

First report of *Trichospilus diatraeae* (Hymenoptera: Eulophidae) parasitizing pupae of *Methona themisto* (Lepidoptera: Nymphalidae)

Primer informe de Trichospilus diatraeae (Hymenoptera: Eulophidae) que parasita pupas de *Methona themisto* (Lepidoptera: Nymphalidae)

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ABSTRACT

Urban afforestation is a practice used in urban centers. Of the plant species used, *Brunfelsia pilosa* and *B. uniflora* are used in most cities. The main pest for *B. pilosa* and *B. uniflora* is the lepidopteran *Methona themisto* which can feed on the leaves of the plant and cause its death. As a solution, biological control with parasitoid insects can be an alternative to chemical means. The present study aimed to investigate if *M. themisto* can be parasitized by *Tichospilus diatraeae*. Six pupae of *M. themisto* were offered to *T. diatraeae* and exposed to parasitism for 72 hours. The observed parasitism was 66% with 90% of the emergence of adult parasitoids. The parasitoid egg-to-adult life cycle was 18 ± 1 days and an average of 510 ± 91.21 insects emerged per pupa. Each parasitoid consumed an average of 1.13 ± 0.16 mg of pupal content to complete its cycle. The results record for the first time in the literature that *M. themisto* may be a host of *T. diatraeae* and consequently applied in biological control programs of this pest.

Keywords: insects parasitoids, biological control, Forest entomology.

RESUMEN

La forestación urbana es una práctica utilizada en los centros urbanos. De las especies de plantas empleadas, *Brunfelsia pilosa* y *B. uniflora* se usan en la mayoría de las ciudades. La principal plaga para *B. pilosa* y *B. uniflora* es el lepidóptero *Methona themisto*, que puede alimentarse de las hojas de la planta y causar su muerte. Como solución, el control biológico con insectos parasitoides puede ser una alternativa a los medios químicos. Este estudio tuvo como objetivo investigar si *M. themisto* puede ser parasitado por *T. diatraeae*. Se ofrecieron seis pupas de *M. themisto* a *T. diatraeae* y se expusieron al parasitismo durante 72 horas. El parasitismo observado fue del 66% con el 90% de la aparición de parasitoides adultos. El ciclo de vida parasitoide de huevo a adulto fue de 18 ± 1 días y un promedio de 510 ± 91.21 insectos emergieron por pupa. Cada parasitoide consumió un promedio de 1.13 ± 0.16 mg de contenido de pupa para competir en su ciclo. Los resultados muestran por primera vez en la literatura que *M. themisto* puede ser un huésped de *T. diatraeae* y, en consecuencia, aplicarse en programas de control biológico de esta plaga.

Palabras clave: parasitoides de insectos, control biológico, Entomología forestal.

Introduction

Urban afforestation is understood as a system of green spaces in a city: squares and their vegetation, public gardens, urban parks, road afforestation and all forest cover in the cities. The Manacá (*Brunfelsia pilosa* and *B. uniflora*) is a tree of great importance in urban afforestation. It is native from the south and southeast of Brazil and

has economic relevance as it contains medicinal, nutritional and ornamental properties (Quintans-Júnior, 2008). Among the possible factors that can negatively affect the planting of manacá is the attack of pests, the main one being the manacá butterfly (Ruszczyk, 1999).

Methona themisto (Hübner, 1818) (Lepidoptera: Nymphalidae, Ithomiinae), known as the manacá butterfly, is listed as the main manacá pest

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(*Brunfelsia pilosa* and *B. uniflora*). Insects of the order Lepidoptera can be controlled with natural enemies such as predators and parasitoids. Among the enemies, we highlight the pupae parasitoid *Trichospilus diatraeae* Cherian and Margabandhu (Hymenoptera: Eulophidae), of Asian origin and with gregarious behavior (Pastori *et al.*, 2012a). This natural enemy has already been reported by parasitizing pupae of species from eight lepidopteran families, both in agriculture and in planted forests (Biezanko, 1960; Brown, 1992; Bennett *et al.*, 1987; Oliveira *et al.* 2016; Silva *et al.*, 2015; Zaché *et al.*, 2012a; Zaché *et al.*, 2012b).

This study aimed to evaluate parasitism and report, for the first time, *M. themisto* as an alternative host of *T. diatraeae*.

Adults of *T. diatraeae* were obtained from the creation of the Laboratory for Biological Control of Forest Pests at Universidade Estadual Paulista, Botucatu Campus, São Paulo, Brazil. The parasitoid was multiplied in pupae of *Diatraea saccharalis* Fabricius (Lepidoptera: Crambidae). Six pupae of *M. themisto* are reared in laboratory were weighed and individualized in test tubes and offered to 10 females of *T. diatraeae*, in a 10: 1 ratio (parasitoid: host). Each pupa with 36 hours of metamorphosis, was considered a repetition (Figure 1).

After 72 hours, the parasitoid females were removed and the test tubes were kept at $25 \pm 2^\circ\text{C}$, 60% relative humidity and 12 hours photophase. The parameters: percentage of parasitism, number of emerged/retained parasitoids, consumption and the duration of the egg to adult cycle were evaluated. The parasitism by *T. diatraeae* was 66.66% in pupae of *M. themisto* on laboratory with an average of

adult emergence of $90 \pm 0.92\%$. The results when compared with the literature with other lepidopterans such as *Eupalamides cyparissias* (Fabricius), *Brassolis sophorae* L. (Lepidoptera: Nymphalidae) *Opsiphanes invirae* (Lepidoptera: Nymphalidae) the observed parasitism rate was 90%, 100% and 90% respectively (Ribeiro *et al.*, 2013). We noticed a lower value in this study (66%), however with a high emergence of parasitoids. In biological control programs, one of the factors observed is whether the host can be parasitized and whether it is possible to develop as many insects as possible.

The cycle of the parasitoid from egg to adult in pupae of *M. themisto* took an average of 18 ± 1 days. The life cycle it was longer than in *Diatraea saccharalis* (Lepidoptera: Crambidae), 17 days and shorter in *Thyrintina arnobia* (Lepidoptera: Geometridae), 21 days and 20 days in *Tenebrio molitor* (Coleoptera: Tenebrionidae) (Chichera *et al.*, 2012; Pastori *et al.*, 2012b; Favero *et al.*, 2013). From the parasitized pupae, a total of 2,041 adult parasitoids emerged, with an average of 510.25 ± 91.21 per repetition. The mean of emerged insects is considered satisfactory when compared with the results in other studies. Similar averages were obtained from *O. invirae* (447.83 ± 51.52) and *B. sophorae* (669.00 ± 89.62) (Ribeiro *et al.*, 2013). The greater number of parasitoids emerging from pupae in an area with a lepidopteran outbreak promotes a greater chance of effective control, as it increases the chances of females seeking hosts to perform oviposition and consequently reduce the pest population.

Each individual consumed an average of 1.13 ± 0.16 mg of pupa of *M. themisto* to complete

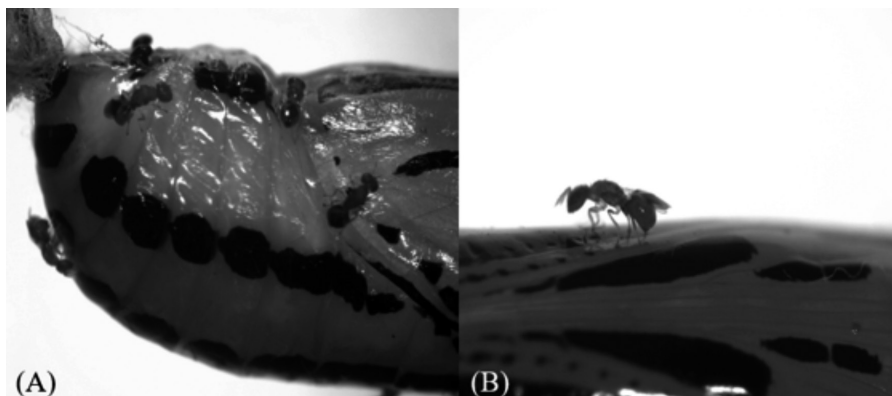


Figure 1. *Trichospilus diatraeae* (Hymenoptera: Eulophidae) adults parasitizing *Metona themisto* pupae on laboratory.

the cycle (Figure 2). The ratio of host weight is directly related to the number of parasitoids emerging from a pupa. The larger the pupa, the more are the conditions for the development of insects. In other lepidopterans such as *Opsiphanes invirae* Hübner (Lepidoptera: Nymphalidae) the consumption was 3.35 mg and in *Brassolis sophorae* L. (Lepidoptera: Nymphalidae) 3.43 mg (Ribeiro *et al.*, 2019). In *M. themisto*, the parasitoid *T. diatraeae* needed fewer pupae consumption to complete its development.

Pupae that did not suffer parasitism were those that had the lowest weight. Parasitoid females look for the largest possible host, as it will possibly have the greatest quantity and quality of food resources for their offspring (Lin and Alves, 2003; Nofemela and Kfir, 2008). Non-parasitism of pupae 5 and 6 may be linked to the quality of the host. In this research, they were the ones that obtained less weight and inferior quality. The high number of

adult parasitoids emerging per pupa illustrates that *M. themisto* may be an alternative host for *T. diatraeae*.

From the results obtained in this research, it is possible to guide future studies such as the effective use of *T. diatraeae* to control this and other urban pests of the order lepidoptera. It is an incipient study line that lacks basic studies like this, but it is of great environmental relevance and an alternative for the use of synthetic insecticides.

This work records for the first time the parasitism of *Methona themisto* by *Trichospilus diatraeae*.

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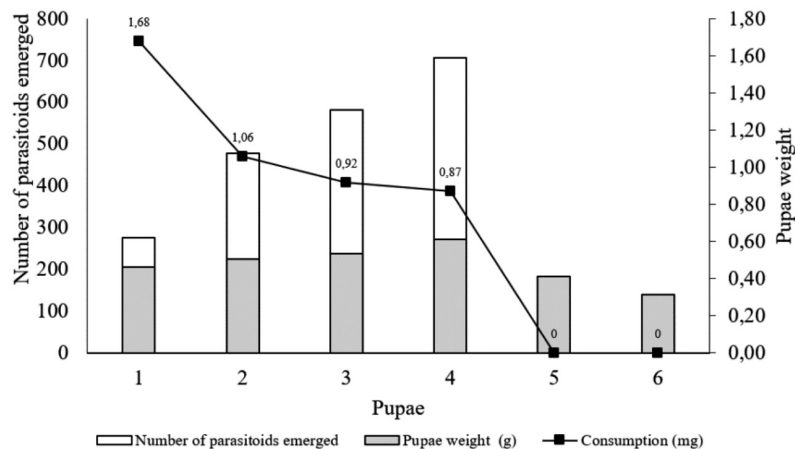


Figure 2. Number of adults of *Trichospilus diatraeae* (Hymenoptera: Eulophidae) emerged, consumption and pupae weight of *Methona Themisto* (Lepidoptera: Nymphalidae).

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