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Trichogramma
and other egg parasitoids

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Contribution to the study of the egg parasitic *Hymenoptera* of the Azores Islands

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Summary

During the summer of 1989, several Hymenoptera egg and non egg parasitoids were captured in the island of Sao Miguel, Azores. The non egg parasitoids belong to the Ichneumonoidea, Cynipoidea, Ceraphronoidea, Proctotrupeoidea (Diapriidae and Platygyasteridae) and Chalcidoidea (Aphelinidae and Eulophidae). The egg parasites are Proctotrupeoidea (Scelionidae) and Chalcidoidea (Mymaridae and Trichogrammatidae). These last ones belong to the genera: *Gryon*, *Telenomus*, *Ooconus*, *Anaphes* and *Trichogramma*. They are the first egg parasitoids to be recorded from the Azores. The *Trichogramma* is *T. cordubensis*, only known from Spain and North Africa.

Introduction

In biological control, it is frequent to introduce a parasitoids, then to look for it and to identify the local fauna. This happened in the Azores, where two species of *Trichogramma* were imported from Mexico and Morocco to control *Mythimna unipunctata* Haworth (Lep., Noctuidae). This control became, however, of little effectiveness and in 1989 we searched for eventual autochthonous parasitoids, not previously known. We found a certain number of Hymenoptera parasitoids, and among them several egg parasitoids.

Materials and methods

The capture of the Hymenoptera was done at random in several regions and at different altitudes, in the island of Sao Miguel: Furnas (300m), Sete Cidades (275m), Remédios (250m), Livramento (110m) and Rabo de Peixe (50m) (Fig. 1). We used a sikle shaped net for the capture of the adults and gathered all the

eggs (potential hosts) on several plants: *Lycopersicon esculentum* Mill. (Tubiflorae, Solanaceae), *Brassica campestris* L. (Rhoadales, Brassicaceae), *Pisum sativum* L. (Rosales, Fabaceae), *Rubus ulmifolius* Schott (Rosales, Rosaceae), *Mentha suaveoleus* Ehrh. (Tubiflorae, Labiaceae) and *Scrophularia auriculata* L. (Tubiflorae, Scrophulariaceae). The eggs were maintained in glass vials until hatching of larvae or emergence of parasitoids. These last ones were placed in 70% ethanol, and then mounted under coverslips in Canada balsam according to the technique of Baylac (1986).

The identification was derived from morphologic characteristics and the available keys (Gauld & Bolton, 1988; Medvedev, 1988). It was carried out to the genus level for all the egg parasitoids, except for the *Trichogramma* Westwood where the species level was reached. For this we used not only a morphological characterization but also an electrophoretic analysis. Two enzymatic systems were stained, esterases and superoxide dismutases (SOD), accor-



Figure 1 : Districts of the capture of the Hymenoptera in the Island of S. Miguel, Azores, 1989.

ding to the technique described by Pintureau (1987).

Three strains were studied, all presenting a thelytokous parthenogenesis. The analysed samples were composed of the *in toto* homogenate of 30 daughters of an isolated mother (30 samples of each strain for the esterases and 30 for SOD). As the morphological examinations needed some males, we tried to obtain some by submitting the strains to extreme temperatures : the whole development at 30°C or at 11°C ; 10 days at 6°C and the rest of the development at 23°C.

Results and discussion

Non oophagous parasitoid Hymenoptera. The individuals captured belong to five superfamilies (Ichneumonidae, Cynipoidea, Ceraphronoidea, Proctotrupoidea and Chalcidoidea). The Proctotrupoidea contained the Diapriidae and Platygasteridae, the Chalcidoidea contained Aphelinidae and Eulophidae.

Oophagous parasitoid Hymenoptera. The individuals captured belong to the superfamilies Proctotrupoidea and Chalcidoidea :

(1) Proctotrupoidea. Unidentified species of two genera of Scalionidae were found :

- *Gryon* sp., captured by net in Furnas on the 14th of July. This genus is parasite of eggs of Lepidoptera and Heteroptera according to Medvedev (1988).

- *Telenomus* sp. A. captured in Furnas from 13 to 19 July.

- *Telenomus* sp. B. This species was captured in Remédios, Furnas and Livramento by net on the 15th and the 21st of July, and emerged from noctuid eggs collected from 15 to 21 of July, during the month of August and at the beginning of September. A laboratory multiplication was possible on the eggs of *Sesamia nonagrioides* Left. (Lep., Noctuidae), but not on the eggs of *Ephestia kuehniella* Zeller (Lep., Pyralidae).

(2) Chalcidoidea. The Mymaridae are represented by two genera :

- *Ooctonus* sp. captured by net in Furnas on the 14th and the 17th of July. This genus is known as a Diptera and Homoptera egg parasitoid.

- *Anaphes* sp. captured by net in Furnas on the 17th of July. This genus is known as a Coleoptera, Diptera, Heteroptera and Homoptera egg parasitoid.

The Trichogrammatidae are only represented by *Trichogramma cordubensis* Vargas & Cabello. A specimen was captured by net in Furnas in July and others emerged from several eggs : one egg of *Acherontia atropos* L. (Lep., Sphingidae) collected on *B.campestris* on the 21st of July in Remédios (from which 11 females emerged), eggs of Noctuidae collected on *L.esculentum*, *B.campestris*, *P.sativum* and *R.ulmifolius* during July, August and September in Remédios, Livramento and Rabo de Peixe.

Trichogramma captured in each of the three regions (Livramento, Remédios and Rabo de Peixe) were reared on *E.kuehniella* eggs at 23°C. Notwithstanding the thelytokous par-

thenogenesis, three males were obtained. Among the three thermal treatments used, two (30 and 11°C) produced only females, the 3rd one (6°C followed by 23°C) produced also intersexual individuals (with male antennae and females genitalia organs). The identification was based on the successive used of three groups of characteristics :

(1) Electrophoresis of esterases.

No polymorphism was noticed. The genes Est 1^{0,13}, Est 2^{0,22}, Est 4^{0,51 bis} and Est 5^{0,44} permitted to conclude that our *Trichogramma* may belong to the following groups : *evanescens*, *minutum*, *chilonis*, *japonicum*, *maltbyi* and *achaeae*.

(2) External morphology.

The body is dark yellow, except the abdomen which is brown-yellow over the distal half of the ventral part and presents four zones over the dorsal part (from anterior to posterior part : dark yellow, brown, very dark yellow and brown).

The antenna (Fig.2a) is characterized by setae of moderate length (the length of the longest seta/width of the antenna <3), which allows us to eliminate the groups *evanescens* and *japonicum*.

The shape of the genitalia (Fig.2b) allowed

also the elimination of several groups : *chilonis*, *maltbyi*, *achaeae*. Therefore, there is only the *minutum* group left. Among the species of this group, only *T.cordubensis* has genitalia similar to those of our individuals.

(3) Electrophoresis of the SOD.

This analysis was carried out to confirm our identification. Indeed, *T.cordubensis* presents a characteristic band, corresponding to TO 2^{0,17}, found in all studied specimens.

Conclusion

We found out that the auxiliary entomological fauna of the island of Sao Miguel, includes Hymenoptera widely used in biological control : *Telenomus Haliday* and *Trichogramma*. The palearctic *T.cordubensis* was, up to now, only known in Spain, Morocco and Algeria.

Besides the systematic and zoogeographic aspects, our research leads to the breeding of several strains of the autochthonous *Trichogramma* which are going to be tested as possible biological control agents. We hope, then, to increase the efficiency of the control obtained up to now with introduced laboratory strains which seem poorly adapted to the Azores.

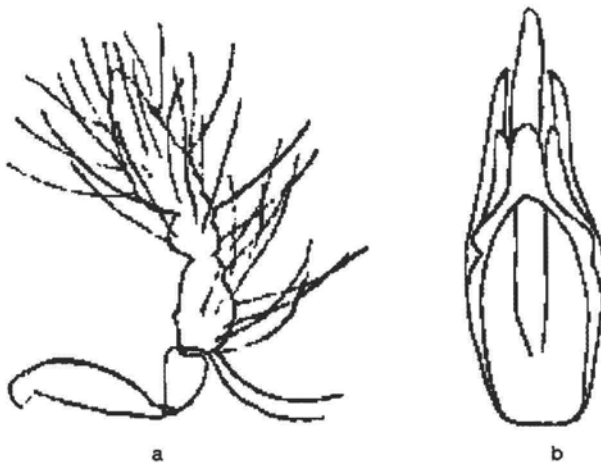


Figure 2 : Male antenna (a) and genitalia (b) of *T.cordubensis*.

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