DOI: 10.1590/1808-1657v76p4612009

SCIENTIFIC COMMUNICATION

PATTERN OF TICK SPATIAL DISTRIBUTION OF A FRAGMENT OF FOREST IN AN URBAN AREA, THROUGH A SURVEY BY CO_2 TRAP*

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ABSTRACT

The study of the ixodofauna in fragments of woods in an urban area is important to the knowledge of species of tick and the dynamic among wild and domestic hosts, allowing to subsidize proposals for the conservation of the fauna and the control of zoonoses such as Brazilian spotted fever. To accomplish the survey, CO_2 traps were built up in six different sites of the forest, during a one- year period, totalizing 12 collections. The ixodids were collected by monitoring the traps and the adjacent vegetation during two hours and put in ethanol 70° GL. At the laboratory they were identified under the stereoscopic optics. At the end of a one-year period of study 2.122 ixodids were colleted, being 793 larvae (37,3%) and 1.277 nymphs (57,8%) of the genus *Amblyomma* and 102 were adults (4,9%) of the *Amblyomma* species. The most constant species was *Amblyomma cajennense*, present in 83,33% of the collections (71 specimen) followed by *Amblyomma dubitatum*, present in 50% (30 specimen), and *Amblyomma calcaratum,* 8,33% (one specimen). The observations showed that in the observed environment the populations of Ixodidae have an aggregate distribution, possibly because of the aggregate distribution of the resource, in the case wild hosts.

KEY WORDS: *Amblyomma cajennense, Amblyomma dubitatum, Amblyomma calcaratum,* fragment of wood.

RESUMO

PADRÃO DE DISTRIBUIÇÃO ESPACIAL DE CARRAPATOS EM FRAGMENTOS DE MATA EM ÁREA URBANA, ATRAVÉS DE LEVANTAMENTO POR ARMADILHAS DE CO_2. O estudo da ixodofauna de fragmentos de mata em área urbana é fundamental para o conhecimento das espécies de carrapatos e para a dinâmica de transmissão entre hospedeiros silvestres e domésticos, gerando subsídios para propostas de conservação da fauna e controle de zoonoses como a Febre Maculosa Brasileira. Para o levantamento, quatro armadilhas de CO_2 foram montadas em seis localidades na mata do Morro do Imperador, Juiz de Fora, MG, durante um ano, totalizando 12 coletas. Os ixodídeos foram coletados por monitoramento das armadilhas e vegetação adjacente durante o período de duas horas e acondicionados em etanol 70° GL. No laboratório, os carrapatos foram identificados sob esterioscopia. Ao final de um ano de estudo, foram coletados 2.122 ixodídeos, sendo 793 larvas (37,3%) e 1.277 ninfas (57, 8%) do gênero *Amblyomma,* além de 102 adultos (4,9%) do gênero *Amblyomma*. A espécie mais constante foi *Amblyomma cajennense,* presente em 83,33% das coletas (71 espécimes), seguido de *Amblyomma dubitatum* presente em 50% (30 espécimes) e *Amblyomma calcaratum* em 8,33% (um espécime). As observações mostram que, no ambiente estudado, os ixodídeos têm um padrão de distribuição agregado, possivelmente em função da distribuição agregada do recurso, no caso hospedeiros silvestres.

PALAVRAS-CHAVE: *Amblyomma cajennense, Amblyomma dubitatum, Amblyomma calcaratum*, fragmento de mata.

In Brazil, there are approximately 60 related species of ticks divided in two families: Ixodidae and Argasidae. In the Ixodidae family, the genus *Amblyomma* is present with 33 species, followed by *Ixodes* with nine, *Haemaphysalis* with three, *Rhipicephaus* with two and *Demacentor* represented by one species. The Argasidae family has the following species: *Ornithodoros* with nine species, *Antricola* with three and *Argas* represented by one species (Barros-Battesti et al., 2006). Among the ticks, the Ixodidae are

*Financial support of Centro de Pesquisa CES/JF.
**Scholarship CNPq/PIC/CES/JF.

the most studied because they represent major importance in Veterinary Medicine, either for the direct plundering action in hematophagy, or by the inoculation of several pathogenic agents. In Brazil, most of the studies of the Ixodidae are turned to the parasitic phase of the ticks. Thus, there are few studies that investigate the aspects of the biology of those parasites, in the non-parasitic phase, in the wild environment such as the studies of Oliveira et al. (2000), Souza et al. (2006), Szabo et al. (2007) and Labruna et al. (2007a). The knowledge of the species of ticks in wild environment becomes important, since many of them participate in a direct way to the enzootic maintenance of the pathogens in nature (Labruna, 2004).

Traps of carbon dioxide are used as an efficient means of chemical attractiveness for some species of ticks (Soneshine, 1993). According to Balashov (1972) and Koch; Mcnew (1982) those traps can attract and capture adult ticks in a radius of approximately 10m. The advantage of this method is that it can be used in any kind of environment, especially in forests where the dragging of a piece of flannel is limited by dense vegetation (Vieira et al., 2004).

The lack of knowledge in relation to the situation in the forest of Morro do Imperador, a fragment of forest of the urban area of Juiz de Fora, in relation to the communities of ticks, and their relationship with the parasitic dynamics, motivated the proposition of this study.

The forest of Morro do Imperador, a fragment located in the central area of Juiz de Fora municipality, Minas Gerais State, Brazil, is a secondary forest, a Semideciduous Atlantic Forest, with a seasonal characteristic (~78ha) with approximately 20 to 25 years of age. There is a relative arboreal space, which does not allow the formation of a compact coverage that turns to be a physical barrier to luminosity. This characteristic associated to the local topography leads to heterogeneity of the fragment explained by the great diversity of vegetal heights and vegetal species found in the inferior strata of the interior of the forest. The high incidence of light allows that the great majority of heliophylus species belonging to the inferior strata of the forest form an entanglement, a big shot of trees, what makes it difficult the access in this area and makes it easier the erosion process due to the great covering of the soil. The great number of lianas and the incidence of few epiphytes are also indications of the succession of the stages. The forest for its location, an urban area, is subjected to great impacts of human interference origin that may contribute to the forest mosaic that is found (Pifano, personal communication).

For the survey of the ticks monthly trappings were carried out, over a year (March 2004 - February 2005), reaching a total of 12 trappings. Six sites of sampling along the edge of the forest, a place of the interface of the wild and urban areas, were selected for the capture of the ticks. In each site four spots were marked, which were arranged in a shape of cross, 10m away from a central imaginary spot, with the exception of the sixth site where two spots were marked, 10m away from each other, due to the unavailability of space, because of the proximity with São Pedro creek. In each spot a trap was built up, made of a piece of white flannel (100 x 80 cm) containing in the center 400 g of dry ice. For the reason that it was not possible to standardize the traps, because of the unavailability of space in site number 6, it was assumed that the index of efficiency of trapping (IET) in each site, by which it was calculated the total ticks captured in the site divided by the mass of dry ice used in the sampling during the period of study. The ticks were collected by monitoring the traps and the adjacent vegetation during two hours. After the capture they were put in plastic flasks containing ethanol 70° GL. The immature forms were grouped as larvae and nymphs and identified until the genus and adults were identified by using the key of Aragão; Fonseca (1961).

According to the index of constancy (IC) (Dajoz, 1983) the ticks were grouped in levels from one to four, as it follows: ticks present in up to 25% of the collections were grouped as constancy 1 (+), from 26-50% constancy 2 (++), from 51-75% constancy 3 (+++) and above 75% constancy 4 (++++). In order to determine if the species of ticks presented a pattern of aggregate distribution it was obtained a ratio between the variation and the mean (S^2/m) (Odum, 1983), and index of discrepancy (D) of Poulin (1993).

At the end of a year of study 2.122 ixodids were collected. 793 of them were larvae, representing (37,3%) of the collected ticks, 1.227 were nymphs of genus *Amblyomma* (57,8%), and 102 were adults (4,9%). Among the adults the following species were found: *Amblyomma cajennense* (Fabricius, 1787) (38 males and 33 females), followed by *Amblyomma dubitatum* Neumann, 1899 (16 males and 14 females) and *Amblyomma calcaratum* Neumann, 1899 (one female).

During the period of study it was observed that the tick population was not regularly distributed throughout the forest. In the area of study, the results showed that the ixodids have aggregate distribution (Table 1), and it is possible that the aggregation is due to the distribution of the hosts. What can be observed in relation to site six, where in spite of the number of traps which were used had been inferior to the other sites, is that this one showed a bigger success in the trappings (IET = 217,9 ticks/kg of dry ice) (Table 1). In order to explain such fact we can rely on the hypothesis of dispersion based on the resource RDH (Resource Dispersion Hypothesis). In this site it must be considered the proximity with São Pedro stream, a hydric resource used by a population of capybaras

(*Hydrochaeris hydrochaeris*), which was restricted to the water nearby, and therefore the population of ticks was concentrated on that point. It is important to emphasize that the species recorded more frequently, *A. cajennense* (IC = ++++) and *A. dubitatum* (IC = +++), are considered as common to capybaras (Aragão, 1936; Souza et al., 2006, Labruna, 2006), although these hosts were not spotted in site six; records of footprints and feces were frequently observed. These species were also the only ones of the genus *Amblyomma*, which were found in studies with a similar methodology (Souza et al., 2006).

The species *A. calcaratum* (IC = +) also found in this site, but only with a record, may have been dispersed, in the nymph phase, by another host different from the capybaras. This species when it is adult is almost exclusive of ant-eaters (*Tamandua tetradactyla, Myrmecophaga tridactyla),* but in the immature stages, with smaller specifity may infest other mammals (Guimarães et al., 2001) and birds (Labruna et al., 2007b) that may be using the stream as resource. Another factor that corroborates the hypothesis of aggregation, in function of the distribution of hosts, is the number of larvae collected in site six (n = 792), since the method used in the collection is pointed out in literature as less efficient to the larvae (Koch; McNew, 1982; Oliveira et al., 2000). By studying the *Amblyomma americanum,* Koch; McNew (1982) noticed that the maximum distance to the trapping of the larvae of this species, with this method, was of 1,5m and the traps needed to be exposed for 2h.

Different from the species *A. dubitatum* restricted to site six, *A. cajennense* was also found in sites four and five, showing itself less aggregate (D = 0,618) than *A. dubitatum* (D = 0,714). Possibly the occurrence of *A. cajennense* in more sampling points is due to the smaller parasite specifity (Guimarães et al., 2001; Oliveira, 2004). There are not systematic studies of the survey of the fauna of possible hosts in this fragment of forest. Rodrigues *et al*. (2006) studying the ecotoparasites in coatis (*Nasua nasua*) of this fragment, found just ixodids in immature stages in hosts. The nymphs that infested the coatis, which molted, were identified as *A. cajennense.* This fact can explain the discovery of this species of tick, even with a lower constancy (Table 1), in sites one, four and five, places where the coatis are fattened and are frequently seen.

In sites two and three no ticks were trapped. It must be emphasized that the sampling spots in these sites were located next to a trail, frequently used by human beings and, as a consequence, few species of wild hosts, especially mammals, would explore these points, limiting the occurrence of Ixodidae.

Carbon dioxide traps have different efficacy in trapping different species of ticks. Argasidae ticks, due to their nest-building behavior, are less captured than Ixodidae, although they had already been captured through this method (Hokama; Howarth, 1977). Among the Ixodidae, the species of the genus *Amblyomma* are more frequently trapped (Ginserberg; Ewing, 1989; Souza et al., 2006) when compared to the other species. Ginserber; Ewing (1989) observed that the efficacy in trapping, using carbon dioxide trap, for *A. americanum* was bigger than for *Ixodes daminni*, even in area with its predominance. An explanation for this is the fact that *A. americanum* moves faster than *I. daminni.* Falco; Fish (1991) observed that to capture *I. daminni* with the same method, it would be necessary a longer time of exposition of the traps (144h) and that the average range of attraction was 1,8 (± 0,28) m. According to the authors, *I. daminni* presents some limitation for the horizontal moving, having a limited capacity of dispersion. The limitation of this method of trapping used in this survey can explain the fact that no Argasidae and other genus of Ixodidae were found, such as *Ixodes*. For a better survey of the area, it would be necessary the dragging of the piece of flannel, as a method to complement it, once it would make it possible the

Table 1 - Pattern of the spatial distribution and index of constancy of ixodides collected, by CO_2 trap in fragments of the urban forest Morro do Imperador, Juiz de Fora municipality, MG, Brazil.

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Pattern of distribution
Larvae of Ixodidae	+	-	-	-	+	+ + +	Aggregate (D=0.714)
Nymphs of *Amblyomma*	+ +	-	-	-	+	+ + + +	Aggregate (D=0.713)
Amblyomma cajennense	-	-	-	+ +	+	+ + + +	Aggregate (D=0.618)
Amblyomma dubitatum	-	-	-	-	-	+ ++	Aggregate (D=0.714)
Amblyomma calcaratum	-	-	-	-	-	+	Not calculated
Total of ticks collected	4	0	0	22	4	2092	
IET	0,2	0	0	1,14	0,2	217,9	

Index of constancy (Dajoz, 1983) – (0%); + (1-25%), + + (26-50%); + + + (51-75%); + + + + (76-100%).
D– Index of discrepancy 0 = Uniform distribution, 1 = maxim of aggregation (Poulin, 1993).
IET – Index of efficiency of trapping expressed in ticks/kg of dry ice.

capture of other ticks, however the kind of vegetation of the inferior strata of the fragment, entanglements and big shots of trees impacted the use of this methodology.

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Received on 3/4/07
Accepted on 11/5/09