PREDATION OF *Boophilus microplus* (CANESTRINI, 1887) (ACARI: IXODIDAE) TICK ENGORGED FEMALE BY THE ANT *Pachycondyla striata* (SMITH, 1858) (HYMENOPTERA: FORMICIDAE) IN PASTURES

PREDAÇÃO DE FÊMEAS INGURGITADAS DO CARRAPATO Boophilus microplus (CANESTRINI, 1887) (ACARI: IXODIDAE) PELA FORMIGA Pachycondyla striata (SMITH, 1858) (HYMENOPTERA: FORMICIDAE) EM PASTAGEM

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ABSTRACT: Faced with difficulties in the chemical control of *Boophilus microplus*, this work intended to observe the principal predator of engorged females in pastures of the grass *Brachiaria decumbens*, at Juiz de Fora, MG, Brazil. A total of 300 engorged female were used, between six experimental replications during the winter of 1998 and the summer of 1998/1999. Such tick samples were released into the pastures every two weeks, being placed in clumps of *B. decumbens* and observed at intervals of two hours throughout the daytime. The ant *Pachycondyla striata* was confirmed as an important predator of the tick that fed on the engorged females *in situ* or taken to its colony. Predation was greater during the summer (50,5% of ticks released) than the winter (33,3%). It was concluded that this ant should be investigated further for possible future employment in the biological control of *B. microplus* in Brazil.

UNITERMS: Tick, *Boophilus microplus, Pachycondyla striata,* Predation.

INTRODUCTION

Serious problems caused by the cattle tick, *Boophilus microplus*, were unknown in the south east and centre west regions of Brazil until the middle of the last century. With the expansion of the industrial sectors after the Second World War, there arose a great necessity to increase the production of milk and its derivatives, resulting in the introduction of European breeds of cattle that are more suited to dairy production. With such improved breeding, the region's herds also became more susceptible to this parasite (LEITE, 1993). Combining this change with climatic and pasture conditions favourable to its development, the tick established itself very successfully. Economic damage and costs caused by *B. microplus* in Brazil have been estimated at almost one billion dollar annually, according to the Ministery of Agriculture (PAIVA, 1997). In Australia, production losses and control costs due to this tick are up to 100 hundred dollar annually (WILLADSEN, 1997).

The most common natural predators of *B. microplus* are beetles, ants, rodents and birds (PEREIRA, 1982). According to Sonenshine (1993), amongst the invertebrates, species of ants together cause a significant loss of engorged female ticks in nature. The tropical fire ant (*Solenopsis geminata*) has been found feeding on large numbers of engorged female *B. microplus*, probably having a significant impact on its population (BARRE et al., 1991). There isn't any record about predation of *B. microplus* by *Pachycondyla striata.* It is a predatory ant of small arthropods and also dead arthropods (necrophage), as cited for *P. villosa* (VALENZUELA-GONZALEZ et al., 1994). *P. striata* is distributed throughout Uruguay, Paraguay, Argentina and Brazil (the states of Goiás, Minas gerais, Espírito Santo, Rio de Janeiro, São Paulo, Paraná, Santa Catarina and Rio Grande do Sul). The majority of investigations on *P. striata* and on *P. obscuricornis* have been limited in little works like Hölldobler; Traniello (1980), Traniello; Hölldobler (1984), Hölldobler (1986), Oliveira; Hölldobler (1991), Dussman et

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al. (1996). There is thus a necessity for a more extensive understanding of the behavioural ecology of this species.

Beetles have been observed feeding off tick larvae in natural vegetation (GARRETT; SONENSHINE, 1974). *Hunterellus hookeri*, a parasitoid wasp, has been observed selecting engorged female *Ixodes dammini* ticks and depositing its eggs in them (MATHER et al., 1987). Detection of the presence of predators opens the way for their possible employment in biological control that, according to Caltagirone (1988), is the regulation of populations of live organisms resulting from antagonistic interactions, such as parasitism, predation and competition. Biological control presents advantages, such as the absence of chemical effects in man, animals and the environment, low cost and absence of development of resistance. It also has disadvantages, such as a relatively long research and development period and usually dependence of the predator population on that of the prey.

Some investigations on natural predators of *B. microplus* have been carried out: Ihering (1948), Gonzales (1975), Menegheti; Arigony (1982), Faleiros et al. (1983), Rocha-Woelz; Rocha (1983), Rocha (1984), Goulart et al. (1986), Branco; Pinheiro (1987). Other works have investigated possibilities for the biological control of *B. microplus* using pathogenic fungi, such as Bittencourt et al. (1996). Considering the difficulties in chemical control of the cattle tick, this work reported sought to observe predation of engorged female in natural conditions. It is an attempt to offer new candidate species for consideration within the development of schemes of integrated pest management (IPM) as applied to the cattle tick in Brazil.

MATERIAL AND METHODS

The engorged female ticks were produced in a colony of *B. microplus,* where the laboratory stock is periodically renewed with local field ticks to prevent excessive inbreeding. Exposure of them in the pastures was divided into two field experiments. Each experiment had six replication, in each of which 20 engorged female ticks were exposed in the winter of 1998 (total 120) and 30 ticks in the summer months of 1998/1999 (total 180). The field experiments were carried out in the grounds of the main laboratories of the EMBRAPA Gado de Leite, in the south west region of the city of Juiz de Fora, MG, Brazil (21°45'35"S, 43°20'50"W) (STAICO, 1977). The experimental *Brachiaria decumbens* Stapf was cut to a height of approximately 20 cm to simulate naturally grazed pasture conditions. The local temperature and relative humidity conditions were recorded by means of a thermohygrometer installed at the experimental site.

The engorged female, that had dropped that morning from the colony's donor cattle, were washed in the laboratory, dried, weighed and marked with an appropriate aeromodelling paint with low toxicity (Laca Nitrocellulose). The ticks were then released into the prepared clumps of *B. decumbens*, by two weeks, and their individual positions on the soil marked with sticks with numbered flags to facilitate their location. Each tick received an individual identification (circle, comma, etc.) so that they and their positions could not be subsequently confused.

In each experimental repetition, the engorged female ticks were placed into the pasture at around 12:30 (soon after their arrival from the Experimental Research Station) and observed daily at; 07:00, 10:00, 12:30, 14:30 and 17:00 in the winter months, and at; 08:00, 11:00, 13:30, 15:30 and 18:00 in the summer (ie. the local "summer-time" change; = +1 h). Any engorged female ticks that did not show evidence of predation were removed from the field at the start of their oviposition so that the pastures would not become infested. At this time also, any of the ticks showing marks of predation were placed in the incubator with controlled conditions (± 27°C, >80% RH). They were observed for mortality and any complete or partial oviposition.

All results were submitted to the variance analysis of General Linear Models Proceeding (STATISTICS ANALYSIS SYSTEM - SAS, 1990) and the means contrast were done using Student Newman Keuls Test.

RESULTS

In the winter, the proportion of ticks suffering predation by ants was 13.3%. Of these, 62.5% died and 37.5% completed only a partial oviposition. Of the 120 engorged female ticks placed in the pastures, 20% disappeared during the observations. It is therefore possible that the true proportion of ticks that suffered predation could have been up to 33.3%. The majority of predation was observed to be caused by the ant *Pachycondyla striata. Pachycondyla obscuricornis* (Emery, 1890), which is smaller than *P. striata* also played a minor role.

In the summer, 19.4% of ticks suffering predation by ants and all died. In this season, 31.1% disappeared and, if considered due to predation, would put the true proportion at 50.5% (91 out of a total 180 ticks exposed) ($p<0.05$). In the first experimental repetition of summer, a higher proportion of ticks suffering predation and disappearing was observed. For this reason, the experimental sample size of ticks exposed was increased, from the 20 per repetition, to 30 ticks per repetition in the summer. *P. striata* was also the species of ant responsible for most of the predation during the summer.

DISCUSSION

According to the observations of Valenzuela-Gonzalez et al. (1994) made on cocoa plantations in Mexico, *P. villosa* has a diet made up of 57% liquids, obtained principally from the extra-floral nectaries of cocoa trees, and of 43% solids, principally of *Clastoptera globosa* (Cercopidae), an insect considered a pest in the cocoa plantations. According to De La Vega (1981), a high incidence but low intensity of infestation (<10 engorged female ticks/animal) by *B. microplus* was observed in different regions of Cuba. He commented on the possible important role of the ant, *Pheidole megacephala* Fabricius, encountered in the vicinity, as a predator of the tick. Wilkinson (1970) indicated that, in areas infested by ticks, half of the engorged female ticks are killed by ants and spiders of the family Lycosidae. Sutherst et al. (1978), however, considered that ticks are little affected by parasites, pathogenic micro-organisms and predators.

In this work, the presumed predation (50.5%) in the summer was greater than in the winter (33.3%) (statistically different, ($p<0.05$). Higher, summer temperatures may favour the foraging behaviour of *P. striata*. Valenzuela-Gonzalez et al. (1994), studying the foraging behaviour of *P. villosa* in Mexico, detected peaks of activity between temperatures of 23-26°C and relative humidity of 75-85%. During the summer at our experimental site the average mean temperature was 21.6°C and that of relative humidity was 88.5%. These values are very near to those for *P. villosa*. It was also observed, during the present study, that *P. striata* not only devoured the engorged female ticks *in situ* but also dragged them to their colonies. Such observations permitted us to suppose that the majority of the ticks that disappeared during the experiments had suffered such predation without leaving evidence.

CONCLUSIONS

In this way, through the high levels of predation encountered in this work, it was concluded that *P. striata* could represent a potentially significant predator to engorged female *B. microplus*, contributing to the maintenance of their populations at low levels. It was considered that this species of ant warrants further studies, especially of its feeding behaviour and seasonal population dynamics in Brazil.

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RESUMO: Diante das dificuldades do controle químico do carrapato do bovino *Boophilus microplus*, buscou-se com esse trabalho observar o principal predador da fêmea ingurgitada em pastagem de *Brachiaria decumbens*, em Juiz de Fora, MG, Brasil. Utilizou-se um total de 300 fêmeas ingurgitadas com seis repetições no inverno de 1998 e seis no verão de 1998/1999. Essas fêmeas foram expostas na pastagem de 14 em 14 dias, sendo colocadas em moitas de *B. decumbens* e observadas a cada duas horas. Verificou-se que a predação foi realizada principalmente pela formiga *Pachycondyla striata*, que se alimentou de fêmeas ingurgitadas no local de encontro ou carregando-as até a colônia. A predação foi mais intensa no verão do que no inverno (50,5% versus 33,3%). Conclui-se que essa formiga necessita de maiores investigações para sua possível utilização no controle biológico do carrapato *B. microplus* no Brasil.

UNITERMOS: Carrapato, *Boophilus microplus, Pachycondyla striata,* Predação.

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