

Full Length Research Paper

Parasitoids of the leafminers (Diptera: Agromyzidae) from Elazığ Province, Turkey

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This study was carried out to determine parasitoid species attacking leafminers in the family Agromyzidae (Diptera) in Elazığ province during 2009-2010. Infested leaves with leafminer larvae were collected from both cultivated and non-cultivated plants twice a month. Adult parasitoids were obtained by rearing them from infested leaves in the laboratory. Four parasitoid species belonging to the Braconidae (Hymenoptera); *Opius* (*Opius*) *agromyzicola* Fischer, *Phaerotoma diversa* (Szépligeti), *Pseudopezomachus cursitans* (Ferrière), and *Xynobius* (*Xynobius*) *discoidalis* (Fischer) and eight parasitoid species; belonging to the Eulophidae (Hymenoptera); *Chrysocharis liriomyzae* Delucchi, *Cirrospilus lyncus* Walker, *Closterocerus formosus* (Westwood), *Diglyphus isaea* (Walker, 1838), *D. minoens* (Walker), *D. pachyneurus* Graham, and two of Pteromalidae: *Halticoptera circulus* (Walker), and *H. patellana* (Dalman) were found. Among the parasitoids reared, *C. lyncus*, *C. formosus*, *H. circulus*, and *H. patellana* were recorded for the first time from species of Agromyzidae in Turkey. In this study, the percentage of *O. agromyzicola*, *P. diversa*, *P. cursitans*, and *C.* was generally low. *D. isaea* was the predominant parasitoid species found, accounting for 47.66% of parasitism.

Key words: Parasitoid, leafminer, Elazığ, Turkey.

INTRODUCTION

Agromyzidae (leafmining flies) is one of the largest fly families, with more than 2742 valid species belonging to 27 genera worldwide (Spencer, 1989). Agromyzids are typically phytophagous, with larvae living in tissues of living plants. Larvae of most leafminers feed within the leaf parenchyma. Some species are serious pests of cultivated plants, for example, *Liriomyza* spp. (Spencer, 1973, 1990; Cerny et al., 2001). *Liriomyza* is a cosmopolitan group of pests that consists of more than 300 species. Larvae of this genus are polyphagous, attacking ornamental and vegetable crops in the families Asteraceae, Brassicaceae, Cucurbitaceae, Fabaceae, Solanaceae, and many other families of plants. Infestation by *Liriomyza* spp., can cause both direct and indirect damage. Such harms cause plants to lose 98% leaves and chlorophyll content of them with water loss being stimulated to increase (Yıldırım et al., 2010). *Liriomyza* spp., are known to have many natural

enemies, particularly in their native home in the New World. In Asia 41 species of parasitoids in four different families were found (Chien and Ku, 1998; Lin and Wang, 1992; Murphy and La Salle, 1999). However, in general and under natural conditions, parasitism is usually low early in crop development and gradually increases as the crop matures (Parralle, 1987). At least 23 species of parasitoids have been used in biological control programmes against *Liriomyza trifolii* Burgess and *L. sativae* Blanchard (Diptera: Agromyzidae) in Senegal, California, Hawaii, Barbados, Marianas, Tonga, Taiwan and Guam (Petcharat et al., 2002). Also, There are a number of parasitoids of *L. huidobrensis* (Blanchard) recorded worldwide (Neder et al., 1985; La Salle and Parrella, 1991; Schuster, 1993; Shepard et al., 1998).

Parasitoid assemblages of dipteran leafminers are dominated by Eulophidae, Braconidae and Pteromalidae that attack the larval and pupal stages of the flies. Overall,

data from agricultural ecosystems suggest that agromyzid leafminers are attacked by a diverse assemblage of hymenopteran parasitoids that often are responsible for significant levels of leafminer mortality (Gratton and Welter, 2001). Parasitoids also have been used successfully to control leafminer infestations in greenhouses (Minkenbergh and van Lenteren, 1986).

Many factors induce leafminer outbreaks, but the loss of natural enemies due to widespread use of insecticides is one of the most important. Parasitoids are the major group of natural enemies of leafminers, and they have played a very important role in leafminer suppression in natural ecosystems or cultivated areas with reduced insecticide use. Leafminer parasitoids have been intensively and extensively investigated and evaluated in many countries with more than 100 species reported, and several species, such as *Diglyphus begini* (Ashmead) (Hymenoptera: Eulophidae), and *Dacnusa sibirica* Telenga (Hymenoptera: Braconidae), have been successfully used as biological control agents in commercial greenhouses planted with vegetables and ornamentals, especially tomato and *Chrysanthemum* spp., in Europe and North America (Chen et al., 2003; Johnson, 1993; Murphy and La Salle, 1999). *Diglyphus isaea* (Walker) (Hymenoptera: Eulophidae), and its congener, *D. begini*, are effective augmentative biological control agents against *Liriomyza* leafminers infesting a wide range of greenhouse and field-grown crops and ornamentals (Öncüer, 1991).

In Turkey, 64 parasitoid species of leafminers have been identified (Campobasso et al., 1999; Civelek and Önder, 1999; Civelek, 2002; Civelek et al. 2002, 2006, 2008; Çıkman and Uygun, 2003; Civelek and La Salle, 2005; Çıkman and Doğanlar, 2006; Çıkman and La Salle, 2011; Gençer, 2004, 2005; Öncüer, 1991; Uygun et al., 1995). The goal of this study is to contribute to the naturally occurring parasitoids and percentage of parasitoid species of leafminers in East Turkey.

Also this study will provide a base for future research regarding the biological control of leafminer species. Representative species were deposited in the laboratories of the Harran University, Agricultural Faculty, Plant Protection Department; Şanlıurfa, Turkey.

MATERIALS AND METHODS

This study was carried out during 2009 and 2010 in Elazığ province, which was divided into four sub-areas for convenience of the collection of the specimens. The leafminer species were collected from both cultivated and non-cultivated plants in different areas twice in a month.

Samples of leaves infested with leafminers were randomly collected from the first week of spring (March) until the end of the autumn (November). Leafminer-infested leaves were taken to the laboratory at 25 ± 2°C, 70 ± 5% RH, photoperiod 14:10 (L:D) h for the emergence of pests and parasitoids. A small piece of leaf containing the larvae was cut and placed in a small glass vial and

then closed with a cotton ball covered with muslin. They were checked for the emergence of leafminers and parasitoids and relevant notes were recorded. After the completion of emergence, all reared pest and parasitoids specimens were identified.

The emerged Braconidae were identified by Prof. Dr. Ahmet Beyarslan (Trakya University, Art and Science Faculty, Biology Department, Edirne), Eulophidae were identified by Prof. Dr. Miktaf Doğanlar (Mustafa Kemal University, Agricultural Faculty, Plant Protection Department, Hatay) and Dr. John La Salle (CSIRO Entomology, Australia). The species of Agromyzidae were identified by Dr. Emine Çıkman (Harran University, Agricultural Faculty, Plant Protection Department, Şanlıurfa, Turkey). Representative species were deposited in the laboratory of Harran University, Agricultural Faculty, Plant Protection Department, Şanlıurfa, Turkey.

RESULTS

In this study 12 parasitoid species were identified. Among these species *C. lycus*, *C. formosus*, *H. circulus*, and *H. patellana* were recorded for the first time in species of Agromyzidae in Turkey.

Diglyphus isaea and *D. minoëus* were recorded as the most common parasitoid species. Thus, these species were considered to be the most important natural enemies of the Agromyzidae in Elazığ province. The ecological and distribution information of these twelve species are provided below. The taxa are presented alphabetically.

Braconidae

Opius Wesmael, 1835

Opius agromyzicola Fischer

Material examined: *O. agromyzicola* was found in Sivrice (Elazığ), 38° 26' 49.1"N, 39° 18' 30.3" E, 1280 m *Agromyza potentillae* Kaltenbach on *Fragaria* spp., on 07.IX.2010 (1♀, 1♂).

Host: *A. potentillae* (Diptera: Agromyzidae) (Yu et al., 2006).

O. agromyzicola is a new record from Agromyzidae in Turkey.

General Distribution: Europe, Oriental, and Western Palaearct regions (Yu et al., 2006).

Distribution in Turkey: Elazığ, Malatya, (Çıkman et al., 2009), Amasra, Bayburt, and Kırklareli (Beyarslan and Fischer, 2011),

Phaedrotoma Förster, 1862

Phaedrotoma diversa (Szépligeti)

Material examined: *Phaedrotoma diversa* was found in Akmezra (Center) 38° 39' 08.3"N, 39° 25' 16.9" E, 842 m on *Chromatomyia horticola* (Goureau) on *Portulaca oleracea* Linnaeus, on 07.IX.2010 (1♀, 2♂).

Host: *Calycomyza solidaginis* (Kaltenbach), *C. horticola*, *C. succisae* (Hering), *C. scabiosae* (Hendel), *C. syngenesiae* (Hardy), *Liriomyza centaureae* Hering *Phytomyza gentianae* Hendel, *P. plantaginis*, (Diptera: Agromyzidae) (Yu et al., 2006; Çıkman and La Salle, 2011).

This species has previously been recorded from *C. horticola* and *P. plantaginis* in Turkey (Çıkman and La Salle, 2011).

General Distribution: Palaearctic region (Yu et al., 2006).

Distribution in Turkey: Adana, Antalya, Aydın, Bolu, Burdur, Bursa, Denizli, Edirne, Isparta, İzmir, Karabük, Kastamonu, Kırklareli, Muğla, Sanliurfa, Tekirdag, Van, Zonguldak (Fischer and Beyarslan, 2005), Elazığ (Çıkman et al., 2009), Malatya (Çıkman and La Salle, 2011)

***Pseudopezomachus*, Mantero, 1905**

***Pseudopezomachus cursitans* (Ferrière)**

Material examined: *Pseudopezomachus cursitans* was found in Baskil (Bağdere), 38° 60' 44.7"N, 39° 04' 73.7" E, 1153 m on *C. horticola* on *Sinapis arvensis* Linnaeus, on 27.IV.2010. (2♀♀, 2♂♂).

Host: *Liriomyza* spp., *Phytomyza ferulae* Hering, *P. obscura* Hendel (Diptera: Agromyzidae) (Yu et al., 2006).

Pseudopezomachus cursitans has previously been recorded from *C. horticola*. In Turkey (Çıkman and La Salle, 2011).

General Distribution: Western Palaearctic (Yu et al., 2006).

Distribution in Turkey: Elazığ (Çıkman and La Salle, 2011).

***Xynobius* Förster, 1862**

***Xynobius discoidalis* (Fischer)**

Material examined: *Xynobius discoidalis* was found in Yazılıkonak (Center), 38° 38' 13.7"N, 39° 20' 33.7" E, 884 m on *Japanagromyza salicifolii* (Collin), on *Populus* sp., 27.IV.2009. (2♀♀, 4♂♂).

Host: *Japanagromyza salicifolii* (Diptera: Agromyzidae) (Çıkman and La Salle, 2011).

Xynobius discoidalis has previously been recorded from *J. salicifolii* in Turkey (Çıkman and La Salle, 2011).

General Distribution: Western Palaearctic (Yu et al., 2006).

Distribution in Turkey: Malatya (Çıkman and La Salle, 2011).

Eulophidae

***Chrysocharis* Foerster, 1856**

***Chrysocharis liriomyzae* Delucchi**

Material examined: *Chrysocharis liriomyzae* was found in

Yazılıkonak (Center), 38° 38' 13.7"N, 39° 20' 33.7" E, 884 m on *C. horticola* on *Sonchus* sp. 27.IV.2009 (2♀♀, 3♂♂); Havaalanı 38° 36' 03.9"N, 39° 17' 22.7", 881 m on *C. horticola* on *Xanthium* sp., 07.IX.2010 (1♀♀, 1♂♂).

Host: *Agromyza frontella* (Diptera: Agromyzidae) (Heimpel and Meloche, 2001); *C. horticola*, *L. trifolii* (Çıkman and Uygun, 2003).

This parasitoid species has previously been recorded from *C. horticola* in Turkey (Çıkman and Uygun, 2003; Çıkman et al., 2006).

General Distribution: Cosmopolitan species. Europe, Asia, North Africa, Canada, USA (Hansson, 1985).

Distribution in Turkey: Şanlıurfa (Çıkman and Uygun, 2003); Diyarbakır (Çıkman et al., 2006), Malatya (Çıkman and La Salle, 2011).

***Cirrospilus* Westwood, 1832**

***Cirrospilus lynceus* Walker**

Material examined: *Cirrospilus lynceus* was found in Havaalanı (Elazığ) on 38° 27' 10.1"N, 38° 22' 33.11,9" E, 776 m on *Agromyza albitarsis* Meigen, on *Triticum* Linnaeus, 29.IV.2010 (2♀♀, 2♂♂).

Hosts: *C. lynceus* is a parasitoid mainly of Eriocraniidae, Gracillariidae, Lyonetiidae, Nepticulidae (Lepidoptera), but will also more rarely act as a parasitoid of diptera or even can act as a facultative hyperparasitoid (Noyes, 2004).

This parasitoid species has previously been recorded from *Tischeria clodonea* Stainton (Lepidoptera) (Boucek and Askew, 1968), *Phyllocnistis citrella* Stainton (Lepidoptera: Gracillariidae: Phyllocnistinae) in Turkey (Elekçioğlu and Uygun, 2006).

Cirrospilus lynceus is a new record from Agromyzidae in Turkey.

General Distribution: Widespread throughout the Holarctic region, (Noyes, 2004).

Distribution in Turkey: Mediterranean region (Elekçioğlu and Uygun, 2006).

***Closterocerus* Walker, 1848**

***Closterocerus formosus* (Westwood)**

Material examined: *Closterocerus formosus* was found in Palu (Merkez) on 38° 42' 10.1"N, 39° 59' 12.10,4" E, 975 m on *C. horticola* on *P. oleracea*, on 05.V.2009 (2♂♂); Beşpınar (Kovancılar) 38° 41' 20.23.08" N, 39° 50' 28.19"E 1000 m on *L. trifolii*, on *Cucumis sativus* Linnaeus 05.IX.2010 (4♀♀, 3♂♂).

Hosts: Larval parasitoid of Chrysomelidae, Curculionidae (Coleoptera), Cimbicidae, Diprionidae, Pamphilidae Tenthredinidae (Hymenoptera), Pyralidae, Gelechiidae, Gracillariidae, Heliozelidae, Lasiocampidae, Lyonetiidae (Lepidoptera) and many species of Agromyzidae (Diptera) (Noyes, 2004).

This parasitoid species has previously been recorded

from *L. trifolii* in Antalya (Bulut and Gocmen, 2000). *Closterocerus formosus* is a new record from Agromyzidae in Turkey.

General Distribution: Widespread in Palearctic region, and also throughout United States (Herting, 1975; Bouček and Askew, 1968; Tyron, 1980; Chen et al., 2000; Hansson, 1990; Bulut and Gocmen, 2000).

Distribution in Turkey: Antalya (Bulut and Gocmen, 2000).

Diglyphus Walker, 1848

Diglyphus isaea (Walker)

Material examined: *Diglyphus isaea* was found in Yazılıkonak (Center), 38° 38' 13.7"N, 39° 20' 33.7" E, 884 m on *C. horticola* on *Sonchus* sp. 27.IV.2009 (8♀♀, 5♂♂); Yazılıkonak (Center), 38° 38' 13.7"N, 39° 20' 33.7" E, 884 m on *C. horticola* on *S. arvensis*, on 10.V.2009 (4♀♀, 7♂♂); Kovancılar (Yeniköy) 38° 52' 14.07"N, 40° 00' 44.73" E, 854 m on *L. trifolii*, on *Lycopersicum esculentum* Mill on 06.IX.2009 (13♀♀, 14♂♂); Palu (Örgülü) 38° 69' 46.01"N, 40° 02' 00.00" E, 1300 m on *L. trifolii* on *Solanum melongena* Linnaeus, on 06.IX.2009 (5♀♀, 7♂♂); Baskil (Bağdere), 38° 60' 44.7"N, 39° 04' 73.7" E, 1153 m on *C. horticola* on *S. arvensis*, on 27.IV.2010. (3♀♀, 2♂♂); Yazılıkonak (Center), 38° 38' 13.7"N, 39° 20' 33.7" E, 884 m on *L. trifolii* on *Centaurea* sp., 27.IV.2010. (6♀♀, 4♂♂); Keban (Baskil), 38° 47' 35.7"N, 38° 44' 39.7" E, 789 m on, on *L. trifolii* on *Tagetes* spp., on 19.V.2010 (7♀♀, 4♂♂); Beşpınar (Kovancılar) 38° 41' 20.23.08" N, 39° 50' 28.19"E 1000 m on *L. trifolii*, on *C. sativus*, 05.IX.2010 (5♀♀, 3♂♂); Ağın (Kaşpınar), 38° 38' 56.7"N, 38° 51' 24.7" E, 940 m on *L. trifolii* on *Cucurbita* sp., on 14.IX.2010. (4♀♀, 1♂);

Hosts: Many species of Agromyzidae, Tephritidae (Diptera), and also Lyonetiidae (Lepidoptera) (Ciampolini, 1952; Gordh and Hendrickson, 1979; Minkenberg and van Lenteren, 1986; Zhu et al., 2000; Noyes, 2004).

This species has previously been recorded from *A. albitarsis*, *C. horticola*, *L. congesta*, *L. huidobrensis* (Blanchard), *L. strigata* (Meigen), *L. trifolii*, *Phytomyza petoei* Hering, *P. tetrasticha* Hendel, in Turkey (Uygun et al., 1995; Civelek and Önder, 1999; Çıkman and Uygun, 2003; Çıkman, 2006; Çıkman et al., 2006).

General distribution: Widespread in Palearctic region, and also Afrotropical, Australian, Pacific, Nearctic, and Oriental regions (Bouček, 1965; Noyes, 2004).

Distribution in Turkey: Adana (Uygun et al., 1995), İzmir (Civelek and Önder, 1999), Southeast Anatolian region of Turkey (Çıkman and Uygun, 2003; Çıkman, 2006), Ankara (Gençer, 2004), Sivas (Gençer, 2005), Çıkman et al., 2006), Malatya (Çıkman and La Salle, 2011).

Diglyphus minoeus (Walker)

Material examined: Sivrice (Doğansu), 38° 36' 28.6"N,

39° 19' 86.6" E, 975 m on *L. congesta* (Becker), on *Medicago sativa* Linnaeus, 15.V.2010 (7♀♀, 7♂♂); Yazılıkonak (Center), 38° 38' 13.7"N, 39° 20' 33.7" E, 884 m on *C. horticola* on *Sonchus* sp. 27.IV.2009 (1♀, 3♂♂); Kovancılar (Yeniköy) 38° 52' 14.07"N, 40° 00' 44.73" E, 854 m on *L. trifolii*, on *L. esculentum* on 06.IX.2009 (12♀♀, 9♂♂); Baskil (Bağdere), 38° 60' 44.7"N, 39° 04' 73.7" E, 1153 m on *C. horticola* on *S. arvensis*, on 27.IV.2010. (2♀♀, 2♂♂); Keban (Baskil), 38° 47' 35.7"N, 38° 44' 39.7" E, 789 m on, on *L. trifolii* on *Tagetes* spp., on 19.V.2010 (3♀♀, 1♂); Beşpınar (Kovancılar) 38° 41' 20.23.08" N, 39° 50' 28.19"E 1000 m on *L. trifolii*, on *C. sativus*, 05.IX.2010 (2♀♀, 3♂♂)

Hosts: *Chromatomyia horticola*, *L. huidobrensis* (Ganiev et al., 1993). *L. congesta* (Çıkman and Uygun, 2003; Çıkman, 2011).

This species has previously been reared from *L. congesta*, *L. trifolii*, *C. horticola* (Çıkman and Uygun, 2003; Çıkman et al., 2006; Çıkman, 2011).

General Distribution: Widespread in Palearctic region, and also Afrotropical, Australian, Pacific, Nearctic, and Oriental regions (Hansson, 1991).

Distribution in Turkey: Şanlıurfa (Çıkman and Uygun, 2003), Diyarbakır (Çıkman et al., 2006).

Diglyphus pachyneurus Graham

Material examined: *Diglyphus pachyneurus* was found in Yazılıkonak (Center), 38° 38' 13.7"N, 39° 20' 33.7" E, 884 m on *J.salicifolii*, on *Populus* sp., 27.IV.2009. (5♀♀, 3♂♂); Akmezra (Center) 38° 39' 08.3."N, 39° 25' 16.9" E, 842 m on *C. horticola* on *P. oleracea*, on 07.IX.2010 (2♀♀, 3♂♂).

Hosts: It has been from *Agromyza salicifolii* (Collin) (Diptera: Agromyzidae), although it may have a wider host range as most species of this genus attack a variety of leaf-mining Agromyzidae (Bouček and Askew, 1968; Noyes, 2004), and *J.salicifolii* (Çıkman and La Salle, 2011).

This species has previously been reared from *C. horticola*, *J. salicifolii*, and *L. trifolii* (Gençer, 2005; Çıkman, 2006, Çıkman and La Salle, 2011).

General distribution: *Diglyphus pachyneurus* is known from Europe (Britain, Sweden, Italy, and Moldavia) (Bouček and Askew, 1968; Noyes, 2004).

Distribution in Turkey: Erzurum, (Doğanlar, 1985), Sivas (Gençer, 2005), Adıyaman (Çıkman, 2006), and Malatya (Çıkman and La Salle, 2011)

Pteromalidae

Halticoptera Spinola, 1811

Halticoptera circulus (Walker)

Material examined: *Halticoptera circulus* was found in

Table 1. Parasitoid species, their host, and percentage of emergence from host species.

Parasitoid specie	Number of parasitoid specie	Percentage of parasitoid	Agromyzidae specie
Family: Braconidae			
<i>Opius (Opius) agromyzicola</i>	2	0.93	<i>Agromyza potentillae</i> Kaltenbach
<i>Phaedrotoma divers</i>	3	1.40	<i>Chromatomyia horticola</i> (Goureau)
<i>Pseudopezomachus cursitans</i> (Ferrière)	4	1.86	<i>C. horticola</i>
<i>Xynobius (Xynobius) discoidalis</i> (Fischer)	6	2.80	<i>Japanagromyza salicifolii</i> (Collin)
Family: Eulophidae			
<i>Chrysocharis liriomyzae</i> Delucchi	7	3.27	<i>C. horticola</i>
<i>Cirrospilus lynceus</i> Walker	4	1.86	<i>Agromyza albitarsis</i> Meigen
<i>Closterocerus formosus</i> (Westwood)	9	4.20	<i>C. horticola</i> , <i>Liriomyza trifolii</i> Burgess
<i>Diglyphus isaea</i> (Walker)	102	47.66	<i>C. horticola</i> , and <i>L. trifolii</i>
<i>D. minoeus</i> (Walker)	52	24.29	<i>C. horticola</i> , <i>L. trifolii</i> and <i>L. congesta</i> (Becker),
<i>D. pachyneuru</i> Graham	13	6.07	<i>C. horticola</i> , and <i>J. Salicifolii</i>
Family: Pteromalidae			
<i>Halticoptera circulus</i> (Walker)	7	3.27	<i>J. salicifolii</i>
<i>Halticoptera patellana</i> (Dalman)	5	2.33	<i>L. trifolii</i> and <i>L. congesta</i>

Yazılıkonak (Center), 38° 38' 13.7"N, 39° 20' 33.7" E, 884 m on *J. salicifolii* and *Salix* sp., on 06.V.2009 (2♀♀, 3♂♂); Sivrice (Alıncık), 38° 26' 35.3"N, 39° 15' 33.3" E, 1195 m on *J. salicifolii*, on *Populus* sp., 15.V.2010 (2♂♂)
Hosts: Species in several genera of Agromyzidae (Peck, 1963; Burks, 1979; Noyes, 2004; Çıkman and La Salle, 2011).

General distribution: Wide distribution throughout United States and Southern Canada; also Mexico and Europe (Peck, 1963; Burks, 1979; Doğanlar, 2006).

Distribution in Turkey: Erzurum (Doğanlar, 1985), Malatya (Çıkman and La Salle, 2011).

Distribution in Turkey: Adıyaman (Çıkman, 2006), Erzurum (Doğanlar, 1985), Adana, Tokat, Erzurum (Doğanlar, 2006).

***Halticoptera patellana* (Dalman)**

Material examined: *H. patellana* was found in Hanevleri (Maden), 38° 43' 33.0"N, 39° 56' 24.67" E, 1049 m on *L. trifolii* on *Cucumis melo* L., on 05.IX.2009 (2♀♀, 1♂); Sivrice (Doğansu), 38° 36' 28.6"N, 39° 19' 86.6" E, 975 m on *L. congesta*, on *M. sativa*, 15.V.2010 (2♂♂).

Hosts: Many species of Agromyzidae, and also family of Cecidomyiidae, Chloropidae, Drosophilidae, Tephritidae (Diptera); Lyonetiidae (Lepidoptera) (Noyes, 2004; Doğanlar, 2006).

H. patellana is a new record from Agromyzidae in Turkey.

General distribution: Widespread in Palearctic, Nearctic, and Neotropical regions (Noyes, 2004)

Distribution in Turkey: Erzurum (Doğanlar, 1985; Doğanlar, 2006)

DISCUSSION

Twelve parasitoid species were obtained from infested leaves in the laboratory. The identified parasitoid species their percentages and agromyzid species are given Table 1.

In this study, the percentage of *O. agromyzicola*, *P. divers*, *P. cursitans*, and *C.* was generally low.

Diglyphus isaea was found to be the most common species with percentage of parasitism 47.66% and this finding agrees with reports by Uygun et al. (1995), Çıkman and Uygun (2003), Çıkman et al. (2006), and Çıkman, 2006 in the East Mediterranean and the South East of Turkey.

Diglyphus isaea is considered to be an important parasitoid of agromyzid flies. A rate of emergence higher than 10% among all parasitoids is reported to be significant, and such parasitoids are to be considered as potential biological control agents (Murphy and La Salle, 1999). The relatively higher parasitism level may suggest that parasitoids could be an important mortality factor in the population dynamics of leafminer populations. However, in addition to high parasitoid levels, several important factors have to be taken into account in order to increase success rates in biological control programs. These factors include distribution, climate and host specificity. More detailed studies considering these factors are required in order to explore the potential use of agromyzid parasitoids for biological control program. Among the species, *C. lynceus*, *C. formosus*, *H. circulus*, and *H. patellana* were recorded the first time in species of Agromyzidae in Turkey.

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