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Potential of *Tyrophagus putrescentiae* (Schrank) (Astigmata: Acaridae) for the Biological Control of *Lasioderma sericorne* (F.) (Coleoptera: Anobiidae)

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ABSTRACT

This work investigated the potential of Tyrophagus putrescentiae *(Schrank) (Astigmata: Acaridae) to control* Lasioderma sericorne *(F.) (Coleoptera: Anobiidae) in the laboratory.* L. sericorne *is the most destructive insect pest ever found on stored tobacco. The experimental delineation had 33 arenas being each experimental unit with 11 arenas of experiments with eggs, larva of* L. sericorne *with the density of* T. putrescentiae *maintained constant, where from 11 of these arenas, eight were for the analysis of predation and three to evaluate the natural mortality of the insect. The highest predation rate was found during the larval stage with, approximately, 54, 68 and 78% mortality of* L. sericorne *from the fourth until the sixty day of predation. These results indicated that it was possible to use the predatory mite* T. putrescentiae *in pest management programs of* L. sericorne *in the storage units of tobacco.*

Key words: Biological control, *Lasioderma sericorne*, Predators, Stored products, *Tyrophagus putrescentiae*

INTRODUCTION

Lasioderma sericorne (F.) (Coleoptera: Anobiidae) is an important pest of some stored products mainly tobacco (Papadopoulou and Buchelos 2003; Papadopoulou and Athanassiou 2004). The demand for tobacco free from chemical residues in the international market have increased the studies on *L. sericorne*. Environmental concerns, including health problems and resistant insects have been increasing the interest on the biological control of agricultural pests to surrogate chemical control (Schöller et al. 1997; Oberlander et al. 1997; Collins 2006; Azevedo et al. 2007; Ramalho et al. 2007; Silva et al. 2009). Although the mites *Tyrophagus putrescentiae* (Schrank) (Astigmata: Acaridae), *Pyemotes tritici* (Cross and Krantz) (Prostigmata: Pyemotidae), *Acarophenax lacunatus* (Cross and Krantz) (Prostigmata: Acarophenacidae) and *Blattisocius tarsalis* (Berlese) (Mesostigmata: Ascidae) have potential

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to be used as biological control agents, they are poorly studied (Faroni et al. 2000; Serpa et al. 2004; Papadopoulou, 2006; Oliveira et al. 2007). *Lasioderma serricorne* is found in the tropical and subtropical regions, but temperature and humidity conditions can limit its occurrence (Toews et al. 2001; Arbogast et al. 2003). The females of *L. serricorne* lay egg masses in the rifts of the tobacco bales and its eggs can survive during the cigarette production. Its larvae are agile and they dig galleries in tobacco leaves (Lecato 1978; Mahroof and Phillips 2008). Besides being a primary pest of tobacco, the adults of *L. serricorne* can perforate plastic packing and cause problems in food products as dry fruits, grains, crumbs and flours. The phosphine is the main chemical to control this insect, after adults of this pest are found in pheromone traps (Rangaswamy et al. 1997; Arbogast 2001; Hubert et al. 2007b; Campbell et al. 2008).

Tyrophagus putrescentiae (Schrank) (Astigmata: Acaridae) is a cosmopolitan mite found in the cereals, stored foods and home dust, nests of birds and bees, feeding on different developmental stages of insects, including eggs (Allee and Davis 1996; García 2004; Papadopoulou 2006). This predator is found in the foods stored with high fat and protein levels such as linseed, peanut, cheese, ham, oats, barley and flour (García 2004; Aygun et al. 2007; Kheradmand et al. 2007; Hubert at al. 2007a). However, *T. putrescentiae* can cause enteritis, diarrhea and damages to the urinary tract besides allergic reactions when products with this mite are ingested, manipulated or inhaled (Li et al., 2003; Matsumoto and Satoh, 2004; Hubert et al., 2006 2007b; Aygun et al. 2007).

Tyrophagous putrescentiae has been reported feeding on the eggs of *Diabrotica undecimpunctata* Howardi (Barber) (Coleoptera: Chrysomelidae) and larvae, pupae and adults of *L. serricorne* (Kumar 1997; Brust and House 1988; Papadopoulou 2006) in laboratory. In addition, other mites as *Acaropsis docta* (Berlese), *Acaropsis solers* (Kuzin), *Cheyletus eruditus* (Schrank) (Acari: Cheyletidae), *P. tritici* have also been found predating *L. serricorne* in the stored products (Bruce and Lecato 1979; Oliveira et al. 2003a, Papadopoulou 2006).

This work evaluated the percentage of eggs, larvae and adults of *L. serricorne*, the main pest of tobacco and their by-products, death due to predation by the mite *T. putrescentiae*.

MATERIAL AND METHODS

The experiment was carried out at 25 ± 2°C, 70 ± 2% RH and 12L:12D photoperiod. The eggand larvae of *L. serricorne* were obtained from a colony from the municipality of Picos, Piauí State, Brazil. Predator *T. putrescentiae* was obtained from the laboratory of IPM-G where they were fed on *Acanthoscelides obtectus* (Say) (Coleoptera: Bruchidae). The potential of predation of *T. putrescentiae* on the eggs, larvae and adults of *L. serricorne* was daily evaluated. The experimental design had 33 arenas (Petri dishes 90 mm in diameter and 10 mm height). The experimental units were 11 arenas of experiments with eggs (n = 10), larva (n = 10) and adults (n = 10) *L. serricorne* with the density of *T. putrescentiae* (n = 8) maintained constant, where from 11 of these arenas, eight were for the analysis of predation rate and three to evaluate the natural mortality of the insect.

The predation of the eggs, larvae and adults of *L. serricorne* in the presence or absence of *T. putrescentiae* was evaluated in an entirely randomized design with four replications of eight arenas**.** The results were submitted to ANOVA and the averages compared with the Tukey test (P= 0.05).

RESULTS AND DISCUSSION

Although the potential of *T. putrescentiae* as a biological control agent has been reported (Brust and House 1988; Serpa et al. 2004; Papadopoulou 2006), it was found that *T. putrescentiae* did not fed on the eggs of *L. serricorne*. *A. lacunatus* was also unable to parasitize the eggs of *Oryzaephilus surinamensis* (L.) (Coleoptera: Cucujidae) (Oliveira et al. 2003a). On the other hand, the eggs of *Isotomurus* spp**.** (Collembola: Isotomidae) were eaten by *Lasioseius fimetorum* Karg (Acari: Podocinidae) (Enkegaard and Brodsgaard 2000).

The predation rate of *T. putrescentiae* on *L. serricorne* adults did not affect the population of this pest, with similar values for adult mortality with the control (P > 005). The mite *A. lacunatus* did not predated *Tribolium castaneum* (Herbst) (Coleoptera: Curculionidae) adults (Oliveira et al. 2006), but other predatory mites have high biotic potential for the control of beetles pests such as *Dinoderus minutus* (Fabricius) (Coleoptera:

Bostrichidae), *Cryptolestes ferrugineus* (Stephens) (Coleoptera: Cucujidae), *Rhyzopertha dominica* (Fabricius) (Coleoptera: Bostrichidae), *L. serricorne* and blood sucking insects as *Aedes aegypti* (L.) and *Aedes albopictus* (Skuse) (Diptera: Culicidae) (Diptera: Culicidae) (Faroni et al. 2000; Serpa et al. 2004; Papadopoulou 2006). This could be explained by the high reproductive capacity that allowed these organisms to increase their populations in short periods and to develop faster than the Coleoptera pests (Oliveira et al. 2003b 2006). The low predation rate of *T. putrescentiae* on *L. serricorne* adults could be due to the hard cuticle of this prey, which made the injection of the toxin by this mite difficult. The mite *Stratiolaelaps scimitus* (Berlese) (Acari: Mesostigmata: Laelapidae) controlled the species of *Bradysia* and *Lycoriella* (Diptera: Sciaridae) in different cultures (Freire et al. 2007).

The predation of *T. putrescentiae* on the larvae of *L. serricorne* resulted in 54, 68 and 78% mortality of them in the presence of that mite from the fourth, fifth and sixth days, respectively (Fig. 1). This mite had high predation rate on *L. serricone* larvae as found for *A. lacunatus* which reduced the larval population of *R. dominica* to 61% and those of *T. castaneum* and *C. ferrugineus* to 53% and 26%, respectively (Oliveira et al. 2003b). Predatory mites such as *P. tritici*, *T. putrescentiae*, *A. lacunatus* have potential for the biological control of insects in the stored products (Oliveira et al., 2003ab). The mite *P. tritici* attacks all the stages of *Plodia interpunctella* (Hübner) and *Cadra cautella* (Walker) (Lepidoptera: Pyralidae), *Oryzaephilus mercator* (Fauvel) (Coleoptera: Cucujidae) and *L. serricorne* (Bruce and Lecato 1979; Faroni et al. 2000). In spite of the high potential for the biological control, the commercial use of *P. tritici* is limited as for other members of the Pyemotidae, because they also harm human (Faroni et al. 2000).

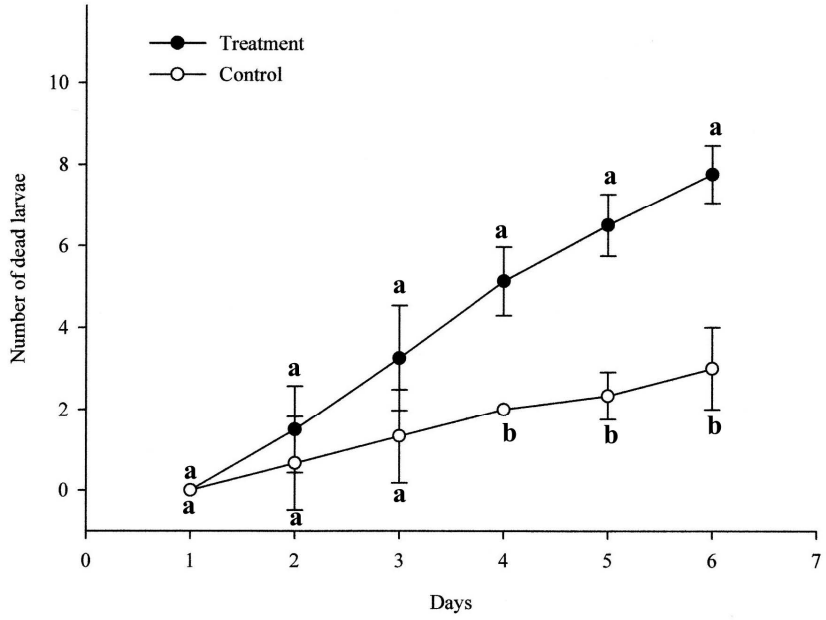

Figure 1 - Predation rate of *Tyrophagus putrescentiae* (Schrank) (Astigmata: Acaridae) on *Lasioderma serricorne* (F.) (Coleoptera: Anobiidae) larvae in the laboratory at 25 ± 2°C, 70 ± 2% RH and 12L:12D photoperiod. Means followed by same letter did not differ by the Tukey test at 5% probability.

Tyrophagus putrescentiae began to attack *L. serricorne* larvae from the abdomen, with higher rate form the fourth day, as found for *T. putrescentiae* on *L. serricorne* in the stored tobacco (Papadopoulou 2006). Similar results were found for the young and adults of *T. putrescentiae* which attached to the thorax, abdomen and legs of *A. aegypti* and *A. albopictus* adult (Serpa et al. 2004).

The control of population of *L. serricorne* larvae by *T. prutescentiae* could be considered important when infestation on tobacco might be relatively high. Then this predator could be used in pest management programs of this pest in the stored grains. These results confirmed the potential of predation of *L. serricorne* by the mite *T. putrescentiae*, but additional studies should be carried out in order to evaluate the effect of the prey on the biology of the predator and also because this mite could be harmful to the humans.

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