



## Food and mating influencing the parasitism potential of *Trichogramma* spp. (Hymenoptera: Trichogrammatidae)

### *Alimentação e acasalamento influenciando no potencial de parasitismo de Trichogramma spp. (Hymenoptera: Trichogrammatidae)*

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**SUMMARY** - *Trichogramma* species have been employed in the pests control, in different crops and aimed at increase the discussion on the behavior of this parasitoid the objective of this work was to evaluate the mating and feeding in the parasitism potential of *Trichogramma* species. For that, four treatments were performed for each parasitoid species, which are: females fed of male presence, females fed without the males presence, females not fed on the male presence and female not fed without the male presence. It was observed that the mating is not a factor that affects the two *Trichogramma* species parasitism. However, the food proved to be very important in the increasing of the two species parasitism potential, not only in increasing longevity and consequent higher eggs parasitized total number, but also in the parasitism occurred in the first 24h. Basing on data of this research, for the species studied use, in biological control programs for the release or mass rearing food becomes an important factor to increase its performance.

**Keywords:** insecta, behavior, reproduction, biological control

**RESUMO** - Espécies de *Trichogramma* têm sido empregadas no controle de diversas pragas, em diferentes culturas e visando incrementar a discussão sobre o comportamento desse parasitóide objetivou-se com esse trabalho avaliar o acasalamento e a alimentação no potencial de parasitismo de duas espécies de *Trichogramma*. Para tanto, foram realizados quatros tratamentos para cada espécie do parasitóide, sendo estes: fêmeas alimentadas com presença de macho, fêmeas alimentadas sem a presença de macho, fêmeas não alimentadas com presença de macho e fêmeas não alimentadas sem a presença de macho. Observou-se que o acasalamento não é um fator que afeta o parasitismo das duas espécies de *Trichogramma*. No entanto, a alimentação mostrou-se muito importante no aumento do potencial de parasitismo das duas espécies, não somente no aumento da longevidade e consequente maior número total de ovos parasitados, mas também no parasitismo ocorrido nas primeiras 24h. Baseando nos dados desta pesquisa, para a utilização das espécies estudadas, em programas de controle biológico para a liberação ou criação massal a alimentação torna-se um fator importante para aumento do seu desempenho.

**Palavras-chave:** insecta, comportamento, reprodução, controle biológico

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## INTRODUCTION

*Trichogramma* species have been applied in the control of several field pests, in different crops all over the world (CONSOLI; PARRA; ZUCCHI, 2010). As an advantageous characteristic of these egg parasitoids it can be mentioned their production facility in laboratory, which when created in alternative hosts, make possible the success of their production and commercialization (WANG et al., 2013).

However, their use as biological control agents must be measured in studies which demonstrate the behavior of these egg parasitoids, when submitted to the influence of biotic and abiotic factors, which can compromise their efficiency (BUENO; PARRA; BUENO, 2012; ZUIM et al., 2013).

Among the abiotic factors, feeding is preponderant to the development of the parasitoid, and it can even alter the characteristics as longevity and fecundity, the flying tendency and the parasitism ability (DÍAZ; RAMÍREZ; POVEDA, 2012). On field conditions the nectar and pollen are used as food to the adults of *Trichogramma* spp. (BIANCHI; WACKERS, 2008).

The availability of food increases the longevity of *Trichogramma* species (WITTING-BISSINGER; ORR; LINKER, 2008). Sugar feeding can increase parasitoid longevity up to 20-fold, and nectar feeding can also enhance parasitoid fecundity, increasing the reproductive lifespan and/or accelerating the rate of egg maturation (WACKERS, 2001; WINKLER et al., 2006).

The most common reproduction in *Trichogramma* is the arrhenotokous, as in the Hymenoptera in general, that is, fertilized eggs produce diploid females and unfertilized eggs produce haploid males (LUNDGREN; HEIMPEL, 2003). Nevertheless, this reproduction can be thelytokous or complete parthenogenesis, where the fertilized and the unfertilized eggs produce diploid females (STOUTHAMER et al., 1993). The fecundity evaluations are generally used in laboratory assays to determine the quality of the species and/or lineages of *Trichogramma* before its liberation on the field. Nevertheless, there are a little information's about the relevance of this characteristic for the success of these parasitoids (THOMSON; HOFFMANN, 2002). In order to increase the discussion about this subject, the objective of this work was to evaluate the mating and feeding on the parasitism potential of two *Trichogramma* species.

## MATERIAL AND METHODS

The experiment was carried out in the Entomology Laboratory of the Nucleus of Scientific and Technologic Development in Phytosanitary Management (NUDEMAFI) of the Center of Agrarian Sciences of the Federal University of Espírito Santo (CCA-UFES), in the

city of Alegre – ES, in climatic chamber adjusted in  $25 \pm 1^\circ\text{C}$ ,  $70 \pm 10\%$  RH and 14 hours of photofase.

The species used were *Trichogramma atopovirilia* Oatman and Pinto and *Trichogramma exiguum* Pinto and Platner (Hym., Trichogrammatidae), which were withdrawn from the stock collection of NUDEMAFI where they were maintained and created in the eggs of the alternative host *Anagasta kuehniella* Zeller (Lep., Pyralidae), following the methodology developed by Parra (1997) with adaptations to the laboratory conditions.

To evaluate the influence of mating and feeding, parasitized eggs from both species were isolated in Duran tubes (0,5 x 4,0 cm), until the birth of the adults, the eggs which presented birth of two individuals with different genders were discarded.

After the birth, for each specie, four lots of individuals were isolated, they consisted of: one lot of females with the presence of male and one lot in the absence of male, a droplet of honey was offered to them as food in the internal part of the tube walls; they also consisted of a females lot with the presence of male and another lot in the absence of male, for these lots, food wasn't offered.

Each lot (treatment) was compounded by 10 replications, and this was compounded by a Duran tube (0,5 x 4,0 cm) containing a paper card with 40 eggs of the alternative host *A. kuehniella* and one female with or without the presence of male fed or not. The parasitism was allowed for 24h in acclimatized chamber in the previously mentioned conditions.

The experimental delineament used was the entirely randomized in factorial design with four treatments (females with the presence of male and food, female without the presence of male with food, females with the presence of male without food and females without the presence of male without food), two species of *Trichogramma* (*T. atopovirilia* and *T. exiguum*) and 10 replications per treatment, the data was submitted to the F test, with the level of 5% of probability.

## RESULTS AND DISCUSSION

The total number of parasitized eggs per female of *T. atopovirilia* and *T. exiguum* was significantly affected by the feeding, nevertheless, the presence of males from both species did not show to be a preponderant factor for this parameter. The smallest parasitism was presented by females from both species which did not receive honey in their feeding (Table 1), what demonstrates that the food is one of the most important factors to increase the quantity of parasitized eggs per female of *Trichogramma* throughout its life, once that in field conditions the adults of this parasitoid feed themselves with nectar and pollen (BIANCHI; WACKERS, 2008; DÍAZ; RAMÍREZ; POVEDA, 2012).

**Table 1** - Total number of eggs *A. kuehniella* parasitized and longevity of female *T. atopovirilia* e *T. exiguum* with and without the presence of male, food or not. 25±1°C, RH 70±10% and 14 hours of photofase.

	Total number of eggs parasitized		Longevity (Days)	
<i>Trichogramma atopovirilia</i> <sup>1</sup>				
Food / Male	without presence	with presence	without presence	with presence
without	8,20 ± 4,36 bA	16,70 ± 4,65 bA	2,00 ± 0,00 bA	2,00 ± 0,63 bA
with	103,60 ± 18,73 aA	101,70 ± 16,86 bA	15,13 ± 0,99 aA	12,40 ± 4,12 aA
<i>Trichogramma exiguum</i> <sup>1</sup>				
without	20,80 ± 6,10 bA	8,70 ± 5,17 bA	2,00 ± 0,63 bA	1,70 ± 0,67 bA
with	151,30 ± 23,69 aA	133,60 ± 20,04 aA	11,56 ± 5,22 aA	11,74 ± 4,52 aA

<sup>1</sup>Means followed the same letter in the column and capitalized on the line, for each species, do not differ, the test "F" at 5% probability.

The observed longevity for both evaluated species was significantly affected by the offer or not of food, and the female adults which received food presented longevity which varied from 11,56 to 15,13 days, while the ones which were not fed presented longevity between 1,70 and 2 days, this parameter, did not present influence in the presence or absence of males from both species either (Table 1).

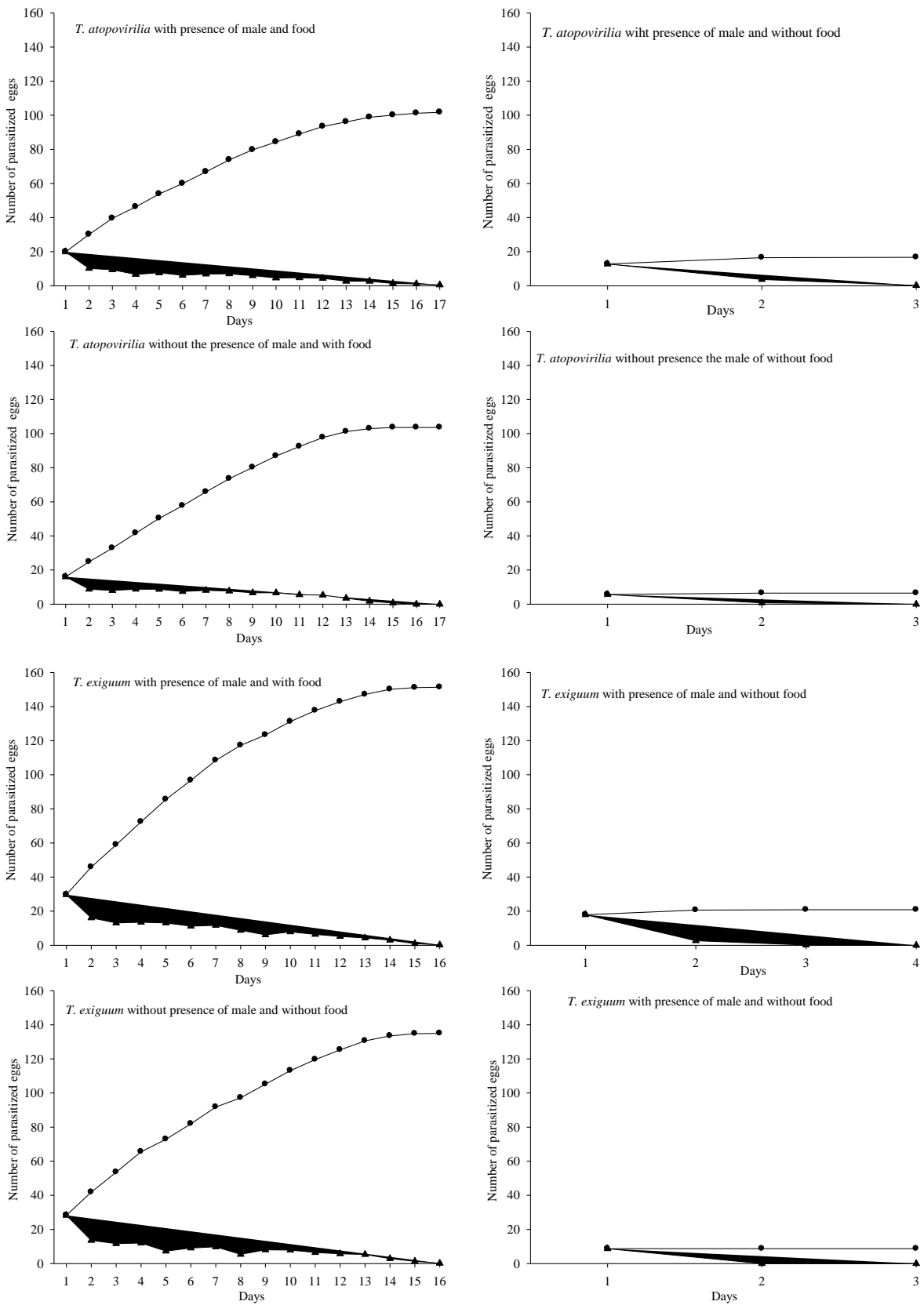
There are several factors which influence the longevity of adults of *Trichogramma*. Among them, we can mention the temperature as the main factor (PRATISSOLI et al., 2005; 2007), nevertheless, the results show that in similar temperature conditions the individuals which had the presence of food presented a considerable increase in their survival capacity (DÍAZ; RAMÍREZ; POVEDA, 2012), although some authors assert the opposite (SANTA-CECILIA; MATIOLI; SOUSA, 1987).

During the first 24h, period of higher parasitism concentration throughout the parasitoid life, it was verified a parasitism reduction for the females which did not receive food source (Figure 1), showing that the food is an important factor to the parasitism and that the

increase in the total number of parasitized eggs happens in the function of the increase of the parasitism capacity of the fed individuals and not only for the increase of longevity (PRATISSOLI et al., 2004; OLIVEIRA et al., 2005).

The daily rhythm of parasitism from both species did not present difference to the females which received food in the presence or absence of male. For the females which did not receive food, there was a significantly reduction in the parasitism potential for the females of *T. atopovirilia* without the presence of male and of *T. exiguum* when they were in the presence of male (Figure 1).

The accumulated parasitism presented similarity for the females with the presence or absence of male. The difference presented was to individuals which did not receive food, the fed females reached 80% of their parasitism potential by the 9, 9, 5 and 6 days to *T. atopovirilia* with or without the presence of male and *T. exiguum* with or without the presence of male. While the females which were not fed presented this potential by 2, 2, 1, 1 days of life (Figure 1).



**Figure 1:** Daily and cumulative parasitism of female *T. atopovirilia* and *T. exiguum* in eggs of *A. kuehniella* with and without the presence of male, food or not.  $25\pm 1^{\circ}\text{C}$ , RH  $70\pm 10\%$  and 14 hours of photofase.

These results come to confirm that the food quality would be one of the most important factors to the parasitism potential of *Trichogramma* species, since similar results have already been demonstrated by other authors to other species of the parasitoid in different hosts (PRATISSOLI et al., 2006; PEREIRA et al., 2007), showing this way, that the host and the specie of the parasitoid may have influence in the capacity of individuals to parasitize, nevertheless this difference is significantly higher in function of feeding.

## CONCLUSIONS

Based in the data of this research, for the use of the studied species, in biological control programs for the liberation or mass creation, food becomes an important factor for the increasing of its performance. These results also show, that the offer of food as a source of energy for these parasitoids will result in a higher number of parasitized eggs and higher longevity, increasing this way, its capacity of search for the host in the field. About the effect of the mating, this has not presented any interference in the studied parameters.

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