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Article

Amblyomma species infesting amphibians and reptiles in the seasonally dry Amazon forest, with new host records for *Amblyomma rotundatum* (Acari: Ixodida: Ixodidae)

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Abstract

Our study yielded a list of ticks found on amphibians and reptiles at five sites within seasonally dry Amazon forest in Mato Grosso State, central Brazil, in addition to new host records for *A. rotundatum*. We collected 431 tick specimens: 79 larvae, 115 nymphs, 38 females, and 199 males belonging to *A. humerale*, *A. rotundatum*, and *Amblyomma* sp., on 39 anurans and 21 reptiles. The toads *R. guttatus* and *R. margaritifera* and the frog *L. pentadactylus* are new hosts for *A. rotundatum.*

Key words: *Amblyomma*, Brazil, amphibians, reptiles, new host records

Introduction

Amphibians and reptiles are hosts for a wide variety of micro- and macroparasites. Microparasites include bacteria, viruses, protists and fungi, while macroparasites typically encompass helminths (e.g. monogeneans, trematodes, cestodes, nematodes, acanthocephalans) and some arthropods such as mites, ticks, copepods and lice (Koprivnikar *et al.* 2012). As important pathogen vectors in humans (Guglielmone *et al.* 2006, 2014) as well as domestic and wild animals (Dantas-Torres *et al.* 2008, 2009, Luz *et al.* 2016), ticks (Acari: Ixodida) are ectoparasites of great medical and veterinary interest.

The ixodid tick genus *Amblyomma* currently includes 137 valid species distributed worldwide (Guglielmone *et al.* 2014, Nava *et al.* 2017), of which 32 are found parasitizing domestic and wild animals in Brazil (Dantas-Torres *et al.* 2009, Krawczak *et al.* 2015, Martins *et al.* 2016). Among these, only six species—*Amblyomma cajennense* sensu lato, *Amblyomma dissimile*, *Amblyomma fuscum*, *Amblyomma goeldii*, *Amblyomma humerale*, and *Amblyomma rotundatum*—have been reported parasitizing amphibians and reptiles (Guglielmone & Nava 2010, Luz & Faccini 2013,

Guglielmone *et al*. 2014), including *A. dissimile* and *A. rotundatum*, commonly found parasitizing species of Anura and Squamata. Guglielmone & Nava (2010) reported that records of all parasitic stages on free-ranging *A. dissimile* hosts related mostly to *Rhinella marina*, *Boa constrictor* and *Iguana iguana*, while the most common hosts of larvae, nymphs and *A. rotundatum* females are *R. marina* and, to a lesser extent, *B. constrictor* and *Rhinella schneideri*. However, except for *A. goeldii* (Martins *et al*. 2015), no studies have been conducted to measure the importance of amphibians and reptiles as hosts of *A. cajennense* s. l., *A. fuscum* and *A. humerale*, which should prompt efforts to clarify such host-parasite interactions.

Brazil has witnessed an increasing number of reports of tick parasitism of amphibians and reptiles over the past few years (Barros-Battesti *et al*. 2015, Witter *et al*. 2016, Nascimento *et al*. 2017, Sá-Hungaro *et al*. 2017), including new host records for *A. rotundatum* (Morais *et al*. 2010, Gambale *et al*. 2015, Quirino *et al*. 2016). However, knowledge of this tick fauna remains incomplete (Barros-Battesti *et al*. 2006), and many amphibian and reptile species from different Brazilian ecoregions have never been surveyed for ticks. Our study yielded a list of ticks found on amphibians and reptiles at five sites within seasonally dry Amazon forest in Mato Grosso State, central Brazil, in addition to new host records for *A. rotundatum*.

Materials and methods

Ticks were collected from amphibians and reptiles between 2011 and 2016 at five sites in the municipalities of Alta Floresta, Cláudia, Cotriguaçu, Novo Mundo, and Sinop, State of Mato Grosso, central Brazil (Figure 1). Host specimens were located during diurnal and nocturnal searches (Crump & Scott Jr. 1994) and visually assessed for ticks. Ticks were removed from host bodies with forceps, preserved in 70% ethanol, and identified using the keys of Barros-Battesti *et al*. (2006) and Martins *et al*. (2010). Tick voucher specimens were deposited in the "*Coleção Nacional de Carrapatos Danilo Gonçalves Saraiva*" (CNC) of *Universidade de São Paulo*, São Paulo, Brazil.

Results and discussion

We collected 39 anurans (four species) and 21 reptiles (two species; Table 1) that together hosted 431 tick specimens (79 larvae, 115 nymphs, 38 females, and 199 males) belonging to two *Amblyomma* species: *A. humerale* (n = 214), *A. rotundatum* (n = 138), and *Amblyomma* sp. larvae (n = 79; Table 1). *Amblyomma rotundatum* was recorded from five host species (four anurans and one snake) followed by *Amblyomma* sp. from two host species (two anurans), and *A. humerale* from one host species (Table 1, Figure 2).

The tick species found had mostly been previously recorded for some amphibian and reptile species examined in this study, according to earlier reports (Guglielmone & Nava 2010, Witter *et al*. 2016). A systematic review of hosts of *A. dissimile* and *A. rotundatum* by Guglielmone & Nava (2010) listed 14 anuran species as *A. rotundatum* hosts: *Discoglossus pictus*, *Anaxyrus terrestris* (as *Bufo terrestris*), *Peltophryne peltocephala*, *Rhinella arenarum* (as *Bufo arenarum*), *Rhinella crucifer* (as *Bufo crucifer*), *Rhinella granulosa* (as *Bufo granulosus*), *Rhinella icterica* (as *Bufo ictericus*), *R. marina* (as *Bufo marinus*), *R. schneideri* (as *Bufo schneideri*), *Rhinella* sp. (as *Bufo* sp.), *Odontophrynus americanus*, *Pipa pipa*, *Pelophylax lessonae* (as *Pelophylax esculentus*), and *Spea bombifrons*. Boffy & Almeida-Santos (2010) found an *A. rotundatum* female on a *Rhinella pygmea* subadult at Grussaí resting, in the municipality of São João da Barra, Rio de Janeiro State. Ferreira & Faria (2011) found five *A. rotundatum* specimens on a *Rhinella jimi* adult at *Unidade de*

Conservação Refúgio de Vida Silvestre Mata do Junco, municipality of Capela, Sergipe State. Gambale *et al.* (2015) found an *A. rotundatum* nymph on a *Physalaemus nattereri* adult female in the municipality of Bonfinópolis, Goiás State. Therefore, the toads *R. guttatus* and *R. margaritifera* and the frog *L. pentadactylus* are new hosts for *A. rotundatum.*

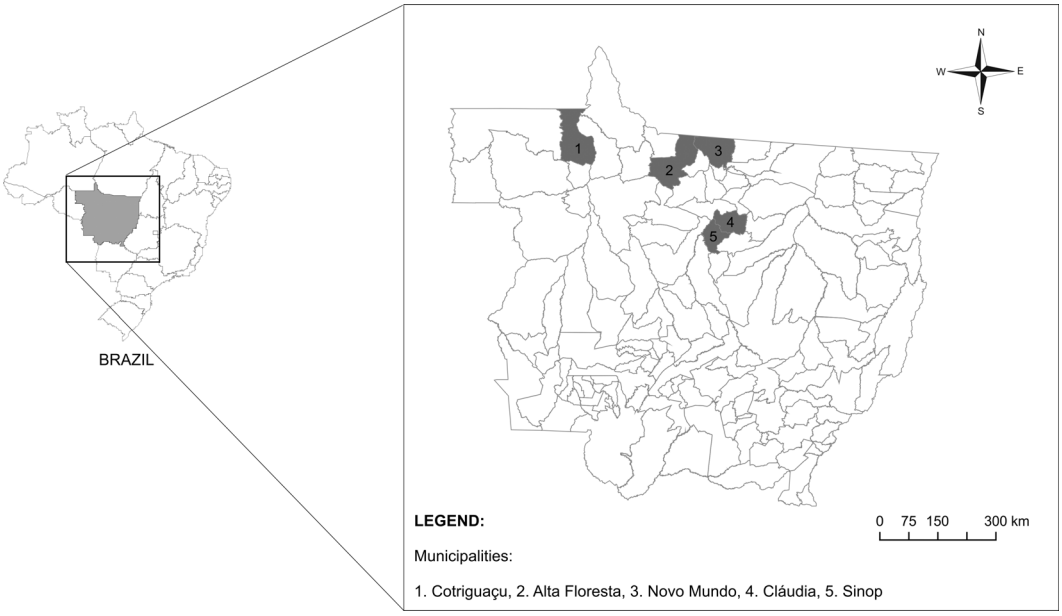

FIGURE 1. Municipalities in Mato Grosso State where amphibians and reptiles were surveyed for ticks.

TABLE 1. Checklist of amphibian and reptile hosts of ticks (M: males; F: females; L: larvae; N: nymphs). Ne —number of examined specimens.

Hosts (Ne)	Origin	Municipality	Date	Ticks
ORDER ANURA				
Bufonidae				
Rhaebo guttatus (6)	Free living	Cotriguaçu	Oct 2013	1F *Amblyomma rotundatum*
Rhaebo guttatus (1)	Free living	Novo Mundo	Oct 2015	1N *A. rotundatum*
Rhinella margaritifera (2)	Free living	Cotriguaçu	Jan 2016	1F, 3N *A. rotundatum*, 28L *Amblyomma* sp.
Rhinella marina (18)	Free living	Cotriguaçu	Jun 2014	2F, 9N *A.rotundatum*, 5L *Amblyomma* sp.
Rhinella marina (5)	Free living	Cotriguaçu	Jul 2014	10F, 17N *A. rotundatum*, 15L *Amblyomma* sp.
Rhinella marina (1)	Free living	Cotriguaçu	Oct 2014	1F, 2N *A. rotundatum*
Rhinella marina (1)	Free living	Cotriguaçu	Jan 2015	2F, 1N *A. rotundatum*
Rhinella marina (2)	Free living	Cotriguaçu	Jul 2015	4F, 4N *A. rotundatum*, 30L *Amblyomma* sp.
Rhinella marina (1)	Free living	Alta Floresta	Oct 2015	3N *A. rotundatum*
Rhinella marina (1)	Free living	Cláudia	Dec 2016	75N *A. rotundatum*, 1L *Amblyomma* sp.
Leptodactylidae				
Leptodactylus pentadactylus (1)	Free living	Cotriguaçu	Jan 2015	1F *A. rotundatum*
ORDER TESTUDINES				
Testudinidae				
Chelonoidis denticulata (9)	Free living	Sinop	Jan/Mar 2013	12F, 146M *Amblyomma humerale*
Chelonoidis denticulata (1)	Free living	Alta Floresta	Oct 2013	2F, 13M *A. humerale*
Chelonoidis denticulata (8)	Free living	Cotriguaçu	Jun 2014	16M *A. humerale*
Chelonoidis denticulata (1)	Free living	Cotriguaçu	Jan 2015	13M *A. humerale*
Chelonoidis denticulata (1)	Free living	Cotriguaçu	Mar 2016	1F, 11M *A. humerale*
ORDER SQUAMATA				
Suborder Serpentes				
Boidae				
Boa constrictor (1)	Free living	Sinop	Fev 2011	1F *A. rotundatum*

FIGURE 2. Toads and chelonian parasitized by *Amblyomma* species. (a) dorsal view of *Rhaebo guttatus*, (b) frontal view of *R. guttatus*, (c) ventral view of an adult male *Rhinella margaritifera*, (d) side view of an adult male *R. margaritifera*, (e) side view of an adult female *R. margaritifera*, (f) side view of *Rhinella marina*, (g) dorsal view of *R. marina*, and (h) frontal view of *Chelonoidis denticulata*.

Our study presents important new data on the tick fauna of amphibians and reptiles at five sites within seasonally dry Amazon forest, in northern Mato Grosso State. The northern region of Mato Grosso State has suffered a massive loss of native vegetation resulting from agricultural expansion. Nevertheless, our study reports new findings, which include three new host records for *A. rotundatum*, suggesting that much is yet to be revealed about the ticks of Brazilian amphibians and reptiles. Therefore, a better characterization of the tick fauna of amphibians and reptiles in this country will require further inventory studies of tick biodiversity.

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