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Contribution to the knowledge of Agromyzidae (Diptera) in the cultivated vegetables of Greece (*)

Abstract - Between September 1996 and October 1997 in Greece an extensive study of the Agromyzidae attacking cultivated vegetables in the field as well as in greenhouses was carried out. The following species were collected: *Liriomyza strigata* (Meigen), *L. bryoniae* (Kaltenbach), *L. huidobrensis* (Blanchard) *L. trifolii* (Burgess) and *Chromatomyia horticola* (Goureau). *L. huidobrensis* was found to be the most wide-spread, with higher populations than all the others; it was present in all the samples coming from different regions, attacking cultivated vegetables both in fields and in greenhouses. *L. strigata* and *L. bryoniae* have fewer hosts and they were found in lower populations than the previous species. *L. strigata* attacks leaves of tomato, bean, eggplant, cucumber and squash plant in Central and Southern Greece as well as the Oriental Aegean Islands. *L. bryoniae* infests tomato, bean, cucumber and okra in North Greece and in Cyclades Islands. *L. trifolii* was found only on bean and tomato leaves in Southern Greece and Crete. Finally *Chr. horticola* was found on tomato leaves in Attica and on eggplant leaves in the Western Coast of Greece.

Riassunto - *Contributo alla conoscenza degli Agromizidi delle colture ortensi in Grecia.*

Durante il periodo da settembre 1996 ad ottobre 1997 è stata effettuata una ricerca sugli Agromizidi che attaccano le colture di piante ortive,sia in serra che in pieno campo, in Grecia.
Sono state raccolte: *Liriomyza strigata* (Meigen), *L. bryoniae* (Kaltenbach), *L. huidobrensis* (Blanchard), *L. trifolii* (Burgess) e *Chromatomyia horticola* (Goureau). Da queste, *L. huidobrensis* è la più comune, perchè si trova con forti popolazioni, dispersa in tutte le parti della penisola e sulle isole, attaccando tutte le colture ortive, tra cui in particolare pomodoro, fagiolo, patata, cetriolo, zucca e sedano. *L. strigata* e *L. bryoniae* si trovano con popolazioni più ridotte su un numero inferiore di piante ortive. *L. strigata* infesta le coltivazioni di pomodoro, fagiolo, melanzana, cetriolo e zucca nella Grecia del sud e centrale, come pure sulle isole del mar Egeo orientale, mentre *L. bryoniae* preferisce le coltivazioni

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di pomodoro, fagiolo, cetriolo e *Hibiscus esculentus*, nella Grecia del nord e sulle isole Cicladi. *L. trifolii* , malgrado la polifagia, è limitata solo alle coltivazioni di fagiolo e di pomodoro del territorio continentale del sud della Grecia e a Creta. *Chr. horticola* è stata trovata in coltivazioni di pomodoro in Attica, come pure nella Grecia centro-occidentale su melanzana.

Key words: Agromyzidae, *Liriomyza strigata, Liriomyza bryoniae, Liriomyza huidobrensis, Liriomyza trifolii, Chromatomyia horticola,* vegetables.

Agromyzidae attack cultivated vegetables and ornamentals, in fields as well as in greenhouses, besides wild plants. Until today more than 2.500 species have been described. The most destructive ones belong to the genera *Liriomyza* Mik, *Phytomyza* Fallèn, and *Chromatomyia* Hardy (Spencer, 1973); specifically in the genus *Liriomyza* about 50 species attack cultivated vegetables (Spencer, 1973; Martinez, 1993). *Liriomyza strigata* (Meigen), *L. bryoniae* (Kaltenbach), *L. huidobrensis* (Blanchard), *L. sativae* (Blanchard) and *L. trifolii* (Burgess) are considered to be of economic importance. These species are polyphagous, with a rather large geographic distribution. *L. strigata* and *L. bryoniae* are palaearctic species, meanwhile *L. huidobrensis* and *L. trifolii* are from the nearctic region. Only two species of the genus *Chromatomyia*, *Chr. horticola* (Goureau) and *Chr. syngenesiae* (Hardy) are harmful. These species are very similar and for many years they were considered to be *Phytomyza atricornis* (Meigen), until Griffiths (1967) reviewed the species on the basis of male genitalia.

Liriomyza spp. in particulary are considered to be "new" pests of the cultivated plants, given the fact that serious problems in the crops appeared at the beginning of the 80's. Today these are among the harmful pests in field as well as in greenhouses.

Studies on Agromyzidae in Greece are limited and so is the bibliography. Some information exists about *L. bryoniae* and *L. huidobrensis* in Crete, recorded for the first time in 1992 (Roditakis, 1993). Very little is known also about the phenology of *L. huidobrensis* (Roditakis & Golfinopoulou, 1995) as well as its control in greenhouses (Roditakis & Roditakis, 1995). Finally some information concerning leaf miners in Greece can be found in relation to Integrated Pest Management of vegetables in greenhouses (Michelakis, 1983; Nucifora & Michelakis, 1984).

The main object of this work is to record the harmful leaf miners attacking vegetables cultivated in Greece along with their geographic distribution in the various agricultural ecosystems of continental Greece and of the maritime regions, given the fact that the climatological conditions and especially temperature play a very important role in the distribution and in the population density of these insects (Spencer, 1973).

MATERIALS AND METHODS

Eighty-nine leaf samples were collected from various regions of Continental Greece and the Greek Islands during the period September 1996 - October 1997. Each sample was placed in separate plastic trays and the leaves were placed in a stack, with wet cotton paper between them. The cotton paper was kept wet by spraying twice a day with tap water. In this way the infected leaves were kept fresh to let the larvae complete the life cycle. The adults from each sample were preserved in 75% ethyl alcohol until their identification.

RESULTS AND DISCUSSION

The vegetables grown in Greece are infested by *Liriomyza strigata, L. bryoniae, L. huidobrensis, L. trifolii* and *Chromatomyia horticola.*

L. huidobrensis was found in 52 samples, *L. bryoniae* in 16, *L. strigata* in 11, *L. trifolii* in 4 and *Chr. horticola* in 2 samples (Table 1).

Table 1- Species found in various vegetables in Greece.

Species	No. of samples	No. of insects /sample	No. of males /sample	No. of females /sample
L. huidobrensis	52	836	358	478
L. bryoniae	16	141	60	81
L. strigata	11	145	69	76
L. trifolii	4	37	22	15
Chr. horticola	2	2	2	0
L. huidobrensis - L. strigata ?	3	18	0	18
Chr. horticola ?	1	3	0	3
TOTAL :	89	1182	511	671

?=only ♀♀ were collected.

The analysis of the data according to the "preference" of the Agromyzidae show that tomato comes in the first place since all the five species found are attacking this plant (Table 2). Bean plants are the second choice since we were able to find *L. huidobrensis, L. bryoniae, L. strigata* and *L. trifolii*, meanwhile in cucumber leaves were found *L. huidobrensis, L. bryoniae* and *L. strigata.*

For the remaining vegetables it appears that eggplant is infested by *L. strigata* and *Chr. horticola* and squash by *L. huidobrensis* and *L. strigata.* Finally *L. bryoniae* attacks *Hibiscus esculentus* (okra) and *L. huidobrensis* celery. Additionally *L. huidobrensis* was the most widely spread leaf miner since it was found in high populations in Continental and maritime regions of Greece (Fig.1). This insect is wide-spread in countries of N. and S. America, in all the European countries and it has been found in the Hawaian Islands, in the Reunion and Seychelles Islands (Chavez & Raman, 1987; Martinez, 1993; Olivera *et al.,* 1993; Trouve *et al.,* 1993; Cabello *et al.,* 1994).

L. bryoniae follows with a lower numbers of records. It was found to attack numerous vegetables of many regions of Greece except Thessaly and the Ionian Islands. In contrast *L. strigata* was not found in regions north of the 40° parallel (Macedonia, Thrace). This preliminary observations indicate that this leaf miner is a harmful insect for the vegetables in Greece.

Although it is considered to be a palaearctic species in some regions of Europe it is not included between the insects of economic importance since the damages induced are considered to be rather localized (Olivera *et al.*, 1993).

The geographic distribution of *L. trifolii* in Greece appears to be rather limited since it was found in few regions, south of the 39° parallel attacking only bean and tomato plants. The host preference of this leaf miner as well as its relatively limited range has to be verified in the future since it is known that *L. trifolii* attacks more than 120 species of plants (Spencer, 1973; Arzone, 1979; Süss, 1985, 1988; Parrella, 1987); of these 40% are *Compositae (Asteraceae)* and 15% are *Leguminosae* (Stegmaier, 1966, 1968; Spencer, 1973; Powell, 1981). Additionally it is known that this leaf miner is considered to be one of the most harmful Agromyzidae since attacks plants of the families Caryophyllaceae, Chenopodiaceae, Compositae Cucurbitaceae, Leguminosae, Liliaceae, Malvaceae, Solanaceae, Umbelliferae and Zygophyllaceae (Stegmaier, 1966).

In Europe *L. trifolii* attacks many vegetables in greenhouses (Lyon *et al.*, 1989) among them melon, cucumber, squash, bean and celery (Del Bene, 1984; Süss, 1985; Calabretta *et al.*, 1987) meanwhile accidentally was found on barley (Süss, 1988). The host range of *L. trifolii* in the various regions appears to be influenced by the temperature since this insect can survive in areas with cold climate, while the attacks are limited in vegetables grown in greenhouses (Spencer, 1973). It was confirmed in laboratory that the behavior of this insect depends on the temperature (Leibee, 1984; Olivera *et al.,* 1993).

Chr. horticola, was found only in two samples, the first in tomato from Attica and the second one in eggplant from the coast of Central Western Greece (Table 2).

Table 2 - Agromyzidae in Greece on cultivated vegetables.

	Species				
Host	*Liriomyza huidobrensis*	*Liriomyza bryoniae*	*Liriomyza strigata*	*Liriomyza trifolii*	*Chromatom. horticola*
Tomato	■	■	■	■	■
Bean	■	■	■	■	
Eggplant			■		■
Potato	■				
Cucumber	■	■	■		
Squash	■		■		
Okra		■			
Celery	■				

Chr. horticola is considered to be polyphagous since it attacks more than 34 plant families, among them the most representatives are Compositae, Cruciferae, Curcubitaceae and Leguminosae (Griffiths, 1967). In relation of its geographic range *Chr. horticola* is considered to be very common in the Mediterranean area and N. European regions (C.A.B., 1987).

In samples from the islands of the Eastern Aegean were found some Braconidae (*Opius pallipes* Wesmael, *Dacnusa sibirica* Telenga and *D. austriaca* Fischer); their population do not appear to limit the density of the Agromyzidae since they were found in a few cases.

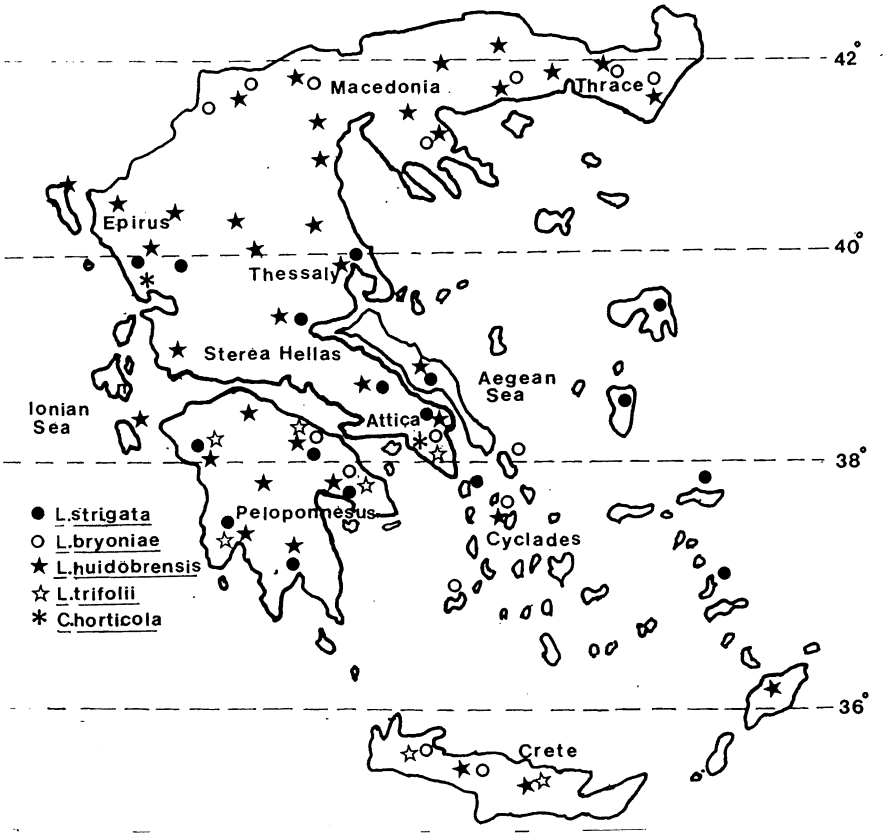

Fig.1 - Distribution of polyphagous leaf miners in Greece.

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