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Carrapatos (Acari: Ixodidae) associados com o ambiente em Campo Grande, Mato Grosso do Sul, Brasil

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Abstract

Herein, we report tick species found on wild and domestic animals and in the environment during a one-year sampling period at the Brazilian Farming Research Company beef cattle unit (Embrapa Beef Cattle), which is located within the urban area of Campo Grande, Mato Grosso do Sul, Brazil. From 55 wild hosts including six different species (*Nasua nasua*, *Cebus* spp., *Cerdocyon thous*, *Myrmecophaga tridactyla*, *Tamandua tetradactyla* and *Dasyprocta aguti*), 323 ticks were collected. *Amblyomma ovale* ticks were found solely on coatis, and *Amblyomma nodosum* was identified solely on anteaters. No ticks were found on capuchin monkeys. However, *Amblyomma cajennense* was found on all parasitized host species with the exception of capuchin monkeys. Giant anteaters displayed the highest infestation abundance, with a mean of 53 ticks/animal. Environmental sampling yielded 166 adult *A. cajennense* ticks. The tick species found on domestic animals (*Rhipicephalus* (*Boophilus*) *microplus*, *R. sanguineus*, *Dermacentor nitens* and *A. cajennense*) were those typically found on these hosts in Brazil. The most prevalent tick species, *A. cajennense,* was found on both wild and domestic animals and was also prevalent in the environment. Thus, this tick species is the primary vector that allows pathogens to bridge wild and domestic animals in the Cerrado.

Keywords: Ticks, wild animals, urban area, Campo Grande, Mato Grosso do Sul.

Resumo

Neste trabalho são descritas as espécies de carrapatos de animais selvagens e domésticos e do ambiente coletados por um ano na EMBRAPA Gado de Corte localizado na área urbana de Campo Grande, Mato Grosso do Sul, Brasil. Dos 55 hospedeiros selvagens de seis espécies diferentes (*Nasua nasua*, *Cebus* spp., *Cerdocyon thous*, *Myrmecophaga tridactyla*, *Tamandua tetradactyla* e *Dasyprocta aguti*) foram coletados 323 carrapatos. *Amblyomma ovale* foi encontrado apenas em quatis e *Amblyomma nodosum* apenas sobre tamanduás. Nenhum carrapato foi encontrado sobre macacos-prego. Por outro lado, *Amblyomma cajennense* foi encontrado em todos os hospedeiros com exceção dos macacos-pregos. A maior abundancia de infestação foi aquela em tamanduás-bandeira com média de 53 carrapatos/animal. No ambiente foram capturados 166 carrapatos, todos da espécie *A. cajennense*. As espécies de carrapatos em animais domésticos (*Rhipicephalus* (*Boophilus*) *microplus*, *Rhipicephalus sanguineus*, *Dermacentor nitens* e *A. cajennense*) foram aquelas características nestes hospedeiros no Brasil. De forma geral a espécie de carrapato *A. cajennense* foi a mais prevalente sendo encontrada em animais domésticos e selvagens bem como no ambiente. Portanto, esta é a principal espécie de vetor a estabelecer uma ponte para bioagentes patogênicos entre animais domésticos e selvagens.

Palavras-chave: Carrapato, animais selvagens, área urbana, Campo Grande, Mato Grosso do Sul.

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Introduction

The tick fauna of Brazil is estimated to comprise 61 species, mostly from the *Amblyomma* genera (DANTAS-TORRES et al., 2009), although this number will certainly increase as new species are described. Concurrently, the country has continental dimensions, and the fauna of individual states are certainly different from each other, but this matter has not been thoroughly studied thus far.

The state of Mato Grosso do Sul in midwestern Brazil has a territory of 357.125 km^2 and a very rich biodiversity in its dominant biomes, a savannah ("Cerrado") and a huge floodplain (Pantanal). The state is also devoted to agriculture, including beef cattle production. Thus, wildlife and domestic animals frequently share the same environment, potentiating the mixing of parasites such as ticks. This mixing is a matter of concern as ticks are important infectious disease vectors for both animals and humans, and the species distribution of these parasites is linked to specific diseases (JONGEJAN; UILENBERG, 2004).

Twenty tick species from Mato Grosso do Sul have been described (GARCIA et al., 2012); however, this number is an underestimate, because a systematic evaluation over the state has not been conducted. Campo Grande, the capital of this state, has 786,797 inhabitants and is located within the Cerrado biome. There are several natural areas within the urban zone, particularly at the outskirts, and wild animals are common, as indicated by the high frequency of road-killed animals such as capybaras, wild Canidae and anteaters.

Herein, we report tick species found at the Brazilian Farming Research Company beef cattle unit (Embrapa Beef Cattle), which is located within the urban area of Campo Grande.

Materials and Methods

1. *Sampling location and period*

The study was conducted in the urban area of the Campo Grande municipality, Mato Grosso do Sul, Brazil. The study location is within the Brazilian Farming Research Company beef cattle unit (Embrapa Beef Cattle), which is located 15 km away from the city center. This unit comprises 3,081 hectares and includes buildings, pastures and native vegetation. Three sampling sites were chosen for the study, two in areas with native vegetation and one pasture (Table 1 and Figure 1).

2. *Tick sampling*

Ticks were collected from wild and domestic animals and from the environment (host-questing ticks) and were either placed in 70% ethanol (adults) or taken alive to the laboratory and kept at 28 °C and 80% relative humidity (nymphs). Ticks from each animal and each location were stored in individual bottles until the species were identified.

Mid-sized wild mammals were captured during four consecutive seasons, with one campaign in each season (winter - 15th to 30th of August 2011; spring - 10th to 25th of November 2011; summer - 14th to 26th of February 2012; and autumn - 15th to 30th of May 2012). During each campaign, eight Tomahawk traps were used; six small traps (40 × 45 × 1.10 cm) were baited with fruit (banana, pear, apple, papaya, mango, tomatoes), whereas two large traps (70 × 45 × 1.20 cm) were baited with meat. The traps were baited in the evening and examined every morning. Three small traps were used at locations 1 and 2 at sites with wild animal vestiges (scat and tracks), whereas the two large traps were used at location 3 to capture the wild Canidae that are frequently observed in the pasture. The captured animals were anesthetized using a mixture of tiletamine and zolazepan (Cloridrato de Tiletamina 125 mg, Virbac, Cloridrato Zolazepan 125 mg, Virbac) according to the manufacturer's recommendation. The entire body of each animal was thoroughly examined for ticks by visual inspection and with the aid of a comb. Examined animals were marked by cutting

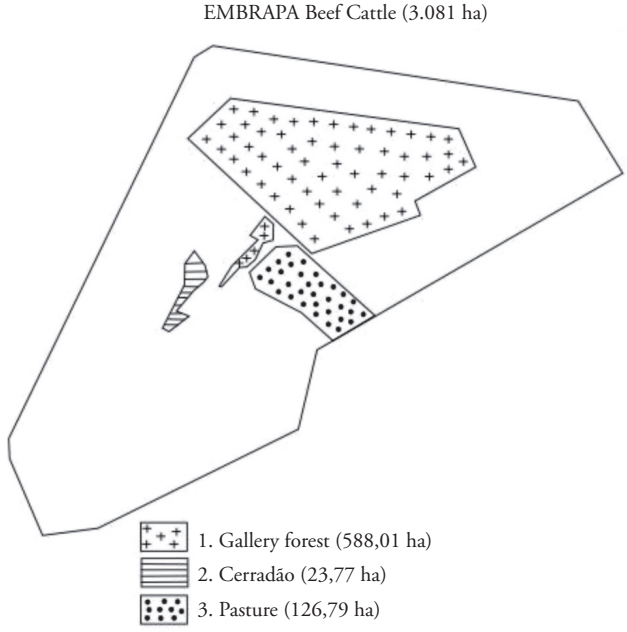

Figure 1. Representative Map of Embrapa Beef Cattle, showing the three study areas and their respective sizes, Campo Grande, Mato Grosso do Sul, Brazil.

Table 1. Tick sampling location and vegetation within the Brazilian Farming Research Company – Embrapa, Campo Grande, Mato Grosso do Sul, Brazil, 2011-2012.

Location	Coordinates	Altitude (m)	Vegetation
1	S 20° 44 24 70'	519.6	Gallery forest[1]
	W 54° 72 49 60'		
2	S 20° 44 30 84'	504.4	Cerradão[2]
	W 54° 72 90 21'		
3	S 20° 44 25 76'	530.0	Pasture[3]
	W 54° 72 20 66'		

[1]Narrow forest strips found along streams and flanked by grasslands or Cerrados; [2]Almost closed woodland with crown cover of 50% to 90%, consisting of trees, often of 8-12 m or even taller, casting considerable shade so that the ground vegetation layer is greatly reduced; [3]Non-native pasture (*Brachiaria decumbens*). Cerrado phytophysignomies according to Oliveira Filho and Ratter (2002).

their fur to avoid repeated examination of the same animal during each campaign. The hosts were released at the capture site after complete recovery from the anesthesia. The Brazilian Environment Institute (IBAMA, Permit No. 29430-1) authorized the wild animal capture, and the permits are on file under one author's name (Andreotti, R.).

Host-questing ticks from the environment were collected with CO_2 traps that were used as previously described (OLIVEIRA et al., 2000). Briefly, approximately 200 g of dry ice was placed in the middle of a 50 × 50 cm white flannel cloth. The cloth had double-sided adhesive tape along its perimeter and was laid on the ground to let the ice sublimet for two hours. At each campaign, 10 CO_2 traps were used at each sampling site (n = 30 CO_2 traps), with a distance from 20 to 80 m between traps. As with the Tomahawk traps, the CO_2 traps were placed in areas with wild animal vestiges or where wild animals were occasionally observed (pasture).

Random tick samples were collected from domestic animals during the study year. For this purpose, chickens, dogs, cattle and horses on the property were inspected.

3. Tick identification

Adult ticks were identified according to Barros-Battesti et al. (2006), and *Amblyomma* nymphs were reared to the adult stage in the laboratory.

Results

In total, 55 midsized mammals from six different species (*Nasua nasua* – Coati; *Cebus* spp. – Capuchin; *Cerdocyon thous* - Crab-eating Fox; *Myrmecophaga tridactyla* - Giant Anteater; *Tamandua tetradactyla* - Southern Anteater; *Dasyprocta aguti* – Agouti) were captured (Table 2). With the exception of capuchin monkeys, all of the animals were tick-infested (the prevalence of tick infestation was 0% and 100%, respectively, Table 2). Overall, 323 nymphs and adults from three tick species were collected from the animals. Of the 141 engorged nymphs, 85 (60%) molted to *A. cajennense* adults. Flat nymphs (n = 103) were fed on rabbits in the laboratory, and 21 (25%) molted to *A. cajennense* adults.

Amblyomma ovale ticks were found solely on coatis, and *A. nodosum* were found solely on anteaters. However, *A. cajennense* was found on all host species. Giant anteaters displayed the highest infestation abundance, with a mean of 53 specimens/animal.

Environmental sampling yielded 166 adult *A. cajennense* ticks. Most adult ticks were captured during the spring (46.4%) and summer (32.5%). Of these, 34.9% were female and 65.1% were male (Table 3).

An inspection of four dogs living unrestrained on the property yielded eight adult *Rhipicephalus sanguineus* and 12 *A. cajennense* nymphs. The only tick species found on the 39 crossbred bovines (Zebu x Holstein) was *Rhipicephalus* (*B.*) *microplus,* and various stages of both *Dermacentor nitens* and *A. cajennense* were found on the 15 horses. Ticks were not found on chickens or in their pens.

Tick specimen samples collected in the present study were deposited in the Embrapa Beef Cattle Tick Collection, Embrapa Campo Grande (accession numbers: 23-47).

Discussion

The results showed a high prevalence of tick infestation of wild animals within the urban areas of Campo Grande. Even within the same area, some tick species were clearly linked to wild hosts, whereas others were linked solely to domestic animals. However, the most prevalent tick species, *A. cajennense,* was found on both wild and domestic animals and was prevalent in the environment.

Overall, the high prevalence and abundance of *A. cajennense* appears to rely on its adaptation to the Cerrado (SZABÓ et al., 2007; VERONEZ et al., 2010) and its wide host range, which includes both domestic and wild hosts for the most host-specific stage, the adult (ARAGÃO, 1936; PEREIRA et al., 2000; LABRUNA et al., 2001). Thus, this tick is the primary vector for tick-borne pathogens that pass between wild and domestic animals in the Cerrado. This tick species is also aggressive toward humans, and bites are frequent (GUGLIELMONE et al., 2006). Not surprisingly, it is the main vector of *Rickettsia rickettsii*, the causative agent of a lethal spotted fever in Brazil (LABRUNA, 2009).

The second most abundant tick, *A. ovale*, was found solely in the adult stage on coatis. This tick species has a preference for carnivores such as coatis in its adult stage (LABRUNA et al., 2005), and larvae and nymphs are believed to parasitize small rodents (MARTINS et al., 2012), which were not sampled in this work. Additionally, *A. ovale* was not found on the other carnivores (Crab-eating fox) that are known to host this tick species (LABRUNA et al., 2005). We speculate that this finding was most likely due to the low numbers of hosts that were captured. This tick species is also known to bite humans (GUGLIELMONE et al., 2006) and to harbor Atlantic rainforest Rickettsia (SZABÓ et al. 2013, in press),

Table 2. Tick numbers (N), species and abundance (A) on wild animals captured in the Brazilian Farming Research Company – Embrapa, Campo Grande, Mato Grosso do Sul, Brazil, 2011-2012.

Hosts (n)	*A. cajennense*		*A. ovale*	*A. nodosum*	*Amblyomma* spp.	Abundance (%)
	A	N	A	A	N	
Coati (35)	10	46	38	0	37	3.7
Capuchin (10)	0	0	0	0	0	-
Crab-eating Fox (04)	7	15	0	0	25	11.8
Giant Anteater (02)	0	79	0	9	18	53.0
Southern Anteater (02)	1	0	0	13	20	17.0
Agouti (02)	1	1	0	0	3	2.5

% – percentage.

Table 3. Host-seeking *A. cajennense* ticks collected from the environment during four consecutive seasons in the Brazilian Farming Research Company – Embrapa, Campo Grande, Mato Grosso do Sul, Brazil, 2011-2012.

Tick sex	Sampling time			
	Winter 2011	Spring 2011	Summer 2012	Autumn 2012
Female	10	22	16	10
Male	8	55	38	7
Total	18	77	54	17

an agent of a novel rickettsiosis in Brazil (SPOLIDORIO et al., 2010).

The third tick species, *A. nodosum*, was found in the adult stage on both anteater species. In fact, the adult stage is restricted to members of the Myrmecophagidae family, which includes the Southern anteater and the giant anteater (PEREIRA et al., 2000; GUGLIELMONE et al., 2003; ARZUA et al., 2005). By contrast, their immature stages are bird parasites (JONES et al., 1972; LABRUNA et al., 2007; OGRZEWALSKA et al., 2009a; TOLESANO-PASCOLI et al., 2010). It is important to note that spotted fever group *Rickettsia* have been found in *A. nodosum* ticks parasitizing birds (OGRZEWALSKA et al., 2009b), but a link with human diseases has not yet been established. In a recent report by Almeida et al. (2013), this agent was found in *A. nodosum* ticks collected from anteaters in Mato Grosso do Sul.

The tick species found on domestic animals were those typically found on these hosts in Brazil. The infestation sources must have been pasture for *R.* (*B.*) *microplus*, *D. nitens* and *A. cajennense* and human dwellings for *R. sanguineus*. However, *A. cajennense* specimens may have infested dogs in forest environments as well. The absence of these tick species, with the exception of *A. cajennense*, on wild hosts may be explained by variations in the use of the study area microenvironments and tick preferences for particular hosts. The crab-eating fox, for example, can be an adequate host for *R. sanguineus* (BECHARA et al., 1995); however, it is a cautious host and does not approach human dwellings, which are a source of that tick species. However, *R.* (*B.*) *microplus* infestation of dogs that use tick-infested pasture is possible but usually restricted to few ticks (SZABÓ et al., 2001). In that case, inadequacy of the host seems to be an important restrictive factor for intense parasitism.

The lack of ticks on capuchin monkeys may also be attributed to the decreased usage of the tick-infested ground environment as well as effective self-grooming behavior. In fact, parasitism of monkeys in Brazil is often associated with wounded animals that exhibit altered behavior, including prolonged presence on the ground and decreased grooming (MARTINS et al., 2006; LAVINA et al., 2011).

On the whole, our work shows that urban areas with vegetation harbor ticks that parasitize domestic animals and wild hosts. Most of these ticks are restricted to specific microenvironments. The *A. cajennense* tick, however, is spread over several phytophysignomies of the Cerrado and in anthropized areas. This wide distribution, in addition to its high agressiveness toward various hosts, makes this tick species the most prevalent in the studied area and a vector to be closely monitored.

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