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Trichogramma cordubensis (Hym., Trichogrammatidae): a dynamics study of an Azorean population

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Abstract

Following a previous survey of oophagous parasitoids at Ribeira do Guilherme, São Miguel, Azores, a two-year trial for Lepidoptera eggs was undertaken in order to study their dynamics. Between November 1991 and November 1993 only two parasitoids were discovered: *Telenomus* sp. (Scelionidae) and *T. cordubensis*. During winter no eggs parasitized by *Trichogramma* were collected. From April to November 1992 and June to November 1993, eggs parasitized by *Telenomus* sp. and *T. cordubensis* were detected in the field. *Telenomus* sp. always appeared earlier in the season than *Trichogramma*. In the present paper, the plant/host/parasitoid interactions are discussed and a comparative analysis is made between the two-year field data.

Introduction

The oophagous parasitoids of the genus *Trichogramma* are used world wild as biological control agents against several agricultural pests. The success of parasitism in the fields is related with the host selection process, which depends on many environmental and host factors, involving chemical cues. The chemical cues produced by hosts are known as kairomones, and have a very important role in the stimulation of parasitoid searching behavior (Noldus, 1989; Noldus *et al.*, 1991; Frenoy *et al.*, 1992; Renou *et al.*, 1992). Other chemical cues are produced by different plants, which might stimulate the exploitation of hosts' egg laying sites by wasps (Nordlund *et al.*, 1985; Tumlinson *et al.*, 1993).

The host/parasitoid and plant/parasitoid interactions are thereby of major importance for biological control. The main objective of this work is to understand better these relations in a natural biotope, as well as the population dynamics of the oophagous parasitoids found in the fields.

Material and methods

Between November 1991 and November 1993, a weekly survey for Lepidoptera eggs on the following six plant species, was carried out at Ribeira do Guilherme - São Miguel, Azores: *Rubus* sp. (Rosaceae), *Rumex* spp. (Polygonaceae), *Scrophularia auriculata* L. (Scrophulariaceae), *Plantago lanceolata* L. (Plantaginaceae), *Polygonum capitatum* D. Don (Polygonaceae) and *Eupatorium adenophorum* Sprengel (Compositae). The Lepidoptera eggs were surveyed in 200 plants for each species, with the observation of three leafs per plant. The encountered eggs were individually isolated in glass tubes (7x1 cm) for observation of the hatching Lepidoptera larvae or parasitoids.

A ratio (Ir) was calculated between the parasitism percentages (regarding one or more hosts) for one parasitoid species and the total parasitism percentages (regarding the same hosts) for all encountered parasitoids species (Hawkins & Goeden, 1984; Rasplus, 1988; in Pintureau & Keita, 1990). A comparative analysis was made between the two-year field data, based on non-parametric tests (Kolmogrov-Smirnov). All data were transformed by sqrt(x+0.5) to reduce variance differences.

Results

During the two years trial, only two parasitoids were found: *Trichogramma cordubensis* Vargas & Cabello (Hym., Trichogrammatidae) and *Telenomus* sp. (Scelionidae).

Plant/parasitoid interaction

Lepidoptera eggs were collected on all the observed plants. However, on *S. auriculata, E. adenophorum* and *Rumex* spp., the collected number of Lepidoptera eggs was much higher than on the others. In the survey's second year, we captured more eggs on all plants, with the exception of *P. lanceolata* (table 1 & 2).

Table 1: Collected eggs number, and annual parasitism percentages for *T. cordubensis* and *Telenomus* sp. during two successive years. *: Significant difference ($p<0.05$) between years (Kolmogrov-Smirnov test). (*S. auriculata, E. adenophorum* and *Rumex* spp.).

	S. auriculata		*E. adenophorum*		*Rumex spp.*	
	91/92	92/93	91/92	92/93	91/92	92/93
Eggs	2082 *	4931 *	2320	3740	1214	2638
Telenomus sp. (%)	5.52	3.31	1.68	7.20	3.30	1.93
T. cordubensis (%)	3.41 *	6.69 *	5.73	5.10	0.82	4.09

Table 2: Collected eggs number, and annual parasitism percentages for *T. cordubensis* and *Telenomus* sp. during two successive years. *: Significant difference ($p<0.05$) between years (Kolmogrov-Smirnov test). (*Rubus* sp., *P. lanceolata* and *P. capitatum*).

	Rubus sp.		*P. lanceolata*		*P. capitatum*	
	91/92	92/93	91/92	92/93	91/92	92/93
Eggs	258 *	2905 *	922	322	168 *	446 *
Telenomus sp. (%)	1.16	0.14	3.69	6.52	10.71	4.26
T. cordubensis (%)	1.64	1.06	0.00	1.55	1.79	0.67

Concerning parasitism, we found, on all plants, eggs parasitized by *Telenomus* sp. and *T. cordubensis*, but their parasitism percentages varied between plant. For both parasitoids, parasitism percentages were higher on *S. auriculata* and *E. adenophorum*, followed by *Rumex* spp. On *Rubus* sp., the collected number of parasitized eggs was very low when compared with the other plants. On *P. capitatum* and *P. lanceolata*, most of the eggs were parasitized by *Telenomus* sp. The parasitism percentages for both parasitoids increased during the summer, which is related with a higher number of host eggs detected on the plants during this season.

Host/parasitoid interaction

Several Lepidoptera species were captured during this study: *Authographa gamma* L. (Lep., Noctuidae), *Peridroma saucia* Hübner (Lep., Noctuidae), *Chrysodeixis chalcites* Esper (Lep., Noctuidae), *Udea ferrugalis* Hübner (Lep., Pyralidae), *Phlogophora meticulosa* L. (Lep., Noctuidae), *Xestia c-nigrum* L. (Lep., Noctuidae), *Noctua pronuba* L. (Lep., Noctuidae) and *Cynthia cardui* L. (Lep, Nymphalidae). All these species were parasitized by *T. cordubensis* and *Telenomus* sp., with the exceptions of *U. ferrugalis* and *C. cardui*, which were only parasitized by *T. cordubensis*.

In the present study we will take into account the first four Lepidoptera species only. For the others, the total number of collected eggs was very low (<100 eggs per year). There was a very good host/parasitoid temporal coincidence, with parasitoids occurrence in the field from April to November 1992 and June to November 1993. However, in 1993, few *U. ferrugalis* and *P. saucia* eggs, parasitized by *T. cordubensis*, were collected in December, and *Telenomus* sp. appeared isolated in February 1992 and January/February 1993, parasitizing *A. gamma* eggs. *Telenomus* sp. always appeared earlier in the season than *Trichogramma*. Finally, *T. cordubensis* parasitized the last collected eggs after the summer season.

Regarding annual parasitism ratios, we can verify that *A. gamma* eggs were almost equally parasitized by *Telenomus* sp. and *T. cordubensis* in both years. *T. cordubensis* parasitized a larger number of *P. saucia* eggs than *Telenomus* sp. (table 3). *P. saucia* egg masses were found to be simultaneously parasitized by both parasitoids.

Table 3: Annual ratios (Ir) concerning *T. cordubensis* and *Telenomus* sp. parasitism on four different hosts.

	A. gamma		*P. saucia*		*C. chalcites*		*U. ferrugalis*	
	91/92	92/93	91/92	92/93	91/92	92/93	91/92	92/93
Telenomus sp.	0.14	0.46	0.07	0.33	0.96	0.21	0.00	0.00
T. cordubensis	0.86	0.54	0.93	0.68	0.04	0.79	1.00	1.00

Significant differences ($p<0.05$) between the two years data were found only for *T. cordubensis* parasitism on *A. gamma*, and for the collected eggs number of *A. gamma* and *P. saucia*.

Conclusions

Differential parasitism associated with host plants has been previously reported (Magrini & Botelho, 1991). These differences might result from plant structural complexity (Andow & Prokrym, 1990), plant semiochemicals (Noldus, 1989) and the differential adsorption of the moth sex pheromone to leaf surface (Noldus *et al.*, 1991). In the present study, the effect of host plants on parasitism is revealed through different parasitism percentages obtained for each plant. For example, the presence of a large number of tricomes on *P. lanceolata* leafs might be the cause for the low number of *T. cordubensis* parasitized eggs found on this plant.

Results of this study show that *T. cordubensis* tend to be highly polyphagous (as well as *Telenomus* sp.) and occurs in close ecological association with *Telenomus* sp. Some host egg masses can be attacked by the two species simultaneously. However, we can observe great parasitism differences between the different hosts species. For example, *U. ferrugalis* eggs were only parasitized by *T. cordubensis* (which might be a consequence of the eggs' small dimensions) and *P. saucia* eggs were more attractive to *T. cordubensis* than to the other parasitoid.

Concerning the parasitoids population dynamics, no parasitized eggs were collected during the winter season (with few exceptions), and *Telenomus* sp. always appeared earlier in the summer season than *T. cordubensis*.

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