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Original article

Ticks (Acari: Ixodidae) on wild birds in north-central Argentina

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ABSTRACT

Ixodid ticks were collected from wild birds in five ecoregions in north-central Argentina, namely: Selva de las Yungas, Esteros del Iberá, Delta e Islas del Paraná, Selva Paranaense and Chaco Seco. A total of 2199 birds belonging to 139 species, 106 genera, 31 families and 11 orders were captured, but ticks were collected only from 121 birds (prevalence = 5.5%) belonging to 39 species (28.1%) and three Orders: Tinamiformes (Tinamidae) and Falconiformes (Falconidae) in Selva de las Yungas and Passeriformes (Conopophagidae, Corvidae, Emberizidae, Furnariidae, Icteridae, Parulidae, Thamnophilidae, Thraupidae, Troglodytidae, Turdidae) for all ecoregions. The following tick species were found: *Haemaphysalis juxtakochi*, *Haemaphysalis leporispalustris*, *Ixodes pararicinus* plus *Amblyomma* sp. and *Haemaphysalis* sp. in Selva de las Yungas; *Amblyomma triste* and *Ixodes auritulus* in Delta e Islas del Paraná; *Amblyomma dubitatum*, *A. triste* and *Amblyomma* sp. in Esteros del Iberá; *Amblyomma ovale* and *Amblyomma* sp. in Selva Paranaense, and *Amblyomma tigrinum* in Chaco Seco. *Amblyomma dubitatum* was found for the first time on Passeriformes, while the records of *A. ovale* on avian hosts are the first for Argentina. Birds are also new hosts for *I. pararicinus* females. Besides 2 larvae and 1 nymph, and 1 larvae found on Tinamidae (Tinamiformes) and Falconidae (Falconiformes), respectively, all other ticks (691 larvae, 74 nymphs and 2 females) were found on Passeriformes with a relevant contribution of the family Turdidae. Birds are important hosts for *I. pararicinus* as shown by a prevalence of 45% while all others prevalence were below 15%. All the species of *Amblyomma* and *Haemaphysalis* found on birds in Argentina have been also detected on humans and are proven or potential vectors for human diseases. Therefore, their avian hosts are probable reservoirs of human pathogens in Argentina.

Introduction

Ticks are blood-feeding ectoparasites of tetrapods and represent one of the main vectors of infectious agents. They transmit a great variety of infectious organisms as protozoan, viral (flavivirus, coltivirus, and one nairovirus, among others), bacterial and fungal pathogens (Sonenshine et al., 2002). Around 30 species of ticks (mostly from the genus *Ixodes*) are specific to birds because all parasitic stages feed on them but its main role is to support the nourishment of larvae and nymphs of many species worldwide as discussed in Guglielmone et al. (2014). Furthermore, wild birds are among the most mobile tick-hosts, being relevant in the dispersion of ticks and their pathogens (Olsén et al., 1995; Bjöersdorff et al., 2001; Elfving et al., 2010).

A total of 126 species of Ixodidae are established in the Neotropical Zoogeographic Region (Guglielmone et al., 2014; Nava et al., 2014) and 38 are found in Argentina (Guglielmone and Nava, 2005, 2006; Nava et al., 2009, 2014). Information of the role of the birds as hosts for ixodids established in Argentina is not abundant with recent evidences in Beldoménico et al. (2003), Nava et al. (2006, 2008, 2011), Ortiz et al. (2011) and Cicuttin et al. (2013) who present some tick-birds associations in studies with a broader scope than birds. The present study aims to further understand the role of birds as tick-hosts in different ecoregions of northern-central Argentina, which may also be relevant for epidemiological research on tick-borne pathogens.

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Fig. 1. Localities for tick-collections of birds in five Argentinean ecoregions: CS, Chaco Seco; DP, Delta e Islas del Paraná; EI, Esteros del Iberá; SP, Selva Paranaense; SY, Selva de las Yungas.

Materials and methods

This study was conducted in five ecoregions as defined in Burkart et al. (1999) as follows: (1) Selva de las Yungas: rainforest in north-western Argentina, hot and humid sub-humid climate; annual rainfall from 1000 to 1300 mm more frequent in summer; forest composition changing with altitude and the vegetation includes grasslands. Sampling locality: Parque Nacional El Rey (24°43′ S, 64°38′ W), in Salta Province; (2) Esteros del Iberá: a wetland characterized by the presence by swamps and marshlands connecting an extensive system of shallow lakes in eastern-northern Argentina, humid subtropical climate with floating vegetation, shrubland and flooded grasslands. Sampling locality: Estancia Rincón del Socorro (28° 40′ S, 57° 26′ W) in Corrientes Province; (3) Delta e Islas del Paraná: encompasses floodplains and islands along the Paraná and Paraguay rivers from eastern-northern to eastern-central Argentina, humid subtropical climate with forests, grasslands and marshlands. Sampling locality: Campana (34° 11'S, 58° 50′W) in Buenos Aires Province; (4) Selva Paranaense: rainforest in northeastern Argentina, hot and humid climate, annual rainfall from 1600 to 2000 mm evenly distributed through the year; 4–5 vertical layers of vegetation reaching up to 40 m high. Sampling locality: Reserva de Biosfera Yaboty (26° 53′ S, 53° 52′ W) in Misiones Province; (5) Chaco Seco: this region is characterized by continental subtropical climate, 500–700 mm yearly rainfall concentrated in summer and dry woodland vegetation in central-northern Argentina. Sampling localities: La Para (30° 50′ S, 62° 54′ W) and Dean Funes (30° 22′ S, 64° 21′ W), both in Córdoba Province. Sampling localities are shown in Fig. 1.

Birds were caught with permissions of Argentinean authorities from the Administración de Parques Nacionales or Provincial authorities. Collections of birds were performed using mist nets, which remained active during morning and twilight hours, in convenience samplings in 2011 and 2012 with focus in the Chaco Seco. Each individual bird was identified using Narosky and Yzurieta (2010), classified under Clements et al. (2012) criteria and examined for ticks using fine-tipped tweezers. After being processed birds were released and ticks obtained were stored until specific determination in the laboratory. Most of the ticks collected were larvae and nymphs; therefore, identification was carried out using the key for *Amblyomma* nymphs (Martins et al., 2010), specific descriptions for Neotropical ticks (Nuttall, 1916; Joan, 1930; Kohls, 1960; Keirans et al., 1985; Guglielmone et al., 2003; Estrada-Peña et al., 2005; Barbieri et al., 2008; Venzal et al., 2005a,b) and by comparison with laboratory-reared material deposited in the tick collection of Instituto Nacional de Tecnología Agropecuaria, Estación Experimental Agropecuaria Rafaela, Argentina. Prevalence of infestation and means were obtained for each tick species and corresponding hosts.

Results

A total of 2199 birds belonging to 139 species, 106 genera, 31 families and 11 orders were captured, but ticks were collected from 121 birds (prevalence 5.5%), belonging to 39 species (28.1%) and three Orders: Tinamiformes (Tinamidae), Falconiformes (Falconidae) and Passeriformes (Conopophagidae, Corvidae, Emberizidae, Furnariidae, Icteridae, Parulidae, Thamnophilidae, Thraupidae, Troglodytidae, Turdidae). Details for wild birds negative or positive to tick infestation are provided in Tables 1 and 2, respectively. Both localities in Chaco Seco show no differences in tick fauna and the results were combined. A total of 771 ticks (694 larvae, 75 nymphs and 2 females) representing eight ticks species were collected as follows: *Ixodes parareicinus*, *I. auritulus*, *Haemaphysalis juxtakochi*, *H. leporispalustris*, *Amblyomma dubitatum*, *A. ovale*, *A. tigrinum* and *A. triste* plus unidentified specimens of *Haemaphysalis* (larvae) and *Amblyomma* (larvae and nymphs).

Species richness was highest in Selva de las Yungas where specimens of *Amblyomma* (*Amblyomma* sp.1), *Haemaphysalis* (*H. juxtakochi*, *H. leporispalustris*) and *Ixodes* (*I. parareicinus*) were determined; followed by Delta e Islas del Paraná where two genera, *Amblyomma* (*A. triste*) and *Ixodes* (*I. auritulus*), were found. All ticks collected in the remaining three ecoregions were *Amblyomma*: *A. dubitatum* and *A. triste* in Esteros del Iberá; *A. ovale* (and *Amblyomma* sp.2) in Selva Paranaense and *A. tigrinum* in Chaco Seco. The prevalence of tick species on birds according to ecoregions are shown in Fig. 2, *I. parareicinus* has a prevalence of 45% clearly indicating that birds in Selva de las Yungas are important hosts for its survival; all others prevalence were below 15%.

Almost all hosts were Passeriformes and the role of Turdidae appears to be relatively more important as tick-host than the role of passerines from other families. *Turdus* spp. were infested with all species found in Selva de las Yungas but also one bird carried more than 100 *A. dubitatum* larvae in Esteros del Iberá. Nevertheless, *Cyanocorax chrysops* (Plush-crested Jay) was also found infested with *Amblyomma*, *Haemaphysalis* and *Ixodes* in Selva de las Yungas. Non-passeriformes hosts were birds from the orders Tinamiformes and Falconiformes captured in Selva de las Yungas. Details of tick infestation according to orders, families and species of birds in five Argentinean ecoregions are presented in Table 2 where new host-parasite relationships are also indicated.

Discussion

As expected for tick studies in the Neotropics, the genus *Amblyomma* was represented by more species than other genera. Several new host-parasite relationships were detected in this study but two of them are probably more relevant than others. The only precedent of birds as hosts of *A. dubitatum* is a nymph from *Rhea americana* (Struthioniformes: Rheidae) in Brazil (Nava et al., 2010); therefore, passerine birds are new hosts for larvae and nymphs of *A. dubitatum* and high larval infestation found on *Turdus rufiventris* (Table 2) may indicate a role as an alternative host for this species. It is known the

Table 1
Order, family, species and numbers of wild birds captured in five Argentinean ecoregions (ER) found negative to tick infestation; 1, Selva de las Yungas; 2, Esteros del Iberá; 3, Delta e Islas del Paraná; 4, Selva Paranaense; 5, Chaco Seco.

Order, family, species	No.	ER
CAPRIMULGIFORMES		
Caprimulgidae		
Caprimulgus longirostris	1	5
Nyctidromus albicollis	2	4
COLUMBIFORMES		
Columbidae		
Columbina picui	555	2, 5
Leptotila rufaxila	1	4
Leptotila verreauxi	5	2, 4, 5
Zenaida auriculata	5	5
CUCULIFORMES		
Cuculidae		
Coccyzus melacoryphus	4	5
Tapera naevia	1	5
FALCONIFORMES		
Falconidae		
Falco sparverius	1	5
GALBULIFORMES		
Bucconidae		
Nystalus maculatus	9	5
PICIFORMES		
Picidae		
Colaptes campestris	5	2
Colaptes melanochloros	11	5
Melanerpes cactorum	13	5
Picumnus temminckii	3	4
Veniliornis mixtus	4	5
PSITTACIFORMES		
Psittacidae		
Myiopsitta monachus	21	5
STRIGIFORMES		
Strigidae		
Glaucidium brasilianum	3	4, 5
TROGONIFORMES		
Trogonidae		
Trogon rufus	1	4
Trogon surrucura	1	4
PASSERIFORMES		
Cardinalidae		
Cyanocompsa brissonii	13	1, 4, 5
Corvidae		
Cyanocorax chrysops	3	4[a]
Cotingidae		
Phytotoma rutila	128	5
Emberizidae		
Ammodramus humeralis	2	5
Chlorospingus ophthalmicus	2	1
Piranga flava	1	2
Zonotrichia capensis	11	4[a]
Furnariidae		
Asthenes pyrroleuca	2	5
Cranioleuca pyrrophia	8	5
Dendrocolaptes platyrostris	2	4
Drymornis bridgesii	6	5
Furnarius rufus	3	3, 4[a]
Lepidocolaptes angustirostris	23	2, 5
Phacellodomus sibilatrix	1	5
Philydor rufum	1	4
Pseudoseisura lophotes	3	5
Sittasomus griseicapillus	2	1[a]
Synallaxis azarae	1	1
Synallaxis cinerascens	1	4
Synallaxis frontalis	6	3, 5
Synallaxis ruficapilla	2	4
Synallaxis spixi	1	4
Syndactyla rufosuperciliata	1	4[a]
Hirundinidae		
Progne tapera	5	2, 5
Icteridae		
Cacicus solitarius	1	2
Icterus cayanensis	3	2
Molothrus bonariensis	23	2, 5
Molothrus rufoaxillaris	7	5
Mimidae		
Mimus saturninus	4	5
Mimus triurus	8	5
Parulidae		
Basileuterus culicivorus	11	1, 3, 4
Geothlypis aequinoctialis	9	3, 5
Myioborus brunniceps	1	1
Myiothlypis leucoblephara	20	4[a]
Myiothlypis signata	1	1
Setophaga pitiayumi	1	4
Passeridae		
Passer domesticus	12	5
Polioptilidae		
Polioptila dumicola	1	5
Pipridae		
Chiroxiphia caudata	1	4
Rhinocryptidae		
Rhinocrypta lanceolata	2	5
Thamnophilidae		
Drymophila malura	2	4
Drymophila rubricollis	1	4
Dysithamnus mentalis	2	4
Pyriglena leucoptera	2	4
Taraba major	6	5
Thamnophilus caerulescens	9	4, 5
Thraupidae		
Catamenia analis	2	5
Donacospiza albifrons	1	3
Paroaria coronata	1	2[a]
Pipraeidea melanonota	1	1
Poospiza lateralis	1	3
Poospiza melanoleuca	15	5
Poospiza nigrorufa	1	5[a]
Pyrrhocoma ruficeps	1	4
Saltator aurantiirostris	2	2[a]
Saltator coerulescens	21	5
Sicalis flaveola	29	5
Sicalis luteola	1	5
Sporophila caerulescens	12	5
Tachyphonus coronatus	7	4
Thraupis bonariensis	21	5
Thraupis sayaca	7	1, 4, 5
Tityridae		
Schiffornis virescens	3	4
Troglodytidae		
Troglodytes aedon	2	4[a]
Troglodytes solstitialis	1	1
Turdidae		
Turdus amaurochalinus	1	4[a]
Turdus leucomelas	17	4
Turdus rufiventris	5	4[a]
Tyrannidae		
Elaenia albiceps/parvirostris	134	2,3,5
Elaenia mesoleuca	1	2
Empidonomus aurantioatrocristatus	8	5
Hemitriccus margaritaceiventer	2	5
Knipolegus hudsoni	1	5
Knipolegus striaticeps	2	5
Lathrotriccus euleri	2	2, 4
Lessonia rufa	1	5
Machetornis rixosa	3	5
Megarhynchus pitangua	2	4
Mionectes rufiventris	3	4
Myiarchus ferox	1	2
Myiarchus swainsoni	2	5
Myiophobus fasciatus	14	2, 3, 5
Pitangus sulphuratus	16	1, 2, 5
Platyrinchus mystaceus	2	4
Pyrocephalus rubinus	4	5
Serpophaga munda	1	5
Serpophaga subcristata	6	3, 5
Stigmatura budytoides	9	15
Suiriri suiriri	1	5
Tolmomyias sulphurescens	4	1, 4
Xolmis irupero	3	5
Vieronidae		
Cyclarhis gujanensis	7	1, 2, 3, 5
Vireo olivaceus	1	5

[a] Species found infested with ticks in others ecoregions.

Table 2
Ixodid ticks collected on wild birds in five ecoregion in north-central Argentina. P, % prevalence; I/C, infested/captured; L, larvae; N, nymphs; F, females.

Birds				Ticks			
Order, family, species	I/C	P	Mean	Species	L	N	F
(1) Selva de las Yungas							
						TINAMIFORMES	
Tinamidae							
Crypturellus tataupa	1/1	100	1.0	*Haemaphysalis leporispalustris*[a]	0	1	0
	1/1	100	2.0	*Haemaphysalis* sp.	2	0	0
						FALCONIFORMES	
Falconidae							
Micrastur ruficollis	1/1	100	1.0	***Amblyomma* sp.1**	1	0	0
						PASSERIFORMES	
Corvidae							
Cyanocorax chrysops	2/3	66.7	5.3	*Ixodes parareicinus*	14	2	0
	2/3	66.7	5.0	*Haemaphysalis juxtakochi*	14	1	0
	1/3	33.3	1.0	*H. leporispalustris*	0	3	0
	1/3	33.3	0.7	***Amblyomma* sp.1**	2	0	0
Emberizidae							
Arremon flavirostris	4/13	30.8	1.8	*I. parareicinus*[a]	24	0	0
	2/13	15.4	0.2	*H. juxtakochi*	2	0	0
Arremon torquatus	1/2	50.0	0.5	*I. parareicinus*[a]	1	0	0
Atlapetes citrinellus	3/3	100	2.3	*I. parareicinus*[a]	7	0	0
	1/3	66.7	0.3	*Haemaphysalis* sp.	1	0	0
Zonotrichia capensis	1/9	11.1	0.2	*I. parareicinus*[a]	2	0	0
Furnariidae							
Syndactyla rufosuperciliata	3/8	37.5	1.9	*I. parareicinus*	15	0	0
Parulidae							
Myiothlypis bivittata	8/13	61.5	2.8	*I. parareicinus*[a]	36	0	0
	1/13	7.7	<0.1	*H. leporispalustris*[a]	1	0	0
Thraupidae							
Coryphospingus cucullatus	1/1	100	2	*I. parareicinus*[a]	2	0	0
	1/1	100	1	***Amblyomma* sp.1**	1	0	0
Troglodytidae							
Troglodytes aedon	4/4	100	8.2	*I. parareicinus*[a]	33	0	0
Turdidae							
Catharus dryas	1/1	100	4.0	*I. parareicinus*[a]	4	0	0
	1/1	100	4.0	*H. leporispalustris*[a]	4	0	0
Turdus amaurochalinus	1/1	100	36.0	*I. parareicinus*[a]	34	2	0
Turdus rufiventris	9/10	90.0	7.3	*I. parareicinus*	64	7	2[a]
	7/10	70.0	8.0	*H. juxtakochi*	73	7	0
	2/10	20.0	0.8	*H. leporispalustris*[a]	7	1	0
	2/10	20.0	0.7	*Haemaphysalis* sp.	7	0	0
	1/10	10.0	0.6	***Amblyomma* sp.1**	6	0	0
(2) Esteros del Iberá							
Emberizidae							
Zonotrichia capensis	2/4	50.0	2.5	*Amblyomma dubitatum*[a]	10	0	0
	2/4	50.0	0.5	***A. dubitatum/triste***	2	0	0
Furnariidae							
Furnarius rufus	3/6	50.0	0.5	*A. dubitatum*[a]	3	0	0
	2/6	33.3	0.3	*Amblyomma triste*[a]	1	1	0
	1/6	16.7	0.8	***A. dubitatum/triste***	5	0	0
Phacellodomus ruber	1/1	100	3.0	*A. triste*[a]	2	1	0
	1/1	100	1.0	***A. dubitatum/triste***	1	0	0
Turdidae							
Turdus rufiventris	1/1	100	101.0	*A. dubitatum*[a]	101	0	0
	1/1	100	3.0	*A. triste*[a]	3	0	0
(3) Delta e Islas del Paraná							
Emberizidae							
Zonotrichia capensis	3/19	15.8	0.5	*A. triste*	6	3	0
Parulidae							
Myiothlypis leucoblephara	1/1	100	3.0	*Ixodes auritulus*	3	0	0
Thamnophilidae							
Thamnophilus caerulescens	1/1	100	1.0	*I. auritulus*	0	1	0
Thraupidae							
Poospiza nigrorufa	1/2	50.0	1.0	*A. triste*	2	0	0
	1/2	50.0	1.0	*I. auritulus*	0	2	0
Sporophila caerulescens	1/7	14.3	0.1	*I. auritulus*	1	0	0
Turdidae							
Turdus rufiventris	1/2	50.0	0.5	*I. auritulus*	0	1	0
(4) Selva Paranaense							
Conopophagidae							
Conopophaga lineata	1/2	50.0	0.5	***Amblyomma* sp.2**	0	1	0
Furnariidae							
Sittasomus griseicapillus	1/6	16.7	0.2	*Amblyomma ovale*[a]	1	0	0

Table 2 (*Continued*)

Birds				Ticks			
Order, family, species	I/C	P	Mean	Species	L	N	F
Thamnophilidae							
Mackenziaena severa	1/1	100	1	*A. ovale*[a]	0	1	0
Thraupidae							
Thlypopsis sordida	1/7	14.3	0.1	***Amblyomma* sp.2**	0	1	0
Trichothraupis melanops	1/24	4.1	0.3	*A. ovale*[a]	7	0	0
Turdidae							
Turdus albicollis	1/5	20.0	0.2	*A. ovale*	1	0	0
(5) Chaco Seco							
Emberizidae							
Rhynchospiza strigiceps	4/22	18.2	0.4	*Amblyomma tigrinum*	3	5	0
Zonotrichia capensis	4/99	4.0	<0.1	*A. tigrinum*	4	3	0
Furnariidae							
Asthenes baeri	3/18	16.7	0.7	*A. tigrinum*[a]	12	0	0
Coryphistera alaudina	4/19	21.1	1.7	*A. tigrinum*	30	2	0
Furnarius cristatus	2/20	10.0	0.1	*A. tigrinum*	0	2	0
Furnarius rufus	2/38	5.3	<0.1	*A. tigrinum*	2	0	0
Synallaxis albescens	3/16	18.8	0.3	*A. tigrinum*[a]	2	3	0
Tarphonomus certhioides	5/11	45.5	3.6	*A. tigrinum*[a]	39	1	0
Icteridae							
Agelaioides badius	1/31	3.2	<0.1	*A. tigrinum*	2	0	0
Thraupidae							
Coryphospingus cucullatus	5/76	6.6	0.2	*A. tigrinum*	15	2	0
Lophospingus pusillus	1/66	1.5	<0.1	*A. tigrinum*	0	1	0
Paroaria coronata	1/28	3.6	<0.1	*A. tigrinum*[a]	0	1	0
Poospiza ornata	2/24	8.3	1.7	*A. tigrinum*[a]	41	0	0
Poospiza torquata	1/30	3.3	<0.1	*A. tigrinum*	1	0	0
Saltator aurantiirostris	6/92	6.5	0.1	*A. tigrinum*	2	7	0
Saltatricula multicolor	5/25	20.0	0.4	*A. tigrinum*	1	9	0
Volatinia jacarina	1/1	100	1.0	*A. tigrinum*[a]	1	0	0
Troglodytidae							
Troglodytes aedon	5/18	27.8	0.3	*A. tigrinum*	3	3	0
Turdidae							
Turdus amaurochalinus	1/17	5.9	1.8	*A. tigrinum*[a]	30	0	0

[a] New host species-parasite species association.

role of passerines birds as hosts for larvae and nymphs of *I. pararicinus* in Argentina and Uruguay (Beldoménico et al., 2003; Venzal et al., 2005a,b) but the record of female ticks on *T. rufiventris* open the question if this bird is an exceptional host for this stage or *I. pararicinus* is able to complete its life cycle feeding only on birds. The most common birds captured were *Columbina picui* (Columbiformes) (555), and passeriforms *Elaenia* spp. (134) and *Phytotoma rutila* (128) but no ticks were found on them (Table 1). However, *C. picui* has been found previously infested with larvae of *A. tigrinum* in Chaco Seco by Nava et al. (2006).

The ecoregion Selva de las Yungas showed a greater diversity of avian hosts (3 orders), tick genera (*Amblyomma*, *Haemaphysalis* and *Ixodes*) and tick species (2 *Haemaphysalis*, 1 *Ixodes* and 1 unidentified *Amblyomma*) than others ecoregions. Selva de las Yungas

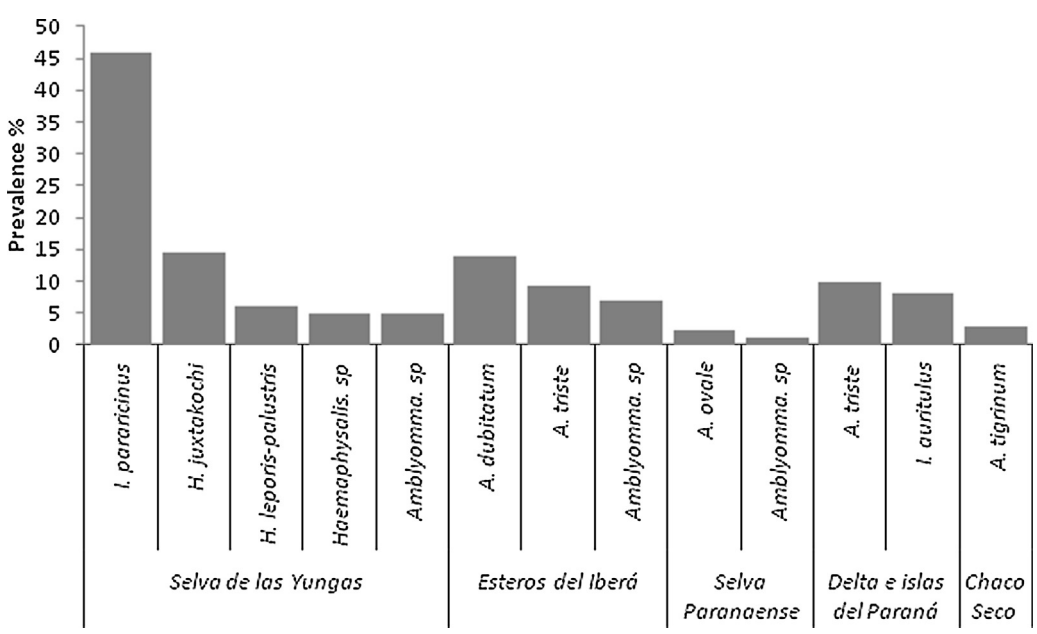

Fig. 2. Prevalence of infestation of tick species found on birds in five Argentinean ecoregions.

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merit further research, especially to identify the species of *Amblyomma* feeding on birds. *Amblyomma sculptum*, a recently reinstated species (Nava et al., 2014), and a new species of *Amblyomma* (Nava et al., unpublished data) are established in this ecoregion, and birds may contribute as hosts for these or other species of this genera.

Amblyomma dubitatum is established in Argentina, Brazil, Paraguay and Uruguay, where the main host for all parasitic stages is the capybara *Hydrochoerus hydrochaeris* but subadult ticks are also found on small rodents (Debárbora et al., 2014). The present study adds Passeriformes as hosts for the larvae and nymphs of *A. dubitatum* (see also above).

Amblyomma ovale has a wide distribution from Argentina to USA (Guglielmone et al., 2003, 2014) but the relevance of birds as hosts for larvae and nymphs of this taxon has been only documented for Brazil and Paraguay by Ogrzewalska et al. (2009, 2014) and Luz et al. (2012) among others. Records from the present study are the first recognition of birds as hosts of *A. ovale* in Argentina.

Amblyomma tigrinum has a wide South American distribution (Guglielmone et al., 2003) and the role of birds as hosts for subadult ticks is recognized, including studies in the Chaco Seco ecoregion by Nava et al. (2006) where most of the host-parasite relationships determined in the present study were first documented (Table 2).

Amblyomma triste is a Nearctic-Neotropical species but differential diagnosis with *Amblyomma maculatum* still remains sometimes uncertain (Guglielmone et al., 2014). Larvae and nymphs of *A. triste* are main parasites of small rodents in the ecoregion Delta e Islas del Paraná where a few subadult ticks were also found on Passeriformes (Nava et al., 2011). The results of the current study just confirm avian hosts for this tick species.

Both, *H. juxtakochi* and *H. leporispalustris* have a wide Nearctic-Neotropical distributions feeding on a variety of hosts including several orders of Aves (Guglielmone et al., 2003, 2014). While no new host-parasite associations were found for *H. juxtakochi*, four new hosts were determined for subadults *H. leporispalustris* which adds to the long list of avian hosts for this species. Nevertheless, main hosts for all stages of *H. leporispalustris* are species of *Sylvilagus* (Lagomorpha: Leporidae) and birds appear to be alternative hosts (Guglielmone et al., 2014).

Ixodes auritulus is specific of birds but the name probably represents a complex of species found on a great variety of birds in the Afrotropical, Australasian, Nearctic and Neotropical Zoogeographic Regions (Guglielmone et al., 2014). No new host-parasite relationship was found.

Ixodes pararicinus is established in Argentina, Colombia, Peru and Uruguay (Guglielmone et al., 2003; Díaz et al., 2007). As in previous studies, birds were found infested with subadult ticks but its record as hosts for adult ticks is relevant.

Finally, the species of *Amblyomma* and *Haemaphysalis* found on birds in Argentina have been also determined on humans in South America (Guglielmone et al., 2006). All of them are proven or potential vectors for human diseases (Parola et al., 2013). Therefore, these avian hosts are probable reservoirs of human pathogens in Argentina.

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