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Seasonal dynamics of *Rhipicephalus sanguineus (Aca*ri: Ixodidae) in dogs from a police unit in Goiânia, Goiás, Brazil

Dinâmica sazonal de *Rhipicephalus sanguineus (Acari*: Ixodidae) em cães de uma unidade da polícia de Goiânia, Goiás, Brasil

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ABSTRACT

*The seasonal dynamics of **Rhipicephalus sanguineus** ticks was evaluated in dogs at a Police Unit in Goiânia, Goiás, Brazil, from July 2001 to July 2002. The study was carried out on seven naturally infested dogs (two English Cocker Spaniels and five mongrel dogs), with ages between six months and 10 years. Every two weeks, the numbers of feeding larvae, nymphs, and adults were determined. Dogs showing infestation levels above 500 adult ticks received three acaricide treatments. Considering that the treatments had affected the development of some peaking populations of ticks, it was inferred the occurrence of the following peaks: - larvae (four peaks): from August to November, from November to February, from March to May, and from May to July; - nymphs (five peaks): from July to September, from October to December, from December to February, from March to May, and from June to July; - adults (four peaks): from July to October, from October to January, from January to March, and from April to July. The occurrence of these consecutive peaks of activity of each stage of **R. sanguineus** may indicate that this tick can develop up to four generations per year in Goiânia. On the other hand, if the acaricide treatment did not interfere with the development of **R. sanguineus peaks**, more than four peaks of each stage have occurred on the dogs. In this case, it is acceptable to infer that more than one population of **R. sanguineus** was developing within the kennel concomitantly. The mean numbers of each tick stage was similar in the different seasons. The main attachment sites were located on the neck, chest, forelegs, armpits, ears, between toes and on the head. The number of adult ticks feeding on English Cocker Spaniel dogs was 1.4 to 11.5 times higher than that feeding on mongrel dogs.*

Key words: ***Rhipicephalus sanguineus**, Brown dog tick, mongrel dogs, English Cocker Spaniel dogs, seasonal dynamics.*

RESUMO

*O estudo de dinâmica sazonal de **Rhipicephalus sanguineus** foi desenvolvido em cães de uma unidade da polícia de Goiânia, Goiás, Brasil, de julho de 2001 a julho de 2002. Sete cães naturalmente infestados com **R. sanguineus** (dois da raça Cocker Spaniel Inglês, e cinco cães sem raça definida), com idades variando de 6 meses a 10 anos, foram utilizados no monitoramento da infestação. A cada duas semanas, o número de larvas, ninfas e adultos parasitando os animais era contado. Três tratamentos acaricidas foram feitos nos cães que tiveram níveis de infestação de 500 adultos. Considerando que os tratamentos interferiram no desenvolvimento de alguns picos do carrapato, pôde-se inferir que ocorreram nos quatro picos de larvas: de agosto a novembro, de novembro a fevereiro, de março a maio e de maio a julho; cinco picos de ninfas: de julho a setembro, de outubro a dezembro, de dezembro a fevereiro, de março a maio e de junho a julho, e quatro picos de adultos: de julho a outubro, de outubro a janeiro, de janeiro a março e de abril a julho. A ocorrência destes picos consecutivos de cada estágio pode indicar que o **R. sanguineus** realiza quatro gerações anuais em Goiânia. Por outro lado, se os tratamentos não interferiram no desenvolvimento dos picos de atividade, mais de quatro picos de cada estágio ocorreram nos cães. Então, é aceitável supor que mais de uma população de **R. sanguineus** estava se desenvolvendo no canil, ao mesmo tempo. O número médio de carrapatos de cada estádio foi similar nas estações do ano. Os sítios preferenciais de fixação foram o pescoço, o peito, as patas, as axilas, as orelhas, os espaços interdigitais e a cabeça. O número de carrapatos contados nos cães da raça Cocker Spainel Inglês foi de 1,4 a 11,5 vezes maior que o número observado nos cães sem raça definida.*

Palavras-chave: ***Rhipicephalus sanguineus**, carrapato vermelho dos cães, cães sem raça definida, Cocker Spaniel Inglês, dinâmica sazonal.*

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INTRODUCTION

The cosmopolitan brown dog tick ***Rhipicephalus sanguineus*** (Latrielle 1806) is one of the most important ectoparasites affecting dogs. In some areas of the world ***R. sanguineus*** has been reported feeding on a wide variety of medium and large-sized mammals and ground-feeding birds (USDA, 1976). In Brazil, however, this tick species is most often found in dogs (LABRUNA & PEREIRA, 2001a).

R. sanguineus causes discomfort, anemia and is known as the main vector of ***Ehrlichia canis***, ***Babesia canis***, ***Haemobartonella canis*** (WOLDEHIWET & RISTIC, 1993), and ***Hepatozoon canis*** (O' DWYER & MASSARD, 2001). In Europe, ***R. sanguineus*** can transmit to humans the agent of the Boutonneuse Fever, ***Rickettsia conorii*** (MERLE et al., 1998). DEMMA et al. (2005) determined that ***R. sanguineus*** is a vector of ***Rickettsia rickettsii*** in Arizona, USA and, in Brazil, it is also regarded as a potential vector of this agent (ROZENTAL et al., 2002).

R. sanguineus is a three-host tick, with endophilous nidicole behavior (SONENSHINE, 1993), known as the "kennel-tick". Studies on its seasonal dynamics have been carried out in many parts of the world, such as Italy (STELLA et al., 1988; PRINCIPIATO et al., 1989), Spain (ESTRADA-PEÑA et al., 1992), India (DAS & BHATIA, 1994), Japan (INOKUMA, 1996), Mexico (CRUZ-VAZQUEZ & GARCIA-VAZQUEZ, 1999), and South Africa (JACOBS et al., 2001). Although ***R. sanguineus*** is highly prevalent on dogs in Brazil (LABRUNA & PEREIRA, 2001a; 2001b; RODRIGUES et al., 2001), no studies have been carried out on its seasonality in dogs or in the environment. The present study was aimed at determining the seasonal dynamics of larval, nymphal and adult ***R. sanguineus*** infestations on seven naturally infested dogs from a Police unit in Goiânia, Goiás, Brazil.

MATERIALS AND METHODS

The experiment was carried out at a kennel of a Police unit in Goiânia (16° 40'S, 49° 15'W, altitude 741m), State of Goiás, Brazil, from July 2001 to July 2002. This municipality has a distinct dry season from April to September (autumn and winter) and a wet season from October to March (spring and summer), with mean temperature, relative humidity and rainfall varying from 20.7°C to 24.6°C, 47% to 76% and 21.7mm^3 to 222.5mm^3, respectively.

The kennel had an area of 1250m^2 with 30 stalls for two dogs each, divided into three pavilions. The experimental dogs were maintained in a separated pavilion (115 m^2), at least six meters apart from other pavilions, with 8 stalls of 2.5 x 5 m, and strictly isolated from contact with other dogs. All dogs in the kennel were naturally infested with ***R. sanguineus***; however, due to the nidicole behavior of this tick (SONENSHINE, 1993), exchange of tick stages between the pavilions was not expected to occur. Besides, several measures were adopted in order to avoid any potential exchanges of ticks, such as: the experimental dogs had no contact with other dogs of the kennel; wax was scattered over the walls to prevent movement of ticks; weekly, 0.025% of amitraz (Bovitraz, Bayer) was sprayed on the outside walls; the personnel taking care of the experimental animals had no contact with other dogs; and each experimental place had its exclusive cleaning material.

The study was carried out on seven dogs (two English Cocker Spaniels and five mongrel dogs), with ages ranging from six months to 10 years, naturally infested with ***R. sanguineus***. One month previous to the beginning of the experiment, the dogs were lodged in the kennel stalls and were allowed to be infested with resident ***R. sanguineus***. All dogs had been vaccinated with Octa-Cino-Vacin (Biovet), against rabies, and had been treated with anthelmintic (Drontal, Bayer). The animals were fed twice a day, received water "ad libitum" and were examined by a veterinarian twice a week. When the level of infestation reached above 500 adult ticks per animal (it ranged from 594 to 1108), the dogs were treated with 2 liters of 0.05% of coumaphos (Asuntol, Bayer), using a hand sprayer. This level of infestation was adopted based on previous results, in which a significant decrease in the packed cell volume was observed when infestation reached 500 ticks (unpublished data). Three animals became sick and were replaced during the experiment: one English Cocker Spaniel in December 2001 and two mongrel dogs in March 2002. Clinical and laboratorial examinations diagnosed canine distemper in two of them and ehrlichiosis in the third dog. Those three dogs were replaced by three tick-free mongrel dogs, which were monitored one month later of their placement in the stalls.

Every two weeks, the numbers of attached engorged larvae, nymphs and adults were recorded. The engorged immature stages were collected by brushing the left side of the animals, as previously described by OLIVEIRA et al. (2003) for collection of ***Amblyomma cajennense*** on horses. After consecutive brushings, the larvae and nymphs were collected and placed into plastic bags and then transported to the laboratory for counting and species identification. The numbers of adult stages were estimated by counting parasites on the attachment sites on the left side of the

animals: (1) head, (2) ears (3) between toes, (4) neck, armpits, forelegs and chest, (5) back, abdomen, hind legs, groin, and tail. The number of ticks counted on the left side was doubled to provide an estimate of the total number of ticks per animal.

Identification of ticks was carried out on adult specimens collected in all countings, according to ARAGÃO & FONSECA (1961). A sample corresponding to thirty percent of the larvae and the nymphs were also examined; larvae were identified using the CLIFFORD & ANASTOS (1960) key, and nymphs were identified using the same characteristics described by ARAGÃO & FONSECA (1961) for adults.

Climatic variables, including mean temperature, rainfall and relative humidity, were obtained from the weather station of the Goiânia Meteorological District (Figure 1).

The results were submitted to a variance analysis and the means were compared using the Student's t-test. The data were log transformed (x + 1) before the analysis (SAMPAIO, 1998). The effect of the season on the dynamic of the tick was evaluated by comparing the dry seasons (autumn and winter) with the wet seasons (spring and summer).

RESULTS AND DISCUSSION

Ticks were found feeding on dogs throughout the year and all of them were identified as R. sanguineus. When comparing data from the cold dry seasons (autumn and winter) with those from the hot wet seasons (spring and summer), the mean numbers of ticks were statistically (P>0.05) similar, ranging from 176.6 to 223.0 for adults, 23.6 to 16.4 for larvae, and 31.3 to 46.6 for nymphs. These results are not in agreement with the literature. GILOT (1984), in France, reported higher numbers of adults during the summer and higher numbers of immature stages (both larvae and nymphs) during the spring. In Italy, STELLA et al. (1988); PRINCIPIATO et al. (1989) found all stages of R. sanguineus in the spring and summer. DAS & BHATIA (1994), in India, observed a single yearly peak of ticks from March to September. CRUZ-VAZQUEZ and GARCIA-VAZQUEZ (1999), in Mexico, reported higher prevalence rates of ticks during spring, summer and fall than during the winter. In Minas Gerais State, Brazil, infestations of ***R. sanguineus*** have higher intensity during the hot and rainy months (RODRIGUES et al. 2001). In South Africa, JACOBS et al. (2001) observed dogs infested with ***R. sanguineus*** throughout the year, with the highest number of ticks being collected during the warmer months (January to April).

The constant high prevalence rates of ***R. sanguineus*** stages throughout the year observed in the present study is probably due to the optimal conditions for their development at the experimental site, which may explain the data differences among the studies. As observed in most tick species, the host-seeking stages of ***R. sanguineus*** are under the influence of climatic conditions, such as temperature and relative humidity (HEATH, 1981; BELLATO & DAEMON, 1997). On the other hand, the development of feeding stage depends exclusively on the availability of the specific host (SARTOR et al., 1996). According to the weather station, during the experiment, the mean temperature in Goiânia ranged from 23.5 to 26.5ºC, the relative humidity from 45 to 80% and the rainfall from 0 to 400mm (Figure 1). Due to the fact that the stalls were washed twice a day, it is probable that the relative humidity in the stalls was different from that measured at the weather station. Thus, in despite of the relative humidity levels measured in the station being bellow the ideal indices for ***R. sanguineus***, as pointed out by JACOBS et al. (2001), the relative humidity within the stalls was probably higher. The mild temperatures, the increased relative humidity and the constant presence of dogs provided ideal conditions to the development of ***R. sanguineus*** ticks.

The acaricide treatments were applied on September 10, and on December 3, in two dogs, and on February 15, in one dog. There was a decrease in the numbers of larvae (87%) and adults (90%) in the first count after the two acaricide treatments. However, in the second count, no increase was observed in the number of both stages: adults (62%) and larvae (70%) (Figures 2a and 2b). The sharp decrease immediately after the treatment indicates that the acaricide interfered with the development of larval and adult peaks, raising the hypothesis that if no acaricide had been used, the number of larvae and adults would not have decreased abruptly during that period. On the other hand, the number of nymphs did not increase in the second count after either treatment. Since the acaricide treatments were based on a short residual period, it is reasonable to assume that this reduction in the number of nymphs would have occurred even if no acaricide had been used. On this perspective, it is possible to infer that the third acaricide treatment did not interfere with the peaks of any tick stages, since the number of ticks was low for at least two counts. Under this point of view, the results indicate the occurrence of the following peaks: - larvae (four peaks): August to November, November to February, March to May, May to July (Figure 2a); nymphs (five peaks): July to September, October to December, December to February, March to

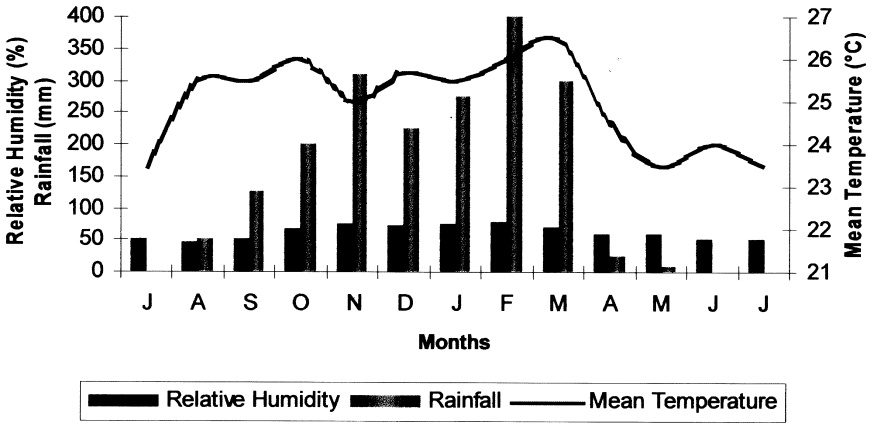

Figure 1 - Climatic data from the Goiânia Meteorological District, Goiás, Brazil, from July 2001 to July 2002.

May, June to July (Figure 2b); and adults (four peaks): July to October, October to January, January to March and April to July (Figure 2c). The dynamic of larvae, nymphs and adults on untreated dogs was very similar to those aforementioned. However, as the peaks were flatter than those including both treated and untreated animals, the complete data were maintained.

The occurrence of four to five consecutive peaks of activity of each stage of ***R. sanguineus*** indicates that this tick can develop up to four generations yearly in Goiânia, where dogs are constantly available. In fact, as the experiment lasted 13 months, we can conclude that a fifth peak of feeding nymphs seemed to occur at the beginning of the first peak of activity, because they occurred concomitantly. Considering that ***R. sanguineus*** may develop four generations yearly in Goiânia, the duration of the complete cycle would be 91 days. These data are in agreement with those obtained by BECHARA et al. (1995), in which ***R. sanguineus*** stages fed on dogs and maintained at a temperature of 27°C developed a complete cycle within 90 days.

The mean temperature observed in Goiânia during the experiment (Figure 1) would not justify the occurrence of a complete cycle shorter than that observed by BECHARA et al. (1995) at 27ºC. Thus, if the assumption about the interference of acaricide treatment with the development of larval and adult peaks is not correct, more than four peaks of each stage would occur on the dogs. Therefore, it is reasonable to assume that more than one population of ***R. sanguineus*** was developing in the kennel during the experimental period. The activity peaks would thus represent an overlapping of different populations occurring during the year, rather than four generations of one population.

Higher numbers of adults (14,446) than nymphs (2,445) or larvae (1,299) were observed and this was due to the sampling technique. The brushing technique was not very efficient for collecting immature ticks, particularly the unengorged ones. On the other hand, nearly every adult ticks, engorged and unengorged, were collected because they were larger in size. The main feeding attachment sites for adults were the neck, chest, forelegs and armpits (29.5%), the ears (24.6%), spaces between toes (21.9%), and the head (20.5%). The preferences of ***R. sanguineus*** for attachment on the neck, ears and between toes are in agreement with JACOBS et al. (2001) and RODRIGUES et al. (2001). However, we found higher numbers of ticks attached on the head than those reported by the previous mentioned authors.

During the entire experiment, although more evidently during the hot and wet months (from October to March), the number of adult ticks feeding on English Cocker Spaniel dogs was 1.4 to 11.5 fold higher than those feeding on mongrel dogs. An equivalent comparison could not be made for immature stages, since the brushing technique did not allow an efficient collection of these stages, particularly from longhair dogs such as the English Cocker Spaniels. The higher number of ticks observed on English Cocker Spaniel dogs could be explained on the basis of breed resistance or due to individual factors, as pointed out by SUTHERST et al. (1988) and RECHAV et al. (1991). However, with regard to this aspect, no conclusions were drawn, since the present study was not design to address this question. Considering that ***R. sanguineus*** is a hunter tick (SONENSHINE, 1993), it is possible that the host produces some key factors to activate or

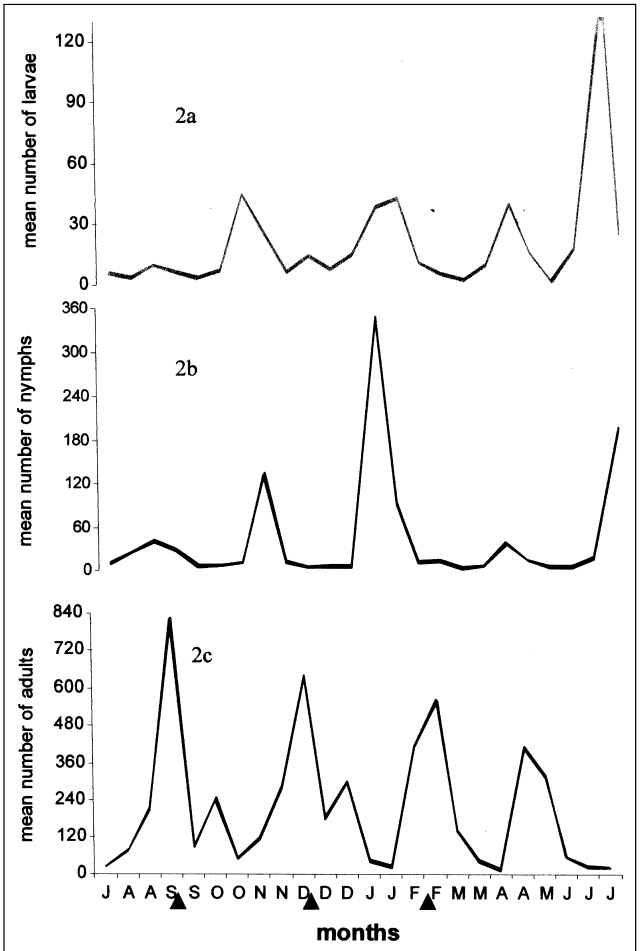

Figure 2 - Mean number of ***R. sanguineus*** larvae (a), nymphs (b) and adults (c) feeding on dogs in a kennel of a Police unit in Goiânia, Goiás, Brazil, from July 2001 to July 2002. The arrows indicate the acaricide treatments.

inhibit the host-seeking behavior of this tick, but further investigations are necessary to confirm the occurrence of ***R. sanguineus***-resistant breeds of dogs and the causes of this resistance.

CONCLUSION

R. sanguineus may develop up to four generations yearly in Goiânia – GO, Brazil, unless more than one population of ***R. sanguineus*** was developing in the kennel at the same time.

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