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OVIPOSITION AND PREDATION OF *Pentilia egena* MULSANT (COLEOPTERA: COCCINELLIDAE) IN RESPONSE TO TEMPERATURE

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ABSTRACT : The species *Pentilia egena* Mulsant is an important predator of armored scales that occur in citrus orchards in Brazil. To intensify this biological control, knowing bioecological aspects in necessary for the improvement of massal insect rearing. This research investigated the influence of temperature (19ºC, 24ºC and 29ºC) on the number of eggs laid by *P. egena* and the number of *Aspidiotus nerii* Bouché scales preyed by this coccinellid. The highest number of eggs laid and of scales preyed, 5.1 ± 0.59 and 11.3 ± 0.19, respectively, occurred at 29ºC. However, egg viability (52.86%) was reduced at this temperature, and was lower than those at 19ºC and 24ºC (78.10% and 74.07%, respectively). Temperature did not affect the ladybeetle oviposition behavior as the eggs were laid under the scale of preyed *A. nerii*.
Key words: Diaspididae, predator, ladybeetle, natural enemies

OVIPOSIÇÃO E PREDAÇÃO DE *Pentilia egena* MULSANT (COLEOPTERA: COCCINELLIDAE) EM RESPOSTA À TEMPERATURA

RESUMO : A espécie *Pentilia egena* Mulsant é importante predadora de cochonilas de carapaças que ocorrem em pomares citrícolas no Brasil. Para intensificar ainda mais este controle biológico, há necessidade de conhecimento dos aspectos bioecológicos deste predador para o aperfeiçoamento de sua criação massal. Este trabalho teve como objetivo estudar a influência da temperatura (19ºC, 24ºC e 29ºC) na oviposição de *P. egena* e na intensidade de predação de cochonilhas *Aspidiotus nerii* Bouché. A 29ºC observaram-se maiores médias de cochonilhas predadas e de ovos colocados, respectivamente, 5,1 ± 0,59 e 11,3 ± 0,19, que nas duas outras temperaturas. Entretanto, a viabilidade dos ovos foi inferior (52,86%), quando comparada àquela obtidas a 19ºC e 24ºC (78,10% e 74,07%, respectivamente). A temperatura não afetou o comportamento de oviposição deste coccinelídeo, sendo os ovos, preferencialmente, colocados sob a carapaça das cochonilhas já predadas.
Palavras-chave: Diaspididae, predador, joaninha, inimigo natural

INTRODUCTION

The coccinellids play an important role in biological insect control worldwide**,** as natural enemies of aphids, scales, mealybugs and mites (Hagen, 1962). The introduction of *Rodolia cardinalis* Mulsant from Australia to a number of countries to control the cottony cushion scale, *Icerya purchasi* Maskell, an important citrus pest, is a landmark for biological control and mass insect rearing (Caltagirone & Doutt, 1989).

The lady beetles are cosmopolitan insects and it is believed that there are ca. 5,000 known species occurring in ecosystems as diverse as forest, "cerrado", tundra and agricultural crops. They are well adapted to most environmental conditions, behaving accordingly to the ecological niche they occupy (Olkowski et al., 1990; Iperti, 1999).

Among the Brazilian coccinellid species, *Pentilia egena* is one of the most important predators of citrus armored scales such as: *Selenaspidus articulatus* Morgan, *Parlatoria pergandii* Comstock, *Parlatoria cinerea* Deane & Hadden, *Chrysomphalus aonidum* L. and *Unaspis citri* Comstock (Gravena, 1986; Busoli, 1992). However, little is known about the preying behavior, the oviposition of *P. egena,* and the influ-

ence of these factors on the population of its preys (Guerreiro, 2000). Data on development, reproduction and predation under several environmental conditions provide important resources for the evaluation of this predator in the field. The variation of temperature, for instance, is an extremely important factor to understand the ecology of this species, for it will act on the above described parameters, directly influencing the dynamics of the predator/prey ratio (Miller & Paustian 1992; Gyenge et al., 1998).

The consumption and ovipositon of coccinellids are closely related to the prey population density and to temperature (Hodek, 1967). Within a favorable limit of temperatures, the feeding ratio, the larval and adult development as well as the oviposition rate, have a considerable increase according to the increase in temperature (Hodek, 1973).

It is needless to point out the importance of determining the best thermal band for implementing coccinellid mass rearing programs, as well as to determine the effect of this parameter on the lady beetles under field conditions. Therefore, this research was carried out to evaluate the influence of temperature on the oviposition and preying behavior of *P. egena* on the armored scale *Aspidiotus nerii* reared on "cabotiá" pumpkins (*Cucurbita maxima* X *Cucurbita moschata*).

MATERIAL AND METHODS

Fifteen *P. egena* mated females were used per temperature treatment: 19ºC, 24ºC and 29ºC. The prey was the armored scale *Aspidiotus nerii* reared on "cabotiá" pumpkins (*Cucurbita maxima* X *Cucurbita moschata*) obtained from the rearing laboratory of UNESP, Jaboticabal, SP, Brazil. Each *P. egena* female was placed in a feeding and oviposition arena, consisting of a section of plastic tube (3 cm diameter x 3 cm high), one side closed with a piece of plastic foam and the other hold by pins on the surface of the pumpkin. Each arena contained ca. 50 adult scales. The coccinellids were kept in the arenas for 24 hour and them transferred to other arenas. The armors of the preyed scales were counted and raised to look for eggs, which when found were transferred to Petri dishes and kept at the corresponding temperature for observing egg viability. The following biological parameters were evaluated: number of eggs layed and of scales preyed per day, egg viability and site preferred for oviposition. Data on oviposition and sites of oviposition were analyzed in a factorial design and means were compared by the Tukey test ($P = 0.05$). Analysis of variance was applied to the studies of preying capacity, and means compared by the Tukey test ($P = 0.05$) and egg viability compared by the χ-Square test ($P = 0.01$).

RESULTS AND DISCUSSION

The temperature did influence the preying behavior of *P. egena*. At 19º C, 4.4 ± 0.56 scales were preyed per lady beetle, a value lower than that of 7.6 ± 0.46 scales per lady beetles obtained at 24ºC. The females kept at the highest temperature (29ºC) consumed 11.3 ± 0.19 scales per lady beetle, quite higher than the results obtained at the other temperatures. These results agree with those reported for the coccinellids *Hippodamia convergens* Guérin-Mèneville, *Coccinella septempunctata* L. and *Coleomegilla maculata* DeGeer (Shands & Simpson, 1972; Roach & Thomas, 1991). Extrapolating these results to field conditions, one should presume that preying efficiency would be higher in the seasons with daily temperatures between 25ºC and 30ºC.

Different temperatures did not affect the oviposition behavior of *P. egena* in relation to eggs laid under the scale of preyed *A. nerii* (Table 1). This is a characteristic behavior of the species to protect the progeny against predation, parasitism and climatic changes (Guerreiro et al., 2001). Total number of laid eggs (inside and outside the armor) was higher at 29ºC, but a decrease in egg viability (52.9%) was observed when compared to those obtained at 19ºC (78.1%) and 24ºC (74.1%). These observation are similar to those of Santos & Bueno (1993), who reported egg viability of *Scymnus (Pullus) argentinicus* Weise being higher at 20º C, although the number of laid eggs had been lower.

The lowest egg viability at the highest temperature (29º C) may be attributed to the egg dehydration, for most of them were wilted. Howe (1981) reported a reduction in the egg viability at high temperatures because of the denaturation of proteins responsible for water absorption.

Within the considered interval (19 to 29ºC), temperature did influence, either directly or indirectly, biology and behavior of this coccinellid. The best results regarding oviposition and preying capacity were obtained at 24ºC and 29ºC. These temperatures are suitable for rearing *P. egena* in laboratory as well as to release this predator in the field

Table 1 - *Pentilia egena*: number (mean ± s.e.) of eggs laid inside and outside of armor, and total.

Temperature	Number of eggs		
	Outside armor	Inside armor	Total
°C			
19	0.4 ± 0.13 Ab	2.2 ± 0.17 Ba	2.6 ± 0.23 B
24	0.5 ± 0.13 Ab	1.7 ± 0.27 Ba	2.2 ± 0.32 B
29	0.9 ± 0.15 Ab	4.2 ± 0.46 Aa	5.1 ± 0.59 A

Means followed by distinct capital letters in the column and small letters in the line differ by the Tukey test ($P \leq 0.05$). Minimum significant difference (5%) temperature by oviposition local = 0,8494 and oviposition local by temperature = 0,7098

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