New Species Records of Agromyzidae (Diptera) from Spain[1]

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J. Entomol. Sci. 45(2): 91-105 (April 2010)

Abstract Twenty-two species collected with Malaise traps are recorded for the first time from Spain. These are: *Agromyza anthracina* Meigen, 1830; *A. bromi* Spencer, 1966; *A. hiemalis* Becker, 1908; *A. megalopsis* Hering, 1933; *Aulagromyza buhri* (de Meijere, 1938); *Au. luteoscutellata* (de Meijere, 1924); *Au. similis* (Brischke, 1880); *Au. trivitatta* (Loew, 1873); *Cerodontha (Poemyza) lapplandica* (Rydén, 1956); *Liriomyza amoena* (Meigen, 1830); *L. erucifolii* de Meijere, 1944; *L. graminivora* Hering, 1949; *L. samogitica* Pakalniškis,1996; *Melanagromyza eupatorii* Spencer, 1957; *M. nibletti* Spencer, 1957; *M. spinulosa* Spencer, 1974; *Ophiomyia labiatarum* Hering, 1937; *O. penicillata* Hendel, 1920; *Phytobia cerasiferae* (Kangas, 1955); *P. lunulata* (Hendel, 1920); *Phytomyza bupleuri* Hering, 1963; and *Ph. tanaceti* Hendel, 1923. These new reports increase the total number of known agromyzid species in Spain to 287. In addition, *M. spinulosa* is a new report for Europe. Information on host plants, phenology, development, and distribution are included.

Key Words Agromyzidae, *Agromyza*, *Aulagromyza*, *Cerodontha*, *Liriomyza*, *Melanagromyza*, *Ophiomyia*, *Phytobia*, *Phytomyza*, new species records

Prior to the study reported herein, the total number of agromyzid (Diptera: Agromyzidae) species reported from Spain was 265. Martínez and Báez (2002) reported 228 species, which Martinez (2004) subsequently updated to 245. Additional reports increased this number by 20 species (Cerny 2004, 2006, Cerny and Merz 2006, Cerny and Vala 2006, Zlobin 2000, 2002). There is a lack of knowledge of the occurrence of agromyzids in most areas of Europe, North Africa, and the Palaearctic region of Asia (Cerny and Merz 2006). A high incidence of monophagous feeding behavior exhibited by many agromyzids and the difficulty of their identification are main contributing factors. This study was undertaken to further expand our knowledge of agromyzid species in Spain and Europe.

Materials and Methods

Sampling. Malaise traps were operated continuously, except in the cold winter months in Tinença de Benifassà and Font Roja, in 3 locations in Spain from 2004 - 2007. GPS coordinates were recorded for each trap location. Samples were removed from the traps on a weekly basis, and the specimens obtained were preserved in 70%

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ethyl alcohol. Identifications to species were conducted with male specimens only, given the difficulty of identifying females to the species level.

Biotope information on sampling areas. Three protected areas, declared as Natural Parks in the Community of Valencia, were sampled in the study. These were the inland mountain ranges of Tinença de Benifassà (Castellón) and Font Roja (Alicante), and the wetland Lagunas de la Mata-Torrevieja (Alicante). These areas were selected for sampling because the floral and environmental conditions within and among the parks would likely support a diversity of agromyzid fauna.

Tinença de Benifassà (Castellón) is located in the northern part of Community of Valencia bordering on the Tarragona and Teruel provinces. The trap operated in the area was located at GPS coordinates N40°39′22.6" / E00°09′26.8" (elevation 680 m). The 25.8-ha park has <250 residents and is characterized by high faunal and floral biodiversity including well-preserved woodlands of pine and oak, scrubland species typical of Mediterranean vegetation including a high number of endemic species, and agriculturally cultivated areas. It typically receives snowfalls in the winter and high temperatures in the summer with an annual precipitation ranging from 450 - 550 mm.

Font Roja (Alicante) is located in Alicante province. The trap operated in this area was at GPS coordinates N38°39'43.1" / W00°31'04.0" (elevation 1076 m). This is basically a holm oak mountain composed of Tertiary calcareous rocks. The floral biodiversity is high and includes areas of deciduous woody species, evergreen or holm oak groves, sunny brushwood zones, rock vegetation, rubble vegetation, pine woods, and agricultural crops. Annual precipitation ranges from 350 - 450 mm where the Malaise trap was located, with cold winters and high temperatures in summer.

Lagunas de la Mata-Torrevieja (Alicante) is located in the southern point of the Community of Valencia. The trap was located at coordinates N38°01′48.8" / W00°42′00.1" (elevation 5 m). It is characterized by saline soils, semiarid climate, annual precipitations lower than 300 mm, and high temperatures. There are salt marsh areas, carrizal-juncal zones, and scrubland. Fresh vegetation is present until mid-May, but high temperatures (>35°C) after that desiccate practically all annual plants.

Results

As a result of our sampling, we identified 22 agromyzid species representing 8 genera—*Agromyza*, *Aulagromyza*, *Cerodontha*, *Liriomyza*, *Melanagromyza*, *Ophiomyia*, *Phytobia* and *Phytomyza*—that are new records for Spain. These species are listed below by subfamily and genus along with collection localities, distribution, host plants, phenology and other biological information.

Order Diptera: Family Agromyzidae

Subfamily Agromyzinae

Genus *Agromyza* Fallén, 1810

The number of Spanish *Agromyza* species cited by Martinez (2004) is 34. No other species have been reported until now. Herein, we present 4 new records for Spain. Thus, the number of species in the genus *Agromyza* is now 38 in Spain.

***Agromyza anthracina* Meigen, 1830**

= *Agromyza freyi* **Hendel, 1931**

Material examined: Lagunas de la Mata-Torrevieja: 3♂, 14.XII.2004 - 21.XII.2004; 4♂, 27.XII.2005 - 03.I.2006; 1♂, 21.XII.2006 - 28.XII.2006; 1♂, 20.II.2007 - 06.III.2007.

Distribution: Palaearctic: Belgium, Czeck Republic, Denmark, Finland, France, Germany, Great Britain, Hungary, Ireland, Lithuania, Netherlands, Norway, Poland, Slovakia, Sweden, Switzerland.

Hosts Plants: *Parietaria*, *Urtica*.

Agromyza anthracina is a monophagous miner in the Urticaceae family and only known in the Palaearctic region. Three other *Agromyza* species were found mining *Urtica* hosts in Europe, *A. hiemalis* Becker, 1908, *A. pseudoreptans* Nowakowski, 1967, and *A. reptans* Fallén, 1823. The *Parietaria* genus is only mined by 2 *Agromyza* species—*A. anthracina* and *A. pseudoreptans*.

Phenology: The species occurred from December until the end of February when temperatures averaged between 13.8 - 15.5°C. There was a strong seasonal response of numbers of *A. anthracina* captured in the Natural Park of Lagunas de la Mata-Torrevieja with a maximum of 111 males/wk at the end of December 2004 (mean temperature 13.8°C; 20°C max and 7.5°C min). In general, members of the *Agromyza* genus occur continuously from mid-November until the end of March (Fig. 1).

***Agromyza bromi* Spencer, 1966**

Material examined: Tinença de Benifassà: 2♂, 20.V.2004 - 27.V.2004; 1♂, 27.V.2004 - 3.VI.2004; 1♂, 3 - 10.VI.2004; 1♂, 30.IX.2004 - 07.X.2004; 1♂, 16.V.2005 - 23.V.2005; 1♂, 12 - 19.IX.2005; 3♂, 06.IV.2006 - 17.IV.2006; 3♂, 24.IV.2006 - 01.V.2005; 1♂, 1 - 8.V.2006; 6♂, 8 - 15.V.2006; 8♂, 15 - 22.V.2006; 8♂, 22 - 29.V.2006; 1♂, 29.V.2006 - 5.VI.2006; 1♂, 11 - 18.IX.2006; 2♂, 18 - 25.IX.2006; 3♂, 25.IX.2006 - 2.X.2006; 14♂, 2 - 12.X.2006; 5♂, 12 - 23.X.2006; 1♂, 23 - 30.X.2006; 2♂, 16.IV.2007 - 23.IV.2007.

Distribution: Palaearctic: Belgium, Czech Republic, Denmark, France, Germany, Great Britain, Hungary, Lithuania, Poland, Slovakia, Switzerland.

Host Plant: *Bromus*.

The only recorded host is *Bromus catharticus* Vahl (= *Ceratochloa unioloides* [Willd.]), but other grasses are likely attacked (Cerny 2005).

Phenology: This species shows significant fluctuations in populations throughout the year apparently in response to abiotic environmental conditions and the presence/absence of host plants. It mainly occurs in spring months, with significant increases in populations beginning in March as ambient temperatures increase. In 2006, 3 generations were indicated by trap captures. In late-May to early-June, a peak occurred

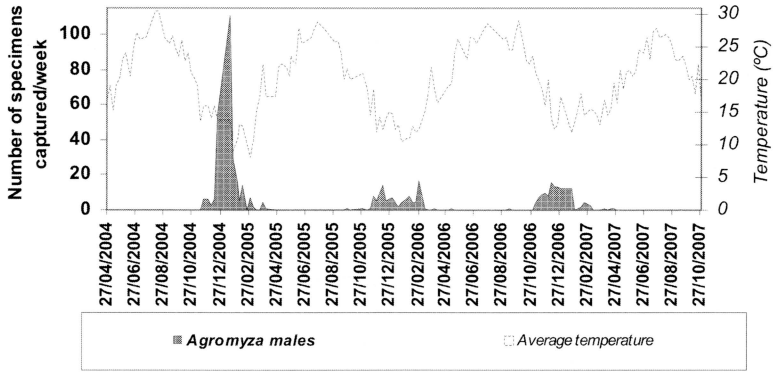

Fig. 1. Total catches of specimens of *Agromyza* genus in the Natural Park of Lagunas de la Mata-Torrevieja over time.

with 8 males captured per wk. Another peak occurred in the fall months with 14 males captured per wk. The temperature range for optimal development of *A. bromi* is between 13 and 23°C (Fig. 2).

***Agromyza hiemalis* Becker, 1908**

Material examined: Font Roja: 1♂, 25.IV.2007 - 30.IV.2007.

Distribution: Palaearctic: France, Greece, Italia, Malta; North Africa, Turkey. This species, restricted to the Mediterranean area, was also recorded in the Balearic and Canary Islands, but this is the first citation for continental Spain.

Host Plant: *Urtica*.

Phenology: Present in early spring with average temperatures of 14.2°C.

***Agromyza megalopsis* Hering, 1933**

Material examined: Lagunas de la Mata-Torrevieja: 1♂, 14.XII.2004 - 21.XII.2004; 4♂, 21.XII.2004 - 18.I.2005; 2♂, 18 - 26.I.2005.

Distribution: Palaearctic: Bulgaria, Crete, Czech Republic, France, Greece Germany, Hungary, Poland, Slovakia, "Yugoslavia"; North Africa.

Host Plants: *Hordeum, Secale, Triticum*.

These plants are members of the Poaceae family. Larvae normally mine *Hordeum* and *Secale* and, less frequently, *Triticum*. The species is widely distributed in Europe and can be a serious pest on barley.

Phenology: Spanish specimens were captured at the beginning of the season in Lagunas de la Mata-Torrevieja when daily temperatures were between 17 - 20°C.

Genus *Melanagromyza* Hendel, 1920

Forty *Melanagromyza* species have been reported from Spain, including *M. ferulae* Spencer, 1966 which was recently added as a new record from Spain by Cerny and Merz (2006). We report here 2 new records for *Melanagromyza* reported for Spain: *M. eupatorii* Spencer, 1957, *M. nibletti* Spencer, 1957; and one for Europe: *M. spinulosa* Spencer, 1974.

***Melanagromyza eupatorii* Spencer, 1957**

Material examined: Tinença de Benifassà: 1♂, 27.VI.2005 - 04.VII.2005; 2♂, 28.VII.2005 - 1.VIII.2005; 1♂, 8.VIII.2005 - 2.IX.2005.

Distribution: Czech Republic, France, Germany, Great Britain, Lithuania, Poland, Slovakia. *M. eupatorii* distribution is exclusively European.

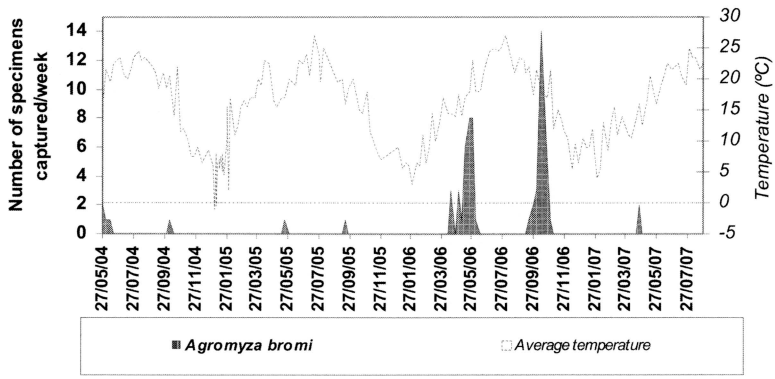

Fig. 2. Numbers of *Agromyza bromi* males captured in the Natural Park of Tinença de Benifassá over time.

Host Plants: *Eupatorium*, *Inula*, *Leucanthemum*, *Senecio*.

This species has been reported mining on *Eupatorium cannabium* L., *Inula hirta* L., *Inula conyza* DC., *Leucanthemum vulgare* Lam., and *Senecio* sp. (Spencer 1990).

Phenology: Species occurs in the summer when the average temperatures range between 19 - 25°C.

***Melanagromyza nibletti* Spencer, 1957**

Material examined: Tinença de Benifassà: 2♂, 24.IV.2006 - 01.V.2006; 2♂, 19 - 26.VI.2006; 2♂, 26.VI.2006 - 3.VII.2006.

Distribution: Palaearctic: Czech Republic, Great Britain.

Host Plant: *Silaum*.

This species was discovered for the first time on *Silaum silaus* (L.) in southern England (Spencer 1990). There are no other records of host plants.

Phenology: This species occurs from midspring to midsummer with moderate average temperatures (17 - 23°C).

***Melanagromyza spinulosa* Spencer, 1974**

Material examined: Tinença de Benifassà: 3♂, 22.IV.2005 - 29.IV.2005; 6♂, 29. IV.2005 - 6.V.2005; 6♂, 16 - 23.V.2005.

Distribution: Palaearctic: Israel.

This species was described from Israel by Spencer (1974) from the capture of 2 males. He suggests an Ethiopian origin because of the similarity of *M. spinulosa* wing venation with *M. curiosa* Spencer, 1959 and *M. cyrtanthi* Spencer, 1960. The latter two species are known to be from Africa. This is the first record of occurrence in Europe.

Host Plant: Unknown.

Phenology: The species was found in the Natural Park of Tinença de Benifassà from mid-April to late-May with moderate average temperatures between 15.5 - 17°C. The largest catches occurred from late-April with weekly catches of 6 males/trap. Catches coincided with the period of greatest catches for the entire *Melanagromyza* genus (8 - 12 males/week) (Fig. 3), generally in May. *Melanagromyza* species in Tinença de Benifassà usually exhibit 5 - 6 generations per year primarily in the spring and summer months. Female captures coincide with the period of male flight, but the females are present in much lower numbers than males.

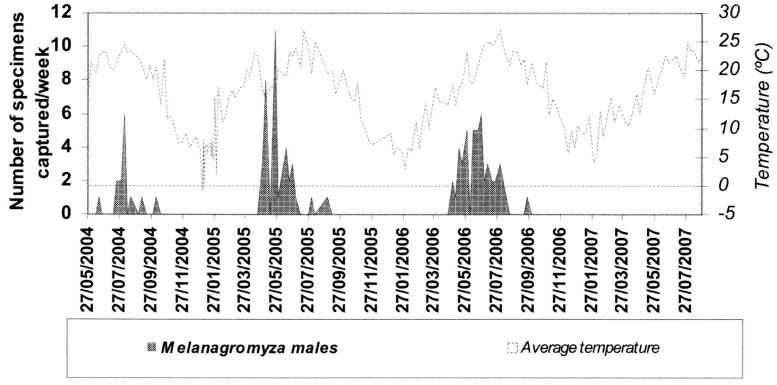

Fig. 3. Total catches of specimens of *Melanagromyza* genus in the Natural Park of Tinença de Benifassà over time.

Comments: This species is characterized by its costa not strongly continuous until vein M_{1+2}, which does not occur in any other Palaearctic species of known *Melanagromyza*. Its introduction into Europe must have been from North Africa. The lack of knowledge of the host plants for the species makes it difficult to predict its potential distribution.

Genus *Ophiomyia* Bražnikov, 1897

The genus *Ophiomyia* is composed of 76 Palaearctic species. It is considered more evolutionarily advanced than the genus *Melanagromyza*. The genus has species that are stem miners and others that are also capable of mining foliage. Relatively few host plants are known because of the difficulty of detecting mines. *Ophiomyia* species are known to attack plants of 2 monocot families—Asparagaceae and Hemerocallidaceae. Martinez (2004) listed 19 species in Spain, to which the 4 additional species have been reported by Cerny (2006) and Cerny and Merz (2006) (Table 1). We report here 2 new records (*O. labiatarum* Hering, 1937 and *O. penicillata* Hendel, 1920) which increases the number of species of the genus *Ophiomyia* in Spain to 25.

***Ophiomyia labiatarum* Hering, 1937**

Material examined: Tinença de Benifassà: 1♂, 29.VII.2004 - 05.VIII.2004; 3♂, 22.IV.2005 - 29.IV.2005; 1♂, 06.VI.2005 - 13.VI.2005; 1♂, 13 - 20.VI.2005; 2♂, 27. VI.2005 - 4.VII.2005; 1♂, 4 - 11.VII.2005; 1♂, 11 - 18.VII.2005; 2♂, 15 - 22.V.2006; 2♂, 22 - 29.V.2006; 1♂, 29.V.2006 - 5.VI.2006; 1♂, 5 - 12.VI.2006; 3♂, 26.VI.2006 - 3.VII.2006; 1♂, 3 - 10.VII.2006; 3♂, 10 - 17.VII.2006; 1♂, 28.VIII.2006 - 6.IX.2006; 1♂, 6 - 11.IX.2006; Font Roja: 1♂, 22.V.2006 - 29.V.2006.

Distribution: Palaearctic: Bulgaria, Czech Republic, Finland, France, Germany, Great Britain, Hungary, Lithuania, Norway, Poland, Slovakia. Nearctic region.

Host Plants: *Clinopodium, Galeopsis, Lamium, Leonurus, Nepeta, Prunella, Salvia, Satureja, Scutellaria, Stachys.*

Spencer (1990) cites *O. labiatarum* as a European species that forms external stem mines on *Galeopsis*, *Lamium*, and *Stachys*, and in the Nepetoideae on *Nepeta*, *Prunella*, and *Satureja*.

Phenology: This species occurred at low population levels (<3 males/week), and its occurrence was highly influenced by temperature changes. It is present in all seasons except for cold winter months when average temperatures are between 5 - 10°C, and in the hottest months of summer when daytime temperatures exceed 35°C. It exhibits 3 - 4 generations per year with maximum population numbers occurring during the spring (Fig. 4).

***Ophiomyia penicillata* Hendel, 1920**

Material examined: Tinença de Benifassà: 1♂, 18.IX.2006 - 25.IX.2006; Font Roja: 1♂, 15.V.2005 - 23.V.2005.

Distribution: Palaearctic: Austria, Czech Republic, France, Great Britain, Greece, "Yugoslavia".

Host Plant: *Euphorbia.*

This species is only recorded mining Euphorbiaceae.

Phenology: It occurs in the fall in Tinença de Benifassà and in midspring in Font Roja. The average temperatures during catches were 22°C and 16.2°C, respectively.

Subfamily *Phytomyzinae*

Genus *Aulagromyza* Enderlein, 1936

Only 7 *Aulagromyza* species have been cited from Spain, although 42 Palaearctic species have been described in this genus. We report here 4 new records for

Table 1. List of Agromyzidae species reported from Spain following the list compiled by Martinez (2004)

Species	Citation/Source*
Agromyza anthracina Meigen, 1830	
Agromyza bromi Spencer, 1966	
Agromyza hiemalis Becker, 1908	
Agromyza megalopsis Hering, 1933	
Amauromyza (Cephalomyza) karli (Hendel, 1927)	Cerny and Merz (2006: 87)
Amauromyza (Cephalomyza) luteiceps (Hendel, 1920)	Cerny and Merz (2006: 87)
Aulagromyza buhri (de Meijere, 1938)	
Aulagromyza luteoscutellata (de Meijere, 1924)	
Aulagromyza similis (Brischke, 1880)	
Aulagromyza trivittata (Loew, 1873)	
Cerodontha (Dizigomyza) fasciata (Strobl, 1880)	Cerny and Merz (2006: 89)
Cerodontha (Poemyza) lapplandica (Rydén, 1956)	
Cerodontha (Xenophytomyza) atronitens (Hendel, 1920)	Cerny and Merz (2006: 91)
Chromatomyia succisae (Hering, 1922)	Cerny and Vala (2006: 38)
Liriomyza aculeolata Zlobin, 2002	Zlobin (2002: 149)
Liriomyza amoena (Meigen, 1830)	
Liriomyza erucifolii de Meijere, 1944	
Liriomyza europaea Zlobin, 2002	Zlobin (2002: 152)
Liriomyza graminivora Hering, 1949	
Liriomyza pedestris Hendel, 1931	Zlobin (2002: 164)
Liriomyza polygalae Hering, 1927	Cerny and Merz (2006: 95)
Liriomyza samogitica Pakalniškis 1996	
Melanagromyza eupatorii Spencer, 1957	
Melanagromyza ferulae Spencer, 1966	Cerny and Merz (2006: 82)
Melanagromyza nibletti Spencer, 1957	
Melanagromyza spinulosa Spencer, 1974	
Metopomyza scutellata (Fallén, 1823)	Cerny and Merz (2006: 95)
Ophiomyia inaequabilis (Hendel, 1931)	Cerny and Merz (2006: 84)
Ophiomyia labiatarum Hering, 1937	
Ophiomyia nasuta (Melander, 1913)	Cerny (2006: 22)

Table 1. Continued

Species	Citation/Source*
Ophiomyia orbiculata (Hendel, 1931)	Cerny (2006: 22)
Ophiomyia penicillata Hendel, 1920	
Ophiomyia vimmeri Zlobin, 1994	Cerny and Merz (2006: 86)
Phytobia cerasiferae (Kangas, 1955)	
Phytobia lunulata (Hendel, 1920)	
Phytoliriomyza dorsata (Siebke, 1864)	Zlobin (2005: 1)
Phytoliriomyza immoderata Spencer, 1963	Cerny and Merz (2006: 97)
Phytomyza bupleuri Hering, 1963	
Phytomyza hellebori Kaltenbach, 1872	Cerny and Merz (2006: 99)
Phytomyza petoei Hering, 1924	Cerny and Vala (2006: 40)
Phytomyza tanaceti Hendel, 1923	
Pseudonapomyza europaea Spencer, 1973	Cerny (2004: 98)

* Reported from current study unless otherwise noted.

Spain—*Au. buhri* (de Meijere, 1938), *Au. luteoscutellata* (de Meijere, 1924), *Au. similis* (Brischke, 1880), and *Au. trivittata* (Loew, 1873).

***Aulagromyza buhri* (de Meijere, 1938)**

= *Aulagromyza approximatonervis* Frey, 1946
= *Aulagromyza incognita* Hering, 1956
= *Aulagromyza simplonensis* Spencer, 1957

Material examined: Tinença de Benifassà: 1♂, 20.V.2004 - 27.V.2004; 1♂, 24. IV.2006 - 1.V.2006; 2♂, 1 - 8.V.2006.

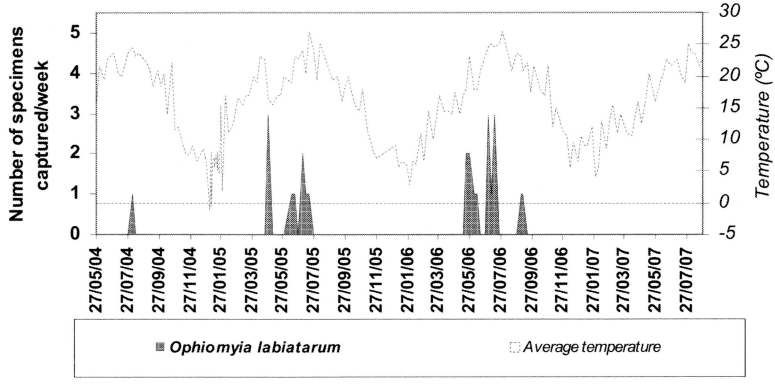

Fig. 4. Numbers *Ophiomyia labiatarum* males captured in the Natural Park of Tinença de Benifassá over time.

Distribution: Palaearctic: Belarussia, Estonia, Turkey, Finland, France, Germany, Great Britain, Lithuania, Poland, Slovakia, Switzerland.

Host Plants: *Asperula, Galium.*

External stem-miner.

Phenology: The species occurred only at low numbers at the end of the spring with moderate average temperatures of 14 - 18°C.

***Aulagromyza luteoscutellata* (de Meijere, 1924)**

= *Aulagromyza lonicerae* (Brischke, 1880)

= *Aulagromyza lonicerarum* (Frey, 1946)

= *Aulagromyza falleni* (Rydén, 1952)

= *Aulagromyza xylostei* auct.

Material examined: Tinença de Benifassà: 1♂, 26.VI.2006 - 03.VII.2006.

Distribution: Palaearctic: Belgium, Czech Republic, Denmark, Finland, France, Germany, Lithuania, Republic of Moldova, Netherlands, Norway, Poland, Sweden. Nearctic region.

Host Plants: *Lonicera*, *Symphoricarpos.*

Phenology: Present in spring when the average temperature is 24.5°C.

Comments: Spencer (1990) cites *A. cornigera* (Griffiths, 1973) and *A. luteoscutellata* (de Meijere, 1924) as sister-species. Both occur in Spain.

***Aulagromyza similis* (Brischke, 1880)**

= *Aulagromyza praecedens* (Strobl, 1898)

= *Aulagromyza centaureana* (Hering, 1925)

Material examined: Tinença de Benifassà: 1♂, 08.V.2006 - 15.V.2006.

Distribution: Palaearctic: Austria, Belarussia, Czech Republic, Finland, France, Germany, Great Britain, Hungary, Ireland, Italia, Lithuania, Norway, Poland, Romania, Sweden.

Plant Hosts: *Knautia, Succisa.*

Phenology: Present in the spring when the average temperature is 17°C.

Comments: This is a taxonomically-isolated species, although its genitalia suggest a direct relationship with the species on *Galium* (Spencer 1990).

***Aulagromyza trivittata* (Loew, 1873)**

= *Aulagromyza tristriata* (Hendel, 1932)

Material examined: Tinença de Benifassà: 1♂, 2 - 12.X.2006; 7♂, 12 - 23.X.2006; 5♂, 23 - 30.X.2006; 3♂, 30.X.2006 - 6.XI.2006; 1♂, 29.I.2007 - 5.II.2007; 1♂, 5 - 12.II.2007; 2♂, 12 - 19.II.2007; 1♂, 19 - 26.II.2007; 8♂, 26.II.2007 - 5.III.2007; 1♂, 5 - 12.III.2007; 5♂, 12 - 20.III.2007; 1♂, 2 - 9.IV.2007; Lagunas de la Mata-Torrevieja: 1♂, 21.XII.2005 - 18.I.2005; 5♂, 18 - 26.I.2005; 3♂, 26.I.2005 - 2.II.2005; 2♂, 2 - 8.II.2005; 4♂, 8 - 15.II.2005; 1♂, 22.II.2005 - 1.III.2005; 1♂, 1 - 8.III.2005; 2♂, 13 - 20.XII.2005; 4♂, 20 - 27.XII.2005; 3♂, 27.XII.2005 - 3.I.2006; 5♂, 3 - 10.I.2006; 4♂, 10 - 17.I.2006; 1♂, 17 - 24.I.2006; 5♂, 24 - 31.I.2006; 4♂, 31.I.2006 - 7.II.2006; 6♂, 7 - 14.II.2006; 2♂, 14 - 21.II.2006; 1♂, 21 - 28.III.2006; 1♂, 12 - 19.XII.2006; 2♂, 19 - 26.XII.2006; 6♂, 26.XII.2006 - 2.I.2007; 1♂, 24 - 30.I.2007; 1♂, 6 - 13.II.2007; 1♂, 13 - 20.II.2007; 1♂, 6 - 13.III.2007.

Distribution: Palaearctic: Austria, Belarussia, Czech Republic, Denmark, Estonia, France, Germany, Great Britain, Hungary, Ireland, Latvia, Lithuania, Netherlands, Norway, Poland, Romania, Slovakia, Sweden, Switzerland.

Host-Plant: *Galium.*

This is a monophagous species whose larvae feed as internal stem miners on *Galium mollugo* L.

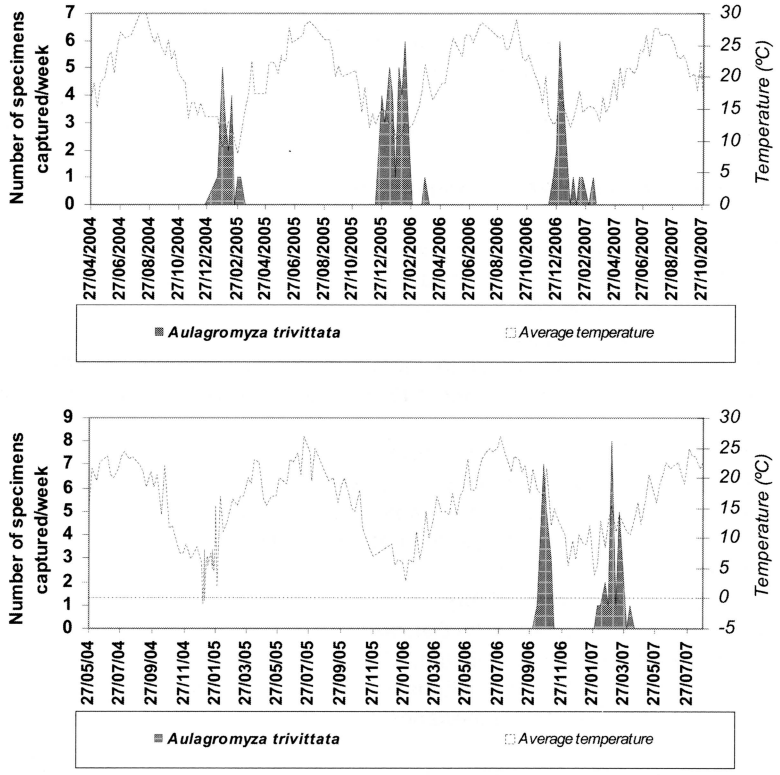

Fig. 5. Numbers of *Aulagromyza trivittata* males captured in the Natural Park of Tinença de Benifassá (top) and in the Natural Park of Torrevieja (bottom) over time.

Phenology: It was captured in Tinença de Benifassà and Lagunas de la Mata-Torrevieja. In Tinença de Benifassà (Fig. 5-top), it demonstrated large seasonal variations between years and has only been captured at the end of 2006 and 2007. It exhibits 3 - 5 generations per year mainly in the spring. The highest population peaks were observed at the beginning of March (8 males/week) and late October (7 males/week). The largest catches occurred when average temperatures were between 15 - 17°C. In Lagunas de la Mata-Torrevieja (Fig. 5-bottom), this species was found regularly in all years of the study, exhibiting between 3 - 5 generations per year primarily in the winter when the average temperature did not exceed 15°C. The maximum number of trap captures was 6 flies/wk which occurred from early-January to mid-February.

Genus *Cerodontha* Rondani, 1961

Genus *Cerodontha* is composed of 7 subgenera: *Butomomyza* Nowakowski, 1967 (10% of the Palaearctic species); *Cerodontha* Rondani, 1861 (16%); *Dizygomyza* Hendel, 1920 (22%); *Icteromyza* Hendel, 1931 (8%); *Phytagromyza* Hendel, 1920 (<1%); *Poemyza* Hendel, 1931 (37%); and *Xenophytomyza* Frey, 1946 (6%). Martinez (2004) cited the presence of 24 species in Spain. Cerny and Merz (2006) included 2 new records: *C. (Xenophytomyza) atronitens* (Hendel, 1920) and *C. (Dizigomyza) fasciata*

(Strobl, 1880). We report 1 additional species from our study —*C. (Poemyza) lapplandica* (Rydén, 1956)—thereby increasing the number of species in Spain to 27.

***Cerodontha (Poemyza) lapplandica* (Rydén, 1956)**

= *Cerodontha (Poemyza) tatrica* Nowakowsky, 1967

Material examined: Tinença de Benifassà: 1♂, 29.IV.2005 - 06.V.2005; 1♂, 03.VII.2005 - 10.VII.2005.

Distribution: Palaearctic: Czech Republic, Estonia, Germany, Great Britain, Lithuania, Norway, Poland, Slovakia, Sweden.

Host Plants: *Calamagrostis, Festuca.*

Phenology: Present in spring and summer in Tinença de Benifassà when average temperatures range between 15.5 and 20.5°C.

Genus *Liriomyza* Mik, 1894

Liriomyza is the second largest genus, with respect to numbers of species, in the Agromyzidae family with a reported 147 Palaearctic species. In Spain, 36 species were cited by Martinez (2004). Zlobin (2002) added 3 additional species: *L. aculeolata* Zlobin, 2002; *L. europaea* Zlobin, 2002 and *L. pedestris* Hendel, 1931. Cerny and Merz (2006) added *L. polygalae* Hering, 1927. We report *L. amoena* (Meigen, 1830), *L. erucifolii* de Meijere, 1944, *L. graminivora* Hering, 1949, and *L. samogitica* Pakalniškis, 1996, as new for Spain to bring the total number of *Liriomyza* species in Spain to 44.

***Liriomyza amoena* (Meigen, 1830)**

Material examined: Tinença de Benifassà: 1♂, 22.VII.2004 - 29.VII.2004.

Distribution: Palaearctic: Belgium, Czech Republic, Demark, Turkey, Finland, France, Germany, Great Britain, Lithuania, Madeira, Republic of Moldova, Poland, Romania, Slovakia, Sweden, Netherlands. Oriental region.

Host Plant: *Sambucus.*

Phenology: Captured in midsummer in Tinença de Benifassà when the average temperature was 23.5°C.

***Liriomyza erucifolii* de Meijere, 1944**

= *Liriomyza senecifolii* Hering, 1944

Material examined: Tinença de Benifassà: 1♂, 17 - 24.IV.2006; 1♂, 15 - 22.V.2006; 7♂, 22 - 29.V.2006; 1♂, 03.VII.2006 - 10.VII.2006; 1♂, 24.VII.2006 - 1.VIII.2006; 2♂, 20.VIII.2006 - 28.VIII.2006; 1♂, 25.IX.2006 - 2.X.2006; 2♂, 2 - 12.X.2006; 4♂, 12 - 23.X.2006.

Distribution: Palaearctic: Czech Republic, Denmark, France, Germany, Great Britain, Poland, The Netherlands.

Host Plant: *Senecio.*

Six *Liriomyza* species are restricted in the Senecioneae: *L. latigenis* (Hendel, 1920); *L. erucifolii*; *L. samogitica* Pakalniškis 1996; *L. sonchi* Hendel, 1931 and *L. kleineae* Hering, 1927. *Liriomyza erucifolii* forms linear mines inside *S. erucifolius* L. and *S. jacobea* L.

Phenology: Specimens were captured only in 2006 in the Natural Park of Tinença de Benifassà, where 6 generations were observed as occurring from midspring to midautumn. The highest population peak occurred in late-May with 7 males/wk and in mid-October with 4 males/wk. The optimal temperature range appears to be between 20 and 25°C (Fig. 6).

***Liriomyza graminivora* Hering, 1949**

Material examined: Tinença de Benifassà: 1♂, 06.IV.2006 - 17.IV.2006; 1♂, 17.IV.2006 - 24.IV.2006.

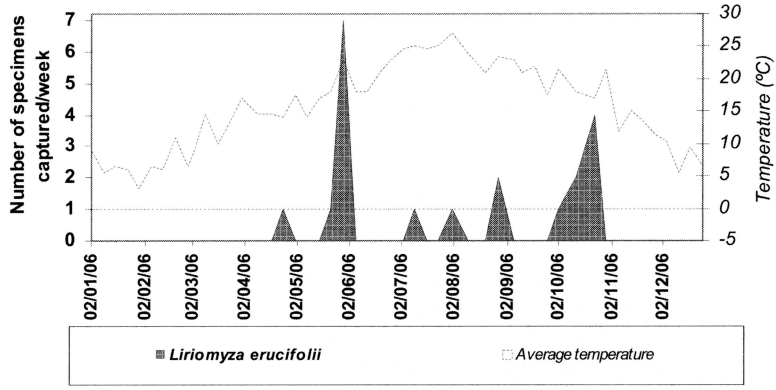

Fig. 6. Numbers of *Liriomyza erucifolii* males in the Natural Park of Tinença de Benifassà over time.

Distribution: Czech Republic, Germany, Lithuania, Poland, Slovakia.

Host Plants: *Hordeum*, *Poa*.

Phenology: A low number was captured in Tinença de Benifassà in the spring when the average temperatures ranged from 15 - 17°C.

Comments: The structure of the male genitalia suggest a close relationship with the more widely distributed species, *L. orbona* (Meigen, 1830) and *L. pedestris* Hendel, 1931.

***Liriomyza samogitica* Pakalniškis 1996**

Material examined: Lagunas de la Mata-Torrevieja: 1♂, 21 - 28.III.2006; 1♂, 28.III.2006 - 4.IV.2006.

Distribution: Palaearctic: Lithuania.

Host-Plant: *Senecio.*

Liriomyza samogitica is a monophagous species mining *Senecio* within the Compositae family.

Phenology: Occurred in spring at low levels in Lagunas de la Mata-Torrevieja when average temperatures ranged between 16 and 18°C.

Genus *Phytobia* Lioy, 1864

Prior to our study, only 2 *Phytobia* species were cited as occurring in Spain (Martinez 2004), although 12 species occur in the Palaearctic region. We report here 2 new records: *Ph. cerasiferae* (Kangas, 1955) and *Ph. lunulata* (Hendel, 1920).

***Phytobia cerasiferae* (Kangas, 1955)**

Material examined: Tinença de Benifassà: 1♂, 29.V.2006 - 05.VI.2006.

Distribution: Czech Republic, Finland, France, Germany, Great Britain, Russia.

Host Plant: *Prunus*.

This species was described from *Prunus cerasifera* Ehrh., and other *Prunus* in England.

Phenology: We captured it in Tinença de Benifassà in the spring with maximum and minimum temperatures of 26 and 10°C, respectively. The relative lack of *Ph. cerasiferae* in this region is due to the relative lack of *Prunus* crops. The main species of *Prunus* occurring in the study zone is *Ph. cerasifera* Ehrh.

***Phytobia lunulata* (Hendel, 1920)**

Material examined: Font Roja: 1♂, 03.VI.2004 - 10.VI.2004; Lagunas de la Mata-Torrevieja: 1♂, 27.III.2007 - 03.IV.2007.

Distribution: Austria, Czech Republic, France, Germany, Slovakia.

It is a stem miner reportedly widely distributed on the European continent. It occurs continuously from central Europe to France, from which this species was likely introduced into Spain. Our lack of knowledge of the host plants of this miner is surprising due to its widespread distribution.

Host Plant: Unknown.

Phenology: Occurs in the spring in Font Roja and Lagunas de la Mata-Torrevieja when the average temperatures are around 19°C and 17°C, respectively.

Genus *Phytomyza* Fallén, 1810

This genus is considered the most widely represented genus of Agromyzidae, constituting about 30% of the total known Palaearctic species (1160 species). Martinez (2004) cited the presence of 282 species in Europe and 46 in Spain. Two additional *Phytomyza* species were reported later in Spain: *P. hellebori* Kaltenbach, 1872 and *P. petoei* Hering, 1924 (Cerny and Vala 2006). We report 2 additional species from our study—*P. bupleuri* Hering, 1963 and *P. tanaceti* Hendel, 1923, bringing the total number of species to 50.

***Phytomyza bupleuri* Hering, 1963**

Material examined: Font Roja: 1♂, 02.V.2005 - 09.V.2005.

Distribution: Palaearctic: Germany

Host-Plant: *Bupleurum.*

Phenology: Occurred in the spring in Font Roja. The average of maximum and minimum temperatures during the week in which the single specimen was captured were 27.5°C and 15°C, respectively.

Comments: Spencer (1990) considers *P. blupleuri* derived from an ancestor in the Ranunculaceae together with other close species like *Napomyza bellidis* Griffiths, 1967 and *N. lyalli* (Spencer, 1976).

***Phytomyza tanaceti* Hendel, 1923**

Material examined: Font Roja: 1♂, 02.V.2005 - 09.V.2005.

Distribution: Palaearctic: Austria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Great Britain, Ireland, Lithuania, Norway, Poland, Slovakia, Sweden.

This species is probably widespread in Europe, closely resembling *P. ptarmicae* Hering, 1937, but with distinctive differences in male genitalia.

Host Plants: *Achillea, Tanacetum.*

Phenology: Specimens were captured in the spring during the same period that *P. bupleuri* was captured with average temperatures of 21.2°C, suggesting they have very similar optimal temperature ranges.

Discussion

This study adds 22 species of agromyzids to the list that are reported from Spain, including members of 8 genera: *Agromyza*, *Aulagromyza*, *Cerodontha*, *Liriomyza*, *Melanagromyza*, *Ophiomyia*, *Phytobia* and *Phytomyza*. The current total number of agromyzid species confirmed as occurring in Spain is 287. This represents only about 30% of the species reported from Europe and only 20% of Palaearctic species. Areas of central Europe have been surveyed more

extensively and report greater percentages of the agromyzid species (e.g., Germany with 62% of the total European species). Other countries, however, report percentages similar to those in Spain (e.g., Italy [23%], Great Britain [42%], Lithuania [44%]).

Approximately 82% of the 1160 Palaearctic species are reported from Europe. In comparison, the percentage of Palaearctic species reported from Spain is low. By genus, these percentages are: *Agromyza* (38%), *Aulagromyza* (24%), *Liriomyza* (28%), *Melanagromyza* (29%), *Phytobia* (24%), and *Pseudonapomyza* (21%). This emphasizes the need for additional survey work to learn the extent of Agromyzidae fauna in Spain and in Europe.

This current lack of knowledge of the occurrence of agromyzid species is due to several factors. For example, feeding behavior and plant damage are often difficult to detect as with stem mining species of the *Phytobia* genus. Only 2 species—*Ph. carbonaria* (Zetterstedt 1848) and *Ph. errans* (Meigen 1830)—were previously reported from Spain. Our study added only 2 species—*Ph. cerasiferae* and *Ph. lunulata*.

Furthermore, the species reported herein are basically monophagous or oligophagous with generally low populations. Mined host plants belong to the families Adoxaceae (*L. amoena*), Apiaciae (*P. bupleuri*), Asteraceae (*L. erucifolii*, *L. samogitica*, *M. eupatorii* and *P. tanaceti*), Caprifoliaceae (*A. luteoscutellata*), Dipsacaceae (*A. similis*), Euphorbiaceae (*O. penicillata*), Lamiaceae (*O. labiatarum*), Poaceae (*Ag. bromi*, *A. megalopsis*, *C. (Poemyza) lapplandica*, *L. graminivora*), Rosaceae (*Ph. cerasiferae*), Rubiaceae (*Au. trivittata*), Umbelliferae (*M. nibletti*) and Urticaceae (*A. hiemalis*). The largest botanical families (mainly Asteraceae and Poaceae) have the largest number of reported hosts for agromyzid miners.

The knowledge of, as well as, the presence/absence of host plants are major factors determining agromyzid occurrence. Prevailing environmental conditions, especially temperature, are also important. The genera listed here generally occur in a range between 15 - 25°C. Below 10°C and above 30°C, catches of Agromyzidae were practically nil. Periods of maximum captures in the Natural Parks of Tinença de Benifassà and Font Roja occurred from midspring to early- to late-summer and early-fall, whereas captures in Lagunas de la Mata-Torrevieja were higher from midwinter to late-spring. The mild winters in Lagunas de la Mata-Torrevieja and high daytime temperatures (>35°C) recorded in summer are responsible for this pattern of occurrence. The summer temperatures cause vegetation to disappear, with a significant decline in the existence of broad-leaved plants in comparison with midspring.

Table 1 updates the list of species reported from Spain following the list published by Martinez (2004). Forty-two species are listed, but especially noteworthy is the citation of *M. spinulosa* as a first report of this species for the European continent. We can further affirm the presence in the Natural Park of Tinença de Benifassà of *Amauromyza (Cephalomyza) karli*, *Chromatomyia succisae* (also found in Font Roja), *Metopomyza scutellata,* and *Ophiomyia orbiculata*, species reported previously by Cerny (2004, 2005, 2006) and Zlobin (2000, 2002, 2008) (Table 1).

Although our study increases the number of agromyzid species reported from Spain, we agree that the presence of additional species from Spain and our knowledge of agromyzid species is underrepresented. Additional studies and surveys are encouraged.

Acknowledgments

The research reported in this manuscript was supported by the Ministry of Education and Science of the Spanish government and by European Regional Development Fund (ERDF) (project CGL2004-02711) CGL2004-02711.

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