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Orijinal araştırma (Original article)

Contributions to leafminer (Diptera: Agromyzidae) fauna and new records of plant pests and weeds in Turkey[1]

Türkiye galerisineği faunasına katkılar ve bitki zararlıları ve yabancı ot zararlılarına yeni kayıtlar

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Summary

This study was conducted between 2011- 2013 in Muğla province in Turkey to determine the biodiversity of family Agromyzidae. Specimens were collected from cultured and non-cultured plants by sweeping net, Malaise trap and rearing methods in different localities. Altogether 19 new records of Agromyzidae species for Turkey belonging to 7 genera were found. Number of Agromyzidae species increased from 189 species to 208 species as result of this study. Altogether 13 important actual or potential pests were identified among these newly found species and four of them have potential for the weed control.

Keywords: Agromyzidae, leafminer, new records, distribution, Turkey

Özet

Bu çalışma 2011- 2013 yılları arasında Muğla ilinde Agromyzidae familyası tür çeşitliliğini belirlemek amacıyla gerçekleştirilmiştir. Galerisineği örnekleri tarım ve tarım dışı alanlardan atrap, malaise tuzağı ve kültüre alma yöntemi kullanılarak farklı lokasyonlardan toplanmışlardır. Çalışmanın sonucunda 7 cinse ait toplam 19 tür Türkiye faunası için yeni kayıt olarak bulunmuştur. Bu çalışma ile birlikte daha önce 189 olarak bilinen galerisineği tür sayısı 208'e yükselmiştir. Bulunan türlerden bazıları önemli kültür bitkisi zararlılarından ve bazıları da yabancı otların biyolojik kontrolünde kullanılma potansiyeline sahip olan türler olarak bilinmektedir. Bu türlerden 13 tanesi tarımsal üretimde zararlı iken 4 tanesi de yabancı ot kontrolünde potansiyeli olan türlerdir.

Anahtar sözcükler: Agromyzidae, galerisineği, yeni kayıt, yayılış, Türkiye

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Introduction

The Agromyzidae is one of the most species-rich families of Diptera with over 3000 species worldwide. About 1210 species occur in the Palearctic region and more than 900 species of the family occur in Europe (Spencer, 1989; Gu et al., 1991; Pakalniškis, 1992, 1994, 1996, 2000; Woodley & Janzen, 1995; Sasakawa, 1997, Scheirs et al., 1999; Černý, 2001, 2005a, b, 2007a, b; Černý & Merz, 2005, 2006, 2007; Çıkman & Sasakawa, 2008; Civelek, 1998, 2002, 2003, 2004; Civelek & Ulusoy, 2000; Civelek et al., 2000a, 2000b, 2007, 2008, 2009; Koçak & Sasakawa, 2010; Dursun et al., 2010; Çıkman & Sasakawa, 2011; Černý, 2012, 2013; Çıkman, 2012). Until now, only 189 species have been recorded in Turkey (Civelek, 1998, 2002, 2003, 2004; Civelek & Ulusoy, 2000; Civelek et al., 2000a, 2000b, 2007, 2008, 2009; Koçak & Sasakawa, 2010; Dursun et al., 2010; Çıkman & Sasakawa, 2011; Černý, 2012, 2013; Çıkman, 2012).

Larvae of most representatives of Agromyzidae are phytophagous. They feed and live on living plant tissues. Most of them feed on the leaf parenchyma. Most species produce a characteristic form of mine in the leaves; in some cases a mine type can help to identify the species. Some species are stem-borers or develop in roots, seeds or cause galls. *Phytobia* spp. develops in the cambium of some trees. About 150 agromyzid species are known as feeding on cultivated plants. Normally, pest species population do not reach to high levels, but sometimes outbreaks can occur. Some species belonging to *Liriomyza* genus can be serious pests in agricultural areas. Also adults are capable of transmitting some diseases from infected plants to healthy ones (Civelek & Önder, 1997). Also female egg laying may act as vector of diseases (Spencer, 1973; Zitter & Tsai, 1977; Matteoni & Broadbent, 1988; Černý et al., 2001).

The aim of this study was to contribute to the knowledge of the leafminer fauna of Turkey.

Material and Methods

This study was carried out between 2011- 2013 in Muğla province in Turkey. The leaf-mining fly specimens were collected from different localities including cultivated plants and wild plants by Oktay Dursun, Hasan Sungur Civelek, Eyyüp Mennan Yıldırım, Miroslav Barták and Štěpán Kubik. Coordinates and altitude data were noted with Global Positioning System.

The collecting methods were as follows: sweeping (SW), rearing from plants (RP) and Malaise trap (MT).

Slide preparations of male genitalia were made for species identification. The following general procedures were applied: the abdomen of each male was boiled in 10% KOH for 10 minutes, then transferred into 5% glacial acetic acid for 5 minutes and then transferred into 96% alcohol for 5 minutes. Later abdomen was dissected under a stereoscopic microscope. The male genitalia were transferred into euparol in order to preserve the material perpetually. Identifications were made by using Spencer (1972, 1973, 1976, 1989, 1990), Černý (2001, 2005a, b, 2007a, b) by Dr. Hasan Sungur CIVELEK, Ing.Miloš ČERNÝ and Oktay DURSUN. Specimens were stored in the Entomology Laboratory, Department of Biology, Faculty of Science, Mugla Sıtkı Koçman University, Turkey, Miloš Černý private collection, Halenkovice, Czech Republic, and collection of Czech University of Life Sciences, Prague.

Results

A total of 19 new species were recorded from Turkey. These species are listed below with their distribution and host data.

Subfamily: Agromyzinae

Genus: *Agromyza* Fallén, 1810

***Agromyza mobilis* Meigen, 1830**

Material examined: 1♂, Muğla, Ula, Akyaka (37º 03' 16" N / 28°19' 57" E), 6 m., 16-27.05.2011 (SW).

Hosts: *Bromus ramosus* Hudson, *Phleum pratense* Linneaus, *Triticum aestivum* Linneaus, (Poaceae) (Robbins, 1991, Spencer, 1972b).

Distribution: Andorra, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, The Netherlands, Hungary, Italy, Japan, Latvia, Lithuania, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland, Ukraine, former Yugoslavia (Sasakawa 1961; Spencer, 1976; Scheirs et al, 1999; Černý & Merz, 2006; Černý, 2007b; Guglya, 2012; Martinez, 2012; Černý 2013).

***Agromyza woerzi* Groschke, 1957**

Material examined: 1♂, Muğla, Ula, Akyaka (37° 03' 16" N / 28° 19' 35" E), 30 m., 30.04.2013 (SW); 1♂, Muğla, Kötekli, Mugla Sıtkı Koçman University Campus Area, (37° 09' 42" N / 28° 22' 21" E), 700 m., 10.05.2013 (MT)

Hosts: *Knautia* sp. (Caprifoliaceae) (Spencer, 1990).

Distribution: Belarus, Czech Republic, Germany, Latvia, Lithuania, Norway, Poland, Slovakia (Černý & Merz, 2006; Martinez, 2012).

Genus*: Ophiomyia* Braschnikov, 1897

***Ophiomyia rostrata* (Hendel, 1920)**

Material examined: 2♂♂, Muğla, Ula, Akyaka (37° 03' 16" N / 28° 19' 35" E), 30 m., 30.04-09.05.2013 (SW).

Hosts: *Convolvulus arvensis* Linneaus (Convolvulaceae) (Ostrauskas et al., 2003).

Distribution: Austria, Bulgaria, Czech Republic, France, Great Britain, The Netherlands,Ireland, Lithuania, Poland, Spain, Sweden, Uzbekistan (Spencer, 1976; Černý & Merz, 2006; Martinez, 2012; Pitkin, 2014).

***Ophiomyia slovaca* Černý, 1994**

Material examined: 1 ♂, Mugla, Fethiye, Kayaköy (36° 34' 77" N / 29° 04' 98" E), 140 m., 8.04.2007 (SW).

Hosts: *Vicia angustifolia* Reichard, *V. cracca* Linneaus, *V. villosa* Roth (Fabaceae) (Pakalniškis, 1996).

Distribution: Cyprus, Czech Republic, Lithuania, Slovakia, Ukraine (Černý, 1994; Černý & Vála, 2006; Pakalniškis, 1994; Martinez, 2012; Guglya, 2011, 2012).

Genus: *Hexomyza* Enderlein, 1936

***Hexomyza simplicoides* (Hendel, 1920)**

Material examined: 1♂, Muğla, Ula, Akyaka (37° 03' 19" N / 28° 20' 07" E), 6 m., 07.05.2013 (SW).

Hosts: *Salix caprea* Linneaus (Salicaceae) (Spencer, 1976)

Distribution: Austria, China, Finland, France, Germany, Great Britain, The Netherlands, Hungary, Italy, Ireland, Japan, Kyrgyzstan, Lithuania, Poland, Slovakia, Spain, Switzerland, U.S.A. (Spencer, 1976; Černý, 2012; Martinez, 2012; Pitkin, 2014).

Subfamily: Phytomyzinae

Genus: *Amauromyza* Hendel, 1931

Subgenus: *Cephalomyza* Hendel, 1931

***Amauromyza (Cephalomyza) labiatarum* (Hendel 1920)**

Material examined: 1♂, Muğla, Ula, Kapız (37° 05' 18" N / 28° 24' 48" E), 592 m., 23.04.2013 (RP from *Stachys* sp.)

Hosts: *Lamium* sp., *Melissa officinalis* Linneaus, *Mentha* sp. *Stachys* sp. (Lamiaceae) (Spencer, 1990; Ellis, 2014).

Distribution: Albania, Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Great Britain, Greece, The Netherlands, Hungary, Italy, Ireland, Lithuania, Luxembourg, Norway, Poland, Romania, Sweden, Slovakia, Switzerland (Spencer, 1976; de Bruyn & von Tschirnhaus, 1991; Černý & Merz, 2005; Černý, 2011; Martinez, 2012).

***Amauromyza (Cephalomyza) monfalconensis* (Strobl 1909)**

Material examined: 1♂, Muğla, Sarnıç Village, Akbük (37° 01' 41" N / 28° 05' 49" E), 30 m., 11.05.2013 (SW).

Hosts: *Rumex* sp. (Polygonaceae) (Spencer, 1990).

Distribution: Austria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Great Britain, Greece, The Netherlands, Hungary, Ireland, Italy, Lithuania, Norway, Portugal, Romania, Slovakia, Spain, Sweden, Switzerland, Uzbekistan, former Yugoslavia (Spencer, 1976; Černý & Merz, 2006; Andersen 2012; Martinez, 2012; Černý, 2009, 2013; Kahanpää, 2014; Pitkin, 2014).

Genus: *Cerodontha* Rondani, 1861

Subgenus: *Cerodontha* Rondani, 1861

***Cerodontha* (*Cerodontha*) *phragmitophila* (Hering, 1935)**

Material examined: 1 ♂, Muğla, Ula, Akyaka (37° 03' 08" N / 28° 20' 17"E), 4 m., 16.-22.09.2012 (SW).

Hosts: *Phragmites* sp. (Poaceae) (Spencer, 1990).

Distribution: Belgium, Bulgaria, Canary Isles, Cyprus, Czech Republic, Egypt, France, Hungary, Israel, Italy, Kazakhstan, Pakistan, Poland Spain, Uzbekistan, former Yugoslavia (Serbia, Kosovo, Voivodina, Montenegro) (Černý & Merz, 2006; Černý & Vála, 2006; Černý, 2011a, b; Martinez, 2012).

Subgenus: *Dizygomyza* Hendel, 1920

***Cerodontha (Dizygomyza) brisiaca* Nowakowski, 1973**

Material examined: 1 ♂, Muğla, Ula (37° 12' 45" N / 28° 27' 42" E), 710 m., 01.05.2013 (SW).

Hosts: Unknown

Distribution: Austria, Czech Republic, Germany, Lithuania, Morocco, Poland (Černý & Merz, 2006; Martinez, 2012).

***Cerodontha (Dizygomyza) fasciata* (Strobl, 1880)**

Material examined: 2♂♂, Muğla, Köyceğiz, Toparlar (36° 58' 39" N/ 28° 39' 30" E), 60 m., 05.05.2013 (SW).

Hosts: *Poa chaixii* Villars (Poaceae) (Spencer, 1990).

Distribution: Andorra, Austria, Belgium, Bulgaria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Great Britain, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, North Korea, Norway, Poland, Slovakia, Spain, Sweden, United States, former Yugoslavia (Serbia, Kosovo, Voivodina, Montenegro), Switzerland (Spencer, 1976; Spencer, 1990; de Bruyn & von Tschirnhaus, 1991; Černý, 2005c; Černý & Merz, 2006; Černý, 2007a, b; Martinez, 2012; Pitkin, 2014).

***Cerodontha (Dizygomyza) iraeos* (Robineau-Desvoidy, 1851)**

Material examined: 2♂♂, Muğla, Köyceğiz, Toparlar (36° 58' 39" N / 28° 39' 30" E), 60 m., 05.05.2013 (SW).

Hosts: *Iris pseudacorus* Linneaus (Iridaceae) (Spencer, 1990).

Distribution: Albania, Austria, Belarus, Belgium, Czech Republic, Denmark, Estonia, Finland, France (including Corsica), Germany, Great Britain, The Netherlands, Hungary, Ireland, Latvia, Lithuania, Moldavia, Norway, Poland, Romania, Slovakia, Spain, Sweden, Switzerland (Černý & Merz, 2006; Martinez, 2012; Pitkin, 2014).

***Cerodontha (Dizygomyza) suturalis* (Hendel, 1931)**

Material examined: 1♂, Muğla, Köyceğiz, Toparlar (36° 58' 39" N / 28° 39' 30" E), 60 m., 05.05.2013; 1♂, Muğla, Ula, Akyaka, (37° 03' 19" N / 28° 20' 07" E), 6 m., 28.04.2013 (SW).

Hosts: *Bolboschoenus maritimus* (Linneaus) Palla,*Carex hirta* Linneaus (Cyperaceae) (Spencer, 1990).

Distribution: Albania, Austria, Belgium, Bulgaria, China, Cyprus, Czech Republic, Denmark, Germany, Great Britain, Greece, France, Hungary, Ireland, Israel, Latvia, Lithuania, Poland, Slovakia, Sweden, Switzerland (Spencer, 1976; Spencer, 1990; de Bruyn & von Tschirnhaus, 1991; Černý & Merz, 2006; Černý & Vála, 2006; Černý, 2009, 2011a, b; Martinez, 2012; Pitkin, 2014).

Subgenus: *Icteromyza* Hendel, 1931

***Cerodontha* (*Icteromyza*) *geniculata* (Fallen, 1820)**

Material examined: 1 ♂, Muğla, Köyceğiz, Ağla village, Gökçeova lake, (37º 03' 42" N / 28° 48' 28" E), 1750 m., 20.09.2012 (SW).

Hosts: *Eriophorum latifolium* Hoppe (Cyperaceae) (Spencer, 1990).

Distribution: Afghanistan, Austria, Bulgaria, China, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Great Britain, Hungary, The Netherlands, Hungary, India, Iran, Ireland, Israel, Italy, Japan, Lithuania, Mongolia, Poland, Romania, Russia: Siberia, Slovakia, South Africa, Spain, Sweden, Switzerland, U.S.S.R. (Former), Tunisia, Ukraine, former Yugoslavia (Spencer, 1976; Ellis, 2014; Černý, 2010, 2011a, b; Martinez, 2012; Pitkin, 2014).

***Cerodontha (Icteromyza) rozkosnyi* Černý, 2007**

Material examined: 2♂♂, Muğla, Ula, Akyaka (37° 03' 19" N / 28° 20' 07" E), 6 m., 05.05.2013 (SW).

Hosts: Unknown

Distribution: Czech Republic, Greece, Israel, Morocco, Romania (Černý, 2011a, b).

Subgenus: *Poemyza* Hendel, 1931

***Cerodontha* (*Poemyza*) *muscina* (Meigen, 1830)**

Material examined: 3 ♂♂, Muğla, Ula, Akyaka (37° 03' 09" N / 28° 20' 17" E), 4 m., 23.-27.09.2012 (SW).

Hosts: *Dactylis* sp., *Festuca* sp., *Poa* sp. (Poaceae) (Spencer, 1990; Ellis, 2014)

Distribution: Andorra, Austria, Belarus, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Great Britain, Greece, The Netherlands, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Poland, Romania, Russia: Yakutia, Slovakia, Spain, Sweden, Switzerland, U.S.A., former Yugoslavia (Spencer, 1976; de Bruyn & von Tschirnhaus, 1991; Černý & Merz, 2006; Černý, 2007b, 2011a; Ellis, 2014; Martinez, 2012; Pitkin, 2014).

***Cerodontha (Poemyza) phragmitidis* Nowakowski, 1967**

Material examined: 2♂♂ 1♀, Muğla, Ula, Yenice- Marmaris intersection (37º 05' 59" N / 28°24' 16" E), 607 m., 15.06.2012 (SW).

Hosts: *Phragmites australis* (Cavalier) (Poaceae) (Spencer, 1990).

Distribution: Belgium, Czech Republic, Denmark, Estonia, France, Germany, Great Britain, Hungary, Ireland, Japan, Latvia, Lithuania, The Netherlands, Poland, Russia, Sweden (Scheirs & de Bruyn, 1992; Spencer, 1976; Martinez, 2012; Pitkin, 2014).

Genus: *Napomyza* Westwood, 1840

***Napomyza scrophulariae* Spencer, 1966**

Material examined: 1♂, Muğla, Ula, Akyaka (37° 03' 19" N / 28° 20' 07" E), 6 m., 28/04-10/05/2013, 1♂, Muğla, Köyceğiz, Toparlar, (36° 58' 39" N / 28° 39' 30" E), 60 m., 05-07/05/2013 (SW); 2♂♂, Muğla, Kötekli, Mugla Sıtkı Koçman University Campus Area (37° 09' 42" N / 28° 22' 21" E), 700 m.,10.05.2013 (MT).

Hosts: *Digitalis purpurea* Linneaus (Plantaginaceae), *Mentha* sp. (Lamiaceae) (Spencer, 1972; Spencer, 1976)

Distribution: Andorra, Czech Republic, Denmark, France, Germany, Great Britain, Ireland, Israel, Lithuania, Morocco, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland (Spencer, 1976; Černý 2007b, 2013; Černý & Merz, 2006, 2007; Martinez, 2012; Pitkin, 2014).

Genus: *Phytomyza* Fallén, 1810

***Phytomyza evanescens* Hendel, 1920**

Material examined: 1♂, Muğla, Kötekli, Mugla Sıtkı Koçman University Campus Area (37° 09' 42" N / 28° 22' 21" E), 700 m., 10.05.2013 (MT).

Hosts: *Ranunculus lanuginosus* Linneaus (Ranunculaceae) (Spencer, 1972)

Distribution: Andorra, Austria, Belarus, Belgium, Canada, Czech Republic, Denmark (including Faroe Is.), Estonia, Finland, France, Germany, Hungary, Iceland, Italy, Lithuania, The Netherlands, Norway, Poland, Russia (including Yakutia), Slovakia, Spain, Sweden, Switzerland, United States, Yugoslavia (Spencer, 1976; Černý, 2005c, 2007b; Martinez, 2012).

***Phytomyza kyffhusana* Hering, 1928**

Material examined: 1 ♂, Muğla, Ula, Akyaka (37° 03' 08" N / 28° 20' 17"E), 4 m., 16.-22.09.2012 (SW).

Hosts: *Helichyrysum* sp. (Asteraceae) (Pitkin, 2014).

Distribution: Austria, Czech Republic, Germany, Lithuania, Poland, Switzerland (Černý & Merz, 2005; Martinez, 2012).

Conclusion

All of the above mentioned 19 species were recorded for the first time in Turkish in the family, Agromyzidae fauna. In this way, the number of Agromyzidae species is now increased to 208 species from 189 species.

It has been estimated that although there are approximately 30.000 insect species contemporary known from Turkey, the actual number of species may be between 60.000 and 80.000 (Anonymous, 2009). This study registers 19 additional species that belong to Agromyzidae family. 13 are known to be pests that are capable to damage plants especially from Poaceae, Apiaceae, Fabaceae, Salicaceae, Lamiaceae, Polygonaceae, Iridaceae, Cyperaceae, Ranunculaceae and Asteraceae families (Spencer, 1990). Among the species registerated in this study, it is known that *A. mobilis*, *C*. (*D.) fasciata* and *C*. (*P*.) *muscina* damage economically Poaceae species (Spencer, 1990; Ellis, 2014). Also *A*. (*C*.) *labiatarum* and *N*. *scrophulariae* may give rise to important losses in *Melissa officinalis* and *Mentha* sp. (Spencer, 1990). *Ophiomyia slovaca* is pest for the vetch (*Vicia* sp.) used as fodder (Pakalniškis, 1996; Guglya, 2013). In addition to that, it is known that *A.* (*C*.) *monfalconensis*, *C*. (*D*) *suturalis*, *C.* (*I*.) *geniculata*, *Phytomyza evanescens* and *Hexomyza simplicoides* species bring about economical losses to *Rumex* sp. (Polygonaceae), *Carexhirta*, *Eriohorumlatifolium* (Cyperaceae), *Ranunculus lanuginosus* (Ranunculaceae) and *Salix caprea* (Salicaceae) plants, respectively (Spencer, 1990).

Biological control of weeds is successfull in many situations. Using herbicides may affect negatively environment and human health (Kolpin et al., 1998). *Agromyza spenceri*, *C.* (*C.*) *phragmitophila* and *C. (P.) phragmitidis* feed on *Phragmites* spp. (common reed). Tewksbury et al. (2002) noticed their potential for control of *Phragmites* populations. Also *Ophiomyia rostrata* is the pest of *Convolvulus arvensis* (field bindweed) (Ostrauskas et al., 2003). We consider important that four of the newly found species maybe used as weed control agents.

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