

The Parasitoid Complex of *Liriomyza huidobrensis* in Cucumber Greenhouses in Izmir Province, Western Turkey

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Liriomyza huidobrensis (Blanchard) (Diptera: Agromyzidae) is an important pest in cucumber greenhouses in Çamönü (Menderes, Izmir), Turkey. In a study carried out in cucumber greenhouses during the spring and autumn seasons of 1999 and 2000, leaves were sampled weekly and kept in the laboratory to observe and count emerging leafminers and parasitoid adults. Five parasitoid species were collected: the braconids *Bracon intercessor* Nees von Esenbeck and *Opius meracus* Fischer, which occurred only in the spring; and the eulophids *Diglyphus crassinervis* Erdős, *Diglyphus isaea* (Walker) and *Neochrysocharis formosa* (Westwood), which occurred in both the spring and autumn seasons. *D. isaea* and *N. formosa* were the predominant parasitoid species found. *O. meracus* was recorded for the first time as a Turkish species and *B. intercessor* was recorded for the first time in *L. huidobrensis*. KEY WORDS: *Bracon intercessor*; *Diglyphus crassinervis*; *Diglyphus isaea*; *Liriomyza huidobrensis*; *Neochrysocharis formosa*; *Opius meracus*; cucumber; Turkey.

Liriomyza huidobrensis has spread virtually worldwide from South America (11,14). In Turkey it was first found in 1994 in the western (Izmir province) and southern (Adana province) regions of the country in vegetable greenhouses (3). It subsequently spread further within these regions, but not to other parts of the country, and is now an economic pest of great importance, especially in Izmir province, on cucumber and beans in greenhouses.

Liriomyza huidobrensis is highly polyphagous. Adult females perforate the upper and lower leaf epidermis with their ovipositor to feed and lay eggs. This behavior results in cosmetic damage to flower crops and also facilitates the spread of various plant diseases (4,7). Furthermore, *L. huidobrensis* larvae feed in the spongy mesophyll leaf layer,

which contains chloroplasts, thereby disrupting photosynthesis (10). Damage caused by *L. huidobrensis* is therefore both direct and indirect.

A number of parasitoids of *L. huidobrensis* have been recorded throughout the world (8,12,13). Most of the parasitoid species belong to three families of Hymenoptera: Braconidae, Eulophidae and Pteromalidae. The species of the Braconidae are endo- and ectoparasitoids on the egg and larval hosts, whereas those of Eulophidae are solitary or gregarious ectoparasitoids on larval and pupal hosts. Because of the rapid increase and spread of this pest, growers in Turkey have frequently applied large quantities of insecticides, especially in greenhouse environments. Insecticides have a negative impact on beneficial fauna (15). To control the leaf-mining flies by non-chemical means, it is necessary first

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to identify key parasitoid species. The aim of this research was to identify the naturally occurring parasitoids in non-insecticide-treated cucumber greenhouses.

This study was carried out during 1999 and 2000 in Çamönü (Menderes, Izmir, Turkey) on cucumber plants (*Cucumis sativus* L.) grown under non-insecticide-treated commercial greenhouse conditions. There are two growing seasons each year, from April to August and August to November. Greenhouses were planted with 'Gordion' F1 cucumbers on 10 April 1999, 12 August 1999, 8 April 2000 and 2 August 2000.

Greenhouses consisted of an iron framework covered with solid polyethylene. Roof and window ventilation ports were covered with insect-proof netting. Ten samples of leaves infested with leafminers were randomly collected starting one week after planting and continuing until the end of production. The cucumber leaves were kept in plastic culture containers (30 × 20 cm) at 25°C and 65% relative humidity. A sheet of absorbent paper was placed between each leaf in the container to prevent contact and the possibility of mold developing in the humid conditions. The infested leaves were kept in the containers for 3 weeks and the emerging parasitoids were counted and recorded according to their collection dates. The classification of the braconid parasitoids was done by Dr. Filiz İnanç (Trakya University, Turkey) and that of the eulophids by Dr. John La Salle (CSIRO Entomology, Australia). Data were analyzed by χ^2 (null hypothesis: all parasitoids would occur in equal numbers) each season.

Two braconid species (*Bracon intercessor* Nees von Esenbeck and *Opius meracus* Fischer) and three eulophid species (*Diglyphus*

crassinervis Erdős, *Diglyphus isaea* (Walker) and *Neochrysocharis formosa* (Westwood)) were found during the study; results are shown in Table 1. *B. intercessor* was found during only one spring (1999) growing season. Although this parasitoid has been found in Lepidoptera, Coleoptera and other Diptera (5), this is a first record in *L. huidobrensis* (F. İnanç, personal communication). *O. meracus* was found during the spring growing seasons only. It is typically found in agromyzid flies (5), but this is the first time it was recorded in Turkey (9). *D. crassinervis* was found on leafminer-infested leaves in both spring and autumn seasons. *D. isaea* individuals were also detected in both spring and autumn seasons. This important ectoparasitoid has been recorded worldwide on agromyzid species (6) and its biology is well known (1). *N. formosa*, found in both spring and autumn seasons, was the most abundant parasitoid identified in this study (Table 1). Cabello *et al.* (2) also reported *N. formosa* as the most abundant parasitoid in a study of greenhouses in southern Spain.

The number of parasitized *L. huidobrensis* was relatively low because the greenhouse was constructed of solid walls (as opposed to screening) and the ventilation windows were covered with insect-proof netting. The results of these trials show that since two parasitoids, *N. formosa* and *D. isaea*, occurred in almost every season, they could potentially be used for control of *L. huidobrensis*. Furthermore, since new records were established for Turkish fauna and for parasitoids of *L. huidobrensis*, this raises the possibility that there might be an even greater variety of leafminer parasitoids found should trials be conducted in unprotected crops.

TABLE 1. Total number of *Liriomyza huidobrensis* and parasitoids reared from cucumber leaves

Season	Number of leaves	<i>L. huidobrensis</i>	<i>Bracon intercessor</i>	<i>Opius meracus</i>	<i>Diglyphus crassinervis</i>	<i>Diglyphus isaea</i>	<i>Neochrysocharis formosa</i>
1999 spring	160	695	4 a	13 b	3 a	5 a	8 b
1999 autumn	130	772	0	0	0	0	14
2000 spring	90*	144	0	4 a	1 a	8 b	17 b
2000 autumn	150	892	0	0	5 a	12 b	14 b

Within rows, numbers followed by a common letter do not differ significantly at $P < 0.05$.

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