EFFECTS OF HIGH TEMPERATURES RECORDED DURING DIAPAUSE COMPLETION OF TRICHOGAMMA BRASSICAE PREPUPAE (HYM.: TRICHOGAMMATIDAE), ON THE TREATED GENERATION AND ITS PROGENY

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Trichogramma brassicae Bezdenko (Hym., Trichogrammatidae) is a parasitoid used for controlling the European corn borer, Ostrinia nubilalis Hübner (Lep., Pyralidae). In parts of south-eastern France, the parasitoids may be placed under a shelter when they are in the prepupal stage for diapause termination, before they are released among the crops. High temperatures (31°C-32°C) can occur during this period.

Prepupae were exposed to one or two high temperature shocks at 32°C in the laboratory, and the effects of these shocks were then recorded on a number of biological parameters of the parasitoids belonging to the experimental generation Go and to the progeny generation G1.

The emergence rate of Go individuals was highly affected, even when the prepupae had been exposed to a single shock. This decreased the number of parasitoids, in addition to reducing the fecundity of the females. The temperature shocks also affected the emergence rate of generation G1. No changes were observed regarding the other parameters (minimum duration of final pupal development, longevity, proportion of females). A temperature shock, even a short-lasting low amplitude one, may thus have strong implications on the efficiency of the parasitoids.

KEY-WORDS: parasitoid, high temperature shock, biological parameters.
wasps emerge in the field, after release. In such conditions and while the parasitoid terminates its diapause and continues its development, temperature peaks of 31-32°C are sometimes observed in the daytime, during brief periods (2 hours), for several days.

We carried out a laboratory study, to assess the effects of these periods of high temperatures on different parameters: emergence rate, proportion of females, longevity and fecundity of *T. brassicae*.

**MATERIALS AND METHODS**

The parasitoids used for our laboratory study were provided by the Union Nationale des Cooperatives Agricoles d’Approvisionnement (UNCAA) as diapausing prepupae. *T. brassicae* have developed until diapause in irradiated *E. kuehniella* eggs enclosed in capsules similar to that used for field release. When arriving in our laboratory, the capsules were located at 3°C in a refrigerator, until the time for experiments. The individuals that emerge from the parasitized eggs will be referred to as generation G₀ (treated generation). The progeny, which also plays a part in crop protection (Frandon & Kabiri, 1990), will be referred to as generation G₁.

**PARAMETERS STUDIED**

The parameters recorded on the treated generation (G₀) that was exposed to the high temperature were: minimum duration of final pupal development (i.e. the mean number of days from cold storage removal to the first emergences), total emergence rate, proportion of females, longevity, fecundity (i.e. total number of parasitized eggs).

The following parameters were recorded on the progeny generation (G₁): total emergence rate and proportion of females.

**EXPERIMENTAL CONDITIONS**

The capsules (within glass tubes 2 cm in diameter and 9 cm in length) were maintained throughout the study — except during the high temperature treatments — in a Bioblock incubator run at a temperature cycle of 15-28°C and a 8D:16L cycle. We chose these temperature and light cycles after analyzing three years of releases. Relative humidity within the incubator varied between 60% and 70%. To simulate the field conditions at best, the shocks were applied at midday.

The controls were untreated parasitoids.

Three high temperature treatments were applied: 1./ a shock of 32°C applied during 2 hours after removal from the cold; 2./ a similar shock followed, 24 hours later, by a second 32°C shock during 2 hours; 3./ a 32°C shock during 2 hours one day after removal from the cold, at the same time as the second shock of the second treatment.

*Generation G₀*

All the capsules used in the experiments were removed from the cold at the same time. Two hours were required in order to prepare the capsules, during which time they remained at room temperature, about 22°C ± 2°C. Several groups of capsules for the different parameters were assigned at random to the different series.

Total emergence rate and female proportion were calculated from 300 eggs (3 groups of 100 eggs, selected at random). Total emergence rate was estimated as the ratio of the