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Tick fauna of wild animals received and attended at the Santarém Zoological Park, western Pará State, Brazil

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ABSTRACT: Ticks are known worldwide for parasitizing a number of wild hosts. However, few studies have been conducted on ticks in zoos in Brazil. The objective of the present study was to collect, identify, and report the parasitic tick fauna found on wild Amazon animals received and attended at the Santarém Zoological Park from September 2004 to September 2013. In all, 56 animals, including 26 mammals and 30 reptiles, were sampled, from which 1172 ticks were collected and identified, comprising 862 adults, 284 nymphs, and 26 larvae. Nymphs of *Amblyomma geayi* on three-toed sloth (*Bradypus tridactylus*), adults of *Amblyomma longirostre* on black dwarf porcupine (*Coendou nycthemera*), and nymphs of *Amblyomma naponense* on southern tamandua (*Tamandua tetradactyla*) were identified for the first time in the country in the present study. Although, the North region is the largest among the five Brazilian regions, this is the first study conducted with ticks and animals attended in a zoo in the Brazilian Amazon.

Key words: Amazon, *Amblyomma*, Wildlife conservation, Brazil.

Ixodofauna de animais silvestres resgatados e atendidos no Jardim Zoológico de Santarém, oeste do estado do Pará, Brasil

RESUMO: Carrapatos são conhecidos mundialmente por parasitar uma série de hospedeiros silvestres. No entanto, poucos são os estudos realizados com carrapatos em Jardins Zoológicos no Brasil. O presente estudo objetivou coletar, identificar e relatar a fauna parasitária de carrapatos de animais silvestres Amazônicos resgatados e atendidos no Zoológico de Santarém, durante o período de setembro de 2004 a setembro de 2013. Ao todo foram amostrados 56 animais incluindo 26 mamíferos e 30 répteis, no qual foram coletados e identificados 1172 carrapatos distribuídos em 862 adultos, 284 ninfas e 26 larvas. Foram identificados de forma inédita no presente estudo ninfas de *Amblyomma geayi* em preguiça-de-três-dedos (*Bradypus tridactylus*), adultos de *Amblyomma longirostre* em ouriço-cacheiro (*Coendou nycthemera*), além de ninfas de *Amblyomma naponense* em tamanduá-mirim (*Tamandua tetradactyla*) no país. Apesar da região Norte ser a maior entre as cinco regiões brasileiras, este é o primeiro trabalho realizado com animais atendidos em Zoológico utilizando os carrapatos como alvo de estudo na Amazônia nacional.

Palavras-chave: Amazônia, *Amblyomma*, conservação de animais silvestres, Brasil.

INTRODUCTION

Ticks are known to parasitize a wide range of hosts, including mammals, birds, reptiles, and amphibians. These parasites are significant for veterinary medicine and public health because they are related to the spread of a number of pathogens to

animals and humans (NAVA et al., 2017). Zoos can play a role in bio surveillance, serving as an advanced guard for detecting exotic arthropods and vector-borne diseases (ADLER et al., 2011).

Although, Brazil is a country with vast territory and has approximately 120 zoos WEMMER et al. (2006), few studies have been

conducted on ticks in zoos. These studies are mostly concentrated in the Southeast region of the national territory, with the Sorocaba Zoo being the pioneer (TEIXEIRA et al., 2003, 2008, 2017; MARTINS et al., 2015b; GONZALEZ et al., 2017). Other studies have been conducted in the South and Northeast regions of the Brazilian territory (BRUM & RICKES, 2003; DANTAS-TORRES et al., 2010a, 2010b; PEREIRA et al., 2012).

The Tapajós Integrated Faculties Zoo, University of Amazon (Zoo FIT/UNAMA), located in the municipality of Santarém, Lower Amazon mesoregion of the state of Pará, was created in 1993 to receive, treat, and adequately shelter many species of wild animals of the Amazon fauna, which, due to anthropogenic actions (mainly deforestation), arrive at the Integrated Faculties of the Tapajós following seizures carried out by government agencies (ZOOFIT, 2017).

The zoo is located on an area of 147 hectares provided by the Ministry of Defense (Brazilian Army/8th Battalion of Engineering and Construction) and contains approximately 54 species of wild animals, kept in enclosures according to the specifications of current legislation. Zoo FIT/UNAMA, in addition to being useful to scientific research, particularly regarding knowledge on the fauna of the Amazon, contributes to regional development through animal releases and environmental education, thus stimulating the local preservation of endangered wild animal species (ZOOFIT, 2017).

Because knowledge on the tick fauna that parasitize wild animals in zoos is relevant (ADLER et al., 2011), the objective of the present study was to collect, identify, and report the parasitic tick fauna of wild Amazon mammals and reptiles received and attended at the Santarém Zoological Park.

MATERIALS AND METHODS

Ticks of wild animals at Zoo FIT/UNAMA were collected from September 2004 to September 2013. All the animals were rescued and taken to the Zoo by the local population and by the Fire Brigade. A total of 56 animals originating from different locations in the municipality of Santarém (2°26'34"S, 54°42'28"W) were sampled, including 26 mammal specimens and 30 reptile specimens of different age groups and sexes. The animals analyzed were 18 three-toed sloths (*Bradypus tridactylus*), one two-toed sloth (*Choloepus didactylus*), one black dwarf porcupine (*Coendou nycthemera*), six southern tamanduas (*Tamandua tetradactyla*), 25 red-tailed

boa (*Boa constrictor*), one green anaconda (*Eunectes murinus*), two green iguanas (*Iguana iguana*), and two Amazon false fer-de-lances (*Xenodon severus*).

During the clinical evaluation and routine management, all animals received from nature were inspected for the presence of ticks as soon as they arrive at the zoo, and the ectoparasites were removed and stored in 70% ethanol for taxonomic identification according to BARROS-BATTESTI et al. (2006) and MARTINS et al. (2010, 2013), using a Zeiss Stemi Sv11 stereoscope. Collected ticks were deposited in the tick collection "Coleção Nacional de Carrapatos Danilo Gonçalves Saraiva" (CNC) of the University of São Paulo under accession numbers CNC-3535-3542.

RESULTS AND DISCUSSION

In total, 1,172 ticks were collected and identified, comprising 862 adults, 284 nymphs, and 26 larvae. The identification of ixodid ticks and their respective hosts is shown in table 1.

The tick *Amblyomma dissimile* is often reported parasitizing reptiles (GUGLIELMONE & NAVA, 2010). In the present study, *A. dissimile* was found on *B. constrictor*, *E. murinus*, *I. iguana*, and *X. severus*, thus corroborating the findings of GUGLIELMONE & NAVA (2010), who also reported these four species of reptiles as hosts of *A. dissimile*.

Ticks species *Amblyomma geayi* and *Amblyomma varium* are usually recorded parasitizing sloths (MARQUES et al., 2002; LABRUNA et al., 2009; SOUZA et al., 2016). In the present study, adults of *A. geayi* and adults and nymphs of *A. varium* were identified on *B. tridactylus*, corroborating the studies of SERRA-FREIRE et al. (1993) and MARQUES et al. (2002), who also identified adults of these same species of ticks in this same host in the North region of Brazil. Additionally, in the present study, ten nymphs of *A. geayi* were identified from *B. tridactylus* for the first time; nymphs of this species of tick had only been previously reported in the Brazilian Amazon region in *Bradypus variegatus* by MARTINS et al. (2013) in the municipality of Belém, state of Pará.

The tick *Amblyomma longirostre* is commonly reported parasitizing porcupines during the adult stage (NAVA et al., 2010). In the present study, two adults of *A. longirostre* were reported on *C. nycthemera*. However, NAVA et al. (2010) recorded *A. longirostre* from three species of the genus *Coendou*: *Coendou bicolor*, *Coendou prehensilis*, and *Coendou rothschildi*. Therefore, the present study is the first report of a new host for this tick species in Brazil.

Table 1 - Ticks identified on wild animals received and attended at the Tapajós Integrated Faculties Zoo, University of Amazon, municipality of Santarém, western Pará State, Brazil, from September 2004 to September 2013.

Species of tick	-----Stages-----			Host (n)	---Mean infestation intensity (*)---		
	A	N	L		A	N	L
Reptiles							
<i>Amblyomma</i> sp.	-	-	2	<i>B. constrictor</i> (1)	0.0	0.0	2.0
<i>A. dissimile</i>	514	239	-	<i>B. constrictor</i> (24)	21.4	9.9	0.0
<i>A. dissimile</i>	21	3	-	<i>E. murinus</i> (1)	21.0	3.0	0.0
<i>A. dissimile</i>	4	-	-	<i>I. iguana</i> (2)	2.0	0.0	0.0
<i>A. dissimile</i>	8	-	-	<i>X. severus</i> (2)	4.0	0.0	0.0
Mammals							
<i>Amblyomma</i> sp.	-	-	24	<i>B. tridactylus</i> (1)	0.0	0.0	24.0
<i>A. varium</i>	21	5	-	<i>B. tridactylus</i> (2)	10.5	2.5	0.0
<i>A. geayi</i>	197	10	-	<i>B. tridactylus</i> (15)	13.1	0.6	0.0
<i>A. geayi</i>	1	-	-	<i>C. didactylus</i> (1)	1.0	0.0	0.0
<i>A. longirostre</i>	2	-	-	<i>C. nycthemera</i> (1)	2.0	0.0	0.0
<i>A. goeldii</i>	19	-	-	<i>T. tetradactyla</i> (1)	19.0	0.0	0.0
<i>A. humerale</i>	-	23	-	<i>T. tetradactyla</i> (1)	0.0	23.0	0.0
<i>A. naponense</i>	-	4	-	<i>T. tetradactyla</i> (1)	0.0	4.0	0.0
<i>A. nodosum</i>	75	-	-	<i>T. tetradactyla</i> (3)	25.0	0.0	0.0

(The number of individuals analyzed is in parentheses).

(*) Mean infestation intensity (total number of ticks / number of infested animals).

A: adult; N: nymph; L: larva.

The ticks *Amblyomma goeldii* and *Amblyomma nodosum* have also been described as parasitizing southern tamanduas during the adult stage (MARTINS et al., 2014, 2015a; SOARES et al., 2015). In the present study, adults of *A. goeldii* and *A. nodosum* were identified on *T. tetradactyla*, corroborating MARTINS et al. (2014, 2015a) and SOARES et al. (2015), who also identified southern tamanduas as hosts for these two species of ixodids in the North region of the country.

In the present study, 23 nymphs of the species *Amblyomma humerale* were identified on *T. tetradactyla*. In addition, four nymphs of *Amblyomma naponense* were identified on this same host species. Nymphal stage of *A. humerale* was recently recorded in southern tamanduas (SOARES et al., 2015; WITTER et al., 2016). In contrast, the identification of *A. naponense* nymphs on *T. tetradactyla* is reported for the first time in Brazil, thus contributing further to the knowledge on the biology and ecology of this understudied tick species.

According to literature, infections with *Rickettsia* species have been previously reported in some tick species collected in the present study. Specimens of the tick *A. dissimile* have been reported to be infected with *Rickettsia* sp. strain

colombianensi (MIRANDA et al., 2012); *A. geayi*, with *Rickettsia amblyommatis* (OGRZEWSKA et al., 2010); *A. varium*, with *R. amblyommatis* and *Rickettsia bellii* (OGRZEWSKA et al., 2012; LUGARINI et al., 2015); *A. longirostre*, with *R. amblyommatis* (LABRUNA et al., 2004); the tick *A. nodosum*, with *Rickettsia parkeri*-like agent and *R. bellii* (OGRZEWSKA et al., 2009); and finally, *A. humerale*, with *R. bellii* (LABRUNA et al., 2004). Of the eight species of ticks reported in the present study, there are already reports of infection with *Rickettsia* species in six; therefore, future epidemiological studies should be conducted in this still little-explored biome, once *R. parkeri* is pathogenic for humans (OGRZEWSKA et al., 2009).

CONCLUSION

Although, the North region of the country is the largest among the five Brazilian regions and is where the Amazon biome predominates, this is the first study conducted in a zoo using ticks as a target of study in the Brazilian Amazon. Thus, it is necessary to conduct further studies to increase the knowledge of the invertebrates that parasitize wild vertebrates, particularly the Amazon tick fauna.

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