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Palmistichus elaeisis (Delvare & LaSalle, 1993) (Hymenoptera: Eulophidae), possible agent for the biological control of *Urbanus proteus* (Linnaeus, 1758) (Lepidoptera: Hesperiidae)

M. C. Candelária & C. F. Wilcken

Abstract

The control of agricultural pests is fundamental. Cultivation of food crops such as soy and beans requires methods that reduce the use of chemical insecticides, through alternative means such as biological control through parasitoids. This is the first report of *P. elaeisis* parasitizing *U. proteus* under laboratory conditions.
KEY WORDS: Lepidoptera, Hesperiidae, Hymenoptera, Eulophidae, biological control, parasitoid pupae, defoliating caterpillars, fist report, Brazil.

Palmistichus elaeisis **(Delvare & LaSalle, 1993) (Hymenoptera: Eulophidae), posible agente para el control biológico de** *Urbanus proteus* **(Linnaeus, 1758) (Lepidoptera: Hesperiidae)**

Resumen

El control de las plagas agrícolas es fundamental. El cultivo de alimentos como soja y fríjoles requiere métodos que reduzcan el uso de insecticidas químicos, a través de medios alternativos como el control biológico por medio de parasitoides. Este es el primer registro de *P. elaeisis* parasitando a *U. proteus* bajo condiciones de laboratorio.
PALABRAS CLAVE: Lepidoptera, Hesperiidae, Hymenoptera, Eulophidae, control biológico, pupa parasitoide, orugas defoliadoras, primer registro, Brasil.

Introduction

Urbanus proteus (Linnaeus, 1758) (Lepidoptera: Hesperiidae), known as match-head (GALLO *et al*., 1988), causes damage in several Fabaceae of economic importance such as soy (*Glycine max* (L.) Merr.) and beans (*Phaseolus vulgaris* L.). This caterpillar feeds voraciously on leaf blades, and can cause total defoliation of the plant and damage the thinner stems (NAVA & PARRA, 2002). The occurrence of *U. proteus* has been reported in various countries in the Americas including Colombia, Mexico, the USA and Canada (NAVA & PARRA, 2002).

One *U. proteus* can consume up to 190 cm^2 of soy leaves (GREENE, 1971), a value higher than those presented by other soy pests such as: *Anticarsia gemmatalis* (Hübner, [1818]), which consumes about 90 cm^2, or the loopers *Pseudoplusia includens* (Walker, 1857) and *Rachiplusia nu* (Gueneé, 1852), which destroy approximately 120 cm^2 of leaf area (GALLO *et al*., 1988; PEREYRA, 1998). The control of *U. proteus* has been carried out exclusively with insecticides, thus elevating production costs and favoring environmental disequilibrium.

Parasitoids are important regulators of insect populations of different orders (PENNACCHIO & STRAND, 2006), thus enabling their use as a biological control agent, which provides an alternative to chemical control. The family Eulophidae presents 283 genera and 3977 species, with many reports of success in biological control programs (NOYES, 1998; GAUTHIER *et al*., 2000; HANSSON, 2004). *Trichospilus diatraeae* (Cherian & Margabandhu, 1942) and *Palmistichus elaeisis* (Delvare & LaSalle, 1993) (Hymenoptera: Eulophidae) are highlighted in this family and have been the target of diverse studies due to their parasitism capacity (ZACHÉ *et al*., 2012a; CHICHERA *et al*., 2012).

The parasitoid *P. elaeisis* is a promising agent of biological control (PEREIRA *et al*., 2008), having been reported in pupae of Coleoptera (ZANUNCIO *et al*., 2008) and Diptera (ZÁCHÉ *et al*., 2013), and displaying a preference for Lepidoptera species, with reports in such diverse families as: Lymantriidae (TAVARES *et al*., 2011), Saturniidae (TAVARES *et al*., 2012) and Nymphalidae (TAVARES *et al*., 2013). It was therefore considered worthwhile to evaluate the parasitism and possible control of *U. proteus* through *P. elaeisis* parasitoids.

Material and methods

The experiment was developed at the Laboratory for Biological Control of Forest Pests, São Paulo State University (UNESP), Campus of Botucatu. The parasitoids utilized were originally collected in pupae of *Euselasia eucerus* (Hewitson) (Lepidoptera: Riodinidae) in eucalyptus stands in Lençóis Paulista, São Paulo state, Brazil, in 2011. Thereafter, the laboratory culture was maintained, utilizing pupae of *Spodoptera frugiperda* (Smith, 1797) (Lepidoptera: Noctuidae), aged a maximum of 48 hours at a temperature of 26 ± 2º C and relative humidity of 70 ± 10%.

First instar larvae of *U. proteus* were collected in soy plantations in São Paulo (Brazil). The larvae were raised under environmental conditions on leaves of *G. max*, maintained in a wooden cage (70 x 50 x 40 cm) with a glass front, at 25 ± 1º C, 70 ± 10% relative humidity and 14-hour photoperiod.

Fifteen *U. proteus* pupae aged 48 hours were exposed to parasitism of *P. elaeisis* for 72 hours, and added into glass tubes of 14 cm in length and 2 cm in diameter, closed with "voil" tissue, containing 15 female *P. elaeisis* specimens, having previously copulated, and fed pure honey. The treatments were maintained in a climate-controlled room at 26 ± 2º C, 70% RH and 12-hour photoperiod.

After a 72-hour period, the *P. elaeisis* females were removed, and the tubes containing *U. proteus* pupae were maintained in a chamber whose climate was controlled at 26 ± 2 C, 60 ± 10% relative humidity, and 12-hour photoperiod.

The following parameters were determined: parasitism rate, numbers of emergent and non-emergent parasitoids, life cycle and sex ratio. The *U. proteus* pupae were dissected to evaluate the number of immature non-emerged individuals. The sex of adults was determined based on the morphological characteristics of the abdomen and antenna (DELVARE & LASALLE, 1993).

Results and discussion

This is the first report of *P. elaeisis* parasitizing *U. proteus* (figure 1). The rates of parasitism and emergence were 100%, with a mean of 120.4 (±25.78) emerged parasitoids per pupa, versus 0.8 (±0.29) parasitoids non-emerged. The sex ratio varied from 0.97 to 0.98, while the life cycle (egg-adult) averaged 23.2 (±0.4) days.

The high rates of parasitism and emergence are consistent with the findings on this parasitoid in pupae of *Sarsina violascens* (Herrich-Schäffer, 1856) (Lepidoptera: Lymantriidae) (ZACHÉ *et al*., 2012b), *Thyrinteina arnobia* (Stoll, 1782), *Thyrinteina leucoceraea* (Rindge, 1961) (Lepidoptera: Geometridae), and *A. gemmatalis* characterizing this parasitoid as an efficient agent for controlling lepidopteran defoliators (PEREIRA *et al*., 2008).

The average progeny of 120.4 parasitoids per pupa can be correlated with the size of the host. In pupae of *Citioica anthonilis* (Herrich-Schäffer, 1854) (Lepidoptera: Saturniidae), the progeny of *P. elaeisis* were more numerous than in pupae of *A. Anticarsia* and *Tenebrio molitor* (Linnaeus, 1758)

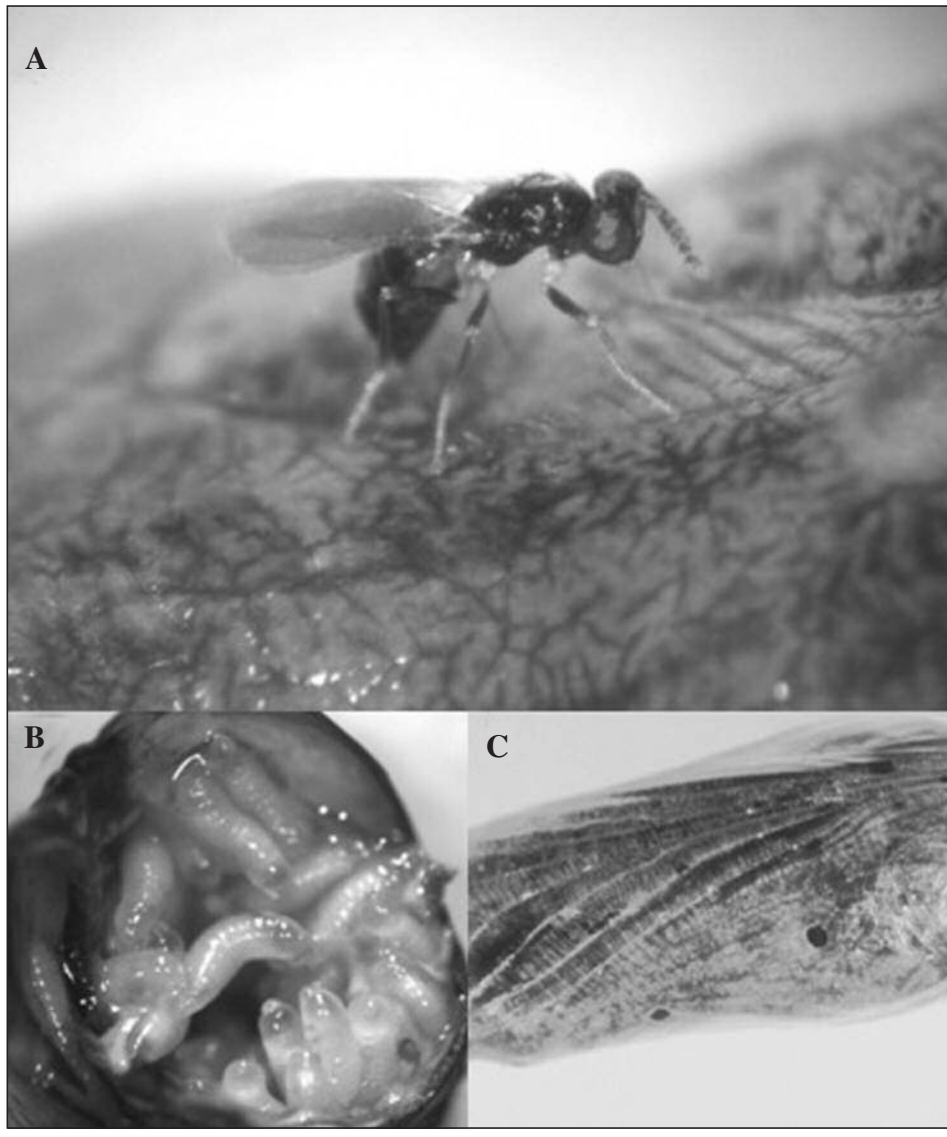

Figure 1.– *Palmistichus elaeisis* female parasitizing *Urbanus proteus* (A); parasitoid larvae within the host (B); parasitoid exit hole (C).

(Coleoptera: Tenebrionidae), probably on account of their greater size (TAVERES *et al*., 2012). In pupae of *Musca domestica* (Linnaeus, 1758) (Diptera: Muscidae), which are smaller than *U. proteus*, the mean progeny of *P. elaeisis* was 11.3 (±0.2) parasitoids per pupa (ZÁCHÉ *et al*., 2013).

The number of non-emerging parasitoids is less than that reported for this parasitoid on the pupae of *S. violascens* (ZACHÉ *et al*., 2012b), and similar to a recent finding on pupae of *M. domestica*

(ZÁCHÉ *et al*., 2013). The density of *P. elaeisis* may affect the number of immature dead individuals, as reported in pupae of *Bombyx mori* (Linnaeus, 1758) (Lepidoptera: Bombycidae) (PEREIRA *et al*., 2010). Thus, the reduced number of immature dead can be explained by an adjustment of the number of immature individuals per host.

The life cycle (egg-adult) of *P. elaeisis* was shorter than that reported for pupae of *Zophobas confusa* (Gebien, 1906) (Coleoptera: Tenebrionidae) (MOREIRA DA SILVA *et al*., 2009), and longer than that found for pupae of *M. domestica* (ZÁCHÉ *et al.*, 2013). Thus, it was demonstrated that the host can affect the developmental period of the parasitoid (BITTENCOURT & BERTI FILHO, 2004).

The sex ratio was lower than that found in *Diatreae saccharalis* (Fabricius, 1798) (Lepidoptera: Crambidae), and *S. violacens*, and similar to findings on *T. molitor* and *B. mori* (BITTENCOURT & BERTI FILHO, 1999; ZANUNCIO *et al*., 2008; MOREIRA DA SILVA *et al*., 2009; PEREIRA *et al*., 2010; ZÁCHÉ *et al*., 2012b).

Conclusions

Palmistichus elaeisis is demonstrated to be viable for utilization in the biological control of *U. proteus*. Compared to other members of the family Eulophidae, *P. elaeisis* shows dominance over parasitism and a greater search capacity (CHICHERA *et al*., 2012). The use of this parasitoid can serve to combat *U. proteus* in Fabaceas crops such as soy and beans, thus contributing to a diminution in the employment of agrotoxins and the reduction of environmental impacts.

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