Notas Científicas

Trichogramma galloi and *Trichogramma pretiosum* for the management of *Duponchelia fovealis* (Lepidoptera: Crambidae) in strawberry plants

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Abstract – The objective of this work was to determine the ideal number for field release of *Trichogramma galloi* and *T. pretiosum* for controlling *Duponchelia fovealis* (Lepidoptera: Crambidae) in strawberry (*Fragaria* x *ananassa*). The experiment was carried out in a greenhouse, where the strawberry cultivar 'Oso Grande' was infected with 100 eggs of *D. fovealis* distributed on the leaf surface area of each plant. A total of 1, 2, 4, 8, 16, 32, 64, and 128 female parasitoids were released per egg of *D. fovealis*. The greatest level of egg parasitism, with no differences for the species of *Trichogramma*, was observed at the densities of four and eight parasitoids per egg of *D. fovealis*, considered ideal for field release.

Index terms: *Fragaria* x *ananassa*, biological control, strawberry caterpillar.

Trichogramma galloi e *Trichogramma pretiosum* para o manejo de *Duponchelia fovealis* (Lepidoptera: Crambidae) em morangueiro

Resumo – O objetivo deste trabalho foi estimar o número ideal de *Trichogramma galloi* e *T. pretiosum* para liberação em campo, para o manejo de *Duponchelia fovealis* (Lepidoptera: Crambidae) em morangueiro (*Fragaria* x *ananassa*). O experimento foi implantado em casa de vegetação, onde morangueiros da cultivar 'Oso Grande' foram infestados com 100 ovos de *D. fovealis* distribuídos na área foliar de cada planta. Foram liberadas 1, 2, 4, 8, 16, 32, 64 e 128 fêmeas parasitoides por ovo de *D. fovealis*. O maior nível de parasitismo, sem diferenças entre as espécies de *Trichogramma*, foi observado às densidades de quatro e oito parasitoides por ovo de *D. fovealis*, consideradas ideais para liberação em campo.

Termos para indexação: *Fragaria* x *ananassa*, controle biológico, lagarta do morangueiro.

Duponchelia fovealis Zeller (Lepidoptera: Crambidae), popularly known in Brazil as the strawberry caterpillar (Paes et al., 2015), is a polyphagous pest with several reported botanical species as hosts (Bonsignore & Vacante, 2010; Franco & Baptista, 2010). Recently introduced in Brazil, *D. fovealis* has been establishing itself in strawberry fields (*Fragaria* x *ananassa*), causing large losses (Zawadneak et al., 2016).

Biological control by the release of parasitoids of the genus *Trichogramma* (Hymenoptera: Trichogrammatidae) has shown promise for controlling agriculture and forestry insect pests before they damage the crop (Pratissoli et al., 2007). Moreover, this control is favored because of *Trichogramma* parasitism on many lepidopteran species (Pizzol et al., 2010). For strawberry cultivation, this type of control is critical because *D. fovealis* caterpillars can damage the fruit, reducing its value, or preventing its commercialization.

The objective of this work was to determine the ideal number for field release of *Trichogramma galloi* and *T. pretiosum* for controlling *D. fovealis* in strawberry.

The experiment was performed in a greenhouse of the Universidade Federal do Espírito Santo, in Alegre, ES, Brazil.

Duponchelia fovealis caterpillars were collected from a strawberry crop in Espírito Santo state, and transported to laboratory, where they were kept at 25±1°C, 70±10% relative humidity (RH), and 14-hour photophase, for the establishment of rearing stock. Eggs were distributed onto four cards (2.5×8 cm), with 25 eggs per card. Newly emerged adults were transferred to 20×20 cm cages made with PVC pipe and lined with sulfite paper. To prevent insect escape, the cage bottoms were closed with Styrofoam lined with sulfite paper, and the cage tops were closed with voile cloth. A 10% honey solution (v/v) embedded in cotton was offered as feed to the adults. Egg-laid papers were collected daily from the cages and immediately stored in acrylic gerbox-type boxes (11×11×3.5 cm). The sheets containing eggs were immersed for 10 seconds in 1% formaldehyde solution (v/v) and, subsequently, in 17% copper sulfate solution (m/v) in an aseptic environment, where they remained until dry. Next, the paper portions containing eggs were cut and transferred to flat-bottomed glass tubes (8.5×2.5 cm) containing an artificial diet (King & Hartley, 1985), which was modified. After the third day of the pupal stage, pupae were transferred to acrylic adult-rearing cages (40×60 cm).

For *T. galloi* and *T. pretiosum* parasitoid reproduction and maintenance, the alternate host, *Anagasta kuehniella* Zeller, was used, raised in accordance with the methodology developed by Parra (1997) and adapted to the conditions of the laboratory.

The experiment was performed in a greenhouse, where strawberry plants of the cultivar 'Oso Grande', transplanted 45 days earlier, were grown in 4 L plastic pots. Then, 100 eggs of *D. fovealis*, from the laboratory rearing stock, were distributed on the leaves of each plant.

After eggs were distributed and fixed, nine strawberry plants were individually covered by fully closed cages (40×40×120 cm), which were made of wire frame and surrounded by nonwoven fabric. In each cage, 100, 200, 400, 800, 1,600, 3,200, 6,400, and 12,800 females of the two *Trichogramma* species were released early in the day, at the following ratios: 1:1, 1:2, 1:4, 1:8, 1:16, 1:32, 1:64, and 1:128 *D. fovealis* egg:parasitoids, respectively. A cage without the *Trichogramma* release was set up as a control.

Parasitism was allowed for 24 hours. After this period, the eggs were collected and kept for 6 to 8 days in fully closed plastic bags (5×23 cm), which were placed in a climatized chamber at 25±1°C, 70±10% RH, and 14-hour photophase, for further assessment of the parasitism percentage.

The evaluations were carried out independently for each parasitoid species, in a completely randomized experimental design. The experiment was replicated six times for each density of the respective parasitoid species. The parasitism percentage data were analyzed by nonlinear regression, in which the number of females of each parasitoid species was related to the number of the pest eggs.

The lowest rates of parasitism were observed for the lower densities – at 1:1 and 1:2 egg:parasitoids. The best performance was obtained with 1:4 and 1:8 densities, which were thus considered the closest to the ideal for release in commercial strawberry crops for *D. fovealis* management. For the higher densities, the rate of parasitism was stable (Figure 1).

The strawberry plant architecture may have influenced this efficiency by facilitating the parasitoid's search for caterpillar eggs.

Different rates of parasitism, which resulted from the plant's architecture, were obtained by Pratissoli et al. (2005) in tomato (*Lycopersicum esculentum* Mill.) cultures, in different vegetative phases and growing conditions. Eggs located in plants with higher vegetative development showed significantly lower rates of parasitism than those located in younger plants. Zago et al. (2010) evaluated the egg-laying behavior of *Plutella xylostella* (Linnaeus, 1758) (Lepidoptera: Plutellidae) and parasitism by *T. pretiosum* on cabbage (*Brassica oleracea* L. var. *capitata*), also observing effect of crop characteristics on parasitism, and noting that it was higher in plants after the formation of the cabbage head.

Host, predation, parasitoid quality, weather conditions, season, and number of releases, as well as the egg-laying dynamics of pest are other factors that may interfere with the efficiency of parasitism by *Trichogramma* (Hassan, 1994; Smith, 1996; Pratissoli et al., 2005; Geremias & Parra, 2014). Molina & Parra (2006) achieved the ideal ratio of 36 individuals of *T. pretiosum* per egg of *Ecdytolopha aurantiana* (Lima, 1927) (Lepidoptera: Tortricidae) in citrus, whereas Pratissoli et al. (2005), evaluating the same parasitoid, found 16 individuals as optimal for the control of *Tuta absoluta* (Meyrick, 1917) (Lepidoptera: Gelechiidae)

on trellised tomato plants. According to Freitas Bueno et al. (2012), the ideal parasitism of *Anticarsia gemmatalis* (Hübner, 1818) and *Pseudoplusia includens* (Walker, 1857) (Lepidoptera: Noctuidae) occurs when 25 to 26 parasitoids are released per egg of the insect pests on cultivated soybean [*Glycine max* (L.) Merr.].

For the management of *D. fovealis* in cultivated strawberry plants, the recommended ratio of release of the parasitoid species *T. galloi* and *T. pretiosum* is four to eight females per egg of the pest.

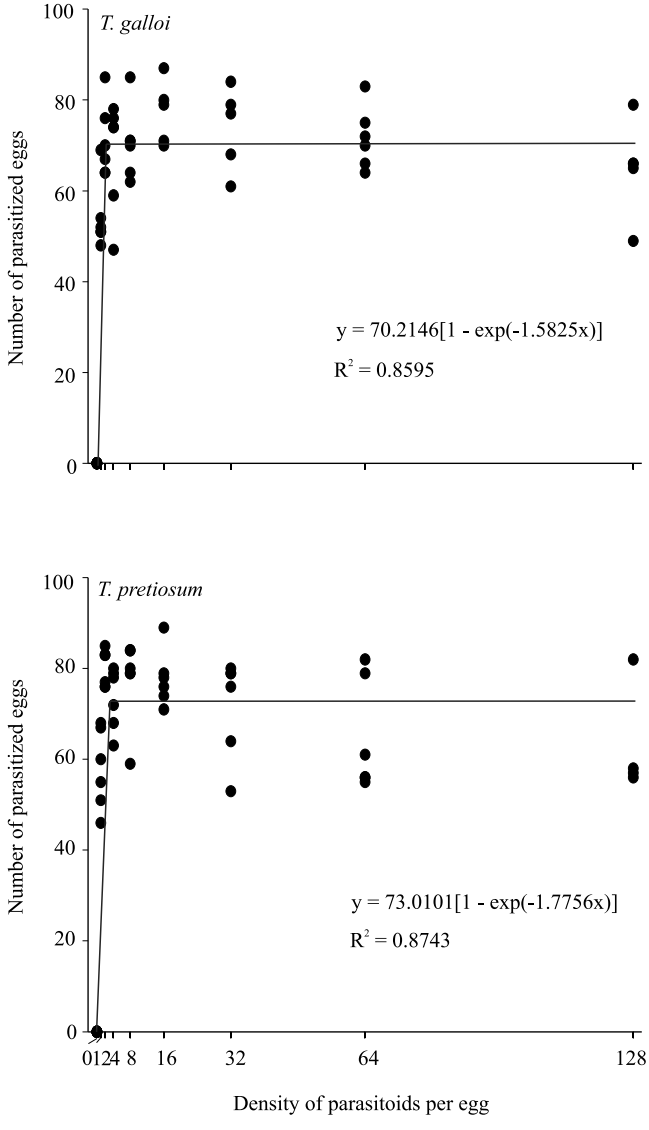

Figure 1. Number of *Duponchelia fovealis* parasitized eggs, as a function of the different densities of *Trichogramma galloi* and *T. pretiosum* on the leaves of strawberry (*Fragaria* x *ananassa*) plants under greenhouse conditions.

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