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## Biology of *Trichogramma cordubensis* (Hym., Trichogrammatidae) under different photoperiods

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### ABSTRACT

This work was carried out to study the effect of photoperiod on *Trichogramma cordubensis* Vargas & Cabello biology. *T. cordubensis* was reared on *Ephesttia kuehniella* Zeller eggs at 20°C and 75±5% of HR. The essay comprised different photophase (L): scotophase (D) combinations that simulated the day length of summer (16:8), winter (8:16) and spring or autumn (12:12) seasons in the Azores. Photoperiod did not influence the parasitoid longevity, emergence rate and parasitism. However, it had a significant effect on the parasitoid egg to adult developmental time, the last enlarging with increasing photophase.

**Key-words:** Insecta, *Trichogramma*, parasitoid, photoperiod, biology

### INTRODUCTION

The armyworm, *Mythimna unipuncta* Haworth (Lep., Noctuidae), is an important pest of the Azorean pastures (TAVARES, 1989; TAVARES *et al.*, 1992). Its high representation has prompted the investigation of various biological control agents, including parasitoids. As part of this research, the evaluation of the native species *Trichogramma cordubensis* VARGAS & CABELLO (Hym., Trichogrammatidae) effectiveness as biological control agent has been oriented towards studying the parasitoid biology (PINTO & TAVARES, 1991; GARCIA & TAVARES, 1995), its population dynamics (GARCIA *et al.*, 1995) and rearing techniques (TAVARES & VIEIRA, 1992). Therefore, the present study was designed to test the effects of different photoperiods on the biology of *T. cordubensis*.

## MATERIAL AND METHODS

The population of *T. cordubensis* used in this study was established from field-collected parasitized eggs in Ribeira do Guilherme (Azores), and reared on eggs of *Ephesia kuehniella* ZELLER (Lep., Pyralidae) (TAVARES & VIEIRA, 1992).

The effects of three different photophase (L) : scotophase (D) combinations on fecundity (number of host eggs that turned black after parasitization), longevity, egg-adult developmental time and adult emergence of *T. cordubensis* were determined. These light:dark combinations simulated the day length of summer (16:8), winter (8:16) and spring or autumn (12:12) seasons in the Azores. All treatments were held in bioclimatic chambers at  $20 \pm 0.5^\circ\text{C}$  with R.H. of  $70 \pm 5\%$ .

For each photoperiod, 40 females with less than 24 hours were individually isolated in glass tubes (7x1 cm) containing a card with  $200 \pm 10.7$  eggs of *E. kuehniella* and a drop of honey for feed. The host eggs had less than 24 hours and had been previously irradiated with ultra-violet for 20 minutes. The egg cards were daily replaced by fresh ones, and parasitized eggs were allowed to develop at the same conditions of its parents.

The number of parasitized eggs was counted (hatched and not hatched), as well as the number of hatched offspring. The number of dead females was daily observed.

An analysis of variance (ANOVA) was conducted. When statistical differences existed between data sets ( $p < 0.05$ ), a Scheffé test was used to separate the differing means. Data were transformed by  $\sqrt{x+0.5}$  or  $\arcsin \sqrt{x}$  to reduce variance differences (ZHAR, 1996).

## RESULTS AND DISCUSSION

Fecundity was not significantly affected by the different photophase:scotophase combinations. However, the highest fecundity was observed for 12L:12D, and the lowest for 8L:16D (Table 1).

	16L:8D	12L:12:D	8L:16D
<b>Fecundity</b>	73.6±31.2	75.8±26.8	72.2±23.1
<b>Longevity (days)</b>	21.6±6.5	21.0±8.0	21.5±5.9
<b>Development(days)</b>	19.3±0.7 a	18.4±0.6 a	17.2±0.4 a
<b>Emergence (%)</b>	98.6±1.4	98.0±1.9	97.1±3.4

Means in the same row followed by the same Letter are significantly different (Scheffé Test,  $p < 0.05$ )

Table 1 Mean±standard deviation of the fecundity (no. of parasitized eggs per female), longevity, developmental time and adult emergence rates of *T. cordubensis* under different photophase:scotophase combinations

Parasitism was higher in the first day after emergence, with an average of  $14.8\pm7.6$  (16L:8D),  $17.8\pm4.6$  (12L:12D) and  $15.3\pm7.5$  (8L:16D) parasitized eggs per female. In the second day, the number of parasitized eggs strongly declined, and in the following days, these values tended to decrease towards zero, although with oscillating values along the time, regardless the photophase length (Figure 1. A, B, C).

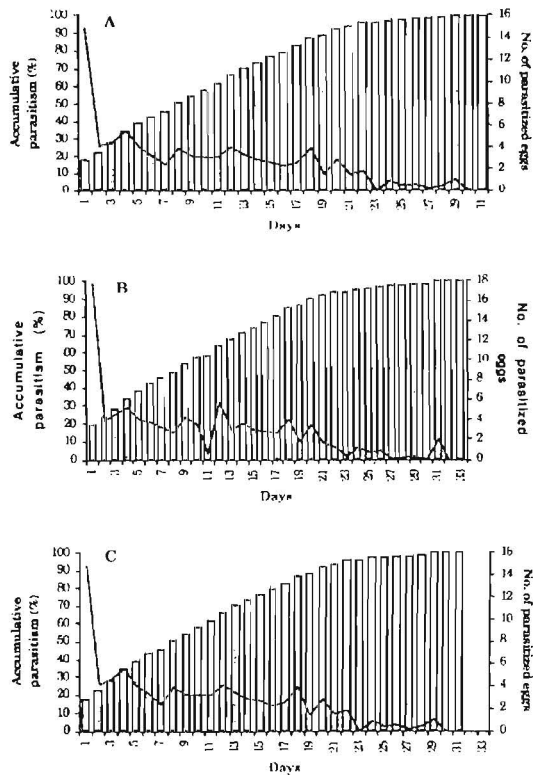


Figure 1. Mean number of parasitized eggs per female (---) and daily accumulative parasitism (%) of *T. cordubensis* under 16L:8D (A), 12L:12D (B) and 8L:16D (C)

Some authors have shown that the fecundity is not influenced by photophase length (CALVIN *et al.*, 1984; CÔNSOLI & PARRA, 1994). However, ZASLAVSKI & KVI (1982) verified that both in *T. evanescens* and *T. chilonis*, the number of eggs laid by progeny females depends on the length of the photophase in the this generation.

Regarding accumulative parasitism, this was more relevant in the first week reaching more than 40% of the parasitized eggs, for all photophase lengths.

For *T. cordubensis*, photophase had no significant effect on parasitoid's longevity (Table 1). CALVIN *et al.* (1984), concluded that the photophase length influenced the females longevity of *Trichogramma pretiosum*, but it did not had a significant effect on the males longevity. However, these authors observed that there appeared to be a trend of higher longevity with an increased photophase, in both sexes. On the contrary, CÔNSOLI & PARRA (1994), concluded that *T. galloi* females life span decreased with an increase in photophase. These contradictory results suggest that the photoperiod influence on the parasitoid longevity probably depends of each species ecological adaptations to their natural habitat.

No significant differences were found between all photophase:scotophase combinations for *T. cordubensis* emergence rates (Table 1). Similar results were obtained by CÔNSOLI & PARRA (1994) for *T. galloi*.

In egg parasitoids, several species are known to respond either to temperature or photoperiod as cues for timing the induction of diapause (VOEGELE *et al.*, 1986; LAING & CORRIGAN, 1995). In *Trichogramma evanescens*, photoperiod acts mostly on the adults while temperature is the most important factor for the developing larva and, together these two factors determine the induction of diapause (ZASLAVSKY & UMAROVA, 1982). CALVIN *et al.* (1984) verified that with decreasing photophase there was an increase on developmental time of *Trichogramma pretiosum*, possibly related with parasitoids quiescence. For *T. cordubensis*, developmental time was the only parameter that was significantly influenced by photophase length (ANOVA,  $F=583.8$ ,  $p<0.0001$ ). However, for this species, as day length increased, developmental time enlarged. A possible explanation for this may relay on the emergence rhythms of *T. cordubensis*. Assuming that most of the adults of this species emerge during the scotophase, some parasitoids would have to delay the emergence to the next scotophase when the last is short (and day length is long), this way enlarging the developmental time.

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