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GALL MIDGES (*Diptera Cecidomyiidae*) OF SICILY

SUMMARY

The gall midge fauna of Sicily presently includes 89 species. They are associated with 77 host plant species belonging to 28 plant families. *Asphondylia coronillae* (Vallot, 1829) inducing galls on *Coronilla emeroides* and *Dasineura acrophila* (Winnertz, 1853) on *Fraxinus angustifolia* are new records for Sicily. *Houardiella salicorniae* Kieffer, 1912 causing galls on *Arthrocnemum* cf. *fruticosum*, is a new record for Sicily, Italy and Europe. The correct host plant species of *Aplonyx chenopodii* De Stefani, 1908, is *Atriplex patula* (L.) (Chenopodiaceae), not *Chenopodium album* L., as it was given in the original description. The gall midge fauna is composed by 48% Mediterranean, 25% European, 13% Eurosiberian, 7% cosmopolitan, 3% Afrotropical, 2% Euroasian and 2% Asian species. *Procontarinia matteiana* Kieffer et Cecconi, 1906, *Contarinia citri* Barnes, 1944, *Dicrodiplosis pseudococci* (Felt, 1914), *Horidiplosis ficifolii* Harris et Goffau, 2003, and *Lestodiplosis aonidiellae* Harris, 1968 are alien species in Sicily. *Pulmilomyia* De Stefani, 1929 is a new synonym of *Pumilomyia* De Stefani, 1919 and *Pulmilomyia artemisiae* De Stefani, 1929 a new synonym of *Pumilomyia protrahenda* De Stefani, 1919. *Dasineura oleae* (Angelini, 1831) is the valid name, *Cecidomyia oleae* F. Löw, 1885 is its synonym (junior homonym). *Asphondylia capparisi* Rübsaamen, 1893 is the native Sicilian species, described on material found in Catania, Sicily, in October 1893. It is the causer of flower bud galls on *Capparis spinosa* L., not *Asphondylia gennadii* (Marchal, 1904). An annotated list of gall midge species and a list of their host plant is given.

RIASSUNTO

Ditteri Cecidomidi di Sicilia. La fauna siciliana di Cecidomidi galligeni attualmente include 89 specie, associate a 77 piante ospiti appartenenti a 28 famiglie. Risultano nuove per la Sicilia *Asphondylia coronillae* (Vallot, 1829) che induce galle su *Coronilla emeroides* e *Dasineura acrophila* (Winnertz, 1853) su *Fraxinus angustifolia*. È invece nuova anche per l'intera Europa *Houardiella salicorniae* Kieffer, 1912 che induce galle su *Arthrocnemum* cf. *fruticosum*. Inoltre, è stato possi-

bile accertare che la pianta ospite di *Aplonyx chenopodii* De Stefani, 1908, è *Atriplex patula* (L.) (Chenopodiaceae), non *Chenopodium album* L., come indicato nella descrizione originale. La fauna di Cecidomidi è composta dal 48% di specie mediterranee, 25% europee, 13% eurosiberiane, 7% cosmopolite, 3% afrotropicali, 2% euroasiatiche e 2% asiatiche. *Procontarinia mateiana* Kieffer et Cecconi, 1906, *Contarinia citri* Barnes, 1944, *Dicrodiplosis pseudococci* (Felt, 1914), *Horidiplosis ficifolii* Harris et Goffau, 2003 e *Lestodiplosis aonidiellae* Harris, 1968 sono specie aliene in Sicilia. *Pumilomyia* De Stefani, 1929 è un nuovo sinonimo di *Pumilomyia* De Stefani, 1919 e *Pumilomyia artemisiae* De Stefani, 1929 un nuovo sinonimo di *Pumilomyia protractenda* De Stefani, 1919. *Dasineura oleae* (Angelini, 1831) è un nome valido, *Cecidomyia oleae* F. Löw, 1885 è un suo sinonimo (omonimo junior). *Asphondylia capparis* Rübsaamen, 1893 è una specie siciliana, descritta su materiale trovato a Catania nell'ottobre 1893; essa, non *Asphondylia gennadii* (Marchal, 1904), è l'induttrice delle galle all'interno dei boccioli florali di *Capparis spinosa* L. Viene infine presentata una check-list delle specie di Sicilia comprendente anche le specie botaniche ad esse associate.

INTRODUCTION

In 1994 a total of 324 species of the family Cecidomyiidae were known to occur in Italy (SKUHRAVÁ & SKUHRAVÝ, 1994; SKUHRAVÁ, 1995); 207 of them have been recorded in the northern regions, 195 in the southern ones, 48 in Sicily and only 12 in Sardinia. In the last thirteen years various investigations have been carried out and Italian fauna has been enriched with new records. At the moment, Italian fauna of Cecidomyiidae includes 490 species (SKUHRAVÁ, *in prep.*). Galls of several interesting species were also discovered in Sicily; in the present article we summarize all data of gall midges found in Sicily till now, including new records and additional records of species whose galls were described by previous authors, but inducing insects were unknown.

The first gall midge was discovered in Sicily in 1840 on the stem of *Seseli* sp. and later on it was named and described as *Lasioptera umbelliferarum* (Kieffer, 1909). Teodosio DE STEFANI PEREZ (1853-1935) (named also STEFANI by non Italian authors) contributed importantly to the knowledge of Sicilian gall midges. He started his scientific career in the Zoological Institute of Palermo University, studying plant galls and discovering several interesting species of gall midges (Diptera Cecidomyiidae) and gall wasps (Hymenoptera Cynipidae). He described ten gall midge species and established two new gall midge genera (*Ampelosucta* and *Pumilomyia*); he also studied plant galls of Somalia, Erithrea, Libya, publishing many papers on this subject (CALECA & MINEO, 1988). He was much esteemed by contemporaneous entomologists and KIEFFER (1898, 1913) established two genera naming them in the honour of T. De Stefani Perez, namely *Stefaniella* Kieffer, 1898 and *Stefaniola* Kieffer, 1913.

Among the great scientific activity carried out by Francesco MINÀ PALUMBO (1814-1899) there was an interesting list of insects noxious to wheat, that he published on 1882 on the “Il Naturalista Siciliano”, the predecessor of our present journal; this list includes two gall midge species, not recorded in Sicily by other authors.

In the meantime, Adolfo TARGIONI-TOZZETTI (1823-1902), professor of Zoology and comparative Anatomy of vertebrates at the Istituto di Studi superiori di Firenze and founder of the Stazione di Entomologia Agraria of Firenze, described two gall midge species found in Sicily; his contribution to cecidology was much appreciated by TROTTER (1902). Afterwards KIEFFER & CECCONI (1906), KIEFFER (1909), FELT (1914) and BARNES (1932) described other gall midge species on the basis of the material collected in Sicily, and TROTTER & CECCONI (1900-1917) listed the occurrence of several Sicilian gall midge species in their important publication “Cecidotheca Italica”.

The homonym grandson of T. De Stefani (1909-1978) inherited the collection of his grandfather and dedicated himself to scientific studies, including entomology. In 1942 he published a list of Sicilian gall inducing arthropods, really not adding any previously unknown species (DE STEFANI-AGRIGENTO, 1942)¹. The collection of T. De Stefani Perez, including many types of species described by him, has to be considered lost (V. Caleca, *pers. comm.*) and it is urgently needed to establish neotypes.

In the last thirty years of the 20th century some gall midge species once more drew the attention of researchers in agriculture. RAGUSA (1970a, 1970b), GENDUSO & RAGUSA (1970) and LIOTTA (1981) carrying out researches on pests of olive mentioned the occurrence of *Lasioptera berlesiana*, while RAGUSA (1970c) studied the biology of *Dasineura affinis*. VACANTE (1985), VACANTE & FIRULLO (1983) and COLOMBO *et al.* (1993) studied the use of the predacious gall midge species *Feltiella acarisuga* (= *Therodiplosis persicae*) as biological control of tetranychid mites in greenhouses. RIZZO & MASSA (1998) reported on two gall midge species from Sicily, one of them previously unrecorded; SISCARO *et al.* (1999) studied natural enemies of *Aonidiella aurantii* and reported the presence of *Lestodiplosis aonidiellae* in Sicily. MINEO *et al.* (1997) recorded an unidentified cecidomyiid as a parasitoid of *Aphis parietariae*, while BLANDO & MINEO (2006) mentioned the occurrence of *Lasioptera berlesiana*. PERI *et al.* (2006) wrote on the key pest of the caper (*Capparis spinosa*) and SUMA *et al.* (2007) on *Horidiplosis ficifolii* damaging *Ficus* trees in Sicilian nurseries.

¹ Agrigento was the mother name of T. De Stefani; hereafter, we report his reference as DE STEFANI jr (1942).

STUDY AREA

Sicily is the largest island of the Mediterranean: with an area of 25,780 km² (including islets), it is only 3 km far away from Calabria, the most southern region of Italy, and 145 km from Tunisia. The climate is Mediterranean; according to the average temperatures recorded, three main climatic zones occur: 1) the coastal zone up to 200 m above sea level, with average winter temperatures over 10 °C and five months a year with more than 20 °C on average; this zone covers c. 10,480 km² (41.2% of the total area); 2) the warm temperature zone up to 1200 m, with average winter temperatures from 4 °C to 9.9 °C and three months a year with more than 20 °C; this zone covers 14,200 km² (55.7% of the total area); 3) the cold temperature zone, restricted to the areas over 1200 m; the average winter temperatures are below 4 °C and the average yearly temperature is below 20 °C. On Mount Etna, at over 2800 m, the temperature is below zero in winter, while it is below 10 °C in summer. The average annual rainfall is 600-700 mm; areas with the highest rainfalls (1200-1400 mm a year) are the Madonie and Nebrodi Mts., the mountains around Palermo and Etna. In most of the inland areas, along the southern coast and islets, rainfall is lower (500-600 mm), only 300-400 in the plains of Gela and Catania and in the inland province of Trapani. Mountains represent 24% of surface of Sicily, hills 56% and plains only 20%, the maximum altitudes achieved are by Etna volcano (3350 m) and the Madonie Mts (1979 m); the northern part of the island shows a regular range of mountains (Peloritani, Etna, Nebrodi and Madonie). There are other discontinuous reliefs near Trapani (Erice, Zingaro Nature Reserve), in the provinces of Agrigento and Palermo (Sicani Mts.), in the provinces of Caltanissetta and Enna (Erei Mts.) and in the provinces of Siracusa and Ragusa (Iblei Mts.) (Fig. 1).

Sicily was once covered by abundant woods and Mediterranean maquis, reduced to small areas during different foreign dominations and largely destroyed by the Romans, when the island became the "granary of the Empire". After the downfall of the Roman Empire and the Moslem conquest, the nomadic pastoralism increased the agricultural decay and the erosion and desertification of the land. Cultivated olives are still the most widespread tree below 700 m, almonds are widely scattered, mostly on the poor soils of central Sicily, along the coasts citrus plantations are widely cultivated. The hills of the central and western areas are dominated by degraded vegetation, with scattered garigue, often characterized by *Ampelodesmos mauretanicus* or overgrazed open lands dominated by *Asphodelus*. The southeastern area (Iblei Mts.) is much dry on the calcareous plateau and cool along the narrow and deep valleys, where abundant vegetation, dominated by *Quercus ilex*, grows. On the western side, Sicani Mts. are covered by scattered thickets of *Q. ilex* and *Q.*

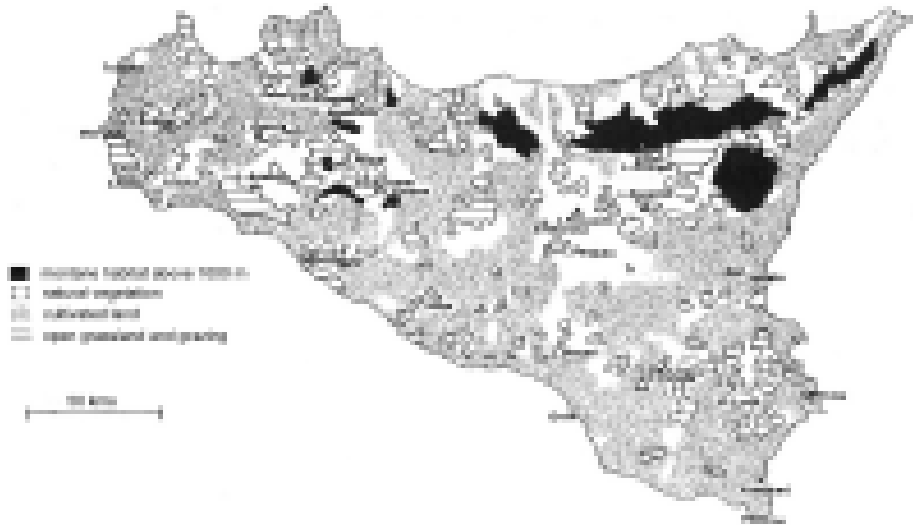


Figure 1 — Sicily shows a mosaic of habitats from coasts up to high mountains, reaching 3350 m on Etna (after IAPICHINO & MASSA, 1989, modified).

pubescens, larger woods of *Q. ilex*, *Q. pubescens* and *Q. suber* grow at Ficuzza and Palazzo Adriano. The most important arboreal cover is on Madonie, Nebrodi, Peloritani and Etna Mts.; hill and mountain vegetation lie in the *Quercion ilicis* association, extending from the coast up to c. 1200 m (altitudinal limit; on Madonie *Q. ilex* reaches 1400 m partially overlapping with *Fagus sylvatica*). *Quercion ilicis* association is characterized by *Q. ilex*, *Q. pubescens*, *Q. suber*, *Calicotome villosa*, *Pistacia terebinthus*, *Rhamnus alaternus*, *Euphorbia dendroides*, *Cistus* spp. Mediterranean maquis, placed in the *Oleo-ceratonion* association, is characterized by *Pistacia lentiscus*, *Arbutus unedo*, *Cistus* spp., *Erica* spp., *Myrtus communis*, *Calicotome spinosa*, etc. Above 1200 m we find the upper Mediterranean vegetation level, characterized by *Quercetalia-Fagetea* association, with *Q. pubescens* and *Q. cerris*, *Fagus sylvatica*, *Castanea sativa*, different species of *Acer*; on Etna there are large woods of *Pinus laricio* and small thickets of *Betula aetnensis*, while on Madonie there are some remnants of *Abies nebrodensis*, now reduced to tens of individuals. Finally, the highest mountain level, dominated by thorny and shrubby species, only occurs on the highest peaks of Madonie (with *Astragalus nebrodensis*) and between 1800 and 2950 m on Etna, with *Astragalus siculus*, *A. aetnensis*, *Berberis aetnensis*, *Juniperus haemisphaerica*, etc (IAPICHINO & MASSA, 1989).

From a biogeographical point of view Sicily belongs to the Mediterranean Sclerophyll Biogeographic province (UDVARDY, 1975).

MATERIAL AND METHODS

We compiled all data on occurrence of gall midges in Sicily from the literature, revising all old findings of gall midge galls in articles of earlier authors, trying to identify the inducing insect previously unidentified. New material has been collected by B. Massa and his collaborators.

Identification of galls is based on HOUARD (1908-1909, 1912), BUHR (1964-1965), of larvae on MÖHN (1955), of adults on SKUHRAVÁ (1997a). Nomenclature of gall midge species follows SKUHRAVÁ (1986, 1989) and GAGNÉ (2004), nomenclature of host plants TUTIN *et al.* (1964-1980) and PIGNATTI (1982). We analysed and evaluated all data that we gathered from the zoogeographical point of view, using the methods described by SKUHRAVÁ (1987, 1994a, 1994b, 1997b). Useful information on gall midges of economic importance may be found in seven-volumes work of BARNES (1946-1956), in NIJVELDT (1969) and in DARVAS *et al.* (2000).

The collection of midge galls (voucher specimens) and microscope slides are preserved in the coll. M. Skuhrová; some gall specimens are preserved in the coll. B. Massa (Palermo University).

RESULTS

Together with species found by earlier authors, the current gall midge fauna of Sicily includes 89 species. They are associated with 77 host plant species belonging to 28 plant families. *Asphondylia coronillae* (Vallot, 1829) inducing galls on *Coronilla emeroides* and *Dasineura acrophila* (Winnertz, 1853) on *Fraxinus angustifolia* are new records for Sicily. *Houardiella salicorniae* Kieffer, 1912 inducing galls on *Arthrocnemum cf. fruticosum*, is a new record for Sicily, Italy and Europe. The correct host plant species of *Aplonyx chenopodii* De Stefani, 1908, is *Atriplex patula* (L.) (Chenopodiaceae), not *Chenopodium album* L. as it was given in the original description.

Five gall midge species given in the list of SKUHRAVÁ (1995) as members of Sicilian fauna, viz. *Contarinia quercicola* (Rübsaamen, 1899), *Dasineura ranunculi* (Bremi, 1847), *Drisina glutinosa* Giard, 1893, *Jaapiella bryoniae* (Bouché, 1847) and *Macrolabis hippocrepidis* Kieffer, 1898, were excluded from our list because their presence in Sicily is not supported neither by the voucher specimens nor by the evidence in the literature record.

The majority of gall midges found in Sicily belongs to phytophagous species; *Aphidoletes aphidimyza*, *Arthrocnodax coryligallarum*, *Feltiella acarisuga*, *Dicrodiplosis pseudococci* and *Lestodiplosis aonidiellae* are preda-

tors; *Ampelosucta illata*, *Asynapta furcifer* and *Lasioptera berlesiana* are mycophagous, *Clinodiplosis pyricola* and *Dasineura sodalis* inquiline.

ANNOTATED LIST OF SPECIES

The following data are given for each species: species name, author and date of description, eventual synonyms, short description of the biology, shape of the gall, host plant species and family (given in the original description), data of occurrence in Sicily including host plant species on which the species was found, locality and date of collection, references and character of distribution.

Acericecis campestre Harris, 2004

A single larva lives in a small depression on the lower side of the leaf of *Acer campestre* L. (Aceraceae) (Pl. VI, Fig. 37). Occurrence: "Monti di Renda (Palermo)" (600 m), leg. T. De Stefani-Perez, May 1906, galls on leaves of *Acer campestre* and identified as "Cecidomyine". References: DE STEFANI (1906a), DE STEFANI jr (1942), TROTTER & CECCONI (1900-1917: N. 378), identified as "Cecidomyidae". SKUHRAVÁ (1995) listed this species under the name *Drisina glutinosa* Giard, 1895. The species was described recently by HARRIS (2004). Distribution: European.

Acericecis vitrina (Kieffer, 1909)

Syn. *Perrisia vitrina* Kieffer, 1909; *Harrisomyia vitrina* (Kieffer, 1909)

A single larva lives in a small gall on the leaf of *Acer pseudoplatanus* L. (Aceraceae). DE STEFANI (1912a) found its galls in August on the Madonie Mts. (Bosco Dragonara) (1400 m) and considered them induced by "Cecidomyinae". Later, KIEFFER (1909) described this species as *Perrisia vitrina*. Distribution: European.

Ampelosucta illata De Stefani, 1912

Larvae are able to live freely under the bark of branches of *Vitis vinifera* L. (Vitaceae) and cause their decomposition. Occurrence: DE STEFANI (1912b) found them in Palermo, reared adults, described the species and established the new genus. Since De Stefani's time this species has not been recorded. Reference: KIEFFER (1913). Distribution: Mediterranean.

Anabremia massalongoi (Kieffer, 1909)

Red larvae live in rolled leaflets of *Vicia villosa* Roth and *V. dasycarpa*

Ten. (= *V. varia* Host) (Fabaceae). KIEFFER (1909) described this species very briefly with the reference to MASSALONGO (1899). He found galls at Ferrara and indicated the causer as “*Cecidomyidarum* sp.”. Occurrence: DE STEFANI (1903) found in Palermo galls on *Vicia dasycarpa* and *V. sativa* misidentifying the inducer as “? *Clinodiplosis bellevoeyi* Kieffer, 1896”. Distribution: Mediterranean.

Aphidoletes aphidimyza (Rondani, 1847)

Cecidomya aphidimyza Rondani, 1847; *Phaenobremia aphidimyza* (Rondani, 1847)

Larvae are predators of many species of aphids (Hemiptera Aphididae). RONDANI (1847) described this species as *Cecidomya aphidimyza* from Italy. SOLINAS (1968) studied the morphology and anatomy of the larva, HARRIS (1973) the biology, host range (61 species of aphids), field populations and geographical distribution and on the basis of his comparative studies of large material established 14 synonyms. *A. aphidimyza* is used for biological control of aphids. Occurrence: LONGO *et al.* (2001) reported the presence of this species from the Etna region. The unidentified cecidomyiid recorded as a parasitoid of *Aphis pariatariae* in Sicily by MINEO *et al.* (1997) probably belongs to this species. Distribution: Holarctic, secondarily cosmopolitan.

Apiomyia bergenstammi (Wachtl, 1882)

Larvae cause woody, plurilocular galls on twigs of *Pyrus communis* L. (Rosaceae) (Pl. VI, Fig. 35). Original material came from Corfu (Greece) and was collected by J.E. Bergenstamm. Only one generation develops a year. Larvae overwinter in galls where they pupate in spring. DELLA BEFFA (1938) redescribed this species and studied its biology in detail. This species appears occasionally in the southern part of Europe as a pest (DARVAS *et al.*, 2000). Occurrence: DE STEFANI (1917) recorded the presence of *A. bergenstammi* in Sicily without giving a locality. Distribution: south European and Mediterranean, reaching up to Turkey (SKUHRAVÁ *et al.*, 2005).

Aplonyx chenopodii De Stefani, 1908

Larvae develop in plurilocular swellings on stems of *Atriplex patula* (L.) (Chenopodiaceae). DE STEFANI (1907b) first recorded it as an unidentified species; afterwards he (1908b) described it as a new species, giving *Chenopodium album* L. as its host plant species. TROTTER & CECCONI (1900-1917, fasc. XIX, N.455) reported that the correct host plant is “*Atriplex hastatum*, var. *patulum*”; we found also that this opinion was handwritten by T. De Stefani in his original papers of 1907 and 1908 (Fig. 2). The gall is similar

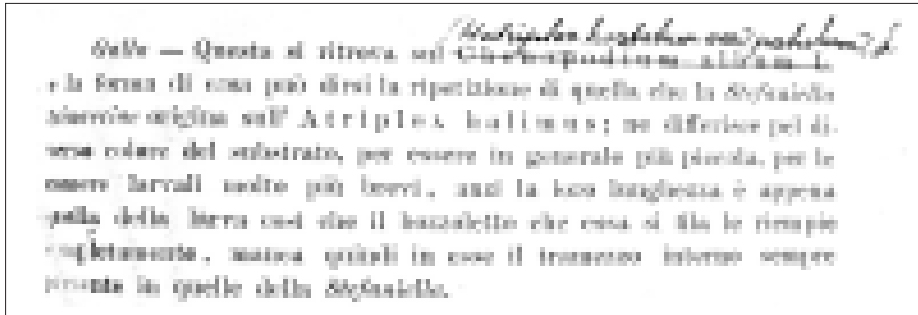


Figure 2 — Original description of the gall induced by *Aplonyx chenopodii* (DE STEFANI, 1908b, p. 175), where the Author himself rectified the host plant, erroneously considered *Chenopodium album*, into *Atriplex hastatum*, var. *patulum* (= *Atriplex patula*).

to that induced by *Stefaniella tinacriensis* on *Atriplex halimus*; De Stefani did not record the gall season, which is possibly autumn. He indeed wrote that larvae (red as the egg yolk) spend all the winter within a silk cocoon in the gall and only in April pupate (DE STEFANI, 1907b, who also recorded some parasitoids). Type-locality: Monti di Renda and Pizzenti near Monreale (Palermo) (c. 600 m), leg. De Stefani, May-June 1907. This species has not been rediscovered since originally described. Distribution: Mediterranean.

Arnoldiella tympanifex (Kieffer, 1909)

Small pustule galls on leaves of *Quercus ilex* L. and *Q. suber* L. (Fagaceae). The gall is 3.5 mm in diameter and has a small nipple on the upper and lower side. KIEFFER (1909) described the gall with reference to the finding of DE STEFANI (1898a) and the type-locality "Sicily". Distribution: Mediterranean.

Arthrocnodax coryligallarum (Targioni-Tozzetti, 1886)

Small larvae feed as predators in bud galls of *Phytoptus avellanae* Nalepa (Acari Eriophyoidea) on *Corylus avellana* L. (Corylaceae). Type-locality: surroundings of Palermo. Occurrence: recorded by DE STEFANI (1906c, 1916-1918). Distribution: Euro-Asiatic, occurring from Europe up to Turkey.

Asphondylia borzi (De Stefani, 1897)

Cecidomyia borzi De Stefani, 1897

A solitary larva develops in flower bud of *Rhamnus alaternus* L. (Rhamnaceae) inducing a small gall. Occurrence: DE STEFANI (1897) found galls between April and October in the Botanical Garden, R. Villa Favorita and

mainly in the “Giardino Inglese” of Palermo; he described the species as *Cecidomyia Borzì* naming it in honour of Prof. A. Borzì, director of the Botanical Garden. Afterwards DE STEFANI (1898c, 1906c) highlighted that it was very abundant in the Botanical Garden of Palermo. DE STEFANI jr (1942) also reported it at Villa Crispi, Palermo (in 1920’ Giardino Inglese was named “Villa Crispi” in honour of the Sicilian character Francesco Crispi). Reference: TROTTER & CECCONI (1900-1917: N. 134), Palermo, 1900, leg. De Stefani. Distribution: Mediterranean.

Asphondylia calycotomae Kieffer, 1912

A solitary larva develops in swollen leaf bud (hibernating generation) and in deformed pod (summer generation) of *Calycotome spinosa* L. (Fabaceae) (Pl. VIII, Figs. 44 and 45). Original material for description came from Algeria. DE STEFANI (1919) recorded this species from Sicily (Monti di Renda, Monreale) (600 m); DE STEFANI jr (1942) reported it also from Ficuzza (700 m) in late May. Distribution: Mediterranean.

Asphondylia capparìs Rùbsaamen, 1893

Larvae develop in swollen flower buds of *Capparis spinosa* L. (Capparidaceae) (Pl. IV, Figs. 19 and 20). RÛBSAAMEN (1893) described this species based on material obtained from Prof. Baccarini, collected in “Catania, Sicily, October 1893”, as it is written on the label of specimens of the type series deposited in the Museum für Naturkunde, Humboldt Universität, Berlin, Germany. Afterwards, DE STEFANI (1905a) reared some parasitoids from its galls. DARVAS *et al.* (2000) evaluate this species as a minor pest of caper. Reference: DE STEFANI (1906c), DE STEFANI jr (1942), who reported it from Mt. Pellegrino (Palermo). Recent records: Linosa Is. 28.7.2007, leg. B. Massa; Macalube di Aragona Nature Reserve 9.8.2007, leg. B. Massa (from galls many adults and some parasitoids emerged in the following days). Distribution: Mediterranean.

Note. PERI *et al.* (2006) reported that the key pest on crops of caper (*Capparis spinosa*) in the Sicilian island is *Asphondylia gennadii*. As the identification of species belonging to the genus *Asphondylia* is very difficult, we prefer to consider *A. capparìs* as a native Sicilian species and the gall inducer on inflorescences of *C. spinosa*, as already reported by GENDUSO (1990) from Pantelleria. This problem needs further taxonomic research.

Asphondylia conglomerata De Stefani, 1900

Larvae cause large galls, up to several centimeters long, on stems of *Atriplex halimus* L. (Chenopodiaceae). Such large gall usually includes the

whole shoot on which all flower buds are changed into small galls, each with one larva inside (Pl. III, Fig. 13). Occurrence: not much abundant. It was recently found at Trapani salt pans, Catania seaf front, Capodarso (Caltanissetta) (leg. B. Massa) and Siculiana Marina (Agrigento) (leg. A. Troia). DE STEFANI (1905a) obtained one Braconid parasitoid in April from galls of this species. Type-locality: Sciacca and Marsala (DE STEFANI, 1900). Reference: TROTTER & CECCONI (1900-1917: N. 215), Trapani, 1901, leg. De Stefani; Trapani and Palermo (DE STEFANI, 1906c). Distribution: Mediterranean.

Asphondylia coronillae (Vallot, 1829)

Larvae develop in swollen buds or deformed pods of *Coronilla emeroides* Boiss. et Spruner (Fabaceae) (Pl. VIII, Fig. 46). Occurrence: bud galls were collected at Zucco (Cinisi, Palermo), loc. F. Nocella and adults emerged on 4.4.2000 (1 male, 1 female), leg. R. Lo Duca. New record for Sicily. Distribution: Mediterranean.

Asphondylia gennadii (Marchal, 1904)

Syn. *Eumarchalia gennadiosi* Del Guercio, 1918; *Cecidomyia ceratoniae* Bevan, 1918; *Asphondylia capsici* Barnes, 1932

MARCHAL (1904) described this species very briefly based on material sent to him from Cyprus by P. Gennadius. Larvae develop in pods of *Ceratonia siliqua* L. (Fabaceae) and cause their misshapen and deformation, attacked fruits remain small and become brown (Pl. VIII, Fig. 47). It is a pest of carob causing disease so called "brachycarpia". GAGNÉ & ORPHANIDES (1992) considered *A. gennadii* to be a polyphagous species with alternation of host plant species. Occurrence: LONGO (1996) reports the presence of this species on *Capparis* spp. in central-southern Italy and Sicily, mainly in autumn; PERI *et al.* (2006) record its presence on Salina, Vulcano, Lipari (Eolian Is.), Ustica, Favignana, Levanzo (Egadi Is.), Pantelleria and Linosa on *Capparis spinosa* L. They write that it is present on the Pantelleria Is. all over the year, inducing galls from autumn to spring within *Ceratonia siliqua* carobs, in spring within *Calicotome spinosa* legumes and finally in summer on *Capparis spinosa* inflorescences. Systematics of *Asphondylia* are very difficult and further detailed studies are necessary (UECHI *et al.*, 2004). Distribution: Mediterranean, reaching up to Turkey (SKUHRVÁ *et al.*, 2005).

Asphondylia menthae Kieffer, 1901

A single larva develops in swollen flower bud of *Mentha* spp. (Lamiaceae). Occurrence: DE STEFANI (1898a, 1905a, 1906c) found galls of this species and their parasitoids in September at Palermo. Distribution: Mediterranean.

Asphondylia pruniperda Rondani, 1867

Syn. *Asphondylia prunorum* Wachtl, 1880

Larvae develop in buds of *Prunus domestica* and *P. spinosa* (Rosaceae) (Pl. VI, Fig. 38). Each gall contains a large cavity with a single larva. Only one generation develops per year. Adults emerge at the end of June and in early July. Females lay eggs in the young buds. Pupation takes place in the gall in the following year. Occurrence: DE STEFANI (1917) recorded this species in Sicily without giving a locality. DARVAS *et al.* (2000) consider this species as a minor pest of plum trees. Distribution: European.

Asphondylia rosmarini Kieffer, 1896

A single larva causes a small pouch gall on a leaf of *Rosmarinus officinalis* L. (Fabaceae). Occurrence: DE STEFANI (1904, 1906c) found galls of this species at "R. Villa Favorita", Palermo from January to April, and obtained from them many species of parasitoids; moreover he recorded it from Latium (DE STEFANI, 1904). Distribution: Mediterranean.

Asphondylia stefanii Kieffer, 1898

A solitary larva develops in deformed siliquas of *Diplotaxis tenuifolia* (L.) DC (Brassicaceae) (Pl. IV, Fig. 17). KIEFFER (1898) described this species basing on material sent him by De Stefani from Palermo and named it to his honour. Galls of this species were discovered by H. Ross at Marsala in 1898 (MAS-SALONGO & ROSS, 1898). Occurrence: DE STEFANI (1901, 1905b, 1906c) found it at Mazara del Vallo, Marsala and Santa Ninfa (Trapani), recording it also on *Sinapis nigra* L. (Brassicaceae) in August-September, when *D. tenuifolia* was no more available for the insect. References: TROTTER & CECCONI (1900-1917: N. 63), Marsala, leg. De Stefani, 1899. Distribution: Mediterranean.

Asphondylia trabuti Marchal, 1896

Larvae live gregariously within the fruits of *Solanum nigrum* L. (Solanaceae). Several generations may develop a year. Occurrence: RIZZO & MASSA (1998) studied the biology and listed some parasitoids attacking this species in Sicily, where it is widespread and common in summer. Distribution: Mediterranean.

Asphondylia verbasci (Vallot, 1827)

Larvae develop in swollen flower buds of *Verbascum sinuatum* L. (Scrophulariaceae) (Pl. V, Fig. 25). Several generations develop a year. Occurrence: Sicily, in summer (DE STEFANI, 1905a, who also records some parasitoids; DE STEFANI, 1906c, DE STEFANI jr, 1942). Distribution: Mediterranean and sub-

Mediterranean, covering a wide area (SKUHRAVÁ, 1987). It also occurs in Turkey (SKUHRAVÁ *et al.*, 2005).

Asynapta furcifer Barnes, 1932

Larvae cause small hollow discoloured patches on fruits of *Olea europaea* (Oleaceae). BARNES (1932) described this species basing on material sent to him from Sicily and Cyprus. Distribution: Mediterranean.

Baldratia salicorniae Kieffer, 1897

Larvae cause swellings on stems of *Arthrocnemum* cf. *fruticosum* L. (Syn. *Salicornia fruticosa*) (Chenopodiaceae) (Pl. III, Fig. 15). Each larva develops in one chamber. Only one generation develops in a year. Pupation takes place in the gall, adults emerge from April to summer. Occurrence: DE STEFANI (1902, 1906c) found galls at Trapani salt pans, where it was abundant; DE STEFANI jr (1942) too reported it from Trapani. It was not possible to find it in the same place, but recently it has been collected on *Arthrocnemum* cf. *fruticosum* near Marsala (Trapani), loc. Margj Milo, on 24.10.2007 (leg. A. Troia). MÖHN (1966-1971) examined larvae from galls on *Arthrocnemum glaucum* (Delile) Ung.-Sterb. collected at Trapani in 1900 (Sammlung Möhn, Nr. 3791). Distribution: Mediterranean.

Braueriella phillyreae (F. Löw, 1877)

Larvae cause pustule galls on leaves of *Phillyrea media* L. (Oleaceae) (Pl. VII, Fig. 42). LÖW (1877) described this species on material emerged from galls discovered by J.E. Bergenstamm at the castle of Miramare, Trieste (N Italy). Occurrence: TROTTER & CECCONI (1900-1917: N. 260), Palermo, 1901, leg. De Stefani; DE STEFANI (1898b, 1905a, 1906c) found it in April and May in Palermo, Parco della Favorita, and from its galls obtained some parasitoids. DE STEFANI jr (1942) found pustule galls on the leaf margin of *Phillyrea media* in Pantelleria Is. indicating them as to be caused by a Cecidomyiidae. Reference: Distribution: Mediterranean.

Clinodiplosis pyricola (Nördlinger, 1855)

Larvae live in dwarfed fruits of *Pyrus communis* L. (Rosaceae). Occurrence: DE STEFANI (1917) recorded this species in Sicily without giving a locality. Distribution: European.

Contarinia citri Barnes, 1944

Larvae develop in flower buds of *Citrus* sp. (Rutaceae). Distribution: Afro-Tropical species occurring in Mauritius, accidentally imported to Sicily (GENDUSO, 1963); it was also found in Turkey (SKUHRAVÁ *et al.*, 2005).

Contarinia coryli (Kaltenbach, 1859)

Syn. *Diplosis corylina* F. Löw, 1878

Larvae develop in swollen catkins of *Corylus avellana* L. (Corylaceae). Only one generation develops in a year. Larvae leave galls in late summer and in autumn and overwinter in the soil. Adults emerge in the following spring. Occurrence: DE STEFANI (1906c) recorded this gall from Sicily. Distribution: Euro-Siberian, reaching up to China; it occurs also in Turkey (SKUHRAVÁ *et al.*, 2005).

Contarinia cracca (H. Loew, 1850)

Syn. *Contarinia cracca* Kieffer, 1897

Larvae develop in flower buds of *Vicia cracca* L. (Fabaceae) modifying them in galls (Pl. VIII, Fig. 48). Occurrence: DE STEFANI (1903) found galls of this species at Palermo on *V. dasycarpa* and *V. sativa*. DE STEFANI jr (1942) reported it from Real Favorita (Palermo) in April-May. Reference: TROTTER & CECCONI (1900-1917: N. 290 and 374), Palermo, 1905, leg. De Stefani; DE STEFANI (1906c). Distribution: Euro-Siberian.

Contarinia ilicis Kieffer, 1898

Larvae cause small galls on the leaf of *Quercus ilex* L. (Fagaceae) with opening on small pipe on the lower side of leaves. Occurrence: DE STEFANI (1901, 1906c) collected galls at R. Villa La Favorita (Palermo). It is quite common in Sicily, on areas dominated by woods of *Q. ilex*. Distribution: Mediterranean.

Contarinia minima (Kieffer, 1909)

A solitary larva causes small, conical gall, about 1 mm high, on the leaf of *Quercus ilex* L. (Fagaceae). Occurrence: DE STEFANI (1906c) discovered galls of this species in Sicily, later described by KIEFFER (1909). Distribution: Mediterranean.

Contarinia nasturtii (Kieffer, 1888)

Larvae develop gregariously in flower buds of *Nasturtium* sp. (Brassicaceae) and other species and genera of this family. Occurrence: DE STEFANI (1906c) recorded it from Sicily on *Brassica amplexicaulis* Janka. DE STEFANI jr (1942) also reported it from Caltanissetta in May. Distribution: Euro-Siberian, covering a wide area to the Caucasus; it also occurs in Turkey (SKUHRAVÁ *et al.*, 2005).

Contarinia pyrivora (Riley, 1886)

Larvae live in deformed and enlarged fruits of *Pyrus communis* L. (Rosaceae). The damaged fruits are blackened inside. Only one generation

develops a year; adults emerge in spring. Females lay eggs in the unopened blossoms. Up to 100 larvae were observed in a single fruit. Fully developed larvae leave fruits, drop to the ground and overwinter in the soil. DARVAS *et al.* (2000) classify this species as a major pest of pears. Occurrence: DE STEFANI (1917) recorded it in Sicily without giving a locality. Distribution: primarily European species, introduced in North America, Australia, Japan and China.

Contarinia quercina (Rübsaamen, 1890)

Larvae develop among small young leaves of the terminal leaf bud of *Quercus robur* L., *Q. petraea* (Matt.) Liebl. and *Q. pubescens* Willd. (Fagaceae). Two generations develop a year. Occurrence: recorded from Sicily by DE STEFANI (1906c) on *Q. pubescens* (incorrectly as *C. quercicola*, which is associated with *Q. cerris*). Distribution: European.

Contarinia tritici (Kirby, 1798)

Yellow larvae develop gregariously in the spikelets of *Triticum aestivum* L. (*T. vulgare* Vill., *T. sativum* Lam.) (Poaceae). Only one generation develops per year. Larvae feed quite hidden on the developing flower organs; as a result no grain develops. Mature larvae drop in the ground and spin a cocoon in the soil where they hibernate. In Central Europe adults emerge from May to June according to climatic conditions. DARVAS *et al.* (2000) evaluate it as a serious pest of wheat in Europe. Occurrence: MINÀ PALUMBO (1882) reported this species from Sicily. Distribution: Euro-Asian species occurring, sometimes quite hidden, in many countries of Europe and known in several parts of Asia. It has been introduced into North America (SKUHRÁVÁ *et al.*, 1984a, 1984b).

Contarinia viticola Rübsaamen, 1906

Larvae develop in swollen flower buds of *Vitis vinifera* L. (Vitaceae) and hibernate in the soil. Only one generation develops a year. This species was relatively abundant in Central Europe at the beginning of 20th century and disappeared after grapes had been treated with sulphur. Occurrence: DE STEFANI (1917) recorded it in Sicily without giving a locality. Distribution: European.

Cystiphora sonchi (Bremi, 1847)

Larvae cause pustule galls on leaves of *Sonchus oleraceus* L. and *S. asper* L. (Hill) (Asteraceae) (Pl. II, Figs. 8 and 9). Several generations develop during vegetative season. Larvae leave galls and pupate in the soil. Occurrence: even if this species was not recorded explicitly, DE STEFANI (1905a) wrote that

obtained from its galls some parasitoids in May-July; RIZZO & MASSA (1998) found galls on many localities of Sicily, where it is widespread and common from spring to autumn. Distribution: Euro-Siberian.

Dasineura acrophila (Winnertz, 1853)

Larvae cause leaflet galls on *Fraxinus excelsior* L. and *F. angustifolia* L. (Oleaceae). Only one generation develops a year. Fully grown larvae leave the galls, fall to the ground where they hibernate. Adults emerge in the spring. Occurrence: Sicily, Lo Zucco (Palermo), 11.4.2000, galls containing 4 larvae, leg. R. Lo Duca. New record for Sicily. Distribution: European up to North Africa.

Dasineura affinis (Kieffer, 1886)

Larvae cause galls on leaves of various *Viola* species (Violaceae). Leaf margins are thickened and curled upwards (Pl. V, Figs. 23 and 24). Several overlapping generations develop in one year. Females usually lay their eggs on the youngest leaves. Fully grown larvae spin cocoons and pupation takes place in the galls. *D. affinis* cause galls on wild and cultivated violets. RAGUSA (1970c) studied the biology of this species in detail on plants of *V. hirta* var. *odorata* near Palermo, advising chemical control to reduce populations of this pest in Sicily. Distribution: European, with large distribution area including North Africa and Kazakhstan.

Dasineura crataegi (Winnertz, 1853)

Larvae live gregariously among deformed leaves in terminal rosette galls on *Crataegus laevigata* (Poiret) DC (= *C. oxyacantha* L.) (Rosaceae) (Pl. VI, Fig. 36). Some larvae pupate in galls, some larvae leave galls and pupate in the soil. Two generations a year. Occurrence: DE STEFANI (1917) recorded this species on *Crataegus azarolus* in Sicily without giving a locality. Distribution: European (large area), it also occurs in Turkey (SKUHRAVÁ *et al.*, 2005).

Dasineura ericaescopariae (Dufour, 1837)

Larvae cause large galls at tips of shoots of *Erica scoparia* L. and *E. arborea* L. (Ericaceae) (Pl. IV, Fig. 21). Many larvae live together inside one gall. Only one generation develops a year. Larvae overwinter in the galls. Adults emerge in spring. Occurrence: coastal areas of Palermo, Cefalù, Caronie, S. Marco d'Alunzio, S. Agata Militello, Messina (DE STEFANI, 1902, 1906c, DE STEFANI jr, 1942). Distribution: Mediterranean.

Dasineura galiicola (F. Löw, 1880)

Larvae cause spongy galls at the vegetative tips of various species of

Galium (Rubiaceae) (Pl. V, Fig. 26). Two generations develop a year. Fully grown larvae leave galls and pupate in the soil. DE STEFANI (1906c) reported galls of this species from Sicily. DE STEFANI jr (1942) reported galls on *Galium cinereum* All. Also the galls on *Galium vaillantia* Weber (= *G. verrucosum* Hudson), found on Pantelleria Is. in March-April and indicated as to be caused by Cecidomyiidae (DE STEFANI jr, 1942), probably belong to this species. Distribution: Euro-Siberian, occurring up to Kazakhstan.

Dasineura mali (Kieffer, 1904)

Larvae cause galls on young leaves of *Malus* species, mainly on *M. domestica* Borkh. and *M. sylvestris* (L.) (Rosaceae) (Pl. VI, Figs. 30 and 31). Young leaves of terminal branches are curled and show rolled leaf margins. Usually three generations develop a year. Fully grown larvae leave galls, drop in the ground and pupate in cocoons in the soil. DARVAS *et al.* (2000) evaluate this species as a serious pest of young apple trees and scions in orchards and nurseries. Occurrence: DE STEFANI (1917) recorded this species in Sicily without giving a locality. Distribution: European species, spread from western and northwestern Europe over Siberia to Far East and introduced into North America and New Zealand.

Dasineura medicaginis (Bremi, 1847)

Syn. *Cecidomyia ignorata* Wachtl, 1884

Larvae cause leaf bud galls on *Medicago sativa* L. and *M. falcata* L. (Fabaceae) (Pl. VIII, Fig. 49). Two or three generations develop a year. Fully grown larvae leave galls, fall to the ground and pupate in cocoon in the soil. DARVAS *et al.* (2000) evaluate this species as a serious pest of alfalfa in Central Europe. Occurrence: Sicily (TROTTER, 1908). Distribution: Euro-Siberian, with a large distribution area.

Dasineura minardii (De Stefani, 1913)

Perrisia Minardii De Stefani, 1913

Larvae cause galls on stems of *Asparagus tenuifolius*, *A. acutifolius* and *A. albus* (Liliaceae) (Pl. III, Fig. 16). DE STEFANI (1913) described adults and larvae of this species from the type-locality: Termini Imerese (Palermo). According to DE STEFANI (1913), galls are identical to those induced by other *Dasineura* on different species of *Asparagus*, that is hypertrophies on the leaf axils and on the stem, which may degenerate and dry up. The main character, differentiating *D. minardii* from other species, is the white colour of larval body. He obtained from mature larvae, collected on 20th-31st October and 3rd December 1912, adults on 20th-23rd November, 29th December and 4th January, respectively. Larvae pupate in the soil. Distribution: Mediterranean.

Dasineura oleae (Angelini, 1831)

Corethra oleae Angelini, 1831: 31

Cecidomyia oleae F. Löw, 1885, new synonym (junior homonym)

Syn. *Dasyneura lathierei* Del Guercio, 1910: in Coutin & Katlabi, 1986

ANGELINI (1831) at first described this species under the name *Corethra Oleae*. Galls were discovered at Verona, in northern Italy. COUTIN & KATLABI (1986) found that *D. oleae* and *D. lathierei* are identical species. Larvae cause slight, indefinite, elongate swellings on the leaves of *Olea europaea* L. (Oleaceae) (Pl. VII, Fig. 40). A single larva inhabits a gall where it also pupates. One or two generations develop a year. Occurrence: DE STEFANI (1906c, 1917) reported it from Sicily as *Perrisia oleae*. GIRALDI (1952) mentioned that the galls of this species in Sicily were found by A. Borzì. DARVAS *et al.* (2000) evaluated *D. oleae* as a pest of olive tree. Distribution: Mediterranean.

Dasineura plicatrix (H. Loew, 1850)

Larvae induce galls formed by contorted and twisted young leaves of *Rubus fruticosus* L. (Rosaceae) (Pl. VI, Fig. 39). Two or three overlapping generations develop a year. Fully developed larvae leave galls, drop to the ground and pupate in cocoons in the soil. Occurrence: DE STEFANI (1903, 1906c) found galls of this species in summer along the Bracco river, loc. Zucco (Palermo); recent records: Castelbuono (Madonie), loc. Vicarietto, 28.7.1999, leg. B. Massa. DARVAS *et al.* (2000) evaluate this species as a minor pest. Distribution: European, occurring up to North Africa.

Dasineura pyri (Bouché, 1847)

Larvae develop in curled and rolled leaf margins of *Pyrus communis* L. (Rosaceae) (Pl. VI, Fig. 32). Up to 50 larvae may live in one gall. Fully grown larvae leave galls, fall to the ground and pupate inside a cocoon in the soil. Several generations may develop per year. Occasionally it may be a serious pest, especially on young trees (DARVAS *et al.*, 2000). Occurrence: DE STEFANI (1906c) reported its occurrence in Sicily on *Pyrus amygdaliformis* Vill. LONGO *et al.* (2001) report it from the Etna region. Distribution: European species widely spread in Europe and introduced into North America and New Zealand.

Dasineura rosae (Bremi, 1847)

Syn. *Cecidomyia rosarum* Hardy, 1850; *Wachtliella rosarum* (Hardy, 1850)

Gregarious orange coloured larvae live in pod-like folded leaflets of various species of the genus *Rosa* (Rosaceae) (Pl. VI, Fig. 33). Occurrence: DE STEFANI (1901, 1903, 1906c, 1909) found galls of this species on *Rosa sempervirens* L. in the Palermo province, along the Bracco river, in the locality

Parrini near Partinico, in June, and in the localities Pizzenti and Giacalone (600 m). LONGO *et al.* (2001) report the occurrence of this species on *Rosa* spp. from the Etna region. Recent records: Castelbuono (Madonie), loc. Vicarietto, 28.7.1999, leg. B. Massa. Distribution: Euro-Siberian, occurring up to Kazakhstan. It also occurs in Turkey (SKUHRVÁ *et al.*, 2005).

Dasineura rufescens (De Stefani, 1898)

Perrisia rufescens De Stefani, 1898

Larvae cause globular or fusiform swellings on branches of *Phillyrea media* L. (Oleaceae), usually on ramifying branches (Pl. VII, Fig. 41) DE STEFANI (1898b) found galls in April on the “Real Villa Favorita”, Palermo, described adults and reared several parasitoids from galls. References: DE STEFANI (1898b, 1905a, 1906c); TROTTER & CECCONI (1900-1917: N. 71), Palermo, 1901, leg. De Stefani. Distribution: Mediterranean, reaching up to Turkey (SKUHRVÁ *et al.*, 2005).

Dasineura sodalis (F. Löw, 1877)

Larvae live asinquilines in galls caused by *Dasineura tortrix* (F. Löw, 1877) on *Prunus spinosa* L. and other *Prunus* species (Rosaceae). Occurrence: DE STEFANI (1917) recorded this species in Sicily without giving a locality. Distribution: European.

Dasineura tortrix (F. Löw, 1877)

Larvae cause fusiform leaf galls at tips of branches on *Prunus spinosa* L. and other *Prunus* species (Rosaceae). Terminal leaves are massed together and leaf margins are loosely rolled. Only one generation develops a year. Occurrence: DE STEFANI (1917) recorded this species in Sicily without giving a locality. Distribution: European, extending to the south. DARVAS *et al.* (2000) evaluate this species as a minor pest of young plum trees, mainly in fruit-grower nurseries.

Dasineura trifolii (F. Löw, 1874)

Larvae live in pod-like folded leaflets of *Trifolium pratense* L. and other *Trifolium* species (Fabaceae) (Pl. VIII, Fig. 51). Several generations develop per year. Larvae pupate in galls. Occurrence: DE STEFANI (1905c, 1906c) reported galls of this species (as *Perrisia trifolii*) collected on *Trifolium pratense* along the Bracco river, at Zucco (Palermo) in June. Distribution: Euro-Siberian, secondarily Holarctic.

Dasineura viciae (Kieffer, 1888)

Larvae cause pod-like galls on leaflets of *Vicia sepium* L., *V. sativa* L. and related species (Fabaceae) (Pl. VIII, Fig. 50). Occurrence: DE STEFANI (1903,

1905a, 1906c) found galls on *Vicia dasycarpa* Ten. at “R. Villa Favorita”, Palermo in April and May, obtaining also some parasitoids. DE STEFANI jr (1942) reported it also from Lo Zucco (Palermo) in spring. Distribution: Euro-Siberian, occurring up to Kazakhstan and Turkey (SKUHRAVÁ *et al.*, 2005).

Dicrodiplosis pseudococci (Felt, 1914)

Larvae prey on *Planococcus citri* (Hemiptera Pseudococcidae) on *Citrus* sp. (Rutaceae). FELT (1914) based its description on the material sent to him from Sicily. Occurrence: LONGO *et al.* (2001) report this species from the Etna region. Reference: SOLINAS (1971) studied morphological characters of larvae. Distribution: Tropical and sub-Tropical species reaching in Sicily the northern boundary of its distribution area.

Dryomyia circinans (Giraud, 1861)

Larvae cause galls on leaves of *Quercus cerris* L. and related species (Fagaceae). Each gall has a densely haired disc on the lower side and a round opening on the upper side of the leaf. Occurrence: DE STEFANI (1898d, 1906c) found very abundant galls of this species on *Quercus suber* L. at Castelvetrano (Trapani) and later (1907a) reported other Sicilian galls on *Quercus persica* Jaulc., host plant originating from Kurdistan. Reference: TROTTER & CECCONI (1900-1917: N. 434), Bosco La Cava sulle Madonie (Sicily), 1904, leg. Prof. F. Cavara (galls on *Quercus suber* L.). LONGO *et al.* (2001) report this species on *Q. ilex* from the Etna region. Distribution: Mediterranean; it also occurs in Turkey (SKUHRAVÁ *et al.*, 2005).

Dryomyia lichtensteinii (F. Löw, 1878)

Larvae cause galls on leaves of *Quercus ilex* L. (Fagaceae), with an egg-like swelling on the lower side, and a slit opening on the upper side. One generation develops a year. Larvae hibernate in galls. Occurrence: DE STEFANI (1906c) recorded it from Sicily; CECCONI (1902) reported galls from Ficuzza, 1876 (leg. Prof. A. Borzi). LONGO *et al.* (2001) report galls from the Etna region. It is quite common on Madonie Mts. (up to 1300 m) and Ficuzza (600-900 m) wood. New records: Castelbuono, loc. Gonato, adults emerged on 1.5.2006 from galls collected 20.4.2006; Ficuzza, 10.5.2007, leg. B. Massa. Distribution: Mediterranean.

Feltiella acarisuga (Vallot, 1827)

Syn. *Therodiplosis persicae* Kieffer, 1912

Larvae are zoophagous and prey on red spider mites of the genus *Tetranychus* (Acarina Tetranychidae). GAGNÉ (1995) revised the genus *Feltiella* and synonymized several species under *Feltiella acarisuga* (Vallot,

1827). VACANTE & FIRULLO (1983), VACANTE (1985) and COLOMBO *et al.* (1993) propose to use larvae of *F. acarisuga* for biological control of red spider mites in Sicilian greenhouses. Occurrence: COLOMBO *et al.* (1993) made their trials in Ragusa, LONGO *et al.* (2001) report occurrence of this species from the Etna region. Distribution: widespread in Europe and occurring in other parts of the world.

Geocrypta galii (H. Loew, 1850)

Larvae cause swellings on stems of various species of *Galium* L. (Rubiaceae) (Pl. V, Fig. 27). Two generations develop per year. Fully grown larvae leave galls, fall to the ground and pupate in the soil. Occurrence: DE STEFANI (1901, 1902, 1905a, 1906c) found in May galls of this species in Palermo and its surroundings (Mt. Pellegrino) on *Galium pallidum* Presl., *G. cinereum* All. and *G. saccharatum* L.; he also recorded it (as Cecidomyine) on *G. saccharatum* on Pantelleria Is. in March and April. Distribution: Euro-Siberian, occurring up to Kazakhstan.

Gephyraulaxia diplotaxis (Solinas, 1982)

Larvae cause flower bud galls on *Diplotaxis muralis* D.C. (Brassicaceae). SOLINAS (1982) described this species from material collected in Bari. Flower bud galls on *Diplotaxis crassifolia* L. were found in Enna (formerly Castrogiovanni), 1000 m a.s.l., in May 1893 by H. Ross (MASSALONGO & ROSS, 1898) and the causer was identified as "Cecidomyidarum spec.". Comparison of the spatula sternalis of the larva figured in MASSALONGO & ROSS (1898) with figures published by SOLINAS (1982) consents to establish that they are the same species. Probably also finding of DE STEFANI jr (1942), described as a hypertrophy on the flowers of *Diplotaxis harra* Boiss. [= *D. crassifolia* (Rafin.)] and *D. crassifolia* from Enna, it is caused by this species. Distribution: Mediterranean.

Hartigiola annulipes (Hartig, 1839)

Larvae produce cylindrical usually densely haired galls on leaves of *Fagus sylvatica* L. (Fagaceae) (Pl. I, Fig. 6). Each gall contains one single larva. Only one generation develops in a year. Larvae remain in galls that separate from leaves in the autumn. Larvae hibernate in galls fallen on the ground and pupate there in spring. Occurrence: DE STEFANI (1912) found galls at Bosco Dragonara on Madonie Mts. (1400 m) and identified them as "*Oligotrophus* sp." Recently galls are quite common on Madonie, Nebrodi and Etna Mts. up to 1800 m. Distribution: European, found also in Turkey (SKUHRAVÁ *et al.*, 2005).

Horidiplosis ficifolii Harris et Goffau, 2003

Its presence may be recognized by decolourized small galls on the leaves of *Ficus benjamina* L. and *Ficus microcarpa* L. (Moraceae), subsequently becoming thick and brown, containing one larva, which, when is mature, emerges and pupates in the soil (HARRIS & GOFFAU, 2003). Occurrence: it has been found only on plant nurseries of Catania province (SUMA *et al.*, 2007) and so far it has to be considered an alien species not yet become naturalized. Distribution: Asian species, found in Taiwan and known from Far East, imported in Europe (HARRIS & GOFFAU, 2003; SUMA *et al.*, 2007).

Houardiella salicorniae Kieffer, 1912

Larvae cause swellings on stems of *Arthrocnemum* cf. *fruticosum* (Chenopodiaceae) (Pl. III, Fig. 15). KIEFFER (1912) described this species based on material from Nefta Oasis in Tunisia. Till present the galls were found only once in Libya (TROTTER, 1914). Occurrence: the galls were found in Sicily at Trapani salt pans on 12.10.2006 (from which 3 males and 7 females were reared) and on 15.5.2007, leg. A. Troia. It is a new record for Sicily, Italy and Europe. *H. salicorniae* is a very rare gall midge species. Distribution: Mediterranean.

Jaapiella floriperda (F. Löw, 1888)

Larvae live in swollen flower buds of *Silene vulgaris* (Moench) Garcke (= *Silene inflata* Sm.) (Caryophyllaceae) (Pl. IV, Fig. 18). At least two generations develop a year. Larvae pupate in the soil. Occurrence: DE STEFANI (1902, 1905a, 1906c, 1906d) found galls in the neighbourhood of Palermo in May and obtained some parasitoids. DE STEFANI jr (1942) reported it in summer from Palermo. Distribution: European.

Janetia cerris (Kollar, 1850)

Lasioptera cerris Kollar, 1850

Larvae cause small galls on leaves of *Quercus cerris* L. (Fagaceae) and rarely also on leaves of other related species. The gall is conical on the upper leaf side and disc-shaped, densely haired, on the lower side and it is inhabited by one larva (Pl. I, Figs. 4 and 5). Fully grown larvae leave galls, fall to the ground and hibernate in the soil. Only one generation develops per year. Occurrence: DE STEFANI (1901, 1906c) recorded it as *Arnoldia cerris* on *Quercus suber* and *Q. pubescens* at Ficuzza (600 m). Distribution: Mediterranean, reaching up to Turkey (SKUHRAVÁ *et al.*, 2005).

Janetia homocera (F. Löw, 1877)

Larvae cause small galls on leaves of *Quercus cerris* L. and related species (Fagaceae). Each gall has a densely haired disc on the lower side with a pro-

jection and a flat, hard cone with a small projection at its tip (Pl. I, Fig. 7). Biology is similar to that of *Janetia cerris*. Occurrence: DE STEFANI (1907a) reported galls of *J. homocera* found on leaves of *Quercus lineata* Bl. cultivated within the Botanical Garden of Palermo, originating from Khasia in Greece. Galls of *J. homocera* have been recently collected on leaves of *Quercus cerris* at S. Alfio (Etna), 29.9.2004, leg. T. La Mantia. Distribution: Mediterranean.

Janetiella euphorbiae De Stefani, 1907

Larvae cause galls at vegetative tips of *Euphorbia characias* L. (formerly *Euphorbia wulfenii* Hoppe ex Koch.) (Euphorbiaceae). The gall consists of several small leaves changed as rosette-like and larvae develop among them. Occurrence: DE STEFANI (1906c, 1907b, 1908a) rarely found galls on Mts. Renda, Monreale (600 m) in October and November, reared adults and described the species. This kind of gall on *Euphorbia characias* has been found some times in autumn on Nature Reserve Zingaro (Trapani) (leg. B. Massa), but no adults emerged. Reference: GAGNÉ (1990), SOLINAS & PECORA (1984). Distribution: Mediterranean.

Janetiella oenophila (Haimhoffen, 1875)

Cecidomyia oenophila Haimhoffen, 1875

Syn. *Janetiella oenophila* Kieffer, 1913: misspelling of *oenophila*

Larvae cause small rounded galls on leaves of *Vitis vinifera* L. (Vitaceae), which are usually located near the leaf veins (Pl. V, Figs. 28 and 29). Fully grown larvae leave galls, fall to the soil where they overwinter. Only one generation develops a year. Occurrence: DE STEFANI (1899, 1905a, 1906c) found in August galls near Palermo, Catania, Agrigento, Trapani and Messina and reared several species of parasitoids. Distribution: Mediterranean, reaching up Turkey (SKUHRAVÁ *et al.*, 2005).

Note: DE STEFANI (1906c, page 92) mentioned that F. Paulsen and F. Guerrieri in their note *Sopra alcune galle rinvenute sui tralci e sulle foglie della vite* (1888) described the gall of *Perrisia* (*Cecidomyia*) *oenophila* Haim. It is probably the first record on occurrence of this species in Sicily.

Kiefferia pericarpiicola (Brems, 1847)

Syn. *Asphondylia pimpinellae* F. Löw, 1874

Larvae cause large fruit galls on inflorescences of various species and genera of the family Apiaceae (Pl. II, Fig. 11). There is only one generation per year. Hibernation and pupation take place in the soil. DARVAS *et al.* (2000) evaluated this species as a minor pest of cultivated carrot and parsnip. Occurrence: DE STEFANI (1903, 1906c) found galls on *Daucus carota* at Giba near

Bocca di Falco [= Boccadifalco] in summer and in the territory of Partinico (Palermo) (100 m), on *Foeniculum officinale* All. and *F. piperitum* Dec. and afterwards (DE STEFANI, 1905a) reared in October parasitoids from galls on *F. piperitum*. Distribution: Euro-Siberian species widely distributed in Europe and spread up to Kazakhstan.

Lasioptera berlesiana Paoli, 1907

Syn. *Lasioptera kiefferiana* Del Guercio, 1910; *Lasioptera carpophila* Del Guercio, 1918; *Lasioptera brevicornis* Melis, 1925

Prolasioptera berlesiana (Paoli, 1907): authors

Larvae develop in fruits of *Olea europaea* L. (Oleaceae) (Pl. VII, Fig. 43). Attacked fruits have small circular spots. Larvae live under these spots and in the galleries caused by larvae of olive fruit fly *Bactrocera oleae* (Gmel.) (Diptera Tephritidae). Larvae of *L. berlesiana* are mycophagous and feed with the fungal mycelium that develops in olive fruits attacked by *Bactrocera oleae*. PAOLI (1907) described this species under the name *Lasioptera berlesiana* from Maremma, Toscana. Later the species was combined with the genus *Prolasioptera* Kieffer, 1913. MÖHN (1968) on the basis of larval morphology synonymized three species under *Lasioptera berlesiana*. SOLINAS (1967) studied details of the biology of *L. berlesiana* in southern Italy and found that the newly hatched larvae destroy eggs of olive fruit fly. GENDUSO & RAGUSA (1970) and RAGUSA (1970a, 1970b) studied the biology of olive fruit fly in Sicily, also finding larvae of *L. berlesiana* within fruits inhabited by flies. BLANDO & MINEO (2006) considered *L. berlesiana* as one of natural enemies of *Bactrocera oleae*. Occurrence: DE STEFANI (1917) recorded this species in Sicily without giving a locality; currently, it is very common and widespread. Distribution: Mediterranean.

Lasioptera carophila F. Löw, 1874

Larvae cause unilocular swellings at bases of umbellules in inflorescences of various species and genera of the family Apiaceae (Pl. II, Fig. 11). A single larva develops in a chamber, the walls of which are covered with mycelium. Larvae of summer generation pupate in galls. Two generations develop per year. Larvae also hibernate in galls where they pupate in the spring. Occurrence: DE STEFANI (1901, 1903, 1906c) found galls in Sicily on *Cnidium apioides* Spr., *Opoponax chironium*, *Daucus carota* L., *Elaeoselinum meoides* Koch, *Foeniculum piperitum* Dec. DE STEFANI (1905a) reared some parasitoids from galls collected on *F. piperitum*. Occurrence: Ficuzza, Partinico, Palermo, mountains near Palermo. DE STEFANI jr (1942) reported galls on *Cnidium silaifolium* (Jacq.) in July at Ficuzza (as Cecidomyidae). Distribution: European, occurring up to North Africa; it occurs also in Turkey (SKUHRAVÁ *et al.*, 2005).

Lasioptera eryngii (Vallot, 1829)

Larvae cause plurilocular swellings on stems, leaf petioles and main leaf veins of *Eryngium campestre* L. (Apiaceae) (Pl. II, Fig. 10). The walls of chambers are covered with fungal mycelium. Larvae pupate in galls. Two generations develop per year. Occurrence: DE STEFANI (1905a, 1905c, 1906c) found galls on *Eryngium tricuspdatum*, *E. campestre* and *E. amethystinum* in Palermo and reared from them several parasitoids. DE STEFANI jr (1942) reported galls also from Santa Ninfa (Trapani); recent records of galls on *E. campestre*: Sciare di Marsala (Trapani), 10.8.2006, leg. B. Massa; Piana degli Albanesi (Palermo), 17.8.2007. Distribution: Mediterranean; it was found also in Turkey (SKUHRVÁ *et al.*, 2005).

Lasioptera thapsiae Kieffer, 1898,

Larvae cause plurilocular swellings at the point of insertion of the umbelules of *Thapsia garganica* L. (Apiaceae), of a size of a walnut (Pl. II, Fig. 12). Two generations develop per year. Larvae pupate in the galls. Occurrence: DE STEFANI (1903) found galls in the mountains surrounding Palermo very abundantly and later he obtained several parasitoids from them (DE STEFANI, 1905a). Recently (6.6.2007) the galls were found on Ustica Is., where they seem very abundant (leg. S. Pasta). Reference: TROTTER & CECCONI (1900-1917: N. 290), Palermo, 1902, leg. De Stefani. Distribution: Mediterranean.

Lasioptera umbelliferarum Kieffer, 1909

Larvae cause plurilocular swellings on stems and leaf stalks of *Hippomarathrum* sp. (formerly *Seseli*) (Apiaceae), up 20 mm long. Galls were discovered at Petrowsk near the Caspian Sea in 1894 by RübSaamen (RÜBSAAMEN, 1895) and afterwards KIEFFER (1909) described the species very briefly. Occurrence: MÖHN (1969-1971) examined larvae of this species coming from S. Martino near Palermo, 600 m, 31.5.1840 (Coll. Möhn, N. 8150). Distribution: Euro-Asian, galls are known to occur in southern Italy (Sicily), Russia (Petrowsk near the Caspian Sea), Georgia, Iran (Kurdistan) and Palestine.

Lestodiplosis aonidiellae Harris, 1968

Adults were reared from larvae preying on *Aonidiella aurantii* (Hemiptera Diaspididae) on *Citrus aurantii* (Rutaceae) in South Africa. SISCARO *et al.* (1999) found this species in eastern Sicily during observations on the natural enemies of *Aonidiella aurantii* in citrus groves. This species was probably introduced in Sicily from Africa and may be evaluated as alien species in Sicily and Italy.

Macrodiplosis roboris (Hardy, 1854)

Syn. *Macrodiplosis volvens* Kieffer, 1895

Larvae cause galls on *Quercus robur* L., *Q. petraea* (Matt.) Liebel and related species (Fagaceae). The gall is formed by a rolled leaf margin segment, situated between two lobes (Pl. I, Fig. 1). Only one generation develops per year. Fully grown larvae leave galls, fall to the ground and enter the soil where they remain till the spring of the following year. Occurrence: DE STEFANI (1907a) recorded galls found on *Quercus coccinea* Wang. in the Botanical Garden of Palermo, the host plant originating from North America. LONGO *et al.* (2001) report this species on *Q. pubescens* from the Etna region. Distribution: European up to Kazakhstan; it was also found in Turkey (SKUHRAVÁ *et al.*, 2005).

Mayetiola destructor Say, 1817

Syn. *Cecidomyia cerealis* Rondani, 1843

Cecidomyia frumentaria Rondani, 1864

White larvae cause swellings on the lower part of the stem on *Triticum aestivum* L. (*T. vulgare* Vill.), *Secale cereale* L. and occasionally also on various species of weed grasses (Poaceae). There are usually two generations per year. In Central Europe adults of the first generation emerge in May. Larvae feed by sucking the sap from the tissues of the stem just above a node; attacked parts of stems are swollen. Larvae pupate within a puparium on the stem. Adults emerge in late summer and produce the second generation. Larvae overwinter in puparia and pupate there in the following spring. When the infestation is severe, the young plants may die. DARVAS *et al.* (2000) evaluate *M. destructor* as a minor pest of cereals in Europe, but the main pest of cereals in North America. Occurrence: MINÀ PALUMBO (1882) reported this species from Sicily. Distribution: Euro-Siberian species introduced from Europe to New Zealand and North America. At the present time, it seems to have nearly a cosmopolitan distribution (SKUHRAVÁ *et al.*, 1984a, 1984b).

Mikiola fagi (Hartig, 1839)

A solitary white larva produces a large, smooth (hairless) hard gall, pointed at the tip, on the upper leaf surface of *Fagus sylvatica* L. (Fagaceae). In summer the galls are green, later they become red (Pl. I, Figs. 2 and 3). In autumn galls fall to the soil and larvae overwinter inside them. In the following spring larvae pupate in galls and then adults emerge from them. Occurrence: DE STEFANI (1906c) recorded galls without giving locality. DE STEFANI jr (1942) reported galls from the Nebrodi mountains, near Troina in June-September. LONGO *et al.* (2001) report the occurrence of this species from the Etna region. In recent times the galls were commonly found on Madonie, Nebrodi and Etna, between 1400

and 1800 m. Distribution: European, reaching up to Caucasus; it was also found in Turkey (SKUHRVÁ *et al.*, 2005).

Mikomya coryli (Kieffer, 1901)

Syn. *Oligotrophus tympanifex* Kieffer, 1909

A solitary hyaline larva develops in a small circular depression on the lower part of the leaf of *Corylus avellana* L. (Corylaceae). Only one generation develops per year. Larvae leave galls, fall to the ground and hibernate in the soil up to the following spring. Occurrence: DE STEFANI (1906c) reported galls from Sicily without giving the name of the inducing insect. Distribution: European, reaching up to Turkey (SKUHRVÁ *et al.*, 2005).

Myricomyia mediterranea (F. Löw, 1885)

Larvae cause small rosette galls on twigs of *Erica arborea* L. and related species (Ericaceae). In the middle of each gall there is a small chamber including one larva. Only one generation develops per year. Larvae hibernate in galls where they pupate in the spring of the following year. Occurrence: DE STEFANI (1902, 1906c) found galls on *Erica peduncularis* Presll. on the coastal areas of Cefalù, Boschi delle Caronie, S. Marco d'Alunzio, S. Agata di Militello and Messina. Distribution: Mediterranean.

Ozirhincus anthemidis (Rübsaamen, 1915)

A single larva develops inside a chamber of a swollen achene in the flower head of *Anthemis austriaca* Jacq. (Asteraceae). Two generations develop a year. Larvae pupate in galls. Occurrence: MÖHN (1966-1971) reported galls found at Polizzi (800 m), Madonie, 6.7.1874 (Coll. Möhn, Nr. 8017). Distribution: European, occurring up to North Africa; it was also found in Turkey (SKUHRVÁ *et al.*, 2005).

Ozirhincus longicollis Rondani, 1840

Syn. *Lasioptera chrysanthemi* H. Loew, 1850; *Lasioptera leucanthemi* Kieffer, 1898

A single larva develops inside a chamber of a swollen achene in the flower head of *Chrysanthemum coronarium* L. (Asteraceae). Two generations develop a year. Larvae pupate in galls. Occurrence: MÖHN (1966-1971) examined larvae collected in Catania, 21.5.1874 (Coll. Möhn, Nr. 8028). Distribution: European, occurring up to North Africa; it was also found in Turkey (SKUHRVÁ *et al.*, 2005).

Procontarinia matteiana Kieffer et Cecconi, 1906

Solitary larva causes a small pustule gall on the leaf of *Mangifera indica* L. (Anacardiaceae). Usually many galls occur on one leaf. Galls were discovered in the Botanical Garden of Palermo by Prof. G.E. Mattei in 1906, described

and named to his honour by KIEFFER & CECCONI (1906). References: DE STEFANI (1906b), TROTTER & CECCONI (1907: N. 412): on the label it is written: “Bombay (India); sviluppato l’insetto a Palermo nel maggio 1906 (Prof. G. E. Mattei)”; material originated from India and adults were reared from galls in Palermo. Distribution: Euro-Asian species, known to occur in India, Kenya, Mauritius, Réunion, Java. It has to be considered an alien species in Sicily.

Psectrosema tamaricis (De Stefani, 1902)

Larvae cause swellings on branches of *Tamarix gallica* L. (formerly *T. tetrandra* L.) (Tamaricaceae). In each gall many larvae develop. Occurrence: DE STEFANI (1902) found galls in the Botanical Garden of Palermo, reared adults and described it as *Rhopalomyia tamaricis*. DE STEFANI jr (1942) reported in January galls again in Palermo Botanical Garden. Reference: TROTTER & CECCONI (1900-1917: N. 290), Catania and Palermo, 1902, leg. De Stefani; DE STEFANI (1906c). Distribution: Mediterranean.

Pumilomyia protrabenda De Stefani, 1919

Pumilomyia De Stefani, 1919

Pulmilomyia De Stefani, 1929: new synonym

Pumilomyia protrabenda De Stefani, 1919

Pulmilomyia artemisiae De Stefani, 1929: new synonym

Larvae cause small galls on leaves, leaf stalks and stems of *Artemisia arborescens* L. (Asteraceae). The galls are small hypertrophies of various form. Each gall includes only one larva. If galls occur in large amount, they may cause a heavy damage (stunting) of the whole host plant. DE STEFANI (1919) found attacked plants at R. Orto Botanico of Palermo, where they were very common from late January to April at his time. He reared adults, described the species, figured a damaged plant, observed the biology and established a new genus for this species. Since his time any more galls of this species have been found. Distribution: Mediterranean.

Note: DE STEFANI (1929) incomprehensibly redescribed the same species with another name (*Pulmilomyia artemisiae*); therefore it has to be considered a new junior synonym, hitherto overlooked.

Putoniella pruni (Kaltenbach, 1872)

Cecidomyia pruni Kaltenbach, 1872

Syn. *Diplosis marsupialis* F. Löw, 1889; *Putoniella marsupialis* (F. Löw, 1889): authors

Larvae cause pouch or pocket-shaped swellings usually along the mid-vein on leaves of various species of *Prunus* (Rosaceae) (Pl. VI, Fig. 34). Only one generation develops per year. Fully grown larvae leave the galls, drop to the soil where they overwinter. Occurrence: DE STEFANI (1917) recorded this

species in Sicily without giving a locality. Distribution: European, with large area. DARVAS *et al.* (2000) evaluate this species as a minor pest of plum trees.

Resseliella oleisuga (Targioni-Tozzetti, 1886)

Diplois oleisuga Targioni-Tozzetti, 1886

Clinodiplois oleisuga (Targioni-Tozzetti, 1886)

Thomasiniana oleisuga (Targioni-Tozzetti, 1886)

Larvae develop under the bark of twigs of *Olea europaea* L. (Oleaceae). They may cause withering of the twigs (BARNES, 1948). Two generations develop per year, one during the spring and summer and the other in the autumn. TARGIONI-TOZZETTI (1886) described this species, without giving any locality where larvae were coming from, presumably in southern Italy and Sicily. Occurrence: LIOTTA (1981) mentioned this species as a pest of table olives in Sicily. Distribution: Mediterranean, known to occur in Italy, Croatia, Greece, Syria, Israel and Morocco; it was also found in Turkey (SKUHRAVÁ *et al.*, 2005).

Stefaniella atriplicis Kieffer, 1898

Larvae cause small swellings on stems of *Atriplex halimus* L. (Chenopodiaceae), only about 4-5 mm in diameter. Larvae pupate in galls. KIEFFER (1898) described this species, basing on material sent him by M. Olivier from Algeria. Occurrence: DE STEFANI (1906c) found galls at Palermo. Distribution: Mediterranean.

Stefaniella trinacriae De Stefani, 1900

Larvae cause fusiform plurilocular swellings on stems of *Atriplex halimus* L. (Chenopodiaceae) of a size of a nut (Pl. III, Fig. 14). Larvae pupate in the galls. Two generations per year. DE STEFANI (1900) discovered this species in Sicily and described adults and larvae without mentioning the exact locality, which presumably was on the western coast of the island. He reared from galls several species of parasitoids (DE STEFANI, 1900, 1905a). DE STEFANI jr (1942) reported it also from Caltanissetta in March. Occurrence: galls were found at Nature Reserve Capodarso (Caltanissetta) on 10.10.2005 and 9.6.2006 (1 male, 2 females emerged from them on 22.6.2006), at Nature Reserve Saline di Trapani on 18.6.2006, 25.8.2006 and 15.5.2007, on Catania seafront on 10.11.2006 (leg. B. Massa), at Mustigarufi (Caltanissetta) on 1.9.2007 and at Siciliana Marina (Agrigento) on 19.8.2006 (leg. A. Troia). Reference: TROTTER & CECCONI (1900-1917: N. 216). Distribution: Mediterranean.

Zeuxidiplois giardi (Kieffer, 1896)

Larvae cause galls on stem of *Hypericum perforatum* L. (Hypericaceae). The gall consists of a pair of small leaves with a large chamber including one

or two larvae that pupate inside (Pl. IV, Fig. 22). Two generations develop per year. Occurrence: DE STEFANI (1903, 1906c) found galls in July on the Monti di S. Martino (Palermo) (600 m). Distribution: primarily Euro-Siberian species with disjunct area. It has been imported to North America and New Zealand for biological control of *Hypericum perforatum*.

UNIDENTIFIED SPECIES

Galls of several gall midge species that were recorded on various host plants in Sicily need further research to ascertain which species is the causer. It is necessary to find galls once more at localities where they were found in the past, to preserve larvae in 75% alcohol for future examination and to try to rear adults to identify the causer. We arrange them in the following part alphabetically, according to the host plants.

Atriplex halimus L.

Galls of about 2 mm size, globulose, protruding on both leaf surfaces, caused by Cecidomyiidae, found at Santa Ninfa (Trapani). Reference: DE STEFANI jr (1942).

Betula aetnensis Rafinesque

Plemeliella sp. Reference: LONGO *et al.* (2001) recorded a species belonging to the genus *Plemeliella* on Etna without giving the description of the gall.

Euphorbia spp.

Galls on *Euphorbia bivonae*, caused by *Perrisia* sp., found at "Favorita", Palermo, in April; they are formed by 4-5 overlapped leaves, like a spindle-shaped button, acutely ending, and contain different yellow-red larvae. Reference: DE STEFANI (1905c).

Galls similar to those above recorded, but containing withish larvae, found on *Euphorbia ceratocarpa* Ten., caused by an unidentified Cecidomyiidae, at Monti di Renda, in October and November. Reference: DE STEFANI (1907b).

Galls on *Euphorbia characias* in the same locality and months, with the same characteristics of those found on *E. bivonae* above cited. Reference: DE STEFANI (1907b) wrote that larvae pupate inside a withish cocoon and galls are similar to those of *Perrisia subpatula* Bremi, with the only difference that they are plurilocular.

Lathyrus clymenum L.

Rolled leaflets caused by *Dasineura* sp. (as *Perrisia* sp.). References: DE

STEFANI (1903, 1906c), TROTTER & CECCONI (1900-1917: N. 11); DE STEFANI jr (1942) reported galls from Real Favorita (Palermo) on *Lathyrus articulatus* L. and *L. clymenum* L.

Inflorescences changed in rounded terminal galls caused by a Cecidomyiidae. References: DE STEFANI (1903, 1906c), TROTTER & CECCONI (1900-1917: N. 12).

Quercus ilex L.

Small galls of about 1 mm size, situated near the leaf vein, caused by *Contarinia* sp. Reference: DE STEFANI (1906c).

Vicia dasycarpa Ten.

Leaflet galls just thickened and folded, including 4-5 small yellowish-white larvae, caused by *Dasineura* sp. (as *Perrisia* sp.), found at Real Villa Favorita in April-May. References: DE STEFANI (1903); TROTTER & CECCONI (1900-1917: N. 28). Flower bud galls caused by *Dasineura* sp. (as *Perrisia* sp.), containing 4-5 yellow larvae. Reference: DE STEFANI (1905c).

ZOOGEOGRAPHY

The gall midge fauna of Sicily may be divided, on the basis of a zoogeographical analysis, according to the occurrence of species in the Palaearctic region, into seven groups. The majority, 42 species (48%) are Mediterranean, 22 species (25%) European and 11 species (13%) Eurosiberian. Five gall midge species occurring in almost all the world may be considered to be cosmopolitans. Among them *Aphidoletes aphidimyza* and *Feltiella acarisuga*, both predacious species, are true cosmopolitans, whereas *Contarinia pyrivora*, *Dasineura mali* and *Dasineura pyri* are secondary cosmopolitans, because origin centres overlap with their host plants in southern Europe. *Horidiplosis ficifolii* and *Procontarinia matteiana* are Asian species associated with host plants originated from Asia. *Contarinia citri*, *Dicrodiplosis pseudococci* and *Lestodiplosis aonidiellae* are Afrotropical species. We consider these five last species as alien for Sicilian fauna, being imported in Sicily probably with plant materials.

Mediterranean species are associated with Mediterranean host plant species that have centres of origin in the Mediterranean area. To this group belong eleven species of the genus *Asphondylia*; *Dasineura oleae*, *Resseliella oleisuga*, *Lasioptera berlesiana* and *Asynapta furcifer* associated with olive tree; *Dryomyia lichtensteinii*, *Contarinia ilicis*, *C. minima* and *Arnoldiella tympanifex* associated with *Quercus ilex* and *Q. suber*; *Braueriella phillyreae* and

Dasineura rufescens with *Phillyrea* spp.; *Baldratia salicorniae* and *Houardiella salicorniae* with *Arthrocnemum* spp. (formerly recorded as *Salicornia*), and many gall midge species associated with herbaceous host plants (Table 1).

European species are associated with European host plant species that have centres of origin in Europe. *Dasineura plicatrix* is a typical representative

Table 1
Host plant species attacked by gall midges in Sicily

Host plants	Gall midges
<i>Acer campestre</i>	<i>Acericecis campestre</i>
<i>Acer pseudoplatanus</i>	<i>Acericecis vitrina</i>
<i>Anthemis austriaca</i>	<i>Ozirhincus anthemidis</i>
<i>Artemisia arborescens</i>	<i>Pumilomyia protrahenda</i>
<i>Arthrocnemum</i> cf. <i>fruticosum</i>	<i>Baldratia salicorniae</i>
	<i>Houardiella salicorniae</i>
<i>Atriplex halimus</i>	<i>Asphondylia conglomerata</i>
	<i>Stefaniella atriplicis</i>
	<i>Stefaniella trinacriae</i>
<i>Atriplex patula</i>	<i>Aplonyx chenopodii</i>
<i>Asparagus</i> spp.	<i>Dasineura minardii</i>
<i>Brassica amplexicaulis</i>	<i>Contarinia nasturtii</i>
<i>Calycotome spinosa</i>	<i>Asphondylia calycotomae</i>
	<i>Asphondylia gennadii</i> (?)
<i>Capparis spinosa</i>	<i>Asphondylia capparis</i>
	<i>Asphondylia gennadii</i>
<i>Cerantia siliqua</i>	<i>Asphondylia gennadii</i>
<i>Chrysanthemum coronarium</i>	<i>Ozirhincus longicollis</i>
<i>Citrus</i> sp.	<i>Contarinia citri</i>
	<i>Dicrodiplosis pseudococci</i> , zoophagous
<i>Cnidium apioides</i>	<i>Lasioptera carophila</i>
<i>Coronilla emeroides</i>	<i>Asphondylia coronillae</i>
<i>Corylus avellana</i>	<i>Contarinia coryli</i>
	<i>Mikomya coryli</i>
	<i>Arthrocnodax coryligallarum</i> , zoophagous
<i>Crataegus laevigata</i>	<i>Dasineura crataegi</i>
<i>Daucus carota</i>	<i>Kiefferia pericarpicola</i>
	<i>Lasioptera carophila</i>
<i>Diplotaxis tenuifolia</i>	<i>Asphondylia stefanii</i>
<i>Diplotaxis crassifolia</i>	<i>Gephyraulus diplotaxis</i>
<i>Elaeoselinum meiodes</i>	<i>Lasioptera carophila</i>
<i>Erica arborea</i>	<i>Dasineura ericaescopariae</i>
<i>Erica arborea</i> , <i>E. peduncularis</i>	<i>Myricomyia mediterranea</i>
<i>Eryngium campestre</i>	<i>Lasioptera eryngii</i>
<i>Eryngium tricuspdatum</i>	
<i>Eryngium amethystinum</i>	
<i>Euphorbia characias</i>	<i>Janetiella euphorbiae</i>
<i>Fagus sylvatica</i>	<i>Hartigiola annulipes</i>
	<i>Mikiola fagi</i>
<i>Ficus benjamina</i>	<i>Horidiplosis ficifolii</i>

table 1 - continued

<i>Foeniculum piperitum</i>	<i>Kiefferia pericarpicola</i> <i>Lasioptera carophila</i>
<i>Foeniculum officinale</i>	<i>Kiefferia pericarpicola</i>
<i>Fraxinus angustifolia</i>	<i>Dasineura acrophila</i>
<i>Galium pallidum</i> , <i>G. saccaratum</i>	<i>Geocrypta galii</i>
<i>Galium cinereum</i>	
<i>Galium</i> sp., <i>G. cinereum</i>	<i>Dasineura galiicola</i>
<i>Hippomarathrum</i> sp.	<i>Lasioptera umbelliferarum</i>
<i>Hypericum perforatum</i>	<i>Zeuxidiplosis giardi</i>
<i>Malus domestica</i> , <i>M. sylvestris</i>	<i>Dasineura mali</i>
<i>Mangifera indica</i>	<i>Procontarinia matteiana</i>
<i>Medicago sativa</i> , <i>M. falcata</i>	<i>Dasineura medicaginis</i>
<i>Mentha</i> sp.	<i>Asphondylia menthae</i>
<i>Olea europaea</i>	<i>Dasineura oleae</i> <i>Lasioptera berlesiana</i> <i>Resseliella oleisuga</i> <i>Asynapta furcifer</i>
<i>Opoponax chironium</i>	<i>Lasioptera carophila</i>
<i>Phillyrea media</i>	<i>Braueriella phillyreae</i> <i>Dasineura rufescens</i>
<i>Prunus spinosa</i> , <i>P. domestica</i>	<i>Asphondylia pruniperda</i> <i>Dasineura sodalis</i> <i>Dasineura tortrix</i> <i>Putoniella pruni</i>
<i>Pyrus amygdaliformis</i>	<i>Apiomyia bergenstammi</i> <i>Contarinia pyrivora</i> <i>Dasineura pyri</i> <i>Clinodiplosis pyricola</i>
<i>Quercus cerris</i>	<i>Janetia homocera</i>
<i>Quercus coccinea</i>	<i>Macrodiplosis roboris</i>
<i>Quercus ilex</i>	<i>Arnoldiella tympanifex</i> <i>Dryomyia lichtensteini</i> <i>Contarinia ilicis</i> <i>Contarinia minima</i>
<i>Quercus lineata</i>	<i>Janetia homocera</i>
<i>Quercus pubescens</i>	<i>Contarinia quercina</i> <i>Janetia cerris</i>
<i>Quercus suber</i>	<i>Arnoldiella tympanifex</i> <i>Dryomyia circinans</i> <i>Janetia cerris</i>
<i>Rhamnus alaternus</i>	<i>Asphondylia borzi</i>
<i>Rosa sempervirens</i>	<i>Dasineura rosae</i>
<i>Rosmarinus officinalis</i>	<i>Asphondylia rosmarini</i>
<i>Rubus fruticosus</i>	<i>Dasineura plicatrix</i>
<i>Silene vulgaris</i>	<i>Jaapiella floriperda</i>
<i>Sinapis nigra</i>	<i>Asphondylia stefanii</i>
<i>Solanum nigrum</i>	<i>Asphondylia trabuti</i>
<i>Sonchus asper</i> , <i>S. oleraceus</i>	<i>Cystiphora sonchi</i>
<i>Tamarix gallica</i>	<i>Psectrosema tamaricis</i>
<i>Thapsia garganica</i>	<i>Lasioptera thapsiae</i>

table 1 - continued

<i>Trifolium pratense</i>	<i>Dasineura trifolii</i>
<i>Triticum aestivum</i>	<i>Mayetiola destructor</i>
	<i>Contarinia tritici</i>
<i>Verbascum sinuatum</i>	<i>Asphondylia verbasci</i>
<i>Vicia dasycarpa</i>	<i>Anabremia massalongoi</i>
	<i>Contarinia craccae</i>
	<i>Dasineura viciae</i>
<i>Vicia sativa</i>	<i>Contarinia craccae</i>
	<i>Dasineura viciae</i>
<i>Viola hirta</i>	<i>Dasineura affinis</i>
<i>Vitis vinifera</i>	<i>Ampelosucta illata</i>
	<i>Janetiella oenophila</i>
	<i>Contarinia viticola</i>

of an European species. It occupies a large distribution area from Britain and Portugal in Western Europe to Greece in Eastern Europe and to Algeria in North Africa.

Eurosiberian species occur abundantly in Europe and extend at least to Western Siberia, some of them to central Siberia and only few species reach up to Far East, China and Japan. *Dasineura rosae* causing galls on leaflets of various *Rosa* spp. is typical representative of Eurosiberian species.

Out of 89 species of the present gall midge fauna of Sicily, one fifth (19 species) were discovered in Sicily where they have their type localities. Ten species were described by DE STEFANI PEREZ (1898, 1900, 1902, 1908, 1912, 1913, 1919), namely *Ampelosucta illata*, *Aplonyx chenopodii*, *Asphondylia borzi*, *A. conglomerata*, *Dasineura minardii*, *D. rufescens*, *Janetiella euphorbiae*, *Psectrosema tamaricis*, *Pumilomyia protrahenda*, *Stefaniella trinacriae*. Further nine species were described by various authors based on material originated from Sicily, that is *Arnoldiella tympanifex*, *Arthrocnodax coryligallarum*, *Asphondylia capparis*, *A. stefanii*, *Asynapta furcifer*, *Dicrodiplosis pseudococci*, *Lasioptera thapsiae*, *Procontarinia matteiana*, *Resseliella oleisuga*.

Unfortunately, all original materials of gall midge species discovered in Sicily, where they have type localities, are lost with the exception of *Asphondylia capparis*, *Asynapta furcifer* and *Dicrodiplosis pseudococci*, the holotypes of which are preserved in the Museum für Naturkunde, Humboldt Universität, Berlin, Germany (*A. capparis*), British Museum of Natural History, London, UK (*A. furcifer*) and New York State Museum, Albany, USA (*D. pseudococci*). It would be necessary to rediscover the galls of gall midges found in Sicily at their type localities, to obtain larvae, pupae and to rear adults, in order to establish the neotypes and to build a new collection of gall midges that will be preserved for future research and for redescriptions of morphological characters of larvae, pupae and adults on modern basis.

RELATIONS OF GALL MIDGES WITH THEIR HOST PLANTS

The fauna of gall midges of Sicily may be considered as very rich in comparison with the gall midge fauna of other Mediterranean islands. In Sardinia 44 gall midge species are currently known (SKUHRAVÁ & SKUHRAVÝ, 2002), while in Malta 36 (SKUHRAVÁ *et al.*, 2002), in Crete 38 (SKUHRAVÁ & SKUHRAVÝ, 1997), in Mallorca 33 species (SKUHRAVÁ & SKUHRAVÝ, 2004), 49 in Corfu, 33 in Samos (SKUHRAVÁ & SKUHRAVÝ, 2006) and only 30 in Cyprus (SKUHRAVÁ & SKUHRAVÝ, 2004). The gall midge species richness in Sicily is probably influenced by the richness of plant species growing in various plant associations from sea level up to mountains, by the size and geographical position of Sicily, but also possibly by its old entomological tradition, particularly for the presence of Teodosio De Stefani Perez, who intensively studied gall midges and wasps for a time longer than 20 years.

Sicilian flora consists of 2793 species belonging to 864 genera and 158 families; as regards plant species, Sicily is one of the richest Italian regions (CONTI *et al.*, 2005a, 2005b). Considering that Sicilian cecidofauna represents c. 18% of Italian one, while Sicilian flora represents the high figure of 41.6% of Italian one, it seems likely that future researches will increase the total amount of gall midge species living in the island. Furthermore, the fact that Sardinian flora consists of 2295 species belonging to 782 genera and 159 families, while the number of gall midge species recorded in Sardinia is half of that one of Sicily, is probably due to the lack of specific long-term researches in Sardinia or to the higher island isolation causing lower species richness; as well, on Crete are known 1742 plant species belonging to 623 genera and 128 families (CHILTON & TURLAND, 1997), while the gall midge species currently known are only 38. It seems evident that further researches on Cecidomyiidae are needed to reach a better picture of the actual number of species living on Mediterranean islands.

In Sicily 89 gall midge species are associated with 77 host plant species, that is to say one gall midge species is associated with 1.16 host plant species. Only few plant species host more than two gall midge species, as for example *Olea europaea* and *Quercus ilex*, each hosting four gall midge species, *Atriplex halimus* and *Vitis vinifera*, each hosting three gall midge species, and *Phillyrea media* two species.

On the other hand, most of gall midge species are monophagous and their larvae develop on only one plant species. Few gall midge species are oligophagous and their larvae may develop on two, three or more species of one genus of the host plant, as for example *Dasineura rosae*. *Lasioptera carophila* and *Kiefferia pericarpicola* are polyphagous and may develop on many species and genera of the family Apiaceae. *Asphondylia gennadii* is con-

sidered to be a polyphagous species with alternation of host plants that may belong to various plant families.

Sicilian gall midge species are associated with 28 plant families (17.7% of Sicilian plant families) (Table 2); most of them are associated with host plant species of the family Rosaceae (11 species), Fagaceae (11 species), Fabaceae (9 species), Oleaceae (7 species), Chenopodiaceae (6 species), Apiaceae (5 species), Asteraceae (4 species), Brassicaceae, Rutaceae, Corylaceae, Vitaceae (3 species), Aceraceae, Ericaceae, Poaceae and Rubiaceae (2 species); each of the remaining 13 plant families hosts only one gall midge species.

Table 2
List of plant families and number of gall midge species associated with them.

Plant Family	Number of gall midge species recorded in Sicily
Aceraceae	2
Anacardiaceae	1
Apiaceae	5
Asteraceae	4
Brassicaceae	3
Capparidaceae	1
Caryophyllaceae	1
Chenopodiaceae	6
Corylaceae	3
Ericaceae	2
Euphorbiaceae	1
Fabaceae	9
Fagaceae	11
Hypericaceae	1
Lamiaceae	1
Liliaceae	1
Moraceae	1
Oleaceae	7
Poaceae	2
Rhamnaceae	1
Rosaceae	11
Rubiaceae	2
Rutaceae	3
Scrophulariaceae	1
Solanaceae	1
Tamaricaceae	1
Violaceae	1
Vitaceae	3

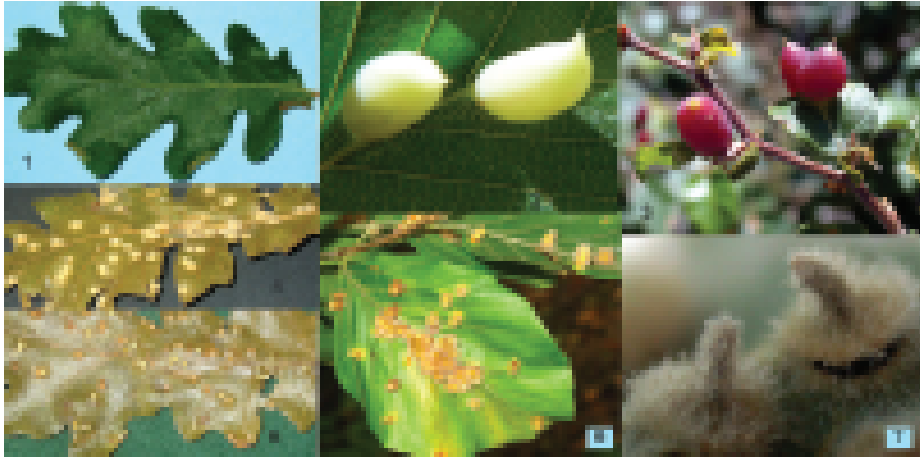


Plate I — Galls of gall midges associated with Fagaceae: 1) Gall induced by *Macrodiplosis roboris* on a leaf of *Quercus petraea*; 2) and 3) galls induced by *Mikiola fagi* on leaves of *Fagus sylvatica*; 4) and 5) lower side (4) and upper side (5) of a leaf of *Quercus cerris*, showing galls induced by *Janetia cerris*; 6) galls induced by *Hartigiola annulipes* on a leaf of *Fagus sylvatica*; 7) galls induced by *Janetia homocera* on a leaf of *Quercus cerris*. 1, 4, 5, 6: photo: V. Skuhrový; 2, 3, 7: photo: B. Massa.

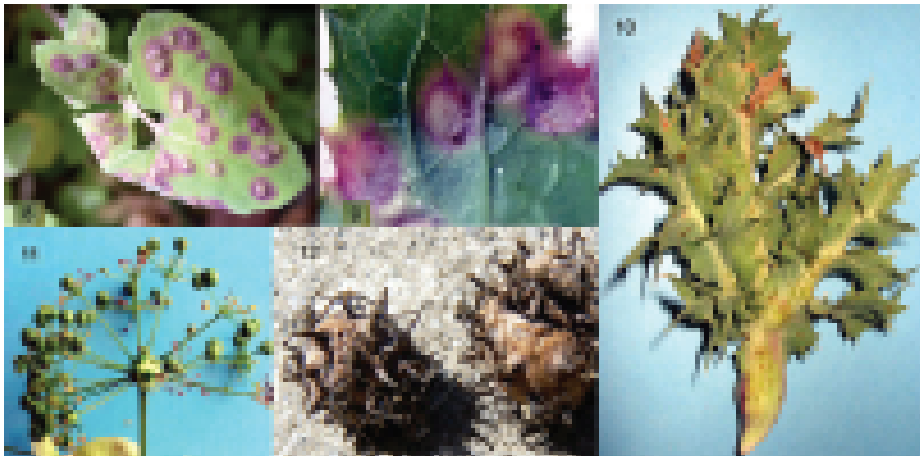


Plate II — Galls of gall midges associated with Asteraceae and Apiaceae: 8) and 9) Upper side (8) and lower side (9) of a leaf of *Sonchus oleraceus*, showing galls of *Cystiphora sonchi*; 10) typical plurilocular swelling on a stem of *Eryngium campestre*, induced by *Lasioptera eryngii*; 11) gall induced at the base of an inflorescence umbellule of *Daucus carota* by *Lasioptera carophila* and fruit galls induced by *Kiefferia pericarpicola*; 12) plurilocular swellings induced on the umbellule insertion of *Thapsia garganica* by *Lasioptera thapsiae*. 8, 9, 12: photo: B. Massa; 10, 11: photo V. Skuhrový.



Plate III — Galls of gall midges associated with Chenopodiaceae and Liliaceae: 13) Galls induced by *Asphondylia conglomerata* on *Atriplex halimus*; 14) gall induced by *Stefaniella trinacriae* on *Atriplex halimus*; 15) swellings on a stem of *Artbrocnemum* cf. *fruticosum* induced by *Baldratia salicorniae* (above) and *Houardiella salicorniae* (below: note their exuviae); 16) *Asparagus* sp. showing a stem gall of *Dasineura turionum*, identical to that induced by *D. minardii* (cf. DE STEFANI, 1913). 13, 14, 15: photo: B. Massa; 16: photo: V. Skuhrový.

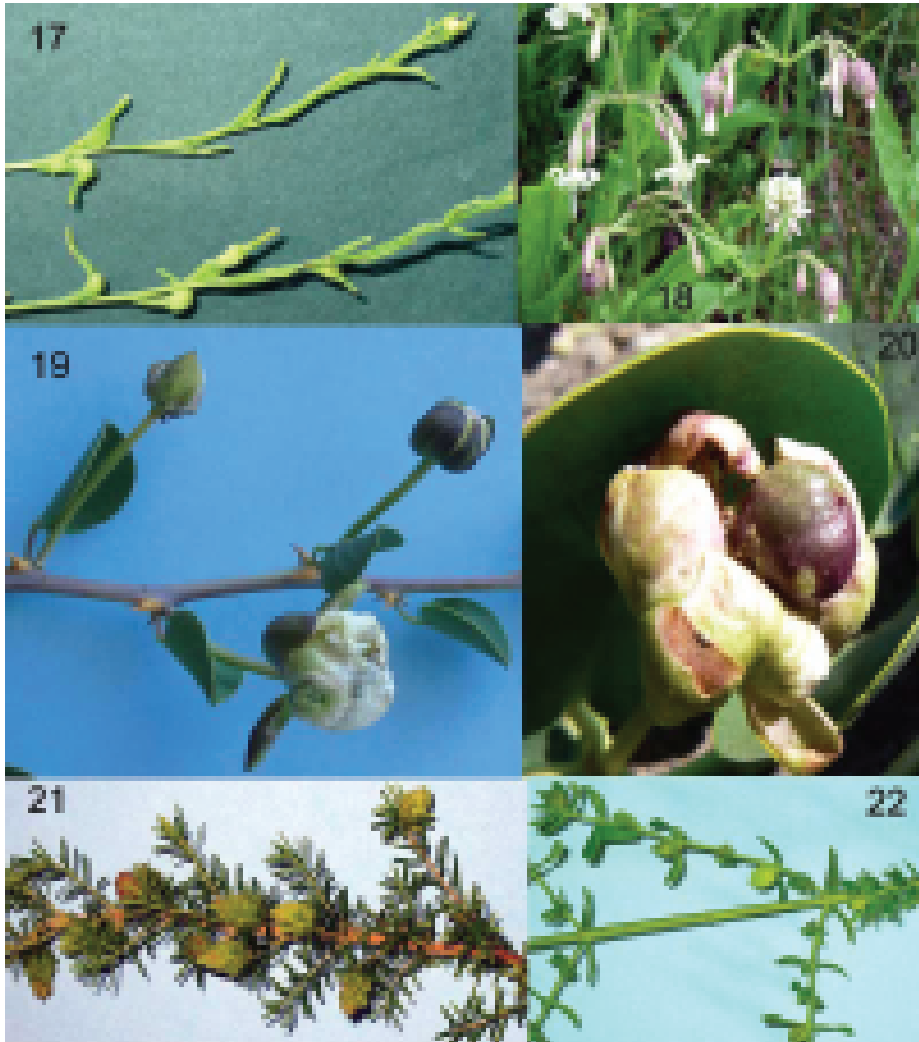


Plate IV — Galls of gall midges associated with Brassicaceae, Caryophyllaceae, Capparidaceae, Ericaceae and Hypericaceae: 17) Deformed siliquas of *Diplotaxis tenuifolia* inhabited by *Asphondylia stefanii*; 18) flower bud galls on *Silene vulgaris*, caused by *Jaapiella floriperda*; 19) branch of *Capparis spinosa* showing an inflorescence inhabited by *Asphondylia capparis*; 20) particular of one inflorescence of *Capparis spinosa* inside containing galls of *Asphondylia capparis*; 21) branch of *Erica* sp. showing the typical large galls on shoot tips, caused by *Dasineura ericaescopariae*; 22) galls produced by a pair of leaves of *Hypericum perforatum* containing a chamber inhabited by *Zeuxidiplosis giardi* larva. 17, 18, 19, 21, 22: photo: V. Skuhravý; 20: photo: B. Massa.

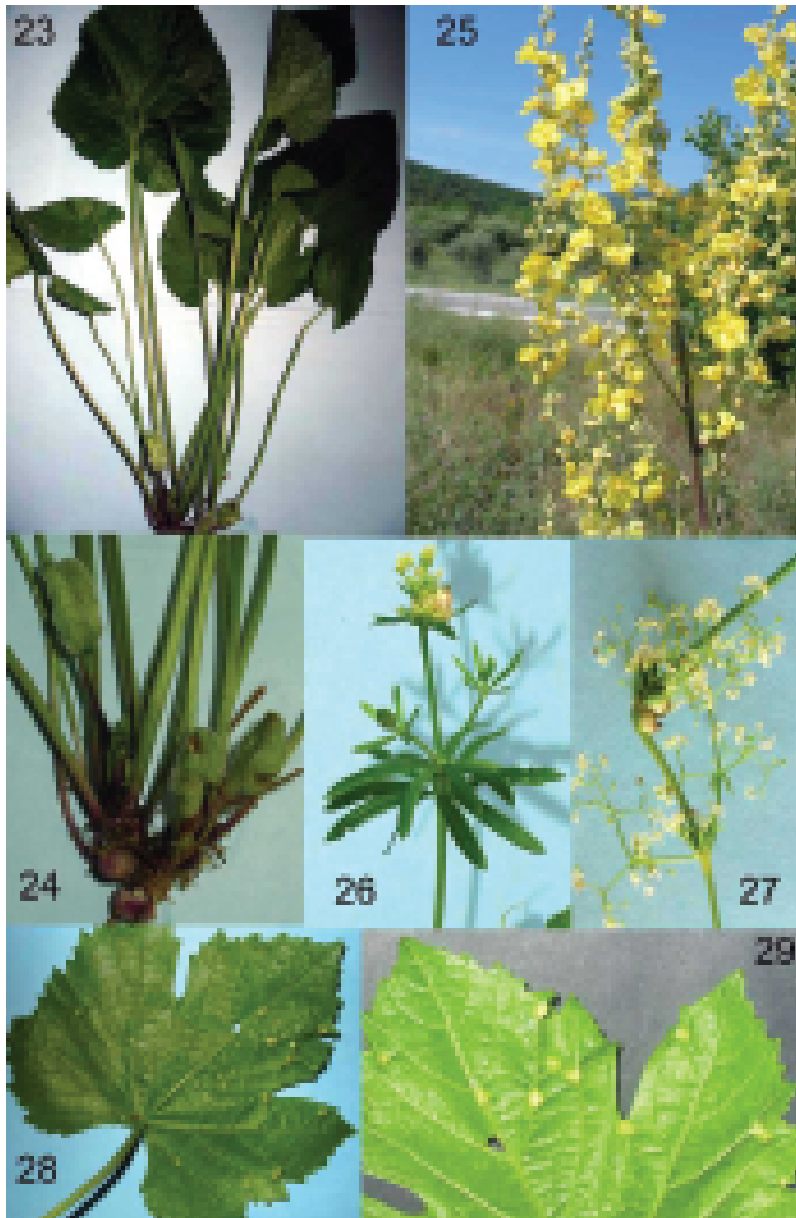


Plate V — Galls of gall midges associated with Violaceae, Scrophulariaceae, Rubiaceae and Vitaceae: 23) and 24) Galls induced by *Dasineura affinis* on young leaves of *Viola* sp.; 25) flower bud galls on *Verbascum sinuatum* induced by *Asphondylia verbasci*; 26) spongy galls caused by *Dasineura galicicola* on the vegetative tips of *Galium* sp.; 27) swellings on the stem of *Galium* sp., produced by *Geocrypta galii*; 28) and 29) small rounded galls on a leaf of *Vitis vinifera* induced by *Janetiella oenophila*. Photos: V. Skuhrový.

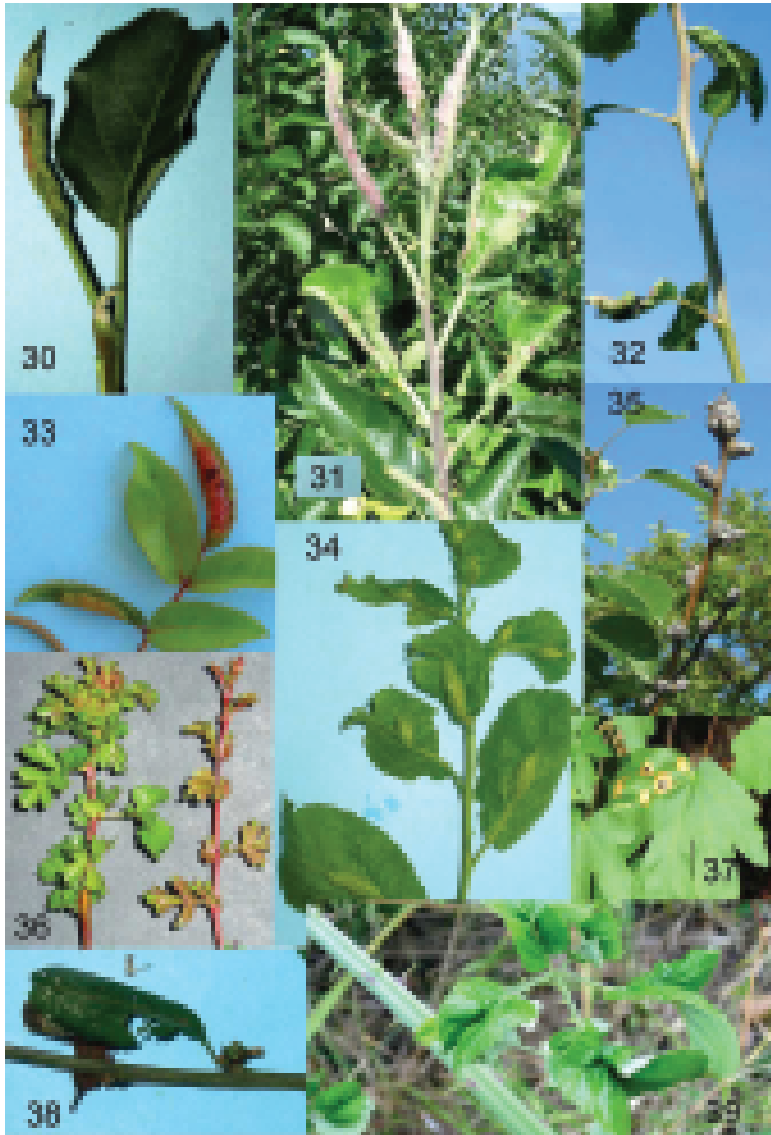


Plate VI — Galls of gall midges associated with Rosaceae and Aceraceae: 30) and 31) Leaves of *Malus domestica* typically rolled for the presence of *Dasineura mali* larvae; 32) rolled leaf margins on *Pyrus communis* caused by *Dasineura pyri*; 33) galls of *Dasineura rosae* on leaves of *Rosa* sp.; 34) galls along the mid-veins of leaves of *Prunus* sp., caused by *Putoniella pruni*; 35) woody plurilocular galls on twigs of *Pyrus communis*, induced by *Apiomyia bergenstammi*; 36) Leaves of *Crataegus laevigata* with rosette galls caused by *Dasineura crataegi* (on left) and ungalled shoot (on right); 37) small depression on the lower side of *Acer campestre*, produced by *Acericecis campestre*; 38) bud gall on branch of *Prunus* sp. from which an *Asphondylia pruniperda* emerged, leaving its exuvia protruding from the chamber hole; 39) young leaves of *Rubus fruticosus* contorted for the presence of *Dasineura plicatrix*. Photos: V. Skuhravý.

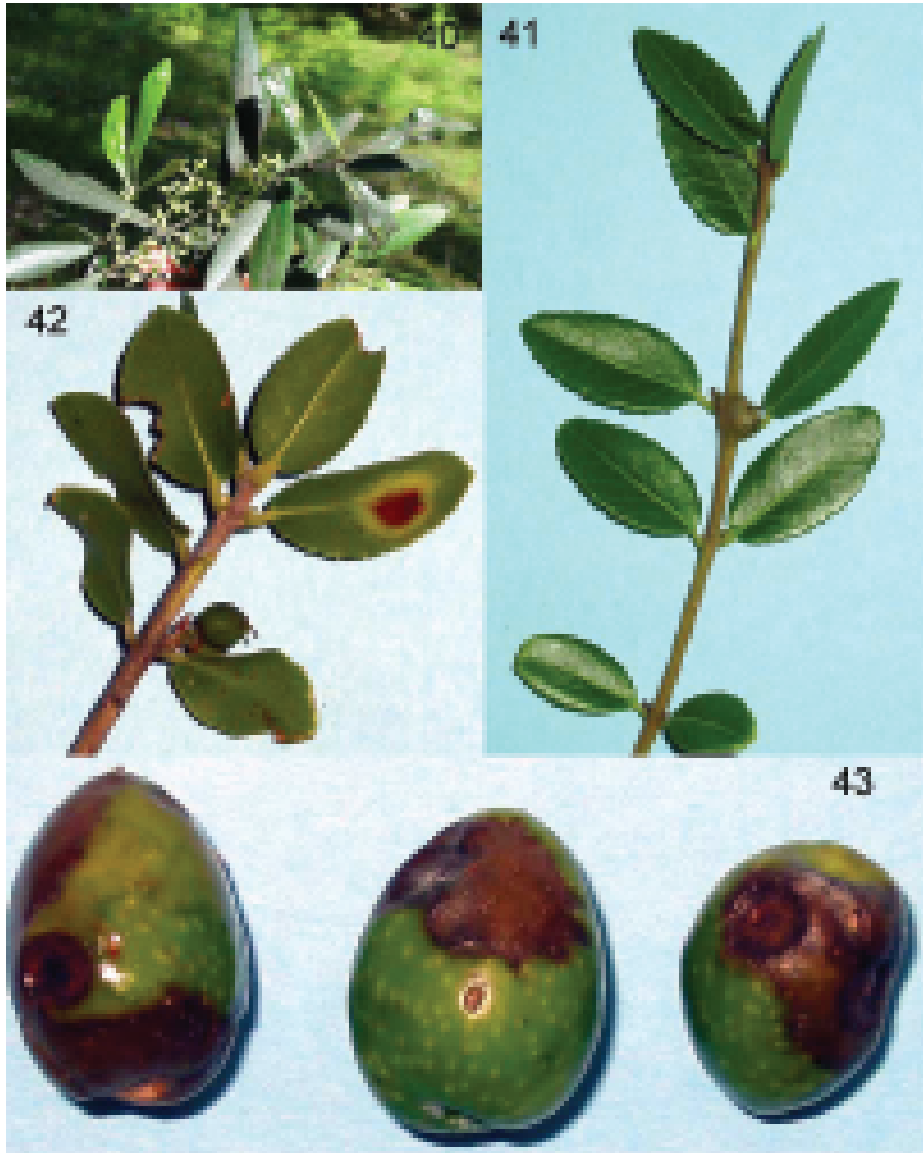


Plate VII — Galls of gall midges associated with Oleaceae: 40) Galls on the leaves of *Olea europaea*, induced by *Dasineura oleae*; 41) globular gall on a branch of *Phillyrea media*, caused by *Dasineura rufescens*; 42) pustule gall of *Braueriella phillyreae* on a *Phillyrea media* leaf; 43) olive fruits damaged by *Bactrocera oleae* and colonized by larvae of *Lasioptera berlesiana*. The latter lays the egg next to that one of *B. oleae*, infecting the chamber with the fungus *Camarosporium dalmaticum* (Thum); newly hatched larva of *L. berlesiana* first attacks *B. oleae* egg, after feeds on fungus. Photos: V. Skuhrový.

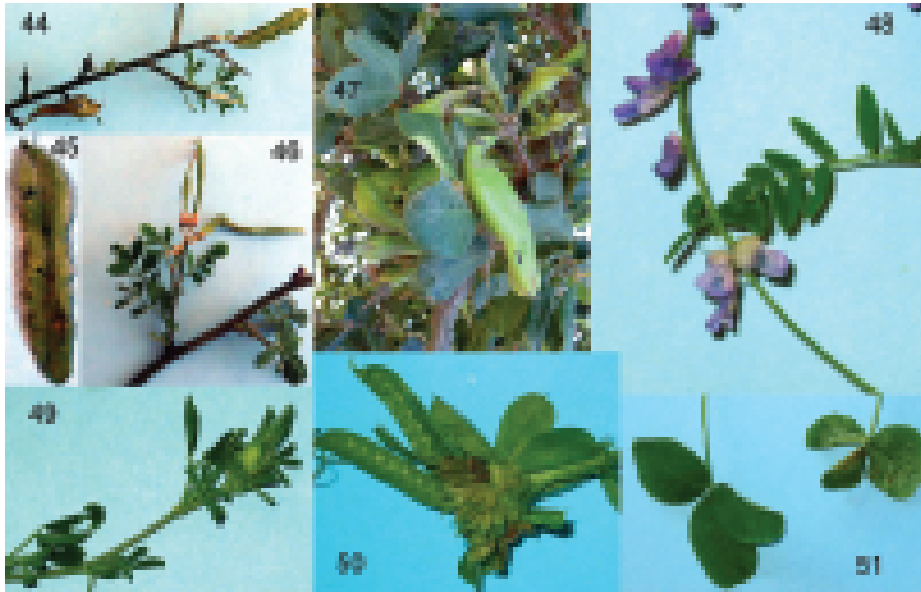


Plate VIII — Galls of gall midges associated with Fabaceae: 44) and 45) *Asphondylia calycotomae* induces galls on leaf buds (44: hibernating generation) and within pods (45: summer generation) of *Calycotome spinosa*; 46) *Asphondylia coronillae* causes galls on buds and pods of *Coronilla emerus*; 47) larvae of *Asphondylia gennadii* develops within pods of *Ceratonia siliqua*, causing their deformation; 48) galls produced by *Contarinia craccae* modifying flower buds of *Vicia cracca*; 49) galls induced on leaf buds of *Medicago sativa* by *Dasineura medicaginis*; 50) pod-like leaflets induced on *Vicia* sp. by *Dasineura viciae*; 51) pod-like leaflets caused by *Dasineura trifolii* on *Trifolium* sp. Photo: V. Skuhravý.

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