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Natural parasitism by *Trichogramma* spp. in agroecosystems of the Mid-North, Brazil

Parasitismo natural por *Trichogramma* spp. em agroecossistemas do Meio-Norte, Brasil

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— NOTE —

ABSTRACT

*The micro-hymenopterans of genus **Trichogramma** are eggs parasitoids used in the biological control of lepidopteran pests. The objectives of this study was to record the interaction of species of **Trichogramma** and their hosts on crops in the Mid-North, in the states of Maranhão and Piauí, Brazil. Lepidopteran eggs were sampled on crops and non-crops. **Trichogramma atopovirilia**, **T. manicobai**, **T. galloi** and **T. pretiosum** occur naturally in eggs of eight lepidopteran species. Natural parasitism shown by **Trichogramma** species reveals the importance of these parasitoids as agents for biological control in the Mid-North region.*

Key words: *egg parasitoid, biological control, lepidopteran pests.*

RESUMO

*Os micro-himenópteros do gênero **Trichogramma** são parasitoides de ovos utilizados no controle biológico de lepidópteros. Os objetivos deste estudo foram registrar as interações de espécies de **Trichogramma** e seus hospedeiros em culturas agrícolas do Meio-Norte, nos estados do Maranhão e Piauí. Foram amostrados ovos de lepidópteros em culturas agrícolas e plantas não cultivadas. **Trichogramma atopovirilia**, **T. manicobai**, **T. galloi** e **T. pretiosum** ocorreram naturalmente parasitando ovos de oito espécies de lepidópteros. O parasitismo natural evidencia a importância das espécies de **Trichogramma** como agente de controle biológico de pragas na região do Meio-Norte.*

Palavras-chave: *parasitoides de ovos, controle biológico, lepidópteros-praga.*

The micro-hymenopterans of genus ***Trichogramma*** have been used in the biological control of lepidopterans pest in Brazil and other countries (PARRA & ZUCCHI, 2004). There are 26 known species of ***Trichogramma*** in Brazil, corresponding to the largest number of native species reported in a South American country (ZUCCHI et al., 2010). The species in genus ***Trichogramma*** are adapted to the climate conditions and characteristics of different habitats. This makes essential to know the existing parasitoid species of ***Trichogramma***, their host insects and the associated plants in a given agroecosystem.

The type of agricultural system (annual crops, forest systems and fruit-growing) is another factor that must be considered when selecting the most suitable ***Trichogramma*** species to be used. For example, ***T. pretiosum*** is commonly observed in agroecosystems, whereas ***T. bruni*** is found in forest environments and on fruit trees (QUERINO & ZUCCHI, 2002, 2016).

Studies on the egg parasitoids of northern and northeastern Brazil have been largely neglected. Only five species have been reported in these regions, including three in the Northeast (***T. atopovirilia*** Oatman & Platner, 1983; ***T. galloi*** Zucchi, 1988; and ***T. pretiosum*** Riley, 1879) and three in the North (***T. marandobai*** Brun, Moraes & Soares, 1986; ***T. lasallei*** Pinto, 1999; and ***T. pretiosum***) (QUERINO & ZUCCHI, 2016). ***Trichogramma pretiosum*** is the only species found in both regions.

In this way, the aim of this study was to investigate the species of ***Trichogramma*** and their

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hosts in agroecosystems of Mid-North, Brazil. This sub-region of northeastern Brazil is located in the states of Maranhão (MA) and Piauí (PI) and has a diverse phytophysiognomy, including Cerrado, Caatinga and Mata de Cocais. The agricultural industry in Maranhão and Piauí is expanding, having occupied 2,700,000 hectares to produce over 7,000,000 metric tons of rice, cotton, corn, and soybeans in the past 15 years (CONAB, 2015).

Egg parasitoids from cultivated plants were sampled in the Mid-North of Brazil in the period from 2011 to 2013 and in 2015 (Table 1). Lepidopteran eggs were sampled from plants that were selected at random. Eggs were collected from ***Glycine max*** L. (soybean), ***Gossypium hirsutum*** L. (cotton), ***Manihot esculenta*** Crantz (cassava), ***Oryza sativa*** L. (rice), ***Passiflora edulis*** Sims. (passion fruit), ***Saccharum officinarum*** L. (sugarcane), ***Vigna unguiculata*** L. (cowpea), ***Zea mays*** L. (corn), and other, non-cultivated plants. Each egg was removed from the plant or maintained on a small piece of the leaf, which was placed in a plastic capsule and observed daily until emergence of the parasitoid or eclosion of the host larva. Parasitoids obtained were sexed and preserved in 80% ethanol, for later identification. ***Trichogramma*** males were prepared, mounted and identified using the keys according to QUERINO & ZUCCHI (2011). *Voucher specimens* were deposited in the Insect Collection at Embrapa Meio-Norte.

Four species of ***Trichogramma*** were obtained from lepidopteran eggs occurring naturally in agroecosystems of Mid-North Brazil: ***T. atopovirilia***, ***T. manicobai***, ***T. galloi*** and ***T. pretiosum*** (Table 2). This is the first report of ***T. manicobai*** in the region. With this finding, four species of ***Trichogramma*** are now known to occur in northeastern Brazil.

Trichogramma pretiosum was the only parasitoid species collected in all sampling sites, on eight species of Lepidoptera from five families. ***Trichogramma pretiosum*** is a generalist, infesting over 240 lepidopteran species (PINTO, 1999) and is widely distributed in Brazil (ZUCCHI et al., 2010). With the exception of ***Nyctelius n. nyctelius*** and ***Panoquina l. lucas*** (newly reported hosts), all of the other lepidopteran hosts observed in this study are economically important (Table 2).

Only ***T. atopovirilia*** and ***T. pretiosum*** were obtained from lepidopteran eggs collected on weeds and non-cultivated plants. Weeds are considered to be reservoirs of parasitoids, which can infest the eggs of pest lepidopterans in adjoining crop areas. Thus, ***Trichogramma pretiosum*** was associated to ***Heraclides thoas brasiliensis*** on ***Piper tuberculatum*** (Jacq.) (***Piperaceae***) in Teresina/PI, and to ***Chrysodeixis includens*** on ***Comelinna benghalensis*** L. (***Commelinaceae***) and ***Borreria*** sp. (***Rubiaceae***) in Bom Jesus/PI. Whereas ***T. atopovirilia*** was associated to unknown Lepidoptera species on ***Panicum*** sp. (***Poaceae***) in Teresina/PI.

Trichogramma galloi was only observed as a parasite of ***D. saccharalis*** eggs on sugarcane in Teresina, PI. ***Trichogramma manicobai*** was collected from eggs of ***Erinnyis ello*** (L., 1758) on cassava in Teresina, PI (Table 2). Both species are specialists, as ***T. galloi*** exclusively infests eggs of ***D. saccharalis*** on sugarcane and ***T. manicobai*** only infests eggs of ***E. ello*** on cassava.

The behavior of many insect groups is changing because of agricultural production systems; and therefore, their status as key pests is also changing. Among these groups, lepidopterans pest represent phytosanitary challenge. Biological control based on

Table 1 - Collection sites of ***Trichogramma*** species in the Mid-North of Brazil (Maranhão and Piauí), from 2011 to 2013 and in 2015.

States	Localities	Latitudes	Longitudes	Altitudes (masl)
Maranhão	Anapurus	3° 41’ 6.65" S	43° 08’ 52.15" W	103
	Chapadinha	3° 42’ 30.40" S	43° 09’ 59.05" W	96
	Mata Romã	3° 42’ 26.1" S	43° 11’ 02.3' W	103
	São Raimundo das Mangabeiras	6º 49' 24" S	45º 24' 43" W	524
Piauí	Bom Jesus -Area 1	9º 16' 5.71" S	44º 44' 15.4" W	491
	Bom Jesus -Area 2	9º 12' 300" S	44º 43' 630" W	491
	Monte Alegre	9° 23’ 56.3" S	45° 07’ 47" W	641
	São João	8º 20' 58.9" S	42 16’ 07.8" W	216
	Teresina	5º 2' 21.36" S	42º 47' 22.44" W	94

Table 2 - ***Trichogramma*** species associated with pest lepidopterans on crops in the Mid-North of Brazil, from 2011 to 2013 and in 2015.

Years	Crops	Locations	Pest lepidopterans	***Trichogramma*** species
2011	Cotton	Monte Alegre/PI	***Alabama argillacea***	***Trichogramma*** sp.
2011	Cotton	São Raimundo das Mangabeiras/MA	***Alabama argillacea***	***T. pretiosum***
2013	Cotton	Teresina/PI	***Alabama argillacea***	***T. pretiosum***
2013	Cotton	Teresina/PI	***Spodoptera*** sp.	***T. pretiosum***
2011	Rice	Chapadinha/MA	***Nyctelius nyctelius nyctelius***	***T. pretiosum***
2011	Rice	Mata Romã/MA	***Panoquina lucas lucas***	***T. pretiosum***
2011	Rice	Teresina/PI	***Diatraea saccharalis***	***T. pretiosum***
2011	Rice	Teresina/PI	-	***T. pretiosum***
2015	Sugarcane	Teresina/PI	***Diatraea saccharalis***	***T. galloi***
2012	Cowpea	Bom Jesus/PI – A1	***Chrysodeixis includens***	***T. pretiosum***
2012	Cowpea	Bom Jesus/PI – A2	***Chrysodeixis includens***	***T. pretiosum***
2015	Cowpea	São João/PI	***Chrysodeixis includens***	***T. pretiosum***
2011	Cassava	Teresina/PI	***Erinnyis ello***	***T. manicobai***
2013	Passionfruit	Teresina/PI	***Agraulis vanillae vanillae***	***T. pretiosum***
2011	Corn	Teresina/PI	***Spodoptera frugiperda***	***T. pretiosum***
2013	Corn	Teresina/PI	***Spodoptera frugiperda***	***T. pretiosum***
2012	Soybean	Anapurus/MA	***Chrysodeixis includens***	***T. pretiosum***
2012	Soybean	Bom Jesus/PI – A1	***Chrysodeixis includens***	***T. pretiosum***
2012	Soybean	Bom Jesus/PI – A2	***Chrysodeixis includens***	***T. pretiosum***
2012	Soybean	Chapadinha/MA	***Chrysodeixis includens***	***T. pretiosum***
2013	Soybean	Teresina/PI	***Chrysodeixis includens***	***T. pretiosum***
2012	Soybean	Teresina/PI	***Chrysodeixis includens***	***T. pretiosum***

*Females (identifications is not possible).

natural parasitism by ***Trichogramma*** is a potential strategy for managing these pests. This study makes the first report of associations between pest lepidopterans and ***Trichogramma*** spp. in the Mid-North region of Brazil. This is basic information for an effort to reveal the diversity of ***Trichogramma*** in the region, and an essential step towards conserving these parasitoids and using them in biological control programs.

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