. 1972. The ticks of Venezuela (Acarina : Ixodoidea) with a key to the species of *Amblyomma* in the western Hemisphere. Provo, Utah: 4th ed., Brigham Young University Science Bulletin, 38p.

Keirans, J.E., C.M. Clifford, A.A. Guglielmone & A.J. Mangold. 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.

Kjemtrup, A.M. & P.A. Conrad. 2000. Human babesiosis: an emerging tick-borne disease. Int. J. Parasitol. 30: 1323-1337.

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.

Kohls, G.M. & C.M. Clifford. 1967. *Ixodes (Haemixodes) uruguayensis*, new subgenus, new species (Acarina: Ixodidae) from small rodents in Uruguay. Ann. Entomol. Soc. Am. 60: 391-394.

Mangold, A.J., A.C. Bermudez & A.A Guglielmone. 1983. Hallazgo de *Anocentor nitens,* Neumann 1897 (Ixodoidea-Ixodidae), en la Republica Argentina. Rev. Med. Vet. (Bs. As.). 64: 140-143.

Peña, M.R. de la & M. Rumboldt. 1998. Birds of Southern South America and Antarctica. Londres, Ed. H. Collins, 304p.

Sonenshine, D.E., E.L. Atwood & J.T. Lamb Jr. 1966. The ecology of ticks transmitting Rocky Mountain spotted fever in a study area in Virginia. Ann. Entomol. Soc. Am. 59: 1234-1262.

Venzal, J.M., O. Castro, P. Cabrera, C. de Souza, G. Fregueiro, D. M. Barros-Battesti & J.E. Keirans. 2001. *Ixodes (Haemixodes) longiscutatum* Boero (new status) and *I. (H.) uruguayensis* Kohls & Clifford, a new synonym of *I. (H.) longiscutatum* (Acari: Ixodidae). Mem. Inst. Oswaldo Cruz. 96: 1121-1122.

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