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An integrative taxonomic approach to characterize *Trichogramma marandobai* (Hymenoptera: Trichogrammatidae)

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Introduction

Trichogramma is the largest genus of Trichogrammatidae, with nearly 210 species worldwide (Pinto 2006), of which 41 species occur in South America and 26 in Brazil (Zucchi *et al*. 2010). *Trichogramma* are tiny parasitoids of eggs of insects, mostly lepidopterans. Some species have been mass-reared for biological control of agricultural pests.

Identification of *Trichogramma* cannot always be based on morphological features alone because of the cryptic nature of some species. In these cases, biological and/or molecular features have been used to identify the species.

Trichogramma marandobai is an egg parasitoid of *Erinnyis ello* (Sphingidae), an important pest of cassava in Brazil. This parasitoid was first associated with *E. ello* (its only known host) in the state of Minas Gerais (Brun *et al*. 1986), and since then it has been recorded in the states of Mato Grosso do Sul (Oliveira *et al*. 2010), Paraná and São Paulo (Querino & Zucchi 2008).

The original description of *T. marandobai* is brief and poorly illustrated (Brun *et al*. 1986), hindering its identification and leading to mistaken identification, most frequently as *T. demoraesi*. In addition, preliminary studies show morphological variations in some features of the male genitalia of *T. marandobai*.

Integration of morphological, biological and molecular data is extremely useful in analyzing species with taxonomic problems such as *T. marandobai*. Crosses were the first biological studies used to solve taxonomic problems of *Trichogramma* (e.g. Nagarkatti & Nagaraja 1968). Molecular analyses for the identification of *Trichogramma* were first conducted using sequencing of the r-DNA ITS2 region (Stouthamer *et al*. 1999). Geometric morphometry is still little used in parasitoids (e.g. Baylac *et al*. 2003); one study using relative deformation analysis was conducted on *T. pretiosum* (Querino & Zucchi 2002).

The present study aimed to determine whether the variations in the male genitalia of *T. marandobai* are intraspecific, in order to clarify the identity of the species through the integration of biological, morphometric, and molecular data.

Material and methods

We analyzed specimens of *T. marandobai* collected from eggs of *Erinnyis ello* in the municipality of Janaúba, northern of state of Minas Gerais, Brazil. We also examined specimens deposited in the *Trichogramma* collection of the College of Agriculture Luiz de Queiroz (ESALQ), Piracicaba, São Paulo, Brazil.

Rearing and maintenance. Parasitized eggs of *E. ello* were placed in individual glass tubes (2.5 cm diameter by 8.5 cm long) with honey droplets for feeding the parasitoid. Twenty-four hours after emergence (mating period), the parasitoids were placed in individual glass tubes. Eggs of the alternative host were placed in the glass tube of each female.

Because of the difficulty of rearing *E. ello* to obtain eggs, various alternative hosts were tested for *T. marandobai* parasitism. The best results were obtained with eggs of *Heliothis virescens* from the insect colony of the ESALQ Biology Laboratory.

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