



Free-living *Panthera onca* (Carnivora: Felidae) as host of *Amblyomma mixtum* and *Rhipicephalus microplus* (Ixodida: Ixodidae) in Darién, Panamá

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ABSTRACT: We report the parasitism of a male of *Amblyomma mixtum* and a molt nymph-adult of *Rhipicephalus microplus* in Darién, Panamá. These data increase the number of tick species that parasitize free-living jaguars in Panama and add information on the environmental conditions that favor the parasitism of *A. mixtum* and *R. microplus*.

Keywords: Environment, *Panthera onca*, *Amblyomma mixtum*, *Rhipicephalus microplus*, new tick-host record.

Zoobank: <http://zoobank.org/3370EC75-2415-43F1-A131-1B0A3A50F776>

Jaguars, *Panthera onca* (Linnaeus), are the largest species of Felidae in America and the only of the genus *Panthera* in this continent (Sunquist and Sunquist, 2002). These predators occupy different environments from the southwest of the United States to northern Argentina; however, its distribution and population has been reduced by habitat loss and hunting (Loveridge et al., 2010). In Panama, the jaguars maintain a discontinuous distribution, living in regions ranging from 0 to 3000 meters above sea level, both in mature forests, as in secondary forests and in buffer areas near parks and nature reserves (Meyer et al., 2019; Moreno et al., 2016). Being a flagship species, in Panama jaguars are mainly studied to determine their ranges of distribution, abundance, density, ecology and potential conflicts with humans, which are designed for the conservation of the species in different countries (Moreno, 2006; Moreno et al., 2016). In contrast, there are few works designed to estimate the parasitic load that these animals can hold.

In general, since predators are in close contact with their prey, they can carry ticks of their own species or those of their prey (Samish and Rehacek, 1999). Under these circumstances, their wide home range exposes to a greater variety of tick species. With the purpose of increasing the knowledge of ticks that parasitize jaguars, this work presents new data obtained from a specimen captured and equipped with a GPS collar in a region of the province of Darién where patches of forests with pastures and stubble collide. The specimen captured as part of a monitoring and conservation study of the jaguar, which was approved through research protocol No. SE/A-15-2019 (Environmental Ministry of Panama), which includes the dosages for anesthesia and animal welfare for veterinarian of wildlife (Fig. 1). Prior to its release, it was checked for ectoparasites, removing two ticks, which were placed in 70% ethanol and transported to the Department of Research in Medical Entomology of the Gorgas Memorial Institute for Health Studies.

Ticks were identified using a Leica MZ125 stereo microscope and photographed with a Leica M205A (Leica Microsystems, Germany) stereoscopic. Following the taxonomic criteria of Bermúdez et al. (2018), ticks were identified as a male of *Amblyomma mixtum* Koch (Fig. 2) and a nymph of *Rhipicephalus microplus* (Canestrini), which had female characteristics (Fig. 3). Both specimens were deposited in the Ectoparasite Collection of the "Dr. Eustorgio Méndez" Zoological Collection of the Gorgas Memorial Institute for Health Studies (CoZEM-ICGES).

This is the first report in Panama of a jaguar as a host of *A. mixtum* and *R. microplus*. Both species are sympatric in paddocks; however, its biology varies considerably. *Amblyomma mixtum* is a native species, three-hosts tick and highly opportunistic, particularly immatures (Guglielmone et al., 2014). In Panama so far, about 20 species of mammals, two of birds and two of reptiles have been found parasitized to this species, although it seems to maintain preferences towards equines and ponchos *Hydrochoerus isthmius* (Goldman) (García et al., 2014; Bermúdez et al., 2018). In addition to pastures, this species is distributed in deciduous forests and riparian vegetation (Fairchild et al., 1966; Bermúdez et al., 2016). On the contrary, *R. microplus* is an introduced species, one-host tick and closely related to cattle; consequently, its distribution is in grazing areas (Guglielmone et al., 2014). These data indicate that the jaguar had to wander in a pasture, or either to move between patches of forest and to prey on domestic animals.

In early studies from Panama, it was reported that jaguars are parasitized by adults of *Amblyomma ovale* Koch, *Ixodes affinis* Neumann and *Ixodes boliviensis* Neumann. Adults of these species are mainly parasites of wild carnivores in perturbed and mature forests, but also domestic mammals in rural zones (Fairchild et al., 1966; Bermúdez and Miranda, 2011; Guglielmone et al., 2014). These species have environmental preferences that restrict their

distribution, e.g. *A. ovale* and *I. affinis* inhabit forested and rural regions below 700 meters above sea level, and *I. boliviensis* subsists at elevations above 1700 m a.s.l. (Fairchild et al., 1966; Bermúdez et al., 2018).



Figure 1. Female jaguar captured and fitted with a GPS collar to monitor her movement. Under sedation the vital signals were monitored while a black towel was used to cover her eyes (© J. Ortega Yaguara Panama Foundation).

Other works in America report a diversity of ticks that parasitize jaguars, according to the region. In a study covering several states and biomes of Brazil nine species of tick were collected in 26 jaguars, highlighting *Amblyomma cajennense* s.l., *R. microplus* and the equine tick *Dermacentor nitens* Neumann (Labruna et al., 2005). In Mexico, adults of *Ixodes scapularis* Say and *A. mixtum* (cited as *A. cajennense*) were collected from a female jaguar captured in Tamaulipas (Almazán et al., 2013). In Belize, Lopes et al. (2016) reported larvae of *Amblyomma coelebs* Neumann, and adults of *A. ovale*, *Amblyomma* cf. *oblongoguttatum* Koch, and *I. affinis* in two jaguars. These data stand out the importance of jaguars as hosts of different tick species, both in ticks that parasitize carnivores, and in those that are opportunistic. Moreover, the presence of ticks as *A. mixtum*, *A. cajennense*, *R. microplus* or *D. nitens*, indicates the presence of jaguars hunting in grazing areas, which is potentially indicative of habitat loss and possibly also of prey.



Figure 2. Dorsal view of *Amblyomma mixtum* male.

Finally, despite the ecological importance of ticks are often underestimated in studies of large carnivores in several Latin American countries. Ticks may provide information on types of environments and also data on potential risks of disease transmission. In this sense, studies in Brazil demonstrate the presence of ticks-borne pathogens in jaguars, such as *Rickettsia* and *Ehrlichia* (Widmer et al., 2011) or parasites such as *Cytauxzoon felis* and *Hepatozoon* (Furtado et al., 2017a,b); although, it is not known how these pathogens could affect the health of their host. Consequently, more research will be needed to assess the impact that parasitism of ticks can have on predators such as jaguars.

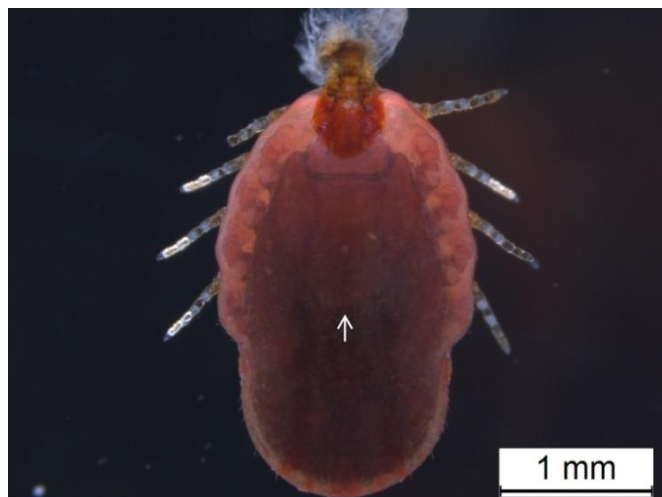


Figure 3. Dorsal view of the nymph of *Rhipicephalus microplus* with female characteristics in scutum (arrow).

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