

New records of ticks (Acari: Ixodidae) infesting wild birds in a forest fragment in Acre, Brazilian Amazon

Novos registros de carrapatos (Acari: Ixodidae) infestando aves silvestres em um fragmento florestal no Acre, Amazônia Brasileira

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Highlights:

Bird species of the order Passeriformes were the most infested by ticks.

New bird species-hosts of *Amblyomma* ticks in the state of Acre.

Unpublished records of *Amblyomma humerale* and *Amblyomma nodosum* parasitizing new bird species.

Abstract

This study aimed to expand knowledge about tick parasitism on wild birds in western Amazonia and provide additional records of species parasitized by ticks in the state of Acre. Birds were captured with mist nets from September 2016 to February 2017 at the *Fazenda Experimental Catuaba*, in Senador Guiomard, Acre State, Brazil, identified, and thoroughly inspected. Detected ticks were removed with tweezers, stored in labeled collectors containing 70% alcohol, and identified using a stereomicroscope with incident lighting and taxonomic keys at the Department of Preventive Veterinary Medicine and Animal Health of the School of Veterinary Medicine and Animal Science of the University of São Paulo. In total, 203 wild birds were captured, comprising nine orders and 24 families. Among them, 24 birds (11.82%) belonging to 13 species were parasitized by 44 ticks at different stages: 26 *Amblyomma* sp. larvae, 10 *Amblyomma nodosum* nymphs, four *Amblyomma longirostre* nymphs, and four *Amblyomma humerale* nymphs. This study reports for the first time nine new species of birds as hosts of ticks of the genus *Amblyomma* in the state of Acre, namely: *Monasa nigrifrons*, *Hypocnemis subflava*, *Dendrocincla fuliginosa*, *Sittasomus griseicapillus*, *Xiphorhynchus guttatoides*, *Poecilatriccus latirostris*, *Hemitriccus flammulatus*, *Ramphotricon megacephalum*, and *Turdus amaurochalinus*. This study also records, for the first time, *A. nodosum* ticks parasitizing *R. megacephalum* and *A. humerale* parasitizing *Momotus momota*, *S. griseicapillus*, and *X. guttatoides*.

Key words: *Amblyomma*. Avifauna. Brazil. Tropical forest. Parasitism.

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Resumo

O objetivo desse estudo foi ampliar o conhecimento sobre o parasitismo de carrapatos em aves silvestres na Amazônia Ocidental e fornecer registros adicionais de espécies de aves parasitadas por carrapatos no Estado do Acre. As aves foram capturadas com redes de neblina, durante os meses de setembro de 2016 a fevereiro de 2017 na Fazenda Experimental Catuaba, Senador Guiomard, Acre, identificadas e inspecionadas minuciosamente. Os carrapatos detectados foram removidos com auxílio de pinça e armazenados em coletores etiquetados, contendo álcool a 70% e identificados utilizando estereomicroscópio com iluminação incidente e chaves taxonômicas, no Departamento de Medicina Veterinária Preventiva e Saúde Animal da Faculdade de Medicina Veterinária e Zootecnia da Universidade de São Paulo. No total, 203 aves silvestres foram capturadas, compreendendo nove ordens e 24 famílias. Destas, 24 aves (11,82%), pertencentes à 13 espécies estavam parasitadas por 44 carrapatos em diferentes estágios: 26 larvas de *Amblyomma* sp., 10 ninfas de *Amblyomma nodosum*, quatro ninfas de *Amblyomma longirostre* e quatro ninfas de *Amblyomma humerale*. O presente estudo relata, pela primeira vez, nove novas espécies de aves como hospedeiras de carrapatos do gênero *Amblyomma* no Estado do Acre: *Monasa nigrifrons*, *Hypocnemis subflava*, *Dendrocincla fuliginosa*, *Sittasomus griseicapillus*, *Xiphorhynchus guttatoides*, *Poecilotriccus latirostris*, *Hemitriccus flammulatus*, *Ramphotrigon megacephalum* e *Turdus amaurochalinus*. O presente trabalho, registra pela primeira vez os carrapatos *A. nodosum* parasitando *R. megacephalum* e *A. humerale* parasitando *Momotus momota*, *S. griseicapillus* e *X. guttatoides*.

Palavras-chave: *Amblyomma*. Avifauna. Brasil. Floresta tropical. Parasitismo.

Introduction

Ticks are hematophagous arthropods belonging to the subclass Acari that parasitize birds, mammals, reptiles, and amphibians at different stages of their biological cycle (larvae, nymphs, and adults) (Martins, Teixeira, & Labruna, 2015). In Brazil, the tick fauna is represented by 74 species, 48 belonging to the family Ixodidae (hard ticks) and 26 to the family Argasidae (soft ticks) (Martins et al., 2019).

The 74 tick species found in Brazil are distributed in nine genera (Guimarães, Tucci, & Barros-Battesti, 2001). The genus *Amblyomma* is the most common in the Amazon Biome (Gianizella, Moraes, Nascimento, & Martins, 2018b). Ticks of this genus have already been observed parasitizing different groups of animals in the Amazon: wild birds (Ogrzewalska, Uezu, & Labruna, 2010; Martins, Fecchio, & Labruna, 2014; Lima et al., 2018), chelonians (Labruna, Camargo, Terrassini, Schumaker, & Camargo, 2002; Soares et al., 2015; Gianizella et al., 2018b), crocodilians (Labruna et al., 2005; Witter et al., 2016; Gianizella et al.,

2018a), wild mammals (Martins et al., 2013; Soares et al., 2015), and even the human being (Aguirre et al., 2019).

There are few data and studies on the occurrence of these ectoparasites in the state of Acre (Lima et al., 2018; Aguirre et al., 2019; Gruhn et al., 2019). The first reference about the presence of ticks in Acre was made by Aragão (1936), who reported the occurrence of *Amblyomma incisum* Neumann, 1906, *Amblyomma ovale* Koch, 1844, and *Rhipicephalus microplus* (Canestrini, 1888) in animals in the then territory of Acre. The occurrence of *Amblyomma calcaratum* Neumann, 1899, *Amblyomma coelebs* Neumann, 1899, *Amblyomma dissimile* Koch, 1844, *Amblyomma longirostre* (Koch, 1844), and *Amblyomma oblongoguttatum* Koch, 1844 in Acre was reported in the list of species of the genus *Amblyomma* found in Brazil, including lots deposited in the collection of the Instituto Butantan (Guimarães et al., 2001).

In 2016, Souza et al. (2016) reported, for the first time, parasitism of a three-toed sloth (*Bradypus*

variegatus) from the Zoobotanical Park of the Federal University of Acre by a male individual of *Amblyomma geayi* Neumann, 1899.

Gruhn et al. (2019) conducted a study in Rio Branco, Acre, intending to investigate the presence of bacteria of the genus *Rickettsia* in ticks collected from free-living capybaras (*Hydrochoerus hydrochaeris*). In that study, three genera of ticks were identified parasitizing the animals, totaling eight species: *Amblyomma dubitatum* Neumann, 1899, *Amblyomma naponense* Packard, 1869, *Amblyomma humerale* Koch, 1844, *Amblyomma pacaе* Aragão, 1911, *Amblyomma rotundatum* Koch, 1844, *Amblyomma varium* Koch, 1844, *R. microplus*, and *Dermacentor nitens* Neumann, 1897. More recently, the presence of *Amblyomma scalpturatum* Neumann 1906, collected in situ, and its parasitism on a human host were confirmed in the state of Acre (Aguirre et al., 2019).

Birds are known as intermediate hosts of ticks, often associated with immature stages (Labruna et al., 2002; Ogrzewalska et al., 2010; Martins et al., 2013, 2014; Lima et al., 2018). Lima et al. (2018) recently released the first study associating ticks with wild bird species in Acre. The authors described the diversity of wild bird species parasitized by larvae and nymphs of the genus *Amblyomma* within the perimeter of the Campus and Zoobotanical Park

of the Federal University of Acre, in Rio Branco. Morphology and molecular identification showed the presence of the species *A. geayi*, *A. humerale*, *A. longirostre*, and *Amblyomma nodosum* Neumann, 1899 parasitizing 28 different wild bird species.

Information on the relationship between the parasite community and its wild hosts is scarce due to the few studies and difficulty in understanding parasite taxonomy (Barros-Battesti, Arzua, & Bechara, 2006; Torga et al., 2013; Lima et al., 2018; Gruhn et al., 2019). In this context, this research aims to expand knowledge about tick parasitism on wild birds in the western Amazon.

Material and Methods

Study area

The study was carried out in an area of Fazenda Experimental Catuaba – FEC (10°04'37.8" S; 67°37'32.3" W), located in the municipality of Senador Guiomard, state of Acre. FEC has an area of 820 ha (Figure 1), belongs to INCRA (National Institute for Colonization and Agrarian Reform), and is granted to the Federal University of Acre (UFAC) for the development of studies in several areas of natural sciences (Rasmussen, Rehg, & Guilherme, 2005; Souza, Souza, & Morato, 2008).

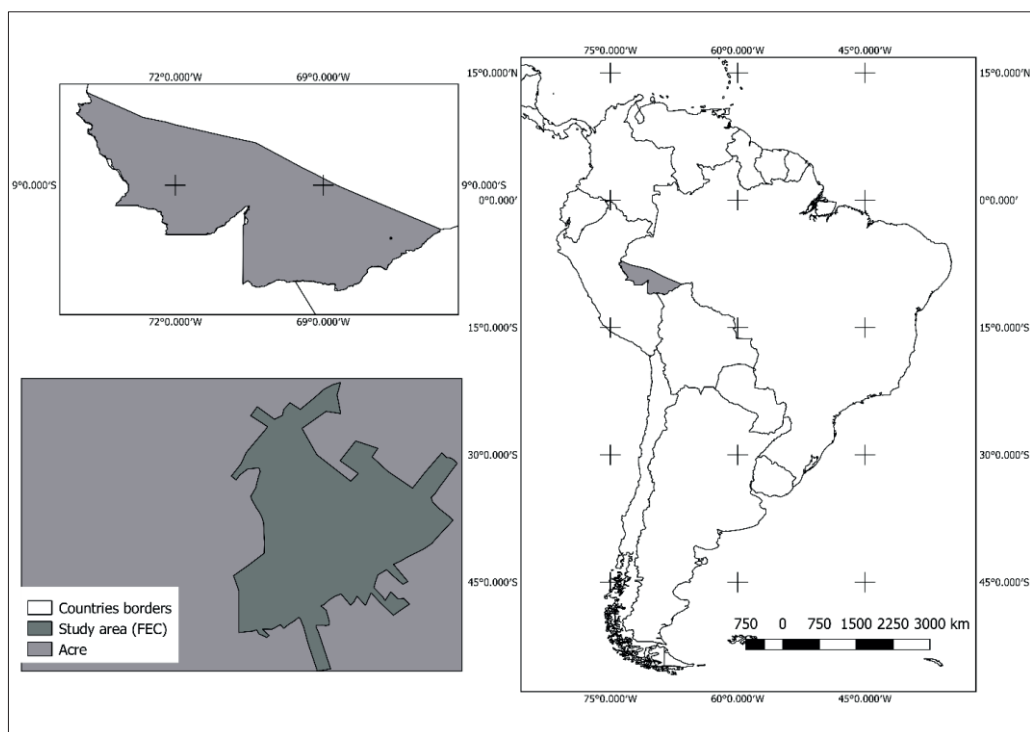


Figure 1. Location of Fazenda Experimental Catuaba, Senador Guimard, state of Acre, Brazil.

The vegetation of FEC is composed of an upland forest at various stages of succession and anthropic action. The predominant vegetation in the area is a mosaic of open forest with bamboo, especially *Guadua weberbaueri* (Silveira, 2005). The forest fragment is bordered by pastures, housing, crop plantations, and roads (Rasmussen et al., 2005; Souza et al., 2008).

Authorizations

The study was carried out under the authorization of the Brazilian Biodiversity Authorization and Information System SISBIO No. 23269-1. The captured birds were banded under a license from the Brazilian Center for Research and Conservation of Wild Birds – CEMAVE through the project 1099 coordinated by Prof. Dr. Edson Guilherme. Bird capture and tick collection were approved by the Ethics Committee on the Use of Animals – CEUA of the Federal University of Acre under process No. 23107.009788/2016-01.

Bird capture

Birds were captured using 20 mist nets of 12 m long, 2.5 m high, and 36 mm meshes from September 2016 to February 2017, totaling 3,640 hours/net. These nets were installed in different transects in the forest fragment. After capture, all birds were identified following the nomenclature proposed by Piacentini et al. (2015) using ornithological guides (Schulenberg, Stotz, Lane, O'Neil, & Paker, 2007; Sigrist, 2014) and banded according to CEMAVE recommendations. The search for ectoparasites in each individual was carried out after banding. The animals were released close to the capture site after this process.

Ectoparasite collection

Birds were thoroughly inspected, and the detected ticks were removed with tweezers. The specimens were stored in labeled collectors containing 70% alcohol and sent to the Department

of Preventive Veterinary Medicine and Animal Health of the School of Veterinary Medicine and Animal Science of the University of São Paulo (VPS/FMVZ/USP). The identification was performed using a stereomicroscope with incident lighting and taxonomic keys (Barros-Battesti et al., 2006; Martins, Onofrio, Barros-Battesti, & Labruna, 2010). Calculations of the prevalence of tick infestation (P) and the average intensity of tick infestation (IM) in each bird species were performed according to Bush, Lafferty, Lotz and Shostak (1997).

Results and Discussion

In total, 203 wild birds were captured, being distributed in nine orders and 24 families. Among them, 24 birds (11.82%) belonging to 13 species were parasitized by 44 ticks at different stages: 26 *Amblyomma* sp. larvae, 10 *A. nodosum* nymphs, four *A. longirostre* nymphs, and four *A. humerale* nymphs. The average infestation intensity of different bird species was low (variation: 1+4). The highest infestation was observed in a *Poecilatriccus latirostris* (Pelzeln, 1868) individual, totaling nine ticks (six *Amblyomma* sp. larvae and three *A. nodosum* nymphs) (Table 1).

Table 1
Ticks collected on wild birds from September 2016 to February 2017 at Fazenda Experimental Catuaba, Senador Guiomard, state of Acre, Brazil

Bird			Tick				Prevalence (%)	Average intensity	
Order	Family	Species	No. infested/ No. captured	<i>Amblyomma</i> sp.	<i>A. humerale</i>	<i>A. nodosum</i>			<i>A. longirostre</i>
Coraciiformes	Momotidae	<i>Momotus momota</i>	1/1		1N			100	1
Galbuliformes	Bucconidae	<i>Monasa nigrifrons</i>	1/4	1L				25	1
Passeriformes	Thamnophilidae	<i>Hypocnemis subflava</i>	1/2	3L				50	3
		<i>Dendrocincla fuliginosa</i>	1/2	4L				50	4
	Dendrocolaptidae	<i>Sittasomus griseicapillus</i>	2/2	2L	1N			100	1.5
		<i>Xiphorhynchus guttatooides</i>	3/4	1L	2N			75	1
		<i>Dendroplex picus</i>	2/4				2N	50	1
	Pipridae	<i>Pipra fasciicauda</i>	2/3	3L				67	1.5
	Rhynchocyclidae	<i>Poecilatriccus latirostris</i>	1/1	6L			3N	100	9
		<i>Hemitriccus flammulatus</i>	1/2	1L				50	1
	Tyrannidae	<i>Ramphotrigon megacephalum</i>	1/2	1L			3N	50	4
Turdidae	<i>Turdus amaurochalinus</i>	1/2	1L				50	1	
Thraupidae	<i>Ramphocelus carbo</i>	7/23	3L			4N	2N	30	1.29
Total			24/52	26L	4N	10N	4N	46.15	1.83

Three tick species (*A. nodosum*, *A. longirostre*, and *A. humerale*) were found parasitizing wild birds. This result is similar to the study carried out by Lima et al. (2018) in Rio Branco in the Zoobotanical Park and campus of the Federal University of Acre, in which, besides these three tick species, *A. geayi* was identified.

The tick *A. nodosum* parasitizes adult anteaters and has already been found infected with *Rickettsia amblyommatis*, *Rickettsia belli*, and *Rickettsia parkeri* (Ogrzewalska & Pinter, 2016). During the adult stage, *A. longirostre* has been frequently found on porcupines, and *R. amblyommatis* and *R. parkeri* have already been detected in this tick species (Ogrzewalska & Pinter, 2016). On the other hand, adults of *A. humerale* preferentially parasitize tortoises and have already been found infected by *R. amblyommatis*, *R. belli*, and *Rickettsia felis* (Soares et al., 2015).

Similarly, Lima et al. (2018) also reported parasitism by *A. nodosum* in the order Passeriformes, Columbiformes, Cuculiformes, and Piciformes. However, these authors described birds as hosts of different tick species, such as *Momotus momota* (Linnaeus, 1766) parasitized by *A. longirostre*; in our study, this bird species was parasitized by *A. humerale*. Moreover, Lima et al. (2018) found *A. longirostre* and *A. nodosum* parasitizing *Dendroplex picus* (Gmelin, 1788), but in our study, this bird was parasitized only by *A. longirostre* (Table 1).

The species *A. nodosum* comprised 55.6% of all ticks identified at the species level and was the tick species that most parasitized birds of the order Passeriformes, similarly to the study by Lima et al. (2018). The order Passeriformes was infested in greater numbers, showing that tick species from different areas can be commonly found parasitizing the same order of birds in the state of Acre. Furthermore, this data corroborates the study carried out in 2008 in the Atlantic Forest by Ogrzewalska, Uezu, and Labruna (2010), who demonstrated that the order Passeriformes was the most parasitized by this tick species.

Nineteen tick species are confirmed in the state of Acre. However, Labruna et al. (2005) stated that the identification of *A. incisum* in the state might be mistaken, as this arthropod is morphologically similar to *A. sculpturatum* and may be mistakenly identified.

Conclusion

This study records for the first time *A. nodosum* ticks parasitizing *R. megacephalum* and *A. humerale* parasitizing *M. momota*, *S. griseicapillus*, and *X. guttatoides*. It also reports, for the first time, nine new species of birds as hosts of ticks of the genus *Amblyomma* in the state of Acre: *Monasa nigrifrons*, *Hypocnemis subflava*, *Dendrocincla fuliginosa*, *Sittasomus griseicapillus*, *Xiphorhynchus guttatoides*, *Poecilatriccus latirostris*, *Hemitericcus flammulatus*, *Ramphotricon megacephalum*, and *Turdus amaurochalinus*.

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