

Trichogramma acacioi (Hymenoptera, Trichogrammatidae) parasitism capacity at different temperatures and factitious hosts

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ABSTRACT. *Trichogramma acacioi* (Hymenoptera, Trichogrammatidae) parasitism capacity at different temperatures and factitious hosts. It was studied the parasitism capacity of *Trichogramma acacioi* on *Anagasta kuehniella* and *Sitotroga cerealella* eggs at different temperatures (15, 20, 25, 30 and 35 ± 1°C). The parasitism of *T. acacioi* varied with temperature and host. The highest parasitism (≥80%) were observed during the first days after emergence in both hosts, at all tested temperatures. The accumulated parasitism varied with both host and temperature, being higher on *A. kuehniella* at 20°C, what shows good parasitoid species adaptation to this temperature. Thus, we conclude that the best host and best temperature to be used at mass-rearing of *T. acacioi* is *A. kuehniella* and 20°C, respectively. Moreover, this *Trichogramma* species has great potential to be used in field releases at regions where average temperature is around 20°C.

KEYWORDS. Biological control; egg parasitoid; factitious host; mass-rearing.

RESUMO. Capacidade de parasitismo de *Trichogramma acacioi* em diferentes temperaturas e hospedeiros alternativos. Foi estudada a capacidade de parasitismo de *Trichogramma acacioi* em ovos de *Anagasta kuehniella* e *Sitotroga cerealella* em diferentes temperaturas (15, 20, 25, 30 e 35 ± 1°C). O parasitismo de *T. acacioi* variou com a temperatura e hospedeiro. O maior parasitismo (≥80%) foi observado durante os primeiros dias após a emergência, em ambos hospedeiros e em todas as temperaturas estudadas. O parasitismo acumulado variou nas diferentes temperaturas e hospedeiros, sendo maior em *A. kuehniella* a 20°C, o que mostra uma boa adaptação da espécie do parasitóide a essa temperatura. Assim, concluímos que o melhor hospedeiro alternativo e melhor temperatura para serem usadas em criações massais de *T. acacioi* é a *A. kuehniella* e 20°C, respectivamente. Ainda, esta espécie de *Trichogramma* tem grande potencial para ser usada em liberações de campo em regiões onde a temperatura média está em torno de 20°C.

PALAVRAS-CHAVE. Controle biológico; criação massal; hospedeiro alternativo; parasitóide de ovos.

Egg parasitoids from the genus *Trichogramma* have been recognized as an important biological control agent, being worldwide distributed and capable of parasitizing eggs of a great diversity of pests from the order Lepidoptera (Pratissoli *et al.* 2004). Studies about *Trichogramma* spp. have been carried out in more than 50 countries and mass releases done in around 32 millions of hectares every year (Smith 1996). A biological control program using parasitoids from the genus *Trichogramma* must follow several steps. *Trichogramma* species performance on different hosts and temperatures will show the best factitious host and temperature for mass-rearing, an important step of a program using *Trichogramma* (Parra & Zucchi 2004).

Pratissoli & Fornazier (1999) first recorded *Trichogramma acacioi* Brun, Moraes & Soares (1984) (Hymenoptera:

Trichogrammatidae) on *Nipteria panacea* Thierry-Mieg (1892) (Lepidoptera: Geometridae) in Brazil. This parasitoid species is an option that might be used in biological control programs, however, there are very few researches on its biological characteristics. They might be greatly influenced by the different temperatures and hosts. Thus, this research was carried out aiming to evaluate the parasitism capacity of *T. acacioi* on *Anagasta kuehniella* Zeller (1879) (Lepidoptera: Pyralidae) and *Sitotroga cerealella* (Olivier, 1819) (Lepidoptera: Gelechiidae) eggs at different temperatures, aiming to acquire enough knowledge to choose the best factitious host and temperature for mass-rearing of this *Trichogramma* species.

The experiment was carried out in a factorial complete randomized design (2 hosts and 5 temperatures) at the

Entomology Laboratory “Centro de Ciências Agrárias, Universidade Federal do Espírito Santo, Alegre, Espírito Santo, Brasil” at controlled conditions ($70 \pm 10\%$ relative humidity, 14:10 L:D) and different temperatures (treatments): 15, 20, 25, 30 and $35 \pm 1^\circ\text{C}$ and 20 replications. Newly emerged females of *T. acacioi* were individualized in glass vials (3.5 x 0.5 cm) with a honey droplet that was internally placed in the inner wall of the vials as food source for the parasitoid.

Each replication was a single female that had 40 eggs of each factitious host species offered for parasitization. Eggs were replaced on a daily basis until the female death. The following parameters were evaluated: the number of parasitized eggs, accumulated percentage of parasitism and total number of parasitized eggs per female. The results were submitted to ANOVA and means were compared using Tukey test ($P \leq 0.05$).

The highest parasitism of *T. acacioi* occurred during the first day at all tested temperatures and hosts, and parasitoid females stopped parasitizing *S. cerealella* eggs earlier than they stopped parasitizing *A. kuehniella* eggs, unless at 25°C (Fig. 1). The parasitoid lived until the 20th day after emergence on eggs of *A. kuehniella* at 15°C (Fig. 1) and laid eggs until the 15th day at the rate of 1.51 parasitized egg per female (Figs. 1 and 2). Also at 15°C , on *S. cerealella* eggs, the parasitoid survived 8 days, during which parasitized an average of 2.7 eggs/day/female (Figs. 1 and 2).

Females of *T. acacioi* were able to parasitize *A. kuehniella* eggs until the 15th day after emergence at 20°C . However, they lived 16 days (Figs. 1 and 2). The parasitism on *S. cerealella* occurred until the third day, whereas the longevity was 5 days. The daily parasitism rate per *T. acacioi* female was 5.3 and 8.23 eggs for *A. kuehniella* and *S. cerealella*, respectively (Fig. 1) at this temperature.

At 30°C , females of the parasitoid lived for 8 days on *A. kuehniella* but were able to lay eggs until the 6th day. The longevity and parasitism period were similar (5 days) on *S. cerealella* eggs. The daily parasitism rate per female was 6.4 and 10.4 eggs, for *A. kuehniella* and *S. cerealella*, respectively. Moreover, *T. acacioi* lived for 5 and 3 days at 35°C on *A. kuehniella* and *S. cerealella* eggs, respectively. However, the parasitism period was 3 and 1 days whereas the parasitism rate was 3.7 and 4.1 eggs/day/female, respectively (Fig. 1).

It is important to consider that temperature influenced *T. acacioi* parasitism differently on *A. kuehniella* and *S. cerealella* eggs. Therefore, when parasitism was compared on both hosts, it was higher on *A. kuehniella* eggs at 20, 25, and 35°C and on *S. cerealella* at 15 and 30°C (Fig. 1). The accumulated parasitism reached 80% at 7, 9, 2, 3 and 1 days on eggs of *A. kuehniella*, and at 2, 2, 2, 2 and 1 days on *S. cerealella* eggs, at 15, 20, 25, 30 and 35°C , respectively (Fig. 2).

The highest parasitism of *T. acacioi* on *A. kuehniella* eggs occurred at 20°C and reached close to 70 eggs/female. Beyond that temperature there was a reduction in the parasitism rate. The lowest parasitism rates were registered for extreme temperatures (15 and 35°C), whereas the maximum parasitism of *T. acacioi* on *S. cerealella* eggs was registered at 25°C with

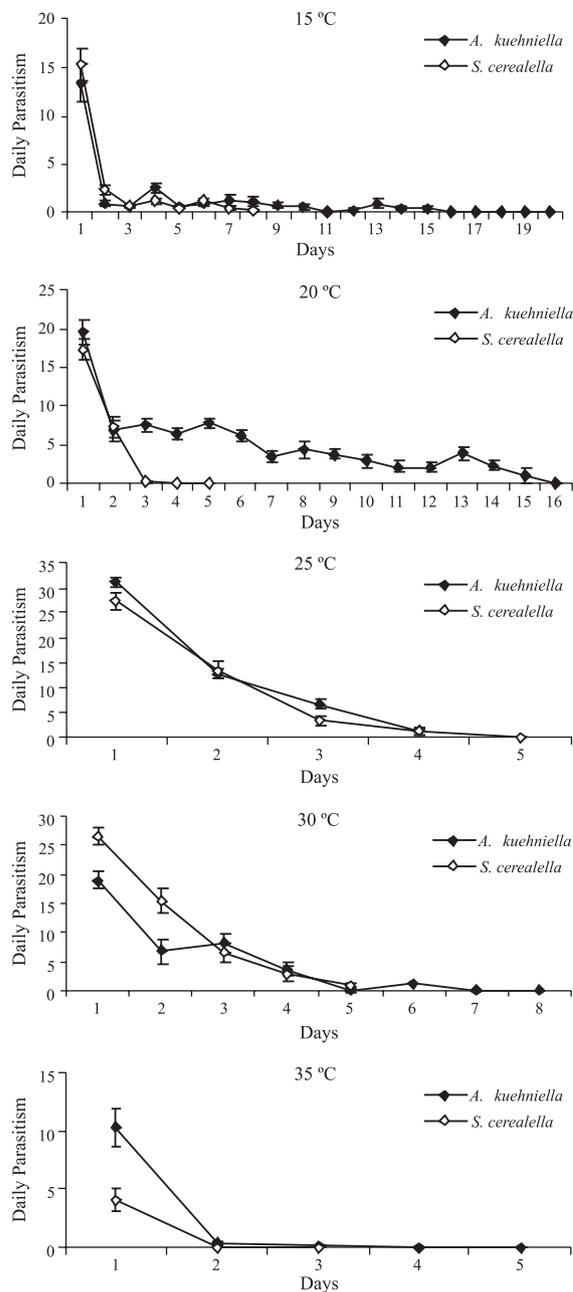


Fig. 1. Daily parasitism of *Trichogramma acacioi* (Hym., Trichogrammatidae) on *Anagasta kuehniella* and *Sitotroga cerealella* eggs, at different constant temperatures ($70 \pm 10\%$ of relative humidity and photo phase of 14 hours).

45.6 eggs/female. This value is similar to what was observed at 30°C and is higher than the parasitism at 15, 20 and 35°C (Fig. 3).

The findings presented in this paper are important for defining the best *T. acacioi* releasing strategy and mass-rearing control. On general, the contrast of parasitism for both alternative hosts at different temperature show that *A. kuehniella* is the best alternative host for mass-rearing of the parasitoid due to this longer lifespan and higher total parasitism at most of the tested temperatures (Figs. 1, 2 and 3).

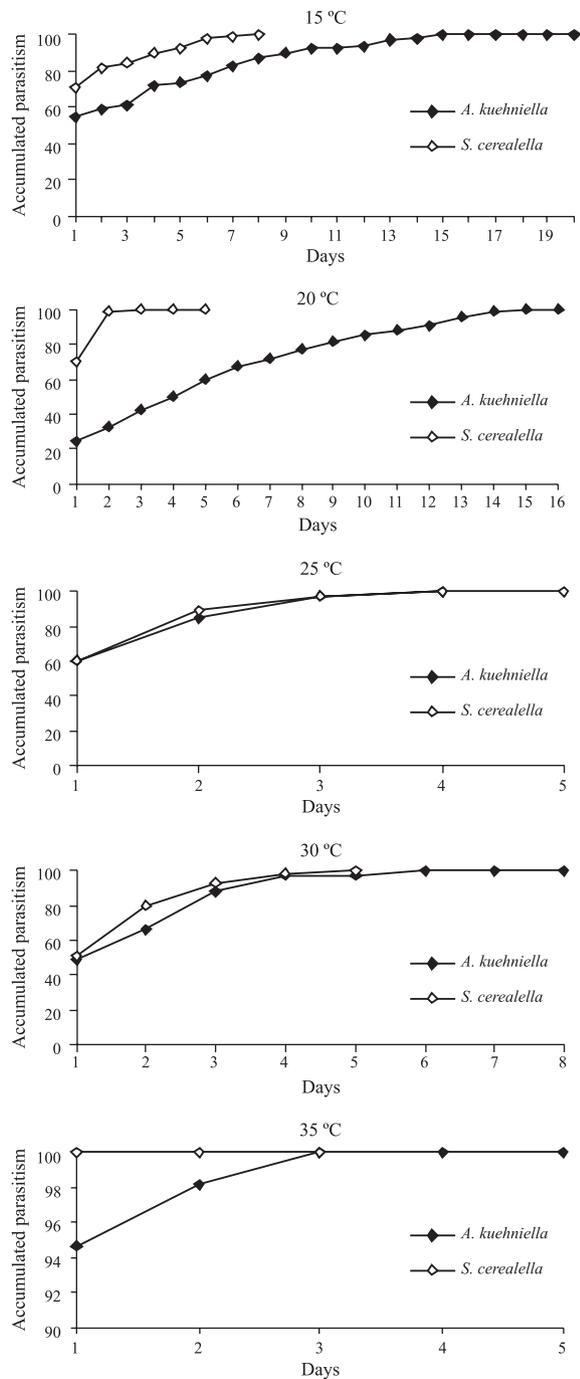


Fig. 2. Accumulated parasitism of *Trichogramma acacioi* on *Anagasta kuehniella* and *Sitotroga cerealella* eggs, at different constant temperatures (70 ± 10% of relative humidity and photo phase of 14 hours).

Furthermore, the highest total parasitism of *T. acacioi* was observed on *A. kuehniella* at 20°C (Fig. 3) what was shown to be the best temperature and host for mass-rearing.

The parasitism period and total number of parasitized eggs were the lowest at 35°C. The fact that the parasitism period of

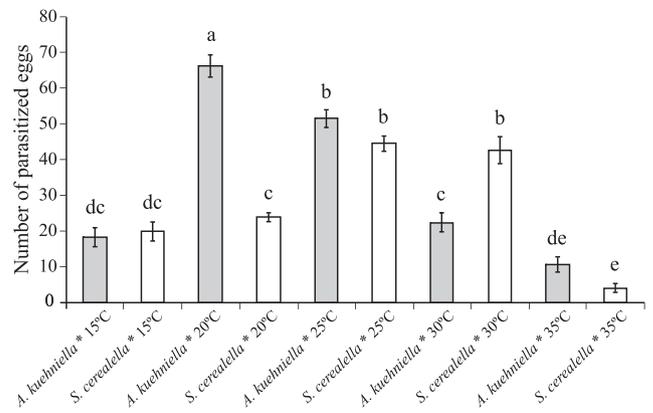


Fig. 3. Total number of eggs parasitized per *Trichogramma acacioi* female in the alternative hosts, *Anagasta kuehniella* and *Sitotroga cerealella* at different constant temperatures (70 ± 10% of relative humidity and photo phase of 14 hours). Means followed by the same letter and do not differ by the test of Tukey (P ≤ 0.05).

T. acacioi was higher at low temperature shows its survival capacity at those temperatures, which is consistent with the fact that this species occurred and was collect at 1000 m altitude where temperatures around 20°C are common during the year. These results shows the importance of using a local *Trichogramma* strain whenever it is possible to ensure better chances for the biological control program to succeed since this species or strain will be more likely well adapted to the local climate. Moreover, the good performance of *T. acacioi* on lower temperature shows that this species might be successfully used in other areas where average temperature around 20°C is common during the year.

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REFERENCES

Parra, J. R. P. & R. A. Zucchi. 2004. *Trichogramma* in Brazil: feasibility of use after twenty years of research. **Neotropical Entomology** **33**: 271–281.

Pratissoli, D. & M. J. Fornazier. 1999. Ocorrência de *Trichogramma acacioi* Brun, Moraes & Soares (Hym.: Trichogrammatidae) em ovos de *Nipteria panacea* Thierry-Mieg (Lep.: Geometridae), um geometrídeo desfolhador do abacateiro. **Anais da Sociedade Entomológica do Brasil** **28**: 347–349.

Pratissoli, D.; J. C. Zanuncio; U. R. Vianna; J. S. Andrade; E. M. Guimarães; M. C. Espindula. 2004. Fertility life table of *Trichogramma pretiosum* and *Trichogramma acacioi* on eggs of *Anagasta kuehniella* at different temperatures. **Pesquisa Agropecuária Brasileira** **39**: 193–196.

Smith, S. M. 1996. Biological control with *Trichogramma*: Advances, successes, and potential of their use. **Annual Review of Entomology** **41**: 375–406.