

OCCURRENCE OF *Amblyomma* spp. TICKS INFESTING *Chironius bicarinatus*, *Bradypus tridactylus* AND *Puma concolor* IN A ZOO OF MANAUS, AMAZONAS, BRAZIL

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INFO ARTIGO	ABSTRACT
Keywords: Ectoparasites; Infestation; Parasitism; Wild animals.	Ticks are ectoparasites arthropods distributed worldwide that can parasitize a wide range of animals, transmitting pathogens such as bacteria, protozoa, helminths, and viruses to the host. The species that parasitize domestic animals are the most studied due to their sanitary importance, but little is known about most of the tick species that parasitize wild animals. The aim of this study was to report the occurrence of the genus <i>Amblyomma</i> infesting vine-snake (<i>Chironius bicarinatus</i>), bentinho's sloth (<i>Bradypus tridactylus</i>) and puma (<i>Puma concolor</i>) in a zoo in the city of Manaus, Amazonas, Brazil. Larvae of <i>Amblyomma</i> as well as adult specimens of <i>A. ovale</i> , <i>A. varium</i> and <i>A. gaeyi</i> were identified. This is the first report of specimens of <i>Amblyomma</i> spp. parasitizing <i>C. bicarinatus</i> with a new geographic distribution for the species. The scarcity of reports of this nature highlights the need for further studies on the distribution of these arthropods in different regions and host species.
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1. Introduction

Ticks are ectoparasite arthropods that are distributed worldwide, and present in a wide range of animals, including terrestrial vertebrates, amphibians, reptiles, birds, and mammals (Vieira et al., 2004; Martins, 2018). According to Dantas-Torres et al. (2019) the genus *Amblyomma* is the largest in Brazil with 29 confirmed species.

These arthropods constitute one of the most important groups of infectious disease vectors for animals and humans, being able to transmit pathogenic agents (i.e., bacteria, protozoa, helminths, and viruses) to domestic and wild animals, including humans (Guimarães et al., 2001; Vieira et al., 2004). The hematophagous habit in large infestations can produce anemia, and lesions that can lead to secondary contamination by pathogens. Thus, it is important to identify control measures to avoid damage to public and animal health (Barros-Battesti et al., 2006).

Ticks that parasitize domestic animals are the most studied for their health importance. On the other hand, little is known about the taxonomy, biology, ecology, geographic distribution, usual hosts, and vectorial capacity of pathogens of the vast majority of tick species that parasitize wild animals (Barros-Battesti et al., 2006).

In Brazil, recent studies have demonstrated the importance of knowledge of tick species in captive animals (Gonzalez et al., 2017; Martins et al., 2017; Araújo et al., 2019). In the captive environment, infestations by ectoparasites (i.e., ticks) in newly arrived animals, especially those from the wild, can colonize the enclosures in which these animals will be kept as well as other nearby cages, contaminating other animals already installed. Thus, in addition to the risk of transmission of pathogens, the control of ectoparasites in these places can become arduous and costly (Martins et al., 2015 a,b). Moreover, the role played by zoos is to preserve the quality of life of animals in captivity (Gonzalez et al., 2017).

The objective of this study was to report the occurrence of parasitism of the genus *Amblyomma* on vine-snake (*Chironius bicarinatus*), bentinho's Sloth (*Bradypus tridactylus*) and puma (*Puma concolor*) in a Zoo located in the City of Manaus, Amazonas (AM), Brazil.

2. Material and methods

One puma (*P. concolor*), one vine-snake (*C. bicarinatus*) and one bentinho's sloth (*B. tridactylus*) were treated by veterinarians who confirmed the infestation by ectoparasites during a routine examination. All animals were adults. The puma was in captivity at a Zoo, while the vine-snake and the bentinho's sloth were brought to the Zoo's team for clinical inspection, after being found in a forest fragment near the Manaus Zoo. Six immature specimens (larvae) of ticks were collected on vine-snake, three adult specimens and one nymph on Sloth, and one adult specimen parasitized the Puma.

The specimens were carefully removed from the animals with tweezers, by twisting their longitudinal axis and immediately immersed in 70% alcohol for preservation and later taxonomic classification. The ectoparasites were sent to the Laboratory of Veterinary Parasitology of the Federal University of Santa Maria, Rio Grande do Sul (RS), Brazil, for species identification.

The specimens were identified with a Leica EZ4 HD (Wetzlar, Germany) binocular stereo microscope with incident lighting. Taxonomic keys for adults of *Amblyomma* spp., and for the nymphs were based on Barros-Battesti et al. (2006), Martins et al. (2010), and Martins et al. (2013). However, there are few morphological studies on immature stages of this genus, and for the larvae, there are no identification keys (Sanches et al., 2009; Martins et al., 2015 a,b).

3. Results

Larvae of *Amblyomma* spp., nymph of *A. geayi*, adults of *A. ovale* (Figure 1), *A. varium* (Figure 2), and *A. geayi* (Figure 3) were identified. All tick specimens (three adult males, one adult female, one nymph, and six larvae) were deposited in the National Tick Collection Danilo Gonçalves Saraiva, of the Faculty of Veterinary Medicine and Animal Science, of the University of São Paulo (USP) under the accession numbers 4380, 4381 and 4382. The identified specimens and their respective hosts are shown in Table 1.

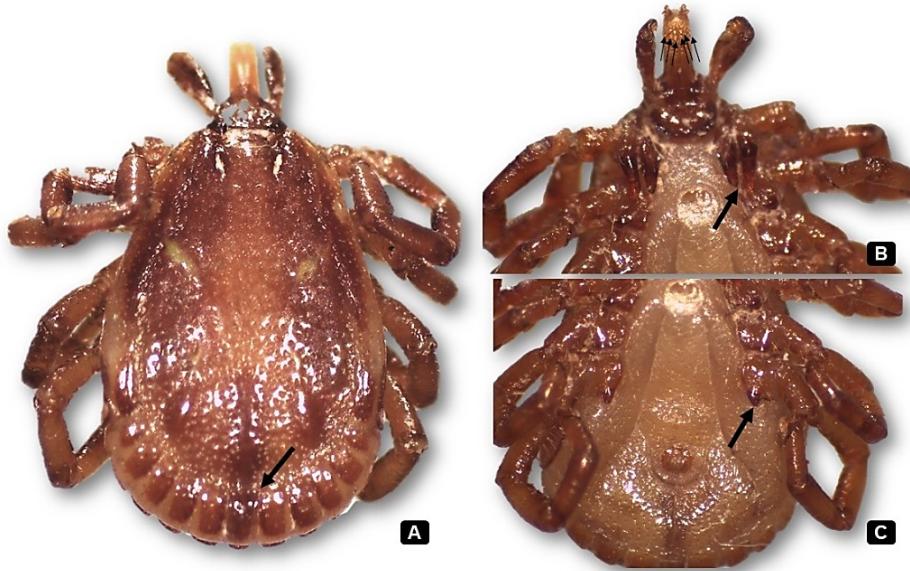


Figure 1 – Adult male of *Amblyomma ovale* species (Koch, 1844) found in puma (*Puma concolor*) in a Zoo in Manaus (AM), Brazil. Arrows: a – Presence of marginal sulcus; b – Hypostomial 3/3 and thigh I with two long spines; c – Thigh IV with a thorn.



Figure 2 – Adult female of *Amblyomma varium* species (Koch, 1844) found in bentinho's sloth (*Bradypus tridactylus*) in a Zoo in Manaus (AM), Brazil. Arrows: a- Dorsal base of the subtriangular gnathosoma; b- Hypostomial 4/4 and thigh I with two spines.

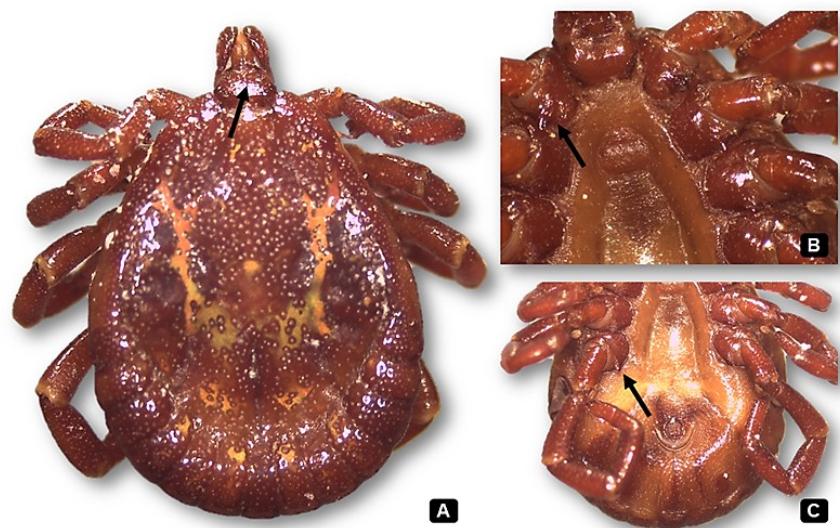


Figure 3 – Adult male of *Amblyomma geayi* species (Neumann, 1899) found parasitizing a bentinho's sloth (*Bradypus tridactylus*) in a Zoo in Manaus (AM), Brazil. Arrows: a- Dorsal base of trapezoidal gnathosoma; b- Thigh I with two spines; c- Thigh IV with a thorn.

Host	N	Stage	Identification
<i>Chironius bicarinatus</i>	6	Larva	<i>Amblyomma</i> spp.
<i>Bradypus tridactylus</i>	1	Nymph	<i>A. geayi</i>
	3	Adult	<i>A. geayi</i> (1F)* e <i>A. varium</i> (2M)*
<i>Puma concolor</i>	1	Adult	<i>A. ovale</i> (1M)*

*(Number of specimens: F - female and M - male)

Table 1 – Number and developmental stage of specimens of *Amblyomma* spp. and their respective wild hosts found in a Zoo in Manaus (AM), Brazil.

4. Discussion

The six specimens found on the vine-snake (*C. bicarinatus*) were, then, classified at the genus level, identifying the denticulate hypostomium, one of the characteristics that separate them from the other mites (Figure 1- b) (Barros-Battesti et al., 2006). In this host species, there were no reports of parasitism by ticks of the genus *Amblyomma* worldwide. Thus, this is the first report on it. According to Sanches et al. (2009), there are few morphological studies on the immature stages of *Amblyomma* spp. So far, there are no identification keys for the larval stage.

The specimen found on puma (*P. concolor*) was classified as an adult, male, *Amblyomma ovale* Koch, 1844 species. This is possibly the first report of this tick in this host species in northern Brazil. It is characterized by having a brown shield with coppery and greenish spots and the presence of a marginal groove that subsequently limits all the festoons (Figure 2 – a). They have a hypostomium with three rows of teeth on each side (3/3) and the thigh I, has two long spines, where the external spine is slightly curved outwards and a little longer than the internal spine (Figure 2 – b). Thigh IV has a thorn (Figure 2 – c) (Barros-Battesti et al., 2006). In the adult phase, this species parasitizes several hosts, mainly carnivores (Barros-Battesti et al., 2006), being the ixodid species most frequently collected from wild carnivores in Brazil (Labruna et al., 2005). Ramos et al. (2020) described the occurrence of *A. ovale* on *P. concolor* in Brazilian Cerrado biome. This species has already been reported in other states parasitizing dogs (Ferreira et al., 2013)

and several other species of wild animals (Andrade et al., 2015; Lavina et al., 2015; Gianizella et al., 2018). Reports by Aragão (1936), Aragão and Fonseca (1961), and Labruna et al. (2005), have also mentioned the presence of *A. ovale* parasitizing *P. concolor*, although the references did not specify the original location of the host species in Brazil. According to Rubini et al. (2009), the protozoan *Hepatozoon canis* and bacteria of the genus *Rickettsia* have been associated with a possible vectorial capacity of *A. ovale* (Nieri-Bastos et al., 2016; Acosta et al., 2018; Seva et al., 2019). *Rickettsia rickettsia*, which causes the zoonosis known as Spotted Fever, for example, has *A. cajennense*, *A. sculptum*, *A. dubitatum*, *A. aureolatum*, and *A. ovale* as main vectors (Araújo et al., 2016). *A. ovale*, despite being a species found in wild habits, commonly found in canids, felids, procyonids, and mustelids (Labruna et al., 2005), it has already been reported parasitizing humans (Reck et al., 2018). Therefore, the infestation deserves attention from public health services due to vector-borne diseases.

On bentinho's sloth (*B. tridactylus*) it was possible to identify an adult female of *A. varium* (Koch, 1844), and two adult males and a nymph of *A. geayi* (Neumann, 1899). The female of *A. varium* has a dark brown shield with greenish to coppery spots and the dorsal base of the gnathosoma is subtriangular, with non-protruding rounded horns (Figure 3 – a). It has a hypostomium with four rows of teeth on each side (4/4) and two large and strong spines on the thigh I, the inner one being slightly smaller than the outer one (Figure 3 – b). The male of *A. geayi* has a shield similar in color, but it is enlarged posteriorly and with the dorsal base of the capitulum trapezoidal (Figure 4 – a). It has a hypostomium with three rows of teeth on each side (3/3). Thigh I with two very short spines (Figure 4 – b). The thigh IV has a very short spine (Figure 4 – c). It has five sclerotized ventral areas, close to the festoons and the marginal sulcus is complete (Barros-Battesti et al., 2006). The nymph of *A. geayi*, on the other hand, is characterized by having an extensively rough surface of the shield and with few large and deep pits in the lateral fields, in addition to an apically rounded hypostomium 2/2 (Martins et al., 2013).

Simultaneous parasitism by these species has already been described in *B. tridactylus* by Serra-Freire et al. (1995), as well as by Oliveira (2012), the last one also in Manaus (AM). According to Marques et al. (2002), *A. varium* is commonly known in Brazil as the giant sloth-tick, found almost exclusively in mammals of the order Xenarthra, which includes *B. tridactylus*. Despite this information, *A. varium* has been found parasitizing other birds (Ogrzewalska et al., 2010), in which there was also carried *Rickettsia* spp. (Ogrzewalska et al., 2012; Bermudez et al., 2020). Additionally, according to Barros-Battesti et al. (2006), *A. geayi* infect sloths, corroborating to the present report.

The ticks identified in the present study were collected from animals from zoos, places of great interaction between humans, wild animals (captive and free-living), and arthropod vectors of pathogens of medical-veterinary importance. In addition, over the years, disorderly urban expansion has led to the loss of natural habitats for wild animals. This has forced animals to occupy modified areas and adapt to the presence of domestic species (Acosta et al., 2014). As a consequence, the interaction between wild animals and the urban population (i.e., humans, and animals) is increasing (Wemmer et al., 2006). For this reason, zoos play a key role in monitoring diseases and the population's biosecurity, as they receive wild animals from nature that serve as sentinels for the detection of exotic arthropods and the introduction of diseases transmitted by vectors. Therefore, knowledge of tick distribution is of great importance to establish public health and epidemiological surveillance programs.

5. Conclusion

It is possible to state that *A. ovale*, *A. varium* and *A. geayi* were present in a zoo in the city of Manaus, Amazonas, Brazil. This is the first report of *Amblyomma* spp. parasitizing *C. bicarinatus*.

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