

Gall midges (Diptera: Cecidomyiidae) of Greece – summary of investigations of 1994–2010 and zoogeographical analysis

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Received 28 June 2015; accepted 14 January 2016
Published 8 September 2016

Abstract. This study summarizes the results of investigations of gall midges carried out in Greece in the period from 1994 to 2010. Investigations were conducted at 116 localities situated in the Greek mainland, the Peloponnese peninsula and six islands at altitudes from sea level up to 1,100 m a. s. l. at Karpenisi in Central Greece in the southern part of the Pindus Mountains. At present the fauna of gall midges in Greece includes 235 species in 80 genera. Of them 213 are valid species and 22 species, still undescribed, are identified to the genus level. The subfamily Cecidomyiinae includes 224 species in 71 genera, Porricondyliinae 2 species in one genus, Lestremiinae 3 species in 3 genera and Micromyinae 6 species in 5 genera. In Greece the two most speciose genera are *Dasineura* Rondani, 1840 with 37 species and *Contarinia* Rondani, 1860 with 27 species, followed by *Asphondylia* Loew, 1850 with 22 species and *Lasioptera* Meigen, 1818 with 10 species. Zoogeographical analysis is based on 1,157 records, of which 40 were obtained by earlier researchers and 1,117 records of the present authors. Until 1996 only 20 species were known to occur in Greece and adjacent islands. We enriched the fauna of Greece by adding 206 species. Results of our investigations are summarized in three lists: list of species of gall midges; occurrence and distribution of gall midges in Greece; host plants and associated gall midges. All results are evaluated using methods of zoogeographical analysis.

Key words. Biodiversity, species richness, zoogeography, frequency, distribution, economic importance, plant-animal interactions, alien species; Diptera, Cecidomyiidae; Greece, Europe, Palaearctic Region.

CONTENTS

Introduction	128
Study area	128
Material and Methods	130
Results	132
List of species of gall midges	132
Occurrence and distribution of gall midges in Greece	137
Host plants and associated gall midges	141
Evaluation of results	146
Species richness	146
Biodiversity	148
Species density	149
Frequency	150
Altitudinal distribution	151
Geographical distribution	152
Plant – animal interactions	154
Economic importance	156
Summary	159
Acknowledgements	161
References	161

INTRODUCTION

Up to 1993 only twenty species of gall midges were known to occur in the large territory of Greece. At that time the gall midges (Diptera: Cecidomyiidae) of Greece were underexplored. Most of these species were recorded because they were pests of agricultural plants, other species were discovered because they caused remarkable formations on various organs of plants so called galls (in Latin: cecidia). Four species were described on the basis of specimens collected in Greece: *Apiomyia bergenstammi* causing woody galls on branches of *Pyrus communis* by Wachtl (1882), *Asphondylia phlomidis* inducing galls on *Phlomis fruticosa* and *Janetiella fortiana* on *Erysimum graecum*, both described by Trotter (1901) and *Odinadiplosis amygdali* producing woody galls on *Prunus amygdalus* by Anagnostopoulos (1929).

In the past, only a few researchers contributed to the knowledge of gall midges and their galls in this large country notable for its rich vegetation and flora including many potential host plants for gall midges. Skuhrová (1986) in the Catalogue of Palaearctic Diptera gathered all data on the occurrence of gall midges in the literature and listed 20 species of gall midges known to occur in Greece up to that time. This very small number of gall midge species recorded from Greece was the reason why we started our investigations in 1994 and continued them in subsequent years 1995 and 1996. During expeditions in the Greek mainland, Peloponnese and Crete we visited 67 localities and gathered 167 species of gall midges of which 149 were first records from Greece (Skuhrová & Skuhrový 1997a). Between 2004 and 2010 we continued in our investigations and collected gall midges in five islands situated in the Mediterranean Sea: in Corfu, Lefkada and Zakynthos in the Ionian Sea and in Samos and Rhodos in the Aegean Sea where we examined 40 localities (Skuhrová & Skuhrový 2006, 2009, 2011). In the course of our investigations we recorded also 16 of 20 species known up to 1993, some of them in large amounts .

In the present paper we summarize all data obtained during our investigation 1994–2010 and evaluate them from the zoogeographical point of view. We also included in our study 33 species of gall midges, 17 firstly recorded in Greece, identified by M. Skuhrová during the biodiversity studies of wetland round the Lake Kerkini in northern Greece in the years 2005–2008 (Skuhrová, unpubl.). This project called “Invertebrate Biodiversity of Wetland Kerkini“ was organized by G. J. Ramel and results of identifications of some groups of animals were published in the internet.

We included also nine species of the subfamily Lestremiinae recorded in Greece by Jaschhof (1998) and several species of gall midges that occurred as pests in Greece in recent years and reported by Greek authors (Tsagkarakis & Mitsopoulos 2007, Perdakis et al. 2011, 2013, Deligeorgidis et al. 2012, Kyttariolou & Tsagkarakis 2013, Bella 2014).

STUDY AREAS

Greece is a country located in southern Europe, its mainland spread at the southern end of the Balkan Peninsula, with an area 131,940 km² (as a whole state, including sea islands). Greece is surrounded on the north by Bulgaria, Macedonia and Albania; to the west by the Ionian Sea; to the south by the Mediterranean Sea and to the east by the Aegean Sea and Turkey. The country consists of a large mainland and the Peloponnese, a peninsula connected to the southern tip of the mainland by the Isthmus of Corinth, and a large number of islands (Fig. 1).

Greece is one of the most mountainous countries of Europe. The large part, about 80% of the whole territory, is formed by mountain systems from which the most important are the Albanian-Greecian, the Thracian-Macedonian and the Aegean Mountain Systems, the last with the highest Greecian mount – Olympus, 2,919 m a. s. l. Three relatively extensive lowlands are spread along the rivers, viz. the Macedonian Lowland in the north, the Thracian Lowland in the east and the Thessalian Lowland in the central part of Greece.

We investigated the gall midge fauna at localities spread in the mainland of Greece, in the Peloponnese and in the following six islands: Corfu, Lefkada and Zakynthos, situated in the Ionian Sea, in Crete in the south and in Samos and Rhodos in the Aegean Sea.

Crete, 8,260 km², is the largest of the Greek island and the fifth largest island in the Mediterranean Sea, after Sicily, Sardinia, Cyprus and Corsica. It is located in the southern part of the Aegean Sea. It is a mountainous island with the highest mount Ida (now: Psiloritis), 2,456 m a. s. l.

Corfu, 592 km², is one of the Ionian Islands in the Ionian Sea, situated at the western seaside of Greece. Corfu is mountainous island with the highest point – Pantokrator Mount, 906 m. It is covered with extensive olive groves and with many cypress trees. Corfu is considered to be the most green of all Grecian island.

Lefkada, 336 km², is an island situated between the islands of Corfu and Kefalonia. It is very close to the shores of the western mainland of Greece. The highest point is Staurotas, 1,182 m a. s. l. The island is covered with forests. The main trees are *Pinus halepensis* and *Cupressus sempervirens* which are accompanied by various other trees and shrubs: *Pistacia*, *Rubus*, *Phillyrea*, *Crataegus* and *Olea europaea*.

Zakynthos, 410 km², is the third largest of the Ionian Islands, with the highest point Vrachionas, 758 m a. s. l. Zakynthos has fertile plains in the south-eastern part and mountainous terrain with steep cliffs along the coasts on the west. The island is covered with dense vegetation.

Samos, 476 km², is one of the Southern Sporades Islands in the Aegean Sea. It is situated in the south-eastern part of Greece, not far (1 km) from Turkey. Samos is also a mountainous island, with the highest point Kerkis Mount, 1,434 m. It is covered with evergreen sclerophyllous shrubs and *Quercus coccifera* is very abundant. Grapes, citruses and olive trees are grown.

Rhodos, 1400 km², is situated in the eastern Aegean Sea, 363 km south-east from Greece mainland and only 18 km south-west of Turkey. It is closer to Asia Minor than to the Greek mainland. It is mountainous, sparsely inhabited and

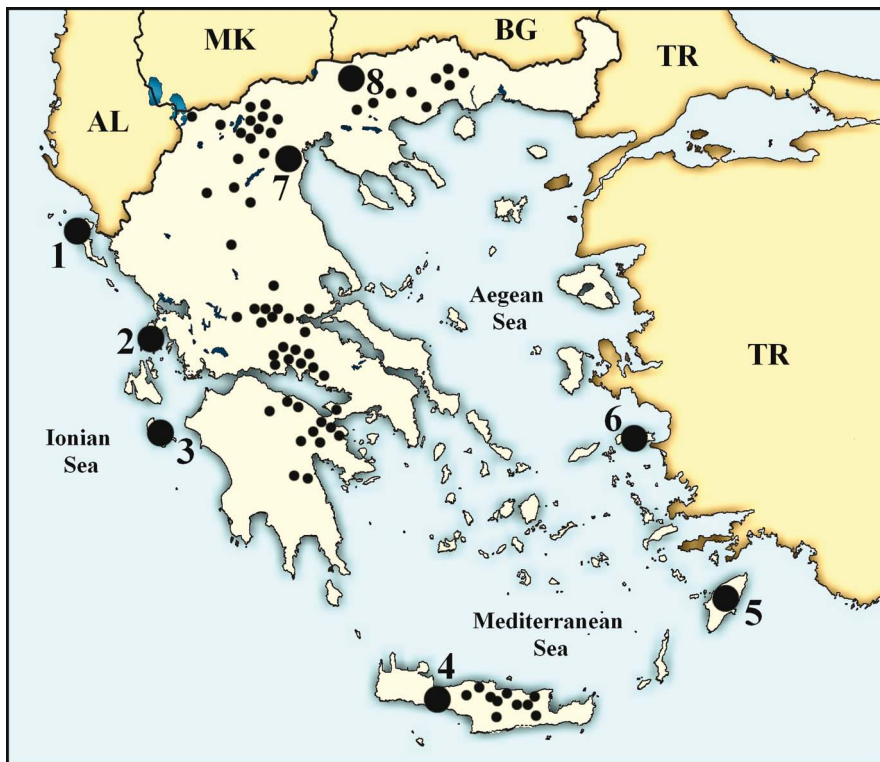


Fig. 1. Greece, showing localities (small black circles) or areas (larger circles) where faunistic investigations of gall midges (Cecidomyiidae) were carried out in the period from 1994 to 2010. 1 – Corfu, 2 – Lefkada, 3 – Zakynthos, 4 – Crete, 5 – Rhodos, 6 – Samos, 7 – Olympos area, 8 – Kerkini Lake. Abbreviations of adjacent countries: AL – Albania, BG – Bulgaria, MK – Macedonia, TR – Turkey.

covered with forests of *Pinus brutia* and *Cupressus sempervirens*, with the highest point Mount Attavyros, 1,216 m a. s. l. The island has arable strips of land where citrus fruit, wine grapes, vegetables, olives and other Mediterranean crops are grown.

From the biogeographical point of view, most of Greece belongs to the Province of Balcan Highlands and only a small part, including a narrow belt along the coast, the whole Peloponesos and all Grecian islands, belong to the Mediterranean Sclerophyll Province (Udvardy 1975).

According to Noirfalise (1987), five zones of natural vegetation may be found in Greece: (1) the thermomediterranean zone with dominant trees of *Olea europea*; (2) the mesomediterranean zone with sclerophyllous oakwoods, *Quercus ilex* and *Q. coccifera*; (3) the supramediterranean zone with deciduous oakwoods with dominant tree of *Quercus pubescens* at altitudes of about 600 m a. s. l.; (4) the oromediterranean or montane zone with conifers; (5) the altimediterranean and supra-forest zone. Corfu belongs to the Hellenic oakwood province with dominant trees of *Quercus ilex*, *Q. coccifera*, *Phillyrea media*, *Erica arborea* and *Fraxinus ornus*, Lefkada, Zakynthos and Crete to Eastern humid thermomediterranean zone, and Samos and Rhodos to the province with dominant trees of *Pinus brutia* and *Cupressus sempervirens*.

MATERIAL AND METHODS

The list of 235 species of gall midges that were found in the mainland and six islands of Greece provides the basis for this zoogeographical study. They represents about 1160 individual records of the occurrence of gall midges at various localities. Twenty species known before 1993 include about 40 records (3.4%) and 1,117 records (96.6%) are results of investigations by the present authors. We included in this list also several pests that occurred in various parts of Greece in recent years (Bella 2014, Kytariolou & Tsagkarakis 2013, Perdikis et al. 2011, Perdikis et al. 2013), nine species of the subfamily Lestremiinae collected in northern Greece in May 1993 by F. Röschmann detailed in Jaschhof (1998) and 33 species that were caught in Malaise traps placed around the Kerkini Lake in northern Greece in the project organized by Gordon Ramel during 2005-2008 and identified by M. Skuhrová. Results have not been published.

Our investigations were carried out during 1994–2010 at 116 localities distributed in the mainland of Greece, in Peloponnese and in six islands: Corfu, Crete, Lefkada, Rhodos, Samos and Zakynthos. We tried to investigate localities situated in various altitudinal zones. We searched for galls of gall midges on coastal herbs and shrubs up to vegetation occurring and growing at the highest situated locality near Karpenisi, 1,100 m a. s. l., in the southern part of the Pindus Mountains in Central Greece. Each record means the finding of one gall midge species at one locality. Distribution of localities in Greece where we investigated gall midges is given in Fig. 1.

During our investigations we used the same collectng method at each sample locality – the time and area unit collection method which is described in detail in our paper (Skuhrová & Skuhrový 2010a). All data obtained during our investigations of gall midge fauna in Greece, enriched with data of earlier authors, we evaluate and analyse from the following points of view using the methods outlined in Skuhrová (1980, 1987, 1994a, b, 1997) and Skuhrová & Skuhrový (2010a).

Zoogeographical analysis includes the following partial analyses of the gathered data: analysis of number of species and average species numbers, biodiversity, density, frequency, altitudinal and geographical distribution, plant-animal interactions and economic importance.

For purposes of zoogeographical analysis, we divided the territory of Greece into the three following parts which are in harmony with the conception of altitudinal zonation given by Noirfalise (1987): (1) the mainland where we carried out our investigations in north-eastern, north-western and middle part, in Olympos area and in the area of Lake Kerkini; (2) the peninsula Peloponnese; (3) six islands, viz. Crete, Corfu, Lefkada, Zakynthos, Samos and Rhodos.

Species richness

We counted the numbers of species of gall midges and average species numbers for the important parts of the country and for six islands, and for the country as a whole, and compared the numbers with numbers from adjacent countries.

Biodiversity

We designated the localities in the main parts of Greece and in six islands with the highest species numbers and discuss species that were described on the basis of material collected in Greece.

Species density

We calculated the number of species of gall midges occurring per 1000 km², that is for a square with four equal sides each 31.62 km long, for parts of the country and for islands, and for the country as a whole, and compared the numbers obtained with numbers of adjacent countries. For calculating species density we used the formula of MacArthur & Wilson (1967): $S = x/a^{0.25}$ where S is the number of species per area of 1000 km², x is the number of gall midge species found in the country or area under study and a is the whole area of the country expressed in 1000 km². Species density makes it possible to compare species numbers occurring in various parts of Europe or countries and in islands.

Frequency

We evaluate the frequency of gall midge species occurring in Greece from two points of view: (1) how frequent is a particular species in the area under study, (2) how many species belong to each of six groups of frequency.

The horizontal occurrence of the gall midge species is analysed according to their overall occurrence throughout Greece, in the mainland and six islands, where the investigations were carried out at 116 localities (= records). The basis for such analysis is the number of localities (records) at which a particular species was found, without taking into account the local abundance of the species. All gall midge species recorded in Greece (235 species) may be divided into six frequency groups using the first six members of the geometrical progression with quotient 2 and coefficient a (Skuhrová & Skuhrový 2010a).

In the first frequency group there belong very rare species recorded in only one or two localities, in the second group rare species recorded from 3 to 5 localities, in the third group moderately frequent species found at 6–12 localities, in the fourth group frequent species recorded from 13 to 26 localities, in the fifth group very frequent species known from 27 to 53 localities and in the sixth group most frequent species recorded at more than 53 localities (Fig. 2).

Altitudinal distribution

We investigated 116 localities situated from sea level up to the highest locality near Karpenisi in Central Greece, 1100 m a. s. l. Elevations of localities at which the particular species of gall midges was found are an essential basis for such evaluation. We counted numbers of species occurring at localities in successive altitudinal zones and counted average numbers of gall midge species which occur in belts by 100 meters in the rising altitudinal zones of Greece.

Geographical distribution

We classify species occurring in Greece on the basis of their natural occurrence in different regions of the earth into five zoogeographical types, viz. European, Eurosiberian, Euroasian, Mediterranean and Holarctic or cosmopolitan. Alien species (introduced species) form a separate category.

Plant-animal interactions

We determined how many species of gall midges are associated with host plant species, plant genera and plant families, and how many species of gall midges are associated with only one plant species, and which organs of plants are changed into galls owing to influence of larvae of gall midges. We determined also the host plant species and genus with the highest number of associated species of gall midges.

Economic importance

We evaluate the economic importance of gall midges, assess actual pests and try to predict gall midge species which may change into pests on agricultural plants in Greece in the future.

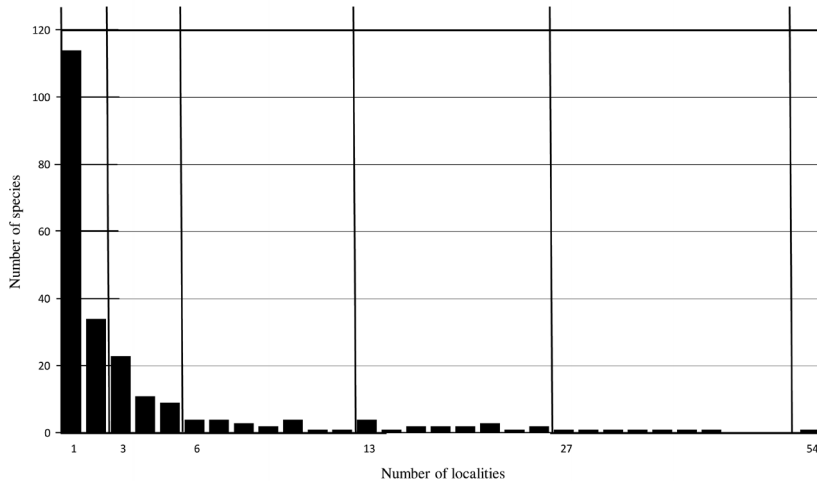


Fig. 2. Frequency of gall midge species (Cecidomyiidae) in Greece. All species found in the period 1994–2010 are arranged in six frequency groups according to the numbers of localities at which each species was found. The first column on the left includes 114 species of which each was found at only one locality, the last point at the right shows only one species, *Dasineura turionum*, the most frequent species in Greece, which was found at 54 localities.

RESULTS

We summarize results of our investigations of gall midges carried out in Greece during the period 1994–2010 in three lists or surveys in which we included all gall midge species recorded in Greece since 1882, when Wachtl described the first gall midge species *Apiomyia bergenstammi*, up to 2015 when *Resseliella piceae*, associated with *Abies cephalonica* was recorded near Athens (P. Petrakis, personal comm.).

List of species of gall midges

This list involves all species of gall midges recorded in Greece, together with their host plants, plant families and biology. Nomenclature of gall midge species is based on Gagné & Jaschhof (2014), nomenclature of host plants on Tutin et al. (1964–1980) and *The Plant List* (2013). Abbreviations: M – mycophagous, P – phytophagous, Z – zoophagous species, U – species the biology of which is unknown.

gall midge species	host plant species	host plant family	biology
<i>Cecidomyiinae</i>			
<i>Aphidoletes aphidimyza</i> (Rondani, 1847)			Z
<i>Apiomyia bergenstammi</i> (Wachtl, 1882)	<i>Pyrus communis</i>	Rosaceae	P
<i>Arnoldiola quercus</i> (Binnie, 1877)	<i>Quercus macrolepis</i>	Fagaceae	P
<i>Arnoldiola (Janetia) tympanifex</i> (Kieffer, 1909)	<i>Quercus ilex</i>	Fagaceae	P
<i>Arthrocnodax coryligallarum</i> Targioni-Tozzetti, 1887	<i>Corylus avellana</i>	Betulaceae	Z
<i>Arthrocnodax vitis</i> Rübsaamen, 1895	<i>Vitis vinifera</i>	Vitaceae	Z
<i>Arthrocnodax</i> sp. (in galls of <i>Eriophyes schmardai</i>)	<i>Campanula</i> sp.	Campanulaceae	Z
<i>Arthrocnodax</i> sp. (in galls of <i>Eriophyes barroisi</i>)	<i>Plantago albicans</i>	Plantaginaceae	Z
<i>Arthrocnodax</i> sp. (<i>Cistus</i> sp.)	<i>Cistus salvifolius</i>	Cistaceae	P
<i>Aschistonyx carpinicolus</i> Rübsaamen, 1917	<i>Carpinus betulus</i>	Fagaceae	P
<i>Asphondylia calycotomae</i> Kieffer, 1912	<i>Calicotome villosa</i>	Fabaceae	P
<i>Asphondylia capparidis</i> Rübsaamen, 1893	<i>Capparis spinosa</i>	Capparidaceae	P
<i>Asphondylia coridothymi</i> Skuhrová, 2011	<i>Coridothymus capitatus</i>	Lamiaceae	P
<i>Asphondylia coronillae</i> (Vallot, 1829)	<i>Coronilla emerus</i>	Fabaceae	P
<i>Asphondylia cytisi</i> Frauenfeldt, 1873	<i>Cytisus</i> sp.	Fabaceae	P
<i>Asphondylia dorycnii</i> Miller, 1870	<i>Dorycnium</i> sp.	Fabaceae	P
<i>Asphondylia echii</i> Loew, 1850	<i>Echium</i> sp.	Boraginaceae	P
<i>Asphondylia genistae</i> Loew, 1850	<i>Genista</i> sp.	Fabaceae	P
<i>Asphondylia gennadii</i> (Marchal, 1904)	<i>Ceratonia siliqua</i>	Fabaceae	P
<i>Asphondylia massalongoi</i> Rübsaamen, 1893	<i>Ajuga chamaeepytis</i>	Lamiaceae	P
<i>Asphondylia ononidis</i> Löw, 1873	<i>Ononis natrix</i>	Fabaceae	P
<i>Asphondylia phlomidis</i> Trotter, 1901	<i>Phlomis fruticosa</i> , <i>Phlomis cretica</i>	Lamiaceae	P
<i>Asphondylia pterosparti</i> Tavares, 1902	<i>Spartium junceum</i>	Fabaceae	P
<i>Asphondylia punica</i> Marchal, 1897 (= <i>A. conglomerata</i> De Stefani, 1900)	<i>Atriplex halimus</i>	Chenopodiaceae	P
<i>Asphondylia ruebsaameni</i> Kertész, 1898	<i>Ferula communis</i>	Apiaceae	P
<i>Asphondylia sarothamni</i> Loew, 1850	<i>Cytisus scoparius</i>	Fabaceae	P
<i>Asphondylia scrophulariae</i> Schiner, 1856	<i>Scrophularia canina</i>	Scrophulariaceae	P
<i>Asphondylia stefanii</i> Kieffer, 1898	<i>Diplotaxis tenuifolia</i>	Brassicaceae	P
<i>Asphondylia verbasci</i> (Vallot, 1827)	<i>Verbascum sinuatum</i>	Scrophulariaceae	P
<i>Asphondylia</i> sp.	<i>Nonea</i> sp.	Boraginaceae	P
<i>Asphondylia</i> sp.	<i>Phillyrea angustifolia</i>	Oleaceae	P
<i>Asphondylia</i> sp.	<i>Laburnum anagyroides</i>	Fabaceae	P
<i>Baldratia salicorniae</i> Kieffer, 1897	<i>Sarcocornia fruticosa</i> (= <i>Salicornia fruticosa</i>)	Chenopodiaceae	P
<i>Bayeriola thymicola</i> Kieffer, 1888	<i>Thymus</i> sp.	Lamiaceae	P

gall midge species	host plant species	host plant family	biology
<i>Blastodiplosis artemisiae</i> Kieffer, 1901	<i>Aretmisia vulgaris</i>	Asteraceae	P
<i>Braueriella phillyreae</i> F. Löw, 1877	<i>Phillyrea angustifolia</i>	Oleaceae	P
<i>Buhriella rubicola</i> Stelter, 1960	<i>Rubus</i> sp.	Rosaceae	P
<i>Clinodiplosis cilicrus</i> (Kieffer, 1889)	various species, genera	various families	M
<i>Contarinia acerplicans</i> (Kieffer, 1889)	<i>Acer monspessulanum</i>	Aceraceae	P
N <i>Contarinia achilleae</i> Fedotova, 1992	<i>Achillea</i> sp.	Asteraceae	P
<i>Contarinia anthobia</i> (F. Löw, 1877)	<i>Crataegus laevigata</i> (= <i>C. oxyacantha</i>)	Rosaceae	P
<i>Contarinia ballotae</i> Kieffer, 1898	<i>Ballota nigra</i>	Lamiaceae	P
<i>Contarinia carpini</i> Kieffer, 1897	<i>Carpinus betulus</i>	Betulaceae	P
<i>Contarinia coronillae</i> Janezic, 1978	<i>Coronilla emerus</i>	Fabaceae	P
<i>Contarinia cotini</i> Kieffer, 1901	<i>Cotinus coggygia</i>	Anacardiaceae	P
<i>Contarinia craccae</i> Kieffer, 1897	<i>Vicia cracca</i>	Fabaceae	P
<i>Contarinia dactylidis</i> Loew, 1851	<i>Dactylis</i> sp.	Poaceae	P
<i>Contarinia galii</i> (Kieffer, 1909)	<i>Galium lucidum</i>	Rubiaceae	P
<i>Contarinia gei</i> Kieffer, 1909	<i>Geum</i> sp.	Rosaceae	P
<i>Contarinia ilicis</i> Kieffer, 1909	<i>Quercus ilex</i>	Fagaceae	P
<i>Contarinia jacobaeae</i> (Loew, 1850)	<i>Senecio jacobaea</i>	Asteraceae	P
<i>Contarinia kiefferi</i> (Schlechtendal, 1891)	<i>Sisymbrium orientale</i>	Brassicaceae	P
<i>Contarinia medicaginis</i> Kieffer, 1895	<i>Medicago sativa</i>	Fabaceae	P
<i>Contarinia merceri</i> Barnes, 1930	<i>Alopecurus pratensis</i>	Poaceae	P
<i>Contarinia nasturtii</i> (Kieffer, 1888)	various species	Brassicaceae	P
<i>Contarinia pruniflorum</i> Coutin & Rambier, 1955	<i>Prunus armeniaca</i>	Rosaceae	P
<i>Contarinia pyrivora</i> (Riley, 1896)	<i>Pyrus communis</i>	Rosaceae	P
<i>Contarinia quercicola</i> (Rübsaamen, 1899)	<i>Quercus cerris</i>	Fagaceae	P
<i>Contarinia quercina</i> (Rübsaamen, 1890)	<i>Quercus pubescens</i>	Fagaceae	P
<i>Contarinia scoparii</i> (Rübsaamen, 1889)	<i>Cytisus scoparius</i>	Fabaceae	P
<i>Contarinia tragopogonis</i> Kieffer, 1909	<i>Tragopogon</i> sp.	Asteraceae	P
<i>Contarinia</i> sp.	<i>Acer monspessulanum</i> .	Aceraceae	P
<i>Contarinia</i> sp.	<i>Calicotome spinosa</i>	Fabaceae	P
<i>Contarinia</i> sp.	<i>Rosa</i> sp. (galls of <i>D. rosae</i>)	Rosaceae	P
<i>Contarinia</i> sp.	<i>Quercus ilex</i> (veg. tip)	Fagaceae	P
N <i>Coquilletomyia lobata</i> (Felt, 1907)			U
<i>Cystiphora sanguinea</i> (Brems, 1847)	<i>Hieracium</i> sp.	Asteraceae	P
<i>Cystiphora schmidtii</i> (Rübsaamen, 1914)	<i>Chondrilla juncea</i>	Asteraceae	P
<i>Cystiphora sonchi</i> (Vallot, 1827)	<i>Sonchus</i> sp.	Asteraceae	P
<i>Dasineura acrophila</i> (Winnertz, 1853)	<i>Fraxinus ornus</i>	Oleaceae	P
<i>Dasineura affinis</i> (Kieffer, 1886)	<i>Viola</i> sp.	Violaceae	P
<i>Dasineura aparines</i> (Kieffer, 1889)	<i>Galium aparine</i>	Rubiaceae	P
<i>Dasineura auriniae</i> Skuhrová, 2011	<i>Aurinia petraea</i>	Brassicaceae	P
<i>Dasineura bayeri</i> (Rübsaamen, 1914)	<i>Sisymbrium</i> sp.	Brassicaceae	P
<i>Dasineura crataegi</i> (Winnertz, 1853)	<i>Crataegus laevigata</i>	Rosaceae	P
<i>Dasineura ericaescopariae</i> (Dufour, 1837)	<i>Erica scoparia</i> , <i>Erica arborea</i>		P
<i>Dasineura fraxinea</i> (Kieffer, 1907)	<i>Fraxinus excelsior</i>	Oleaceae	P
<i>Dasineura fraxini</i> (Brems, 1847)	<i>Fraxinus excelsior</i>	Oleaceae	P
<i>Dasineura gleditchiae</i> (Osten Sacken, 1866)	<i>Gleditsia triacanthos</i>	Fabaceae	P
<i>Dasineura hyperici</i> (Brems, 1847)	<i>Hypericum triquetrifolium</i>	Hypericaceae	P
<i>Dasineura lupulinae</i> Kieffer, 1891)	<i>Medicago polymorpha</i> , <i>Medicago orbicularis</i>	Fabaceae	P
<i>Dasineura mali</i> (Kieffer, 1904)	<i>Malus sylvestris</i>	Rosaceae	P
<i>Dasineura oleae</i> (Angelini, 1831)	<i>Olea europaea</i>	Oleaceae	P
<i>Dasineura papaveris</i> (Winnertz, 1853)	<i>Papaver rhoeas</i>	Papaveraceae	P
<i>Dasineura pteridis</i> (Müller, 1871)	<i>Pteridium aquilinum</i>	Dennstaedtiaceae	P
(= <i>Cecidomyia filicina</i> Kieffer 1889)			
<i>Dasineura plicatrix</i> (Loew, 1850)	<i>Rubus caesius</i>	Rosaceae	P

gall midge species	host plant species	host plant family	biology
<i>Dasineura pyri</i> (Bouché, 1847)	<i>Pyrus communis</i> , <i>Pyrus pyraeter</i> , <i>Pyrus salicifolia</i>	Rosaceae	P
<i>Dasineura rosae</i> (Bremi, 1847) (= <i>Wachtliella rosarum</i> Hardy, 1850)	<i>Rosa</i> sp.	Rosaceae	P
<i>Dasineura rubella</i> (Kieffer, 1896)	<i>Acer campestre</i>	Aceraceae	P
<i>Dasineura rufescens</i> (De Stefani, 1898)	<i>Phillyrea angustifolia</i>	Oleaceae	P
<i>Dasineura teucrii</i> (Tavares, 1903)	<i>Teucrium</i> sp.	Lamiaceae	P
<i>Dasineura thomasiana</i> (Kieffer, 1888)	<i>Tilia tomentosa</i>	Tiliaceae	P
<i>Dasineura tiliae</i> (Schrank, 1803)	<i>Tilia tomentosa</i>	Tiliaceae	P
<i>Dasineura tortrix</i> (F. Löw, 1877)	<i>Prunus spinosa</i>	Rosaceae	P
<i>Dasineura trifolii</i> (F. Löw, 1874)	<i>Trifolium repens</i>	Fabaceae	P
<i>Dasineura tubicoloides</i> Gagné, 2004 (= <i>Dasineura tubicola</i> Kieffer, 1889)	<i>Cytisus scoparius</i>	Fabaceae	P
<i>Dasineura tubularis</i> (Kieffer, 1909)	<i>Quercus cerris</i>	Fagaceae	P
<i>Dasineura turionum</i> (Kieffer et Trotter, 1904)	<i>Asparagus aphyllus</i>	Liliaceae	P
<i>Dasineura tympani</i> (Kieffer, 1909)	<i>Acer campestre</i>	Aceraceae	P
<i>Dasineura urticae</i> (Perris, 1840)	<i>Urtica dioica</i>	Urticaceae	P
<i>Dasineura vagans</i> (Kieffer, 1909)	<i>Erica arborea</i>	Ericaceae	P
<i>Dasineura viciae</i> (Kieffer, 1888)	<i>Vicia lutea</i>	Fabaceae	P
<i>Dasineura</i> sp. (swollen flower bud)	<i>Acer campestre</i>	Aceraceae	P
<i>Dasineura</i> sp. (fruit changed in spongy mass)	<i>Asparagus aphyllus</i>	Liliaceae	P
<i>Dasineura</i> sp. (rolled leaf margin)	<i>Quercus coccifera</i>	Fagaceae	P
<i>Dasineura</i> sp. (stem gall)	<i>Sherardia arvensis</i>	Rubiaceae	P
<i>Dichodiplosis langeni</i> Rübssaamen, 1910	<i>Prunus domestica</i>	Rosaceae	M
N <i>Didactylomyia longimana</i> Felt, 1911			U
<i>Didymomyia tiliacea</i> (Bremi, 1847)	<i>Tilia tomentosa</i>	Tiliaceae	P
<i>Drisina glutinosa</i> Giard, 1893	<i>Acer monspessulanum</i>	Aceraceae	P
<i>Dryomyia circinans</i> (Giraud, 1861)	<i>Quercus cerris</i> , <i>Quercus macrolepis</i>	Fagaceae	P
<i>Dryomyia cocciferae</i> (Marchal, 1897)	<i>Quercus coccifera</i>	Fagaceae	P
<i>Dryomyia lichtensteinii</i> (F. Löw, 1878)	<i>Quercus ilex</i>	Fagaceae	P
<i>Geocrypta galii</i> (H. Loew, 1850)	<i>Galium aparine</i>	Rubiaceae	P
<i>Gephyraulus capsellae</i> Skuhřavá, 2011	<i>Capsella bursa-pastoris</i>	Brassicaceae	P
<i>Giraudiella inclusa</i> (Frauenfeld, 1862)	<i>Phragmites australis</i>	Poaceae	P
<i>Haplodiplosis marginata</i> (von Roser, 1840)	<i>Triticum</i> , <i>Hordeum</i>	Poaceae	P
<i>Hartigiola annulipes</i> Hartig, 1839)	<i>Fagus sylvatica</i>	Fagaceae	P
<i>Jaapiella bryoniae</i> (Bouché, 1847)	<i>Bryonia alba</i>	Cucurbitaceae	P
<i>Jaapiella clematidicola</i> Skuhřavá, 2011	<i>Clematis flammula</i>	Ranunculaceae	P
<i>Jaapiella erysimicola</i> Skuhřavá, 2011	<i>Erysimum graecum</i>	Brassicaceae	P
<i>Jaapiella floriperda</i> (F. Löw, 1888)	<i>Silene vulgaris</i>	Caryophyllaceae	P
<i>Jaapiella hedickei</i> Rübssaamen, 1921	<i>Pimpinella magna</i> , <i>Ferula communis</i>	Apiaceae	P
<i>Jaapiella medicaginis</i> Rübssaamen, 1912	<i>Medicago</i> sp.	Fabaceae	P
<i>Jaapiella schmidti</i> Rübssaamen, 1912	<i>Plantago lanceolata</i>	Plantaginaceae	P
<i>Jaapiella veronicae</i> (Vallot, 1827)	<i>Veronica chamaedrys</i>	Scrophulariaceae	P
<i>Janetia cerris</i> (Kollar, 1850)	<i>Quercus cerris</i> , <i>Quercus macrolepis</i>	Fagaceae	P
<i>Janetia homocera</i> (F. Löw, 1877)	<i>Quercus cerris</i>	Fagaceae	P
<i>Janetia plicans</i> (Kieffer, 1909)	<i>Quercus cerris</i>	Fagaceae	P
<i>Janetia pustularis</i> (Kieffer, 1909)	<i>Quercus cerris</i>	Fagaceae	P
<i>Janetia szepligetii</i> Kieffer, 1896	<i>Quercus cerris</i>	Fagaceae	P
<i>Janetiella euphorbiae</i> De Stefani, 1908	<i>Euphorbia characias wulpenii</i>	Euphorbiaceae	P
<i>Janetiella fortiana</i> Trotter, 1901	<i>Erysimum graecum</i>	Brassicaceae	P
<i>Janetiella lemeei</i> (Kieffer, 1904)	<i>Ulmus minor</i>	Ulmaceae	P
<i>Janetiella onosmae</i> Skuhřavá, 2011	<i>Onosma frutescens</i>	Boraginaceae	P

gall midge species	host plant species	host plant family	biology
<i>Janetiella thymi</i> (Kieffer, 1888)	<i>Thymus serpyllum</i>	Lamiaceae	P
N <i>Karshomyia abnormis</i> Mamaev, 1961			U
N <i>Karshomyia apiculata</i> Mamaev et Krivosheina, 1998			U
N <i>Karshomyia viburni</i> (Felt, 1907)			U
<i>Kiefferia pericarpicola</i> (Brems, 1847)	various species and genera	Apiaceae	P
<i>Lasioptera arundinis</i> Schiner, 1854	<i>Phragmites australis</i>	Poaceae	P
<i>Lasioptera berlesiana</i> Paoli, 1907	<i>Olea europaea</i>	Oleaceae	P
<i>Lasioptera carophila</i> F. Löw, 1874	various species and genera	Apiaceae	P
<i>Lasioptera donacis</i> Coutin, 2001	<i>Arundo donax</i>	Poaceae	P
<i>Lasioptera eryngii</i> (Vallot, 1829)	<i>Eryngium campestre</i>	Apiaceae	P
N <i>Lasioptera flexuosa</i> Winnertz, 1853	<i>Phragmites australis</i>	Poaceae	P
<i>Lasioptera hungarica</i> Möhn, 1968	<i>Phragmites australis</i>	Poaceae	P
<i>Lasioptera rubi</i> (Schrank, 1803)	<i>Rubus</i> sp.	Rosaceae	P
<i>Lasioptera thapsiae</i> Kieffer, 1898	<i>Thapsia garganica</i>	Apiaceae	P
<i>Lasioptera</i> sp. (<i>Solanum</i> , <i>Cucumis</i>)	<i>Solanum lycopersicum</i>	Solanaceae	P
	<i>Cucumis sativus</i>	Cucurbitaceae	P
N <i>Lestodiplosis achilleae</i> Barnes, 1928	<i>Achillea</i> sp.	Asteraceae	Z
N <i>Lestodiplosis pini</i> Barnes, 1928	<i>Pinus</i> sp.	Pinaceae	Z
<i>Lestodiplosis</i> sp. (coccids, <i>Cistus</i> sp.)	<i>Cistus</i> sp.	Cistaceae	Z
<i>Lestodiplosis</i> sp. (<i>Asphondylia capparis</i>)	<i>Capparis spinosa</i>	Capparidaceae	Z
<i>Lestodiplosis</i> sp. (<i>Phytoptus avellanae</i>)	<i>Corylus avellana</i>	Betulaceae	Z
<i>Macrodiplosis pustularis</i> (Brems, 1847) (= <i>M. dryobia</i>)	<i>Quercus pubescens</i> ,	Fagaceae	P
	<i>Quercus robur</i>		
<i>Macrodiplosis roboris</i> (Hardy, 1854) (= <i>M. volvens</i>)	<i>Quercus fraineto</i> ,	Fagaceae	P
	<i>Quercus robur</i>		
<i>Macrolabis behen</i> Skuhravá, 2011	<i>Silene behen</i>	Caryophyllaceae	P
<i>Macrolabis lamii</i> Rübsaamen, 1915	<i>Lamium</i> sp.	Lamiaceae	P
<i>Macrolabis luceti</i> Kieffer, 1899	<i>Rosa</i> sp.	Rosaceae	P
<i>Macrolabis lutea</i> Rübsaamen, 1915	<i>Euphorbia cyparissias</i>	Euphorbiaceae	P
<i>Macrolabis pyricola</i> Skuhravá, 2011	<i>Pyrus salicifolia</i>	Rosaceae	P
<i>Macrolabis</i> sp. (in gall of <i>Dasineura tiliae</i>)	<i>Tilia tomentosa</i>	Tiliaceae	P
<i>Mayetiola destructor</i> (Say, 1817)	<i>Triticum vulgare</i> ,	Poaceae	P
	<i>Hordeum sativum</i>		
<i>Mayetiola</i> sp.	<i>Hyparrhenia hirta</i>	Poaceae	P
<i>Mikiola fagi</i> (Hartig, 1839)	<i>Fagus sylvatica</i>	Fagaceae	P
<i>Monarthropalpus flavus</i> (Schrank, 1776)	<i>Buxus sempervirens</i>	Buxaceae	P
<i>Mycodiplosis gymnosporangii</i> Kieffer, 1904	<i>Juniperus phoenicea</i>	Cupressaceae	M
N <i>Mycodiplosis melamporae</i> (Rübsaamen, 1895)	<i>Salix</i> sp.	Salicaceae	M
<i>Myricomyia mediterranea</i> (F. Löw, 1885)	<i>Erica arborea</i>	Ericaceae	P
<i>Neomikiella beckiana</i> (Mik, 1885)	<i>Inula conyza</i>	Asteraceae	P
<i>Obolodiplosis robiniae</i> (Haldeman, 1847)	<i>Robinia pseudoacacia</i>	Fabaceae	P
N <i>Octodiplosis glyceriae</i> (Rübsaamen, 1895)	<i>Glyceria maxima</i>	Poaceae	P
<i>Odinadiplosis amygdali</i> Anagnostopoulos, 1929	<i>Prunus amygdalus</i>	Rosaceae	P
<i>Oligotrophus juniperinus</i> (Linnaeus, 1758)	<i>Juniperus communis</i> ,	Cupressaceae	P
	<i>Juniperus oxycedrus</i>		
<i>Oligotrophus panteli</i> Kieffer, 1898	<i>Juniperus oxycedrus</i>	Cupressaceae	P
<i>Oligotrophus</i> (<i>Arceuthomyia</i>) <i>valerii</i> Tavares, 1904	<i>Juniperus oxycedrus</i>	Cupressaceae	P
<i>Ozirhincus anthemidis</i> (Rübsaamen, 1916)	<i>Anthemis</i> sp.	Asteraceae	P
<i>Ozirhincus longicollis</i> Rondani, 1840	<i>Chrysanthemum coronarium</i>	Asteraceae	P
<i>Ozirhincus millefolii</i> (Wachtl, 1884)	<i>Achillea millefolium</i>	Asteraceae	P
<i>Ozirhincus tanacetii</i> (Kieffer, 1889)	<i>Tanacetum vulgare</i>	Asteraceae	P
<i>Phlomidomyia pustularis</i> Skuhravá, 2011	<i>Phlomis fruticosa</i>	Lamiaceae	P
<i>Phyllodiplosis cocciferae</i> (Tavares, 1902)	<i>Quercus coccifera</i>	Fagaceae	P
<i>Physemocecis hartigi</i> (Liebel, 1892)	<i>Tilia tomentosa</i>	Tiliaceae	P
<i>Physemocecis ulmi</i> (Kieffer, 1909)	<i>Ulmus minor</i>	Ulmaceae	P
<i>Piranea spartii</i> Janezic, 1990	<i>Spartium junceum</i>	Fabaceae	P

gall midge species	host plant species	host plant family	biology
N <i>Planetella caricis</i> (Rübsaamen, 1911)	<i>Carex</i> sp.	Cyperaceae	P
<i>Polystepha malpighii</i> (Kieffer, 1909)	<i>Quercus</i> sp.	Fagaceae	P
<i>Probruggmanniella phillyreae</i> (Tavares, 1907)	<i>Phillyrea angustifolia</i>	Oleaceae	P
<i>Psectrosema tamaricis</i> (De Stefani, 1902)	<i>Tamarix</i> sp.	Tamaricaceae	P
<i>Putoniella pruni</i> (Kaltenbach, 1872)	<i>Prunus spinosa</i>	Rosaceae	P
<i>Rabdophaga marginemtorquens</i> (Bremi, 1847)	<i>Salix</i> sp.	Salicaceae	P
<i>Rabdophaga rosaria</i> (Loew, 1850)	<i>Salix alba</i>	Salicaceae	P
<i>Rabdophaga saliciperda</i> (Dufour, 1841)	<i>Salix alba</i>	Salicaceae	P
<i>Rabdophaga terminalis</i> (Loew, 1850)	<i>Salix alba</i>	Salicaceae	P
<i>Resseliella oleisuga</i> (Targioni-Tozzetti, 1887)	<i>Olea europaea</i>	Oleaceae	P
N <i>Resseliella piceae</i> Seitner, 1906	<i>Abies cephalonica</i>	Pinaceae	P
<i>Resseliella theobaldi</i> (Barnes, 1927)	<i>Rubus</i> sp.	Rosaceae	P
<i>Rhopalomyia artemisiae</i> (Bouché, 1834)	<i>Artemisia campestre</i>	Asteraceae	P
<i>Rhopalomyia baccarum</i> (Wachtl, 1883)	<i>Artemisia vulgaris</i> , <i>Artemisia campestris</i>	Asteraceae	P
<i>Rhopalomyia tanaceticola</i> (Karsch, 1879)	<i>Tanacetum vulgare</i>	Asteraceae	P
<i>Rhopalomyia tripleurospermi</i> Skuhravá, 2000	<i>Tripleurospermum perforatum</i>	Asteraceae	P
<i>Rhopalomyia tubifex</i> (Bouché, 1847)	<i>Artemisia campestris</i>	Asteraceae	P
<i>Rhopalomyia</i> sp.	<i>Artemisia</i> sp.	Asteraceae	P
<i>Schizomyia galiorum</i> Kieffer, 1889	<i>Galium</i> sp.	Rubiaceae	P
<i>Semudobia betulae</i> (Winnertz, 1853)	<i>Betula pendula</i>	Betulaceae	P
<i>Semudobia skuhravae</i> Roskam, 1977	<i>Betula pendula</i>	Betulaceae	P
<i>Silvestriola asphodeli</i> (Barnes, 1935)	<i>Asphodelus</i> sp.	Liliaceae	P
<i>Spurgia euphorbiae</i> (Vallot, 1827) (= <i>S. capitigena</i>)	<i>Euphorbia czparissias</i>	Euphorbiaceae	P
<i>Stefaniella atriplicis</i> Kieffer, 1898	<i>Atriplex halimus</i>	Chenopodiaceae	P
<i>Stefaniella trinacriae</i> De Stefani, 1900	<i>Atriplex halimus</i>	Chenopodiaceae	P
<i>Thecodiplosis brachyntera</i> (Schwägrihen, 1835)	<i>Pinus halepensis</i>	Pinaceae	P
N <i>Thurauia aquatica</i> Rübsaamen, 1899	<i>Carex</i> sp.	Cyperaceae	P
N <i>Trisopsis punctiventris</i> Mamaev, 1961			U
N <i>Trisopsis vulgaris</i> Mamaev, 1961			U
<i>Trotteria bochkarevi</i> Fedotova, 2004	<i>Verbascum sinuatum</i>	Scrophulariaceae	P
<i>Trotteria obtusa</i> (Loew, 1845)	<i>Coronilla emerus</i>	Fabaceae	P
<i>Vitisiella oenephila</i> (Haimhoffen, 1875)	<i>Vitis vinifera</i>	Vitaceae	P
<i>Wachtliella caricis</i> (Loew, 1850)	<i>Carex</i> sp.	Cyperaceae	P
<i>Wachtliella ericina</i> (F. Löw, 1885)	<i>Erica arborea</i>	Ericaceae	P
<i>Wachtliella niebleri</i> Rübsaamen, 1915	<i>Cytisus</i> sp.	Fabaceae	P
<i>Wachtliella stachydis</i> (Bremi, 1847)	<i>Stachys sylvatica</i>	Lamiaceae	P
N <i>Xylodiplosis nigratarsis</i> (Zetterstedt, 1850)			U
<i>Zeuxidiplosis giardi</i> (Kieffer, 1896)	<i>Hypericum perforatum</i>	Hypericaceae	P
Porricondyliinae			
<i>Asynapta furcifer</i> Barnes, 1932	<i>Olea europaea</i>	Oleaceae	M
<i>Asynapta</i> sp.	in gall of <i>A. verbasci</i>	Scrophulariaceae	M
Lestremiinae			
<i>Allarete barberi</i> (Felt, 1908)			M
<i>Anaretella defecta</i> (Winnertz, 1853)			M
<i>Lestremia cinerea</i> Macquart, 1826			M
Micromyinae			
<i>Aprionus denticulus</i> Berest, 1986			M
<i>Bryomyia bergrothi</i> Kieffer, 1895			M
<i>Monardia atra</i> (Meigen, 1804)			M
<i>Peromyia caricis</i> (Kieffer, 1901]			M
<i>Peromyia palustris</i> (Kieffer, 1895)			M
<i>Polyardis adela</i> Pritchard, 1947			M

Occurrence and distribution of gall midges

Occurrence is given separately for the Greek mainland, peninsula Peloponnese and six islands in number of records; distribution to zoogeographical units is given using the sign +. Abbreviations: M – mainland, P – Peloponnese; islands: Co – Corfu, Le – Lefkada, Za – Zakynthos, Sa – Samos, Rd – Rhodos, Cr – Crete; To – total occurrence. Distribution: EU – European, ES – Eurosiberian, EA – Euroasian, Me – Mediterranean, Ho – Holarctic; Al – Alien. N – species marked with this letter before its species name are unpublished data, new and first records from Greece, identified in samples taken during Kerkini Project.

gall midge species	M	P	Co	Le	Za	Sa	Rd	Cr	TO	EU	ES	EA	Me	Ho	Al
Cecidomyiinae															
<i>Aphidoletes aphidimyza</i>	2		2				1	1	6						+
<i>Apiomyia bergenstammi</i>	9	2	1	4		1	5	4	26						+
<i>Arnoldiola quercus</i>						1		1	2	+					
<i>Arnoldiola tympanifex</i>	2		1						3						+
<i>Arthrocnodax coryligallarum</i>	1								1						+
<i>Arthrocnodax vitis</i>			1	1					2						+
<i>Arthrocnodax</i> sp. (<i>E. schmardai</i>)	1								1						+
<i>Arthrocnodax</i> sp. (<i>E. barroisi</i>)		3							3						+
<i>Arthrocnodax</i> sp. (<i>Cistus</i>)						1			1						+
<i>Aschistonyx carpinicolus</i>	1			1					2	+					
<i>Asphondylia calycotomae</i>	4	6	3	5	1	4	5	5	33						+
<i>Asphondylia capparis</i>	2				1	3	1		7						+
<i>Asphondylia coridothymi</i>				1		1	1		3						+
<i>Asphondylia coronillae</i>	8		4	4			1		17						+
<i>Asphondylia cytisi</i>	2								2		+				
<i>Asphondylia dorycnii</i>				1				1	2						+
<i>Asphondylia echii</i>				1	1		1		3						+
<i>Asphondylia genistae</i>								4	4	+					
<i>Asphondylia gennadii</i>						2		1	3						+
<i>Asphondylia massalongoi</i>	1						1		2						+
<i>Asphondylia ononidis</i>		1							1						+
<i>Asphondylia phlomidis</i>	3		3					2	8						+
<i>Asphondylia pterosparti</i>	3	1							4						+
<i>Asphondylia punica</i>			1					3	4						+
<i>Asphondylia ruebsaameni</i>	3								3						+
<i>Asphondylia sarothamni</i>	1								1		+				
<i>Asphondylia scrophulariae</i>	7	5		1		1			14						+
<i>Asphondylia stefanii</i>						4	1		5						+
<i>Asphondylia verbasci</i>	25	3	1	1	1	3	2	4	40						+
<i>Asphondylia</i> sp. (<i>Nonea</i> sp.)		1							1						+
<i>Asphondylia</i> sp. (<i>Phillyrea media</i>)	1								1						+
<i>Asphondylia</i> sp. (<i>Laburnum</i>)							1		1						+
<i>Baldratia salicorniae</i>	1			1					2						+
<i>Bayeriola thymicola</i>	20	1							21	+					
<i>Blastodiplois artemisiae</i>	1								1	+					
<i>Braueriella phillyreae</i>	14		2	1					17						+
<i>Buhriella rubicola</i>	1								1		+				
<i>Clinodiplois cilicrus</i>	1					2			3		+				
<i>Contarinia acerplicans</i>	1	1							2	+					
N <i>Contarinia achilleae</i>	1								1		+				
<i>Contarinia anthobia</i>	1								1	+					
<i>Contarinia ballotae</i>	1	1							2	+					
<i>Contarinia carpini</i>	2	1							3	+					

gall midge species	M	P	Co	Le	Za	Sa	Rd	Cr	TO	EU	ES	EA	Me	Ho	Al
<i>Contarinia coronillae</i>	1		1	1					3	EU	ES	AE	+	Ho	Al
<i>Contarinia cotini</i>	1								1					+	
<i>Contarinia cracca</i>	1	1						1	3		+				
<i>Contarinia dactylidis</i>		1							1	+					
<i>Contarinia galii</i>	1								1					+	
<i>Contarinia gei</i>	1								1		+				
<i>Contarinia ilicis</i>	1								1					+	
<i>Contarinia jacobaeae</i>				1					1		+				
<i>Contarinia kiefferi</i>	1								1	+					
<i>Contarinia medicaginis</i>	1								1		+				
<i>Contarinia merceri</i>	1								1	+					
<i>Contarinia nasturtii</i>	1			2		1	1		5	+					
<i>Contarinia pruniflorum</i>	1								1					+	
<i>Contarinia pyrivora</i>	11		5	2				3	21						+
<i>Contarinia quercicola</i>	1								1					+	
<i>Contarinia quercina</i>	13	1	2	1		1		1	19	+					
<i>Contarinia scoparii</i>	2								2	+					
<i>Contarinia tragopogonis</i>							2		2	+					
<i>Contarinia sp. (Acer monspessulanum)</i>	1								1					+	
<i>Contarinia sp. (Calicotome spinosa)</i>	1								1					+	
<i>Contarinia sp. (Dasineura rosae)</i>	1								1					+	
<i>Contarinia sp. (Quercus ilex, veg. tip)</i>				1					1					+	
<i>N Coquillettomyia lobata</i>	1								1						+
<i>Cystiphora sanguinea</i>	1								1	+					
<i>Cystiphora schmidti</i>	4								4	+					
<i>Cystiphora sonchi</i>	1	1	1	4			2		9		+				
<i>Dasineura acrophila</i>	2								2	+					
<i>Dasineura affinis</i>	2								2	+					
<i>Dasineura aparines</i>	17	1	2					6	26	+					
<i>Dasineura aurintiae</i>	1								1					+	
<i>Dasineura bayeri</i>			4	2			1		7	+					
<i>Dasineura crataegi</i>	2								2	+					
<i>Dasineura ericaescopariae</i>	1				1		3		5					+	
<i>Dasineura fraxinea</i>	1			1					2	+					
<i>Dasineura fraxini</i>	1								1	+					
<i>Dasineura gleditchiae</i>	1								1						+
<i>Dasineura hyperici</i>	5	3	1				2	2	13	+					
<i>Dasineura lupulinae</i>	2								2	+					
<i>Dasineura mali</i>	1		1					1	3						+
<i>Dasineura oleae</i>	8	3	8	8	1	4	9	7	48					+	
<i>Dasineura papaveris</i>	4	2	1			1	2		10					+	
<i>Dasineura plicatrix</i>	18	7	7	8	1	1	2	1	45	+					
<i>Dasineura pteridis</i>	2		2						4	+					
<i>Dasineura pyri</i>	10	1	4			3	1	2	21						+
<i>Dasineura rosae</i>	7		4						11		+				
<i>Dasineura rubella</i>	3								3		+				
<i>Dasineura rufescens</i>	10	1	1			1			13					+	
<i>Dasineura teucarii</i>						2			2					+	
<i>Dasineura thomastiana</i>	1								1		+				
<i>Dasineura tiliae</i>	1								1		+				
<i>Dasineura tortrix</i>	21	2							23	+					
<i>Dasineura trifolii</i>			5						5						+
<i>Dasineura tubicoloides</i>	1								1	+					
<i>Dasineura tubularis</i>	1								1					+	
<i>Dasineura turionum</i>	24	4	2	8	1	5	5	6	55					+	
<i>Dasineura tympani</i>	1								1	+					

gall midge species	M	P	Co	Le	Za	Sa	Rd	Cr	TO	EU	ES	EA	Me	Ho	Al
<i>Dasineura urticae</i>	1	1							2		+				
<i>Dasineura vagans</i>	1								1				+		
<i>Dasineura viciae</i>	12	1	1				1		15	EU	+	EA	Me	Ho	Al
<i>Dasineura</i> sp. (<i>Acer campestre</i>)	1								1				+		
<i>Dasineura</i> sp. (<i>Asparagus aphyllus</i>)		1							1				+		
<i>Dasineura</i> sp. (<i>Quercus coccifera</i>)							1		1				+		
<i>Dasineura</i> sp. (<i>Sherardia arvensis</i>)	1								1				+		
<i>Dichodiplosis langeni</i>	1								1	+					
N <i>Didactylomyia longimana</i>	1								1					+	
<i>Didymomyia tiliacea</i>	3								3		+				
<i>Drisina glutinosa</i>		1							1	+					
<i>Dryomyia circinans</i>			1						1				+		
<i>Dryomyia cocciferae</i>	1		1				2		4				+		
<i>Dryomyia lichtensteini</i>			1						1				+		
<i>Geocrypta galii</i>	7	3							10		+				
<i>Gephyraulus capsellae</i>			1						1				+		
<i>Giraudiella inclusa</i>	4					2			6			+			
<i>Haplodiplosis marginata</i>	1								1	+					
<i>Hartigiola annulipes</i>	3								3	+					
<i>Jaapiella bryoniae</i>	1								1	+					
<i>Jaapiella clematidicola</i>		1	2	2					5					+	
<i>Jaapiella erysimicola</i>	1								1					+	
<i>Jaapiella floriperda</i>		1							1	+					
<i>Jaapiella hedickei</i>	5	3						1	9		+				
<i>Jaapiella medicaginis</i>		1	2						3		+				
<i>Jaapiella schmidti</i>	1								1	+					
<i>Jaapiella veronicae</i>	1								1	+					
<i>Janetia cerris</i>	3		1					1	5					+	
<i>Janetia homocera</i>	1								1					+	
<i>Janetia plicans</i>	2								2					+	
<i>Janetia pustularis</i>	1								1					+	
<i>Janetia szepligetii</i>	2								2					+	
<i>Janetiella euphorbiae</i>								1	1					+	
<i>Janetiella fortiana</i>	3	3							6					+	
<i>Janetiella lemeei</i>	4								4	+					
<i>Janetiella onosmae</i>	4			1					5					+	
<i>Janetiella thymi</i>	2								2		+				
N <i>Karshomyia abnormis</i>	1								1	+					
N <i>Karshomyia apiculata</i>	1								1		+				
N <i>Karshomyia viburni</i>	1								1					+	
<i>Kiefferia pericarpiicola</i>					1		1	3	5		+				
<i>Lasioptera arundinis</i>	2	1					1	1	5	+					
<i>Lasioptera berlesiana</i>	1		1			1			3					+	
<i>Lasioptera carophila</i>	7	2	3	7	1	6	2	4	32	+					
<i>Lasioptera donacis</i>	1								1					+	
<i>Lasioptera eryngii</i>	4	1		1	1				7					+	
N <i>Lasioptera flexuosa</i>	1								1	+					
<i>Lasioptera hungarica</i>	2								2	+					
<i>Lasioptera rubi</i>	3	1							4		+				
<i>Lasioptera thapsiae</i>	1						1		2					+	
<i>Lasioptera</i> sp. (<i>Solanum, Cucumis</i>)		1							1					+	
N <i>Lestodiplosis achilleae</i>	1								1	+					
N <i>Lestodiplosis pini</i>	1								1	+					
<i>Lestodiplosis</i> sp. (coccids, <i>Cistus</i> sp.)	1								1					+	
<i>Lestodiplosis</i> sp. (<i>Asphondylia capparidis</i>)							1		1					+	
<i>Lestodiplosis</i> sp. (<i>Phytoptus avellanae</i>)	1								1					+	

gall midge species	M	P	Co	Le	Za	Sa	Rd	Cr	TO	EU	ES	EA	Me	Ho	Al
<i>Macrodiplosis pustularis</i> (<i>M. dryobia</i>)	8	1	1						10	+					
<i>Macrodiplosis roboris</i> (<i>M. volvens</i>)	11	1	1						13	+					
<i>Macrolabis behen</i>								1	1				+		
<i>Macrolabis lamii</i>		1							1	+	ES	EA	Me	Ho	Al
<i>Macrolabis luceti</i>	1								1	+					
<i>Macrolabis lutea</i>	1								1	+					
<i>Macrolabis pyricola</i>								1	1				+		
<i>Macrolabis</i> sp. (inq. <i>Dasineura tiliae</i>)	1								1				+		
<i>Mayetiola destructor</i>	1								1					+	
<i>Mayetiola</i> sp. (<i>Hyparrhenia hirta</i>)	1								1				+		
<i>Mikiola fagi</i>	2								2	+					
<i>Monarthropalpus flavus</i>	3								3						+
<i>Mycodiplosis gymnosporangii</i>	2								2				+		
N <i>Mycodiplosis melamporae</i>	1								1		+				
<i>Myricomyia mediterranea</i>	3	3	2	1	1		2	3	15				+		
<i>Neomikiella beckiana</i>			1						1				+		
<i>Obolodiplosis robiniae</i>			1						1						+
N <i>Octodiplosis glyceriae</i>	1								1	+					
<i>Odinadiplosis amygdali</i>	5	1	1					5	12				+		
<i>Oligotrophus juniperinus</i>	3								3	+					
<i>Oligotrophus panteli</i>	19								19	+					
<i>Oligotrophus</i> (<i>Arceuthomyia</i>) <i>valerii</i>	12	1							13				+		
<i>Ozirhincus anthemidis</i>			1						1	+					
<i>Ozirhincus longicollis</i>								1	1	+					
<i>Ozirhincus millefolii</i>	2								2		+			+	
<i>Ozirhincus tanacetii</i>	1								1		+				
<i>Phlomidomyia pustularis</i>	9	1	4	6	1			6	27				+		
<i>Phyllodiplosis cocciferae</i>	14	6	2	2		4	6	1	35				+		
<i>Physemocecis hartigi</i>	1								1	+					
<i>Physemocecis ulmi</i>	4								4	+					
<i>Piranea spartii</i>	2		2	4	1	1			10				+		
N <i>Planetella caricis</i>	1								1	+					
<i>Polystepha malpighii</i>	2							1	3	+					
<i>Probruggmanniella phillyreae</i>	2					1			3				+		
<i>Psectrosema tamaricis</i>	1	1						1	3				+		
<i>Putoniella pruni</i>	8								8	+					
<i>Rabdophaga marginemtorquens</i>		1							1		+				
<i>Rabdophaga rosaria</i>	3								3		+				
<i>Rabdophaga saliciperda</i>	1								1		+				
<i>Rabdophaga terminalis</i>	3	1							4		+				
<i>Resseliella oleisuga</i>	2	3						1	6				+		
N <i>Resseliella piceae</i>	1								1	+					
<i>Resseliella theobaldi</i>	1								1	+					
<i>Rhopalomyia artemisiae</i>	4								4				+		
<i>Rhopalomyia baccarum</i>	3								3		+				
<i>Rhopalomyia tanaceticola</i>	1								1		+				
<i>Rhopalomyia tripleurospermi</i>	1								1	+					
<i>Rhopalomyia tubifex</i>	2								2				+		
<i>Rhopalomyia</i> sp. (<i>Artemisia</i> sp.)	1	1							2				+		
<i>Schizomyia galiorum</i>	1					1			2		+				
<i>Semudobia betulae</i>	1								1		+			+	
<i>Semudobia skuhravae</i>	1								1	+				+	
<i>Silvestriola asphodeli</i>	2								2				+		
<i>Spurgia euphorbiae</i> (= <i>capitigena</i>)	2								2	+				+	
<i>Stefaniella atriplicis</i>								2	2				+		
<i>Stefaniella trinacriae</i>								2	2				+		

gall midge species	M	P	Co	Le	Za	Sa	Rd	Cr	TO	EU	ES	EA	Me	Ho	Al
<i>Thecodiplosis brachytera</i>	1								1		+				
N <i>Thurauia aquatica</i>	1								1	+					
N <i>Trisopsis punctiventris</i>	1								1		+				
N <i>Trisopsis vulgaris</i>	1								1	+					
<i>Trotteria obtusa</i> (ex <i>A. coronillae</i>)			1						1	+					
<i>Trotteria bochkarevi</i> (ex <i>A. verbasci</i>)	1	1				1			3		+				
<i>Vitisiella (Janetiella) oenophila</i>		1							1					+	
<i>Wachtliella caricis</i>			2						2	+					
<i>Wachtliella ericina</i>	4		2	1				1	8					+	
<i>Wachtliella niebleri</i>	1								1	+					
<i>Wachtliella stachydis</i>			1						1	+					
N <i>Xylodiplosis nigritarsis</i>	1								1	+					
<i>Zeuxidiplosis giardi</i> (Olympos)	2							3	5						+
Porricondyliinae															
<i>Asynapta furcifer</i>								1		1					+
<i>Asynapta</i> sp.								1		1					+
Lestremiinae															
<i>Allarete barberi</i> (Felt, 1908)	1								1						+
<i>Anaretiella defecta</i> (Winnertz, 1853)	1								1						+
<i>Lestremia cinerea</i> Macquart, 1826	1								1						+
Micromyinae															
<i>Aprionus denticulus</i> Berest, 1986	1								1	+					
<i>Bryomyia bergrothi</i> Kieffer, 1895	1								1		+				
<i>Monardia atra</i> (Meigen, 1804)	1								1						+
<i>Peromyia caricis</i> (Kieffer, 1901]	1								1						+
<i>Peromyia palustris</i> (Kieffer, 1895)	1								1						+
<i>Polyardis adela</i> Pritchard, 1947	1								1						+

Host plants and associated gall midges

Nomenclature of host plant species names is based on Tutin et al. (1964–1980) and *The Plant List* (2013).

host plant species	gall midge species
<i>Abies alba</i>	<i>Resseliella piceae</i>
<i>Acer campestre</i>	<i>Dasineura rubella</i> <i>Dasineura tympani</i> <i>Dasineura</i> sp.
<i>Acer monspessulanum</i>	<i>Contarinia acerplicans</i> <i>Drisina glutinosa</i> <i>Contarinia</i> sp.
<i>Achillea millefolium</i>	<i>Ozirhincus millefolii</i>
<i>Ajuga chamaepytis</i>	<i>Asphondylia massalongoi</i>
<i>Alopecurus pratensis</i>	<i>Contarinia merceri</i>
<i>Anthemis</i> sp.	<i>Ozirhincus anthemidis</i> <i>Rhopalomyia</i> sp.
Apiaceae, various genera and species	<i>Kiefferia pericarpiicola</i> <i>Lasioptera carophila</i> <i>Rhopalomyia artemisiae</i> <i>Rhopalomyia baccarum</i>
<i>Artemisia campestris</i>	

host plant species	gall midge species
<i>Artemisia vulgaris</i>	<i>Blastodiplosis artemisiae</i> <i>Rhopalomyia baccarum</i> <i>Rhopalomyia</i> sp.
<i>Artemisia</i> sp.	<i>Lasioptera donacis</i>
<i>Arundo donax</i>	<i>Dasineura turionum</i>
<i>Asparagus aphyllus</i>	<i>Contarinia</i> sp. <i>Dasineura</i> sp.
<i>Asphodelus</i> sp.	<i>Silvestriola asphodeli</i>
<i>Atriplex halimus</i>	<i>Asphondylia punica</i> (= <i>A. conglomerata</i>) <i>Stefaniella atriplicis</i> <i>Stefaniella trinacriae</i>
<i>Atriplex</i> sp.	<i>Aphidoletes aphidimyza</i> , zoophagous
<i>Aurinia petraea</i>	<i>Dasineura auriniae</i>
<i>Ballota nigra</i>	<i>Contarinia ballotae</i>
<i>Betula pendula</i>	<i>Semudobia betulae</i> <i>Semudobia skuhravae</i>
<i>Bryonia alba</i>	<i>Jaapiella bryoniae</i>
<i>Bupleurum rotundifolium</i>	<i>Lasioptera carophila</i>
<i>Buxus sempervirens</i>	<i>Monarthropalpus buxi</i>
<i>Calendula officinalis</i>	<i>Aphidoletes aphidimyza</i> , zoophagous
<i>Calicotome villosa</i>	<i>Asphondylia calycotomae</i> <i>Contarinia</i> sp.
<i>Campanula</i> sp.	<i>Arthrocnodax</i> sp., zoophagous
<i>Capparis spinosa</i>	<i>Asphondylia capparis</i> <i>Clinodiplosis cilicrus</i> , mycophagous
<i>Capsella bursa-pastoris</i>	<i>Lestodiplosis</i> sp., zoophagous
<i>Capsicum annuum</i>	<i>Gephyraulus capsellae</i>
<i>Carex</i> sp.	<i>Asphondylia gennadii</i> <i>Wachtliella caricis</i> <i>Planetella caricis</i>
<i>Carpinus betulus</i>	<i>Thurauia aquatica</i> <i>Aschistonyx carpnicolus</i> <i>Contarinia carpini</i>
<i>Cerantonía siliqua</i>	<i>Asphondylia gennadii</i>
<i>Chondrilla juncea</i>	<i>Cystiphora schmidti</i>
<i>Chrysanthemum coronarium</i>	<i>Özihincus longicollis</i>
<i>Cistus salvifolius</i>	<i>Arthrocnodax</i> sp., zoophagous
<i>Cistus</i> sp.	<i>Lestodiplosis</i> sp., on Coccidae
<i>Clematis flammula</i>	<i>Jaapiella clematidicola</i>
<i>Coridothymus capitatus</i>	<i>Asphondylia coridothymi</i>
<i>Coronilla emerus</i>	<i>Asphondylia coronillae</i> <i>Contarinia coronillae</i> <i>Trotteria obtusa</i>
<i>Corylus avellana</i>	<i>Arthrocnodax coryligallarum</i> , zoophagous <i>Clinodiplosis cilicrus</i> <i>Lestodiplosis</i> sp.
<i>Cotinus coggygria</i>	<i>Contarinia cotini</i>
<i>Crataegus laevigata</i> (<i>C. oxyacantha</i>)	<i>Contarinia anthobia</i> <i>Dasineura crataegi</i>
<i>Cucumis</i> sp.	<i>Lasioptera</i> sp.
<i>Cytisus scoparius</i> (= <i>Sarothamnus scoparius</i>)	<i>Asphondylia sarothamni</i> <i>Contarinia scoparii</i> <i>Dasineura tubicoloides</i> (= <i>D. tubicola</i>)
<i>Cytisus</i> sp.	<i>Asphondylia cytisi</i> <i>Wachtliella niebleri</i>
<i>Dactylis</i> sp.	<i>Contarinia dactylidis</i>

host plant species	gall midge species
<i>Daucus carota</i>	<i>Lasioptera carophila</i>
<i>Diplotaxis tenuifolia</i>	<i>Asphondylia stefanii</i>
<i>Dorycnium herbaceum</i>	<i>Asphondylia dorycnii</i>
<i>Echium</i> sp.	<i>Asphondylia echii</i>
<i>Erica arborea</i>	<i>Dasineura ericaescopariae</i>
	<i>Dasineura vagans</i>
	<i>Myricomyia mediterranea</i>
	<i>Wachtliella ericina</i>
<i>Erica manipuliiflora</i>	<i>Myricomyia mediterranea</i>
<i>Eryngium campestre</i>	<i>Lasioptera eryngii</i>
<i>Erysimum graecum</i>	<i>Janetiella fortiana</i>
	<i>Jaapiella erysimicola</i>
<i>Euphorbia cyparissias</i>	<i>Spurgia euphorbiae</i>
	<i>Macrolabis lutea</i>
<i>Euphorbia characias wulpenii</i>	<i>Janetiella euphorbiae</i>
<i>Fagus sylvatica</i>	<i>Hartigiola annulipes</i>
	<i>Mikiola fagi</i>
<i>Ferula communis</i>	<i>Asphondylia ruebsaameni</i>
	<i>Jaapiella hedickei</i>
	<i>Lasioptera carophila</i>
<i>Foeniculum vulgare</i>	<i>Kiefferia pericarpiicola</i>
	<i>Lasioptera carophila</i>
<i>Fraxinus ornus</i>	<i>Dasineura acrophila</i>
	<i>Dasineura fraxinea</i>
	<i>Dasineura fraxini</i>
<i>Galium aparine</i>	<i>Dasineura aparines</i>
	<i>Geocrypta galii</i>
<i>Galium lucidum</i>	<i>Contarinia galii</i>
<i>Galium verum</i>	<i>Geocrypta galii</i>
<i>Galium</i> sp.	<i>Schizomyia galiorum</i>
<i>Genista</i> sp.	<i>Asphondylia genistae</i>
<i>Geum</i> sp.	<i>Contarinia gei</i>
<i>Gleditsia triacanthos</i>	<i>Dasineura gleditchiae</i>
<i>Glyceria maxima</i>	<i>Octodiplosis glyceriae</i>
<i>Hieracium</i> sp.	<i>Cystiphora sanguinea</i>
<i>Hypericum perforatum</i>	<i>Dasineura hyperici</i>
	<i>Zeuxidiplosis giardi</i>
<i>Hyparrhenia hirta</i>	<i>Mayetiola</i> sp.
<i>Inula conyza</i>	<i>Neomikiella beckiana</i>
<i>Juniperus communis</i>	<i>Oligotrophus juniperinus</i>
<i>Juniperus phoenicea</i>	<i>Mycodiplosis gymnosporangii</i> , mycophagous
<i>Juniperus oxycedrus</i>	<i>Oligotrophus valerii</i>
	<i>Oligotrophus juniperinus</i>
	<i>Oligotrophus panteli</i>
<i>Laburnum anagyroides</i>	<i>Asphondylia</i> sp.
<i>Lamium</i> sp.	<i>Macrolabis lamii</i>
<i>Malus sylvestris</i>	<i>Dasineura mali</i>
<i>Medicago polymorpha</i>	<i>Dasineura lupulinae</i>
<i>Medicago sativa</i>	<i>Contarinia medicaginis</i>
	<i>Jaapiella medicaginis</i>
	<i>Asphondylia</i> sp.
<i>Nonea</i> sp.	<i>Asynapta furcifer</i> , mycophagous
<i>Olea europaea</i>	<i>Dasineura oleae</i>
	<i>Lasioptera berlesiana</i>
	<i>Resseliella oleisuga</i>
<i>Ononis natrix</i>	<i>Asphondylia ononidis</i>

host plant species	gall midge species
<i>Onosma frutescens</i>	<i>Janetiella onosmae</i>
<i>Papaver rhoeas</i>	<i>Dasineura papaveris</i>
<i>Phillyrea angustifolia</i>	<i>Braueriella phillyreae</i>
	<i>Dasineura rufescens</i>
	<i>Probruggmanniella phillyreae</i>
	<i>Asphondylia</i> sp.
<i>Phlomis fruticosa</i>	<i>Asphondylia phlomidis</i>
	<i>Phlomidomyia pustularis</i> (<i>Rhopalomyia</i> sp.)
<i>Phragmites australis</i>	<i>Giraudiella inclusa</i>
	<i>Lasioptera arundinis</i>
	<i>Lasioptera hungarica</i>
	<i>Lasioptera flexuosa</i> (Kerkini)
<i>Pimpinella major</i>	<i>Jaapiella hedickei</i>
	<i>Lasioptera carophila</i>
<i>Pinus halepensis</i>	<i>Thecodiplosis brachytera</i>
<i>Pistacia lentiscus</i>	<i>Clinodiplosis cilicrus</i> , mycophagous
<i>Plantago albicans</i>	<i>Arthrocnodax</i> sp. (<i>Eriophyes barroisi</i>)
<i>Plantago lanceolata</i>	<i>Jaapiella schmidti</i>
<i>Pteridium aquilinum</i>	<i>Dasineura pteridis</i>
<i>Prunus armeniaca</i>	<i>Contarinia pruniflorum</i>
<i>Prunus dulcis</i> (= <i>P. amygdalus</i>)	<i>Odinadiplosis amygdali</i>
<i>Prunus spinosa</i>	<i>Dasineura tortrix</i>
	<i>Putoniella pruni</i>
<i>Prunus domestica</i>	<i>Dichodiplosis langeni</i>
<i>Pteridium aquilinum</i>	<i>Dasineura pteridis</i>
<i>Pyrus communis</i>	<i>Apiomyia bergenstammi</i>
	<i>Contarinia pyrivora</i>
	<i>Dasineura pyri</i>
<i>Pyrus salicifolia</i>	<i>Dasineura pyri</i>
	<i>Macrolabis pyricola</i>
<i>Quercus cerris</i>	<i>Contarinia quercicola</i>
	<i>Dasineura tubularis</i>
	<i>Dryomyia circinans</i>
	<i>Janetia cerris</i>
	<i>Janetia homocera</i>
	<i>Janetia plicans</i>
	<i>Janetia pustularis</i>
	<i>Janetia szepigetii</i>
<i>Quercus coccifera</i>	<i>Dryomyia cocciferae</i>
	<i>Phyllodiplosis cocciferae</i>
	<i>Dasineura</i> sp.
<i>Quercus frainetto</i>	<i>Macrodiplosis pustularis</i> (= <i>M. dryobia</i>)
<i>Quercus ilex</i>	<i>Arnoldiella tympanifex</i>
	<i>Contarinia ilicis</i>
	<i>Contarinia</i> sp.
<i>Quercus macrolepis</i> (= <i>Q. aegilops</i>)	<i>Dryomyia lichtensteinii</i>
	<i>Arnoldiella quercus</i>
	<i>Contarinia quercina</i>
	<i>Dryomyia circinans</i>
	<i>Janetia cerris</i>
<i>Quercus pubescens</i>	<i>Contarinia quercina</i>
	<i>Macrodiplosis pustularis</i> (= <i>M. dryobia</i>)
	<i>Macrodiplosis roboris</i> (= <i>M. volvens</i>)
<i>Quercus robur</i>	<i>Macrodiplosis roboris</i> (= <i>M. volvens</i>)
	<i>Polystepha malpighii</i>
<i>Robinia pseudoacacia</i>	<i>Obolodiplosis robiniae</i>

host plant species	gall midge species
<i>Rosa centifolia</i>	<i>Aphidoletes aphidimyza</i>
<i>Rosa</i> sp.	<i>Dasineura rosae</i> (= <i>Wachtliella rosarum</i>)
	<i>Macrolabis luceti</i>
<i>Rubus</i> sp.	<i>Buhriella rubicola</i>
	<i>Dasineura plicatrix</i>
	<i>Lasioptera rubi</i>
<i>Rubus caesius</i>	<i>Dasineura plicatrix</i>
<i>Salix</i> sp.	<i>Rabdophaga marginemtorquens</i>
<i>Salix alba</i>	<i>Rabdophaga rosaria</i>
	<i>Rabdophaga saliciperda</i>
	<i>Rabdophaga terminalis</i>
<i>Sarcocornia fruticosa</i> (= <i>Arthrocnemum fruticosum</i>)	<i>Baldratia salicorniae</i>
<i>Scrophularia canina</i>	<i>Asphondylia scrophulariae</i>
<i>Senecio jacobaeae</i>	<i>Contarinia jacobaeae</i>
<i>Sherardia arvensis</i>	<i>Dasineura</i> sp.
<i>Silene behen</i>	<i>Macroabis behen</i>
<i>Silene vulgaris</i>	<i>Jaapiella floriperda</i>
<i>Sisymbrium loeselii</i>	<i>Dasineura bayeri</i>
<i>Sisymbrium orientale</i>	<i>Contarinia</i> aff. <i>kiefferi</i>
	<i>Contarinia</i> sp., axillary gall
<i>Smyrniium rotundifolium</i>	<i>Lasioptera carophila</i>
<i>Solanum lycopersicum</i>	<i>Lasioptera</i> sp. (Perdikis et al.)
<i>Sonchus</i> sp.	<i>Cystiphora sonchi</i>
<i>Spartium junceum</i>	<i>Asphondylia pterosparti</i>
	<i>Piranea spartii</i>
	<i>Aphidoletes aphidimyza</i> , zoophagous
<i>Stachys sylvatica</i>	<i>Wachtliella stachydis</i>
<i>Tamarix</i> sp.	<i>Psectrosema tamaricis</i>
<i>Tanacetum vulgare</i>	<i>Ozirhincus tanacetii</i>
	<i>Rhopalomyia tanaceticola</i>
<i>Teucrium</i> sp.	<i>Dasineura teucrii</i>
<i>Thapsia garganica</i>	<i>Lasioptera thapsiae</i>
<i>Thymus serpyllum</i>	<i>Bayeriella thymicola</i>
	<i>Janetiella thymi</i>
	<i>Asphondylia serpylli</i>
<i>Tilia tomentosa</i> (= <i>T. argentea</i>)	<i>Dasineura thomasiana</i>
	<i>Dasineura tiliae</i>
	<i>Macrolabis</i> sp., inquiline
	<i>Didymomyia tiliacea</i>
	<i>Physemocecis hartigi</i>
<i>Tragopogon</i> sp.	<i>Contarinia tragopogonis</i>
<i>Triticum vulgare</i>	<i>Mayetiola destructor</i>
	<i>Haplodiplosis marginata</i>
<i>Tripleurospermum perforatum</i>	<i>Rhopalomyia tripleurospermi</i>
<i>Trifolium repens</i>	<i>Aphidoletes aphidimyza</i> , zoophagous
	<i>Dasineura trifolii</i>
<i>Ulmus minor</i>	<i>Janetiella lemeei</i>
	<i>Physemocecis ulmi</i>
<i>Urginea maritima</i>	<i>Asphondylia gennadii</i>
<i>Urtica dioica</i>	<i>Dasineura urticae</i>
<i>Verbascum sinuatum</i>	<i>Asphondylia verbasci</i>
	<i>Asynapta</i> sp., mycophagous
	<i>Trotteria bochkarevi</i>
<i>Veronica chamaedrys</i>	<i>Jaapiella veronicae</i>
<i>Vicia cracca</i>	<i>Contarinia craccae</i>
<i>Vicia sativa</i>	<i>Aphidoletes aphidimyza</i> , zoophagous

host plant species	gall midge species
<i>Vicia</i> sp.	<i>Dasineura viciae</i>
<i>Viola</i> sp.	<i>Dasineura affinis</i>
<i>Vitis vinifera</i>	<i>Vitisiella oenophila</i>
	<i>Arthrocnodax vitis</i> , zoophagous

EVALUATION OF RESULTS

Species richness

The gall midge fauna of Greece is composed of 235 species belonging to 80 genera. Of them 213 are valid species and 22 undescribed species, are identified to the genus level. The subfamily Cecidomyiinae includes 224 species in 71 genera, Porricondylinae 2 species in one genus, Les-tremiinae 3 species in 3 genera and Micromyinae 6 species in 5 genera.

In 1994 when we started our investigations in Greece, only twenty species of gall midges were known. In the course of 16 years from 1994–2010 we visited 116 localities in the Greek mainland, Peloponnese and six islands and gathered 1,117 records on the occurrence of gall midges. We enriched the fauna of gall midges in Greece by adding 204 newly recorded species (Table 1).

Gall midges are unevenly distributed in Greece. In the mainland where investigations have been carried out at 59 localities in the north-western, north-eastern and middle part of Greece, in the Olympos area and near the Lake Kerkini, 185 species of gall midges were recorded, i. e. 79% of all species known to occur in Greece. In the peninsula Peloponnese where investigations have been made at 11 localities, 56 species of gall midges were recorded, of which 40 occur also in the mainland. A smaller part including 35 species occur only in islands and not in the mainland; and about a quarter – 62 species – occur in the mainland and also in one, two or three islands.

The **average species number** per locality has been determined from the whole of Greece and has a value 9.4. In mainland Greece, including north-eastern and north-western parts, middle Greece and Olympos area, displays the highest value – 9.7 average species number and in the Peloponnese lower value – 8.9. Of six islands under study, Corfu has the highest average species number (12.6), followed by Crete (9.2) and Lefkada (9.0). The lowest average species number was counted for Rhodos (7.0). These results correspond to the geographical position and composition of vegetation of these islands: Corfu, called „Green island“ is covered with rich vegetation and is situated in the most northern position of the six islands, in contrast to Rhodos which is situated in the most southern position.

The average species number per locality of the whole of Greece 9.4 is relatively low but it corresponds to the occurrence and distribution of gall midges in the Mediterranean area. In comparison with some other countries of Europe where systematic faunal investigations have been carried out, we counted 14 average species number for Bulgaria, 16.7 for Switzerland, 15 for South Tyrol (northern Italy), 17 for Austria, 19.5 for Slovakia, 26 for the Czech Republic and even 29 species for Hungary (Skuhrová 1991, 1994, Skuhrová & Skuhrový 1997b, 1999, 2009, 2010b, Skuhrová et al. 1991). The higher average species numbers obtained in these countries correspond to the geographical position in Central Europe and adjacent countries with diverse and rich vegetation including many suitable host plants, mainly trees and shrubs, for gall midges.

In Greece the two most species rich genera are *Dasineura* with 37 species and *Contarinia* with 27 species, followed by *Asphondylia* with 22 species and *Lasioptera* with 10 species (Table 2). Each of 43 genera (54%) is associated with only one host plant species. We compared species numbers of the main genera occurring in Greece with that in adjacent countries. The number of species of the main genera is very similar for *Dasineura* and *Contarinia* but it differs for *Asphondylia* and

Table 1. Results of investigations of gall midges in the mainland, Peloponnese and six islands obtained in the period 1994–2010. The division of mainland into parts corresponds to the areas investigated during years 1994–1996 (Skuhravá & Skuhravý 1997); species recorded in the Kerkini area were obtained using other method (caught in various types of traps)

Greece	no. localities	no. records	no. species	average species number
mainland				
north-eastern	8	74	35	8.2
north-western	17	163	78	9.5
Kerkini	4	33	33	
Olympos	10	113	65	10.2
Middle Greece	20	206	80	10.8
Peloponnese	11	107	56	8.9
islands				
Corfu	5	101	49	12.6
Lefkada	9	82	32	9.0
Zakynthos*	1	14	14	(14)
Crete	10	92	38	9.2
Samos	8	62	33	8.8
Rhodos	10	70	33	7.0

* in Zakynthos we investigated gall midges at only one locality.

Lasioptera. The last two genera are relatively rich on species in Greece but poorer in Macedonia and Turkey. Surprising is the incidence of five species in two zoophagous genera, *Arthrocnodax* and *Lestodiplosis*, in Greece and very low number or absence of species in Bulgaria, Macedonia and Turkey, and, on the other hand, low number of species of the genus *Rabdophaga* in Greece (only 4 species) in contrast to nine species occurring in Bulgaria.

According to the feeding habit of larvae, the majority, 204 species (87%) recorded in Greece are phytophagous and their larvae cause galls on plants or live in or on plant organs freely or as inquilines; nine species (3.8%) are zoophagous and their larvae attack other gall midges or arthropods; fourteen species (5.9%) are mycophagous; their larvae are associated with fungi. The biology of eight species (3.4%) is unknown.

Table 2. Species numbers of the main genera of gall midges recorded in Greece in comparison with Bulgaria, Macedonia and Turkey

genus	Greece	Bulgaria	Macedonia	Turkey
<i>Dasineura</i> Rondani, 1840	37	60	37	15
<i>Contarinia</i> Rondani, 1860	27	37	23	11
<i>Asphondylia</i> Loew, 1850	22	16	7	9
<i>Lasioptera</i> Meigen, 1818	10	4	4	8
<i>Jaapiella</i> Rübsaamen, 1915	8	14	6	2
<i>Macrolabis</i> Kieffer, 1892	6	8	0	1
<i>Rhopalomyia</i> Rübsaamen, 1892	6	2	2	3
<i>Janetia</i> Kieffer, 1896	5	5	4	4
<i>Janetiella</i> Kieffer, 1898	5	3	2	3
<i>Arthrocnodax</i> Rübsaamen, 1895	5	1	1	1
<i>Lestodiplosis</i> Kieffer, 1894	5	0	0	0
<i>Rabdophaga</i> Westwood, 1847	4	9	6	5
<i>Wachtliella</i> Rübsaamen, 1916	4	5	2	1
<i>Ozirhincus</i> Rondani, 1840	4	1	1	1

The gall midge fauna of Greece including 235 species may be evaluated as rich in comparison with the gall midge fauna of adjacent countries from which comparable data are available: in Albania only 20 species are known (Skuhrová, unpublished data), in Macedonia 147 species (Simova-Tosic et al. 2007), in Bulgaria 240 species (Skuhrová et al. 1991) and in Turkey 118 species (Skuhrová & Skuhrový 2015). The low number of gall midge species known from Albania is because nobody has investigated gall midges in this country and species were recorded only by chance, in contrast to Bulgaria where gall midges were investigated at 46 localities situated in the western part of the country and in the eastern part near the Black Sea, and to Turkey where investigations were carried out at 36 localities situated in the south-western part along the Mediterranean Sea.

The gall midge fauna of Greece including 235 species may be evaluated as reasonably rich also in comparison with gall midge faunas of countries around the Mediterranean Sea: in Spain where 240 species were recorded (Skuhrová et al. 2006, Sánchez et al. 2012) and in Italy with 324 species (Skuhrová & Skuhrový 1994) but it is not so rich as the fauna of gall midges in France where 668 species were found (Skuhrová et al. 2005). It is necessary to emphasize that the species richness of gall midges in a country is influenced by several factors, mainly by geographic position, size of area of the country and its altitude, climatic factors and composition of vegetation, and also by the number of investigations and by selection of suitable sites for collection of gall midges. More investigations and more samples usually result in increased species numbers, new records and also discovery of new species (Skuhrová & Skuhrový 2010a).

Biodiversity

During our investigations at 116 localities in the mainland and six islands of Greece we recorded from 3 to 21 species of gall midges at individual localities. The most species were found at Apsalos, 506 m a. s. l. in north-western Greece where we found galls of 21 species of gall midges, followed by the locality Agios Dimitrio, 150 m a. s. l. in the island Corfu where galls of 20 species were recorded. We give here also the other localities with highest species numbers recorded in mainland and islands of Greece: Kalesmeno, 800 m a. s. l. in Central Greece, with 18 species; Samos, surroundings of the town on the island, 100 m a. s. l., with 18 species; Nei Poroí in the Dio-Olympos municipality, 5–20 m a. s. l., where we recorded 16 species in virgin forest near seaside with trees 300 years old; Paranesti, 450 m a. s. l., in north-eastern part of Greece, with 16 species; Kalavruta on Peloponesos, 750 m a. s. l., with 15 species; Knosos on Crete, 50 m a. s. l., with 13 species; and Ligia on Lefkada, 60 m a. s. l., with 12 species.

During our investigations we also discovered galls on several host plants which were caused by undescribed species of gall midges. We were successful in rearings some of them which resulted in the description of a new genus and eight new species (Skuhrová 2011b). Several other species of gall midges remain undescribed because we were not able to rear adults during our expeditions.

Altogether thirteen species of gall midges were described on material discovered at localities in mainland and several islands of Greece during period from 1882 to 2011. *Apiomyia bergenstammi* (described as *Hormomyia bergenstammi*) was the first species that was discovered in Corfu by the Austrian entomologist and dipterologist J. von Bergenstamm. Wachtl (1882) named this species in honour of the discoverer. Trotter (1901) described two species: *Asphondylia phlomidis* causing galls on *Phlomis fruticosa* based on material found near Volos in central Greece, and *Janetiella fortiana* causing galls on stems of *Erysimum graecum* on material found at Corint in the Peloponesos. Anagnostopoulos (1929) described *Odinadiplosis amygdali* (as *Cecidomyia amygdali*) which caused serious damage to *Prunus amygdalus* trees at Athens. Skuhrová (2011a) described *Asphondylia coridothymi* developing in flower buds of *Coridothymus capitatus* on the basis of material collected by P. Malagaris at Samos (Malagaris 2011). Skuhrová (2011b) described eight

species of gall midges based on material discovered during investigations in various parts of Greece. Three species were found at Corfu: *Phlomidomyia pustularis* causing leaf pustule galls on *Phlomis fruticosa*, *Gephyraulax capsellae* inducing flower galls on *Capsella bursa-pastoris* and *Jaapiella clematidicola* causing leaf bud galls of *Clematis flammula*. One species *Macrolabis behen* causing terminal leaf galls on *Silene behen* was discovered at Knossos in Crete. Four species were found at localities in mainland Greece: *Dasineura aurinae* causing flower galls on *Aurinia petraea* at Meteora, *Jaapiella erysimicola* inducing flower bud galls of *Erysimum graecum* at Itea, *Janetiella onosmae* inducing rosette leaf galls on *Onosma frutescens* at Delfi and *Macrolabis pyricola* terminal leaf galls on *Pyrus salicifolia* at Rizarion near Trikala in central Greece.

The discovery of a new genus and several new species confirm the theory of biodiversity hotspots (Myers et al. 2000) that Greece as a part of the Mediterranean Basin is one of the biogeographic regions with a significant reservoir of biodiversity.

The biodiversity of gall midges in Greece may be evaluated as good and reasonable and corresponding to the environmental conditions of the Mediterranean area with hot and dry weather and prevalence of sclerophyllous vegetation.

In comparison, the biodiversity of gall midges in South Tyrol in northern Italy is higher, ranged from 3 to 36 species at a single locality (Skuhrová & Skuhrový 2010b), and in the Czech Republic situated in Central Europe even one to 77 species of gall midges have been recorded at individual localities and on average 26 species per locality (Skuhrová 1994a).

The biodiversity of gall midges changes along the latitudinal gradient. The highest biodiversity of species occurs in Central Europe and it decreases rapidly to the north and south. We have shown this phenomenon on the basis of analysis of rich data obtained during many investigations carried out in Europe (Skuhrová & Skuhrový 2010a; Fig. 30).

Species density

The density of gall midge species occurring in an area of 1000 km² for the whole territory of Greece is 62.1 species (Table 3). We calculated this value using the formula of MacArthur and Wilson (1967) and published it already in our earlier paper (Skuhrová & Skuhrový 2010a).

The density of gall midges found in Greece may be evaluated as proportional to natural conditions and the method of research. This density is comparable with density of some other countries of the Balkan Peninsula: density 66.1 was found in Macedonia where 148 species of gall midges were found (Simova-Tosic et al. 2007) and density 63.3 in Bosnia and Herzegovina where 169 species were found (Simova-Tosic et al. 2007, but is a little lower than in Bulgaria where 240 species were found and density is 74.1 (Skuhrová et al. 1991).

The species density does not depend on the size of the area but it is much more influenced by the number of localities that were examined in the area under study. It may be noted that in the Czech Republic with an area 78,866 km² where 670 localities were investigated, 600 species of gall midges were found and the density of 189.2 species per 1000 km² was determined (Skuhrová & Skuhrový 2010a).

The highest species density (60.3) was found for the Greek mainland, where investigations were made at 59 localities, and for the island of Corfu (56.3). The Greek mainland is a part of the Balkan peninsula which is covered with diverse landscapes and rich vegetation and where many gall midge species from Central Europe are present. Six islands where we investigated gall midges are situated at various geographical positions and various distances from the mainland which may influence the abundance of gall midge species. The island of Corfu is separated from Albania by straits varying in width from 3 to 23 km and is covered with rich vegetation.

The low species density in Crete (22.3) may be influenced by the fact that this island lies 160 km south of the Greek mainland. The lowest species density was calculated for the island of

Table 3. Species density of gall midges in mainland Greece and six islands

country part	area in km ²	no. species	species density
Greece, total	131,940	235	62.1
mainland	110,156	199	60.3
Peloponnese	21,549	56	26.0
Crete	8,260	38	22.3
Rhodos	1400	33	29.1
Corfu	49	49	56.3
Samos	34	34	42.5
Zakynthos	410	14	17.5
Lefkada	336	32	40.0

Zakynthos where only one locality was investigated and where only 14 species of gall midges were found.

Frequency

The frequency of 235 species of gall midges occurring at 116 localities in mainland and six islands of Greece is shown in Fig. 2.

The majority – 148 species (63% of all species recorded in Greece) belong in the first frequency group. Each of them was found at only one or two localities. They occur **very rarely**: 114 species were found only once and 34 species at two localities. Many species identified to the genus level and four species, *Dasineura aurinae*, *Jaapiella erysimicola*, *Macrolabis behen* and *M. pyricola*, described as new species on the material obtained from Greece, belong in this category.

Another 43 species (18%) belong in the second frequency group. They were recorded at three, four or five localities and occur **rarely**. Of them 23 species were found at three localities, 11 species at four localities and nine species at five localities. A typical representative of this group is *Kiefferia pericarpicola* causing swellings on umbellules of various host plants of the family Apiaceae.

Nineteen species (8%) belong in the third frequency group. Each of them was recorded at six to eleven localities and may be classified as **moderately frequent**. *Dasineura rosae* causing galls on leaflets of various *Rosa* spp. recorded at 11 localities and *Odinadiplosis amygdali* causing malformations on twigs of *Prunus amygdalus* found at 12 localities belong in this frequency group.

Seventeen species (7%) belong in the fourth frequency group. They may be classified as occurring **frequently**. Each species was found from 13 to 26 localities. *Apiomyia bergenstammi* causing galls on twigs of *Pyrus communis* and *Dasineura aparines* inducing galls on *Galium aparine*, each recorded at 26 localities, belong in this of frequency group.

Only seven species (3%) belong in the fifth frequency group. Each of them was recorded from 27 to 54 localities. These species may be considered as **very frequent**. *Phlomidomyia pustularis* causing flat pustule galls on leaves of *Phlomis fruticosa*, described in 2011, was discovered at 27 localities; *Lasioptera carophila* at 32 localities, *Asphondylia calycotomae* at 33, *Phyllodiplosis cocciferae* at 35, *Asphondylia verbasci* at 40, *Dasineura plicatrix* at 45 and *Dasineura oleae* at 48 localities.

Only one species, *Dasineura turionum* causing galls on *Asparagus aphyllus*, belongs in the sixth frequency group. The galls were found during our investigations at 55 localities situated on the mainland and six islands of Greece. It is **the most frequent species** in Greece.

Altitudinal distribution

Altitudinal distribution of gall midges recorded in Greece is based on average species numbers counted for altitudinal belts by 100 meters from sea level up to the highest locality near Karpenisi, 1,100 m a. s. l. (Fig. 3).

In the thermomediterranean zone we found the highest average species number of gall midges – 9.9 – in the lowest belt situated between sea level up to 100 m a. s. l. where 44 localities were investigated. The average species number falls with increasing altitude and in the fourth belt (301–400 meters) the average species number is 8.2. In the thermomediterranean zone the gall midge species of Mediterranean provenance prevail. Typical representatives of this zone are the following species: *Dasineura oleae* causing galls on leaves of *Olea europaea*, *Phyllocladiplosis cocciferae* with galls on *Quercus coccifera*, *Phlomidiomyia pustularis* on *Phlomis fruticosa*, *Asphondylia calycotomae* on *Calicotome villosa*, *Asphondylia gennadii* on *Ceratonia siliqua* and *Dasineura turionum* on *Asparagus aphyllus*.

In the lowest belt of the mesomediterranean zone (401–500 meters) the average species number of gall midges increases abruptly to 10.6, in the higher belt (501–600) even to 11.5, that is the highest average species number of all belts, and in the following belts the average species number gradually reduces to 10.4 in the belt 601–700, 10.6 in the belt 701–800, 8.6 in the belt 801–900, 7 in the belt 901–1000. Only one species of gall midges – *Oligotrophus juniperinus* causing galls on *Juniperus communis* and *J. oxycedrus* - was recorded near Karpenisi at the altitude of 1,100 m a. s. l., the only locality investigated at such altitude.

In Greece the galls of *Oligotrophus juniperinus* were found at four localities: near Karpenisi, 1,100 m a. s. l. and Agios Nikolaos near Karpenisi, 700 m a. s. l. in Central Greece, at Emborio near Ptolemaida, 500 m a. s. l., in northern Greece and at Stavros, 950 m a. s. l. in the Olympos area. *O. juniperinus* occupies in mainland Greece an altitudinal span from 500 to 1,100 meters. The galls were not found in any of six investigated islands.

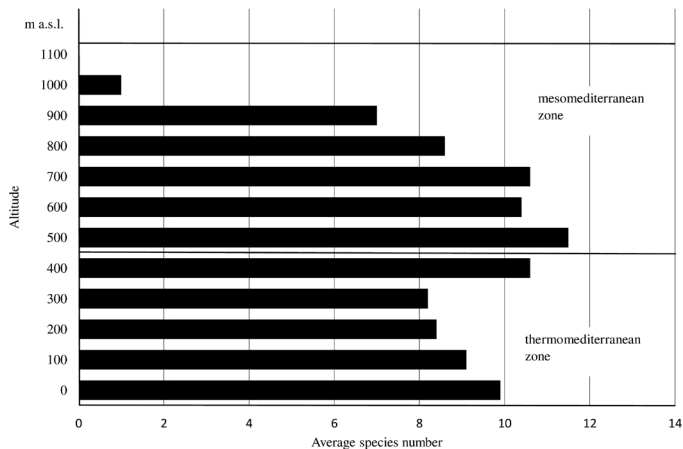


Fig. 3. Altitudinal distribution of gall midges (Cecidomyiidae) shown as average numbers of species in belts by 100 meters in altitudinal zones of Greece.

Oligotrophus juniperinus occupies at present a large distribution area in Europe. Harstad on the island Hinnoya in northern Norway, far above the Arctic Circle, is the northernmost locality where galls have been found (Skuhravá & Skuhrový 2012). Karpenisi in Central Greece and Istanbul in western Turkey are the southernmost situated localities of its known occurrence (Skuhravá et al. 2005). In the southern parts of Europe *O. juniperinus* occurs mainly in the mountains. Its host plant, *Juniperus communis*, is a Holarctic species and occupies a large distribution area in the cool temperate Northern Hemisphere from Arctic south in mountains to around 30° N latitude in North America, Europe and Asia. *O. juniperinus* occupies only a small part of the distribution area of its host plant spread in Europe. *O. juniperinus* occurs over a large altitudinal span including sites in the planare zone up to the Mount Kanzel, 2348 m a. s. l. in the Alps in northern Italy. It is the highest point of its known vertical occurrence (Skuhravá & Skuhrový 2010). *O. juniperinus* has a large ecological tolerance and is able to inhabit places that are distant vertically each other of more than 2000 meters.

Altitudinal distribution of species of gall midges in Greece corresponds to the altitudinal distribution found in other countries of Europe where systematic faunal investigations have been done: in the Czech Republic, Slovakia, Austria, Switzerland and South Tyrol in northern Italy (Skuhravá 1991, 1994a, b, Skuhravá & Skuhrový 1997b, 2009, 2010a, b). Our results also confirm the earlier finding that the average species number decreases with rising altitude.

Geographical distribution

The gall midge species occurring in Greece are divided according to their overall distribution in the Palaearctic region or in the world into the following zoogeographical or biogeographical units: Mediterranean, European, Eurosiberian, Euroasian, Holarctic and Nearctic.

Most species – 97 species (41%) are **Mediterranean**. They have centres of origin in southern Europe and in Mediterranean. The true Mediterranean species are associated with Mediterranean host plant species – trees, shrubs or herbaceous plants. In Greece the following species are truly Mediterranean: *Dasineura oleae* inducing galls on leaves of *Olea europaea*, *Asphondylia calycotomae* causing galls on *Calicotome spinosa*, *Asphondylia gennadii* causing malformations on pods of *Ceratonia siliqua*, *Phyllodiplosis cocciferae* forming swollen leaf bud galls on *Quercus coccifera*, *Dasineura turionum* causing irregular swellings on stems of *Asparagus aphyllus*, *Phlomidomyia pustularis* inducing flat pustule galls on leaves of *Phlomis fruticosa* and *Asphondylia verbasci* causing flower bud galls on *Verbascum sinuatum* are typical representatives of Mediterranean species.

Some species occur over greater areas and a few species reach the northern limits of their distribution areas in Central Europe. In such case they are defined as **Submediterranean species**. Eight gall midges associated with oak *Quercus cerris*, a species native to south-eastern Europe and Asia Minor, viz. *Dryomyia circinans*, *Contarinia quercicola*, *Dasineura tubularis*, *Janetia cerris*, *J. homocera*, *J. plicans*, *J. pustularis* and *J. szepligetii* that occur abundantly in Greece and in the the Mediterranean area reach the northern limits of their distribution in the eastern part of Austria, southern part of the Czech Republic and of the Slovak Republic. These species are Submediterranean (Skuhravá & Skuhrový 2010a).

Seventy species (29%) are **European** having their centres of origin in Europe. They occur abundantly in Central Europe and reach up to northern part of Greece and some of them up to southern part; usually they do not occur in islands. Typical representatives are *Macrodiplosis roboris* and *M. pustularis*, both causing leaf galls on *Quercus robur* and *Q. petraea* in Europe, but in Greece they occur on *Quercus pubescens* and its relatives. Both species occur abundantly in mainland of Greece and in Corfu but not in other Greek islands. *Oligotrophus juniperinus* and

O. panteli causing galls on vegetative tips of *Juniperus communis* and *J. oxycedrus* occur only in mainland Greece and do not occur in islands.

Dasineura plicatrix causing galls on various species of *Rubus* occupies a large area in Europe and reaches to North Africa and Turkey. Galls of this species have been recently confirmed from North America – in southwestern British Columbia. This species is classified as immigrant in North America (Sinclair et al. 2009). In Greece the galls of *Dasineura plicatrix* were recorded at 45 localities spread in mainland and islands. It is one of the two most abundant species in Greece.

Monarthropalpus flavus causing blister leaf galls on *Buxus sempervirens* is European species occurring up to Turkey and it is an immigrant in North America (in California) (Gagné & Jaschhof 2014). The galls were recorded at three localities in mainland of Greece.

Fourty four species (19%) are **Eurosiberian**. They occur abundantly in Europe, and extend at least to Western Siberia, and a few species reach to the most eastern part of the Palaearctic Region. Typical representatives of Eurosiberian species are *Lasioptera rubi* and *Dasineura rosae*. Larvae of *Lasioptera rubi* cause stem swellings on various species of *Rubus*. It occurs abundantly in Europe, galls were recorded in Siberia and found in Far East, Korea and Japan. In Greece this species occurs in the mainland but not in islands. *Dasineura rosae* causing folded leaflets on *Rosa* species occupies a large distribution area: it is known to occur in 31 of European countries, galls were found in Siberia and recorded in the Far East. They were found also in Kazakhstan, Georgia, Armenia, Turkey and northern Iran. In Greece the galls of *D. rosae* were recorded at 11 localities, 7 of them in the mainland and 4 in Corfu.

Only one species – *Giraudiella inclusa* – may be considered to be **Euroasian**. It induces galls inside the stems of *Phragmites australis* (hence its Latin name “*inclusa*”). It is widespread in Europe and galls were found in Iraq, China and northern Egypt. Galls of *Giraudiella inclusa* were found also in eastern USA where this species is considered to be an immigrant (Gagné & Jaschhof 2014). Galls of *G. inclusa* were recorded at 4 localities in northern Greece and at 2 in the island of Samos.

Twenty one species (9%) may be considered to be **Holarctic**. They occur simultaneously in the Palaearctic and in the Nearctic regions. The zoophagous species *Aphidoletes aphidimyza* and phytophagous species *Semudobia betulae* developing in seed of various species of *Betula* are considered to be true Holarctic species. Several other species occurring simultaneously in Europe and North America are primarily European species that were imported into North America with their host plants. Some of them are considered to be immigrants in North America, as for example *Contarinia nasturtii* in Canada (Chen et al. 2009, 2011).

Some species were introduced into many parts of the world and display **cosmopolitan** distribution, for example *Contarinia pyrivora* and *Dasineura pyri* causing galls on *Pyrus communis* and *Dasineura mali* on *Pyrus malus*. In some cases it is not quite clear where a particular gall midge species is native and to which part it was introduced. *Contarinia pyrivora*, a serious pest of pear, is primarily a European species introduced in North America, Australia, Japan and China. *Dasineura pyri* causing leaf roll galls mainly on young trees of *Pyrus communis* is a European species widely spread in Europe and introduced into northern America and New Zealand. The origin of most of them is unknown. *Mayetiola destructor* developing on cereals is considered to be a primarily European species that has been imported into other continents probably with straw.

Larvae of *Zeuxidiplosis giardi* cause leaf bud galls on *Hypericum perforatum*. It is primarily a European species that has been introduced to North America (USA, Canada), Australia, New Zealand and to South Africa for biological control of the weed *Hypericum perforatum*. In Europe it occupies disjunct areas of distribution, in contrast to continuous distribution of *Dasineura hyperici*. In Greece the galls of *Zeuxidiplosis giardi* were recorded at Platamonas and Neoi Poroi in northern Greece and in the island of Rhodos.

Two species – *Dasineura gleditchiae* and *Obolodiplosis robiniae* that were recorded in Greece are primarily **Nearctic** species that have been accidentally imported to Europe probably with their host plants, *Gleditsia triacanthos* and *Robinia pseudoacacia*. In Europe they are considered to be **alien** species (Skuhravá et al. 2010).

Larvae of *Dasineura gleditchiae* develop in leaflets of *Gleditsia triacanthos* and change them into galls. It is a Nearctic species and an immigrant to Europe from the coastal zones of the eastern part of the USA. The galls were first found in the Netherlands in 1975 (Nijveldt 1980) and subsequently were recorded in many countries of Europe and also in Turkey (Bayram et al. 2005). In Greece *D. gleditchiae* was firstly observed in 1995 (Dini-Papanastasi & Skarmoutsos 2001, EPPO 2008). In 2007 the galls of *D. gleditchiae* were recorded at Platamonas in Central Greece (Skuhravá & Skuhravý 2009).

Larvae of *Obolodiplosis robiniae* cause galls on leaflets of *Robinia pseudoacacia*. It is a Nearctic species native to the eastern part of North America. Galls were recorded for the first time by Duso & Skuhravá (2003) at Paese, Treviso Province, in northern Italy. This species has spread rapidly throughout Europe in the course of several years and now it occupies a large distribution area from southern England in the west up to Doneck in Ukraine in the east and from southern Italy up to the southern part of Sweden (Skuhravá et al. 2007). Galls of *O. robiniae* were firstly recorded in Corfu in 2013 by Bella (2014) and not by Skuhravá and Skuhravý (2006) as it is given in Bella's paper.

If we compare the composition of zoogeographical elements of gall midge fauna found in Greece with those found in Europe (Fig. 4), it is clear that in Greece prevail zoogeographical elements of Mediterranean origin. Of 1800 species of the family Cecidomyiidae forming the present fauna of Europe, 71% are European, 12% Eurosiberian, 9.5% Mediterranean and Submediterranean, 4.5% Holarctic, 1.3% Palaearctic, 0.4% cosmopolitan and 1.3% alien species (Skuhravá & Skuhravý 2010a). Of 235 species of the family Cecidomyiidae forming the present fauna of Greece, only 29% are European, 19% Eurosiberian, but 41% are Mediterranean and Submediterranean, 9% Holarctic, 1% Palaearctic and 1% Nearctic species.

Host plant – gall midge interactions

The flora of Greece includes 4100 species of flowering plants (Tutin et al. 1964–1980). Only a small part of them – 148 plant species (3.6%) were found as host plants for gall midges. In Greece 235 species of gall midges are associated with 148 plant species belonging to 41 plant families. The highest number of gall midges – 25 species – are associated with host plant species of the family Fabaceae, 23 gall midge species with Fagaceae, 20 gall midge species with Rosaceae, 19 gall midge species with Asteraceae, 11 gall midge species with Poaceae and Oleaceae and 10 gall midge species with Lamiaceae. Other plant families include host plants for one to eight gall midge species. The majority of host plant species (64%) are herbaceous plants and a smaller part (36%) are trees and shrubs.

Larvae of phytophagous gall midges live in close relationships with plants. Larvae live in, or on, various plant organs where they feed by sucking sap from the tissues. They may feed without causing galls but most induce development of some type of abnormal plant growth or galls. Most gall midges found in Greece are specifically restricted to their host plant species, their larvae feed on only one host plant species and are **monophagous**, larvae of some gall midge species may feed and develop on several species of one plant genus and are **oligophagous**, for example *Dasineura rosae*. Larvae of **polyphagous** species feed on host plant species belonging to several genera of one plant family, as do for example *Lasioptera carophila* and *Kiefferia pericarpiicola* on Apiaceae, *Mayetiola destructor* on Poaceae. The undescribed species *Lasioptera* sp., a new pest recorded in Greece and Turkey, is associated with two plant species belonging to different and non-related

plant families – with *Solanum lycopersicum* belonging to Solanaceae and *Cucumis sativa* belonging to Cucurbitaceae. Other species – *Clinodiplosis cilicrus* is a polyphagous species associated with various species and genera of host plants belonging to various plant families.

Gall midges usually search for host plants and each species of gall midge attacks a specific organ of its host plant, as for example *Contarinia medicaginis* searches only for flower buds of *Medicago sativa*, not for leaf buds. Some species may develop in various organs of one host plant, as does *Contarinia nasturtii* in flower and leaf buds and in stems, and some species may use two organs of one host plant for their development, one organ for the first generation and the second organ for the second generation in their life cycle, for example *Asphondylia calycotomae* in leaf buds and in pods of *Calicotome villosa*. In Greece about one third of phytophagous gall midges (31%) cause galls on leaves of host plants, a slightly smaller part (28.7%) induce galls on leaf buds, a smaller part (14.8%) on stems, 13.8% on flower buds and 11.3% cause galls on fruits.

In Greece one species of host plant is usually associated with only one species of gall midge. Of 148 host plant species about 100 species (65.5%) belong in this group, each of 25 other host plant species (17%) is associated with two species of gall midges, each of other 20 plant species (13.5%) with three species of gall midges. Each of the trees – *Erica arborea*, *Olea europaea* and *Phillyrea angustifolia*, and the common reed *Phragmites australis* are associated with four species of gall midges, one host plant – *Tilia tomentosa* – with five species of gall midges and one species – *Quercus cerris* – is associated even with eight species of gall midges.

Not all species of gall midges that are associated with host plants are gall inducing species. On one host plant there may develop larvae of gall inducing species, one larva or several larvae of inquilines, larvae of zoophagous species or mycophagous species.

In Greece *Quercus* is the host plant genus with the highest number of gall midge species: twenty species belonging to various genera are associated with seven species of *Quercus* growing in the mainland of Greece and six island where our investigations have been done. Three species of the genus *Quercus* native to southern Europe and the Mediterranean – *Quercus cerris*, *Q. ilex* and *Q. coccifera* – host fifteen gall midge species.

Quercus cerris is the host plant species with the highest number of associated gall midge species: eight species cause galls of various shape on this oak: *Contarinia quercicola*, *Dasineura tubularis*, *Dryomyia circinnans*, *Janetia cerris*, *J. homocera*, *J. plicans*, *J. pustularis* and *J. szepligetii*. All these species, with the exception of *Contarinia quercicola*, cause galls of various shape on leaves of *Quercus cerris* and occur in the southern part of the mainland, only *Janetia cerris* was found also in the islands Corfu and Crete and *Dryomyia circinnans* only in Corfu.

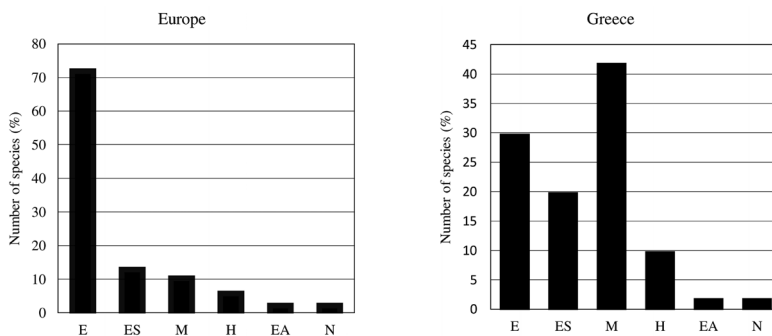


Fig. 4. Comparison of zoogeographical composition of gall midge fauna in Europe and in Greece. Abbreviations for zoogeographical elements: E – European, EA – Euroasian, ES – Eurosiberian, H – Holarctic, M – Mediterranean, N – Nearctic.

Quercus ilex is the host plant of four gall midge species: *Arnoldiola tympanifex*, *Contarinia ilicis*, *Dryomyia lichtensteinii* and an undescribed species of the genus *Contarinia*, and *Quercus coccifera* is the host plant of three gall midge species: *Dryomyia cocciferae*, *Phyllodiplosis cocciferae* and an undescribed species of the genus *Dasineura*. Of them *Phyllodiplosis cocciferae* changing leaf buds into galls is a very frequent species in mainland of Greece and some islands.

Olea europaea, the important agricultural tree in Greece and in the Mediterranean area, is the host plant of the following four gall midge species: *Dasineura oleae*, *Lasioptera berlesiana*, *Resseliella oleisuga* and *Asynapta furcifer*. Of them the most important is *Dasineura oleae*, frequently occurring over the whole area of Greece, may cause damage to olive trees if galls occur in large amount.

Phillyrea latifolia, the tree native to the Mediterranean area, is the host plant of the following four gall midge species: *Braueriella phillyreae*, *Dasineura rufescens*, *Probrugmanniella phillyreae* and *Asphondylia* sp. Galls of *Braueriella phillyreae* occur relatively frequently on leaves of this tree, mainly in southern Greece, and were found also in the islands of Corfu and Lefkada.

Erica arborea, the evergreen shrub or small tree native to the Mediterranean Basin, is the host plant of the following four gall midge species: *Dasineura ericaescopariae*, *D. vagans*, *Myricomyia mediterranea* and *Wachtliella ericina*. Of them only *Myricomyia mediterranea* occurs frequently in southern parts of Greece and in all islands except Samos.

Phragmites australis, the large perennial grass with cosmopolitan distribution, is the host plant of the following four species: *Giraudiella inclusa*, *Lasioptera arundinis*, *Lasioptera hungarica* and *Lasioptera flexuosa*. All these gall midge species were rarely recorded in Greece.

Tilia tomentosa (*Tilia argentea*), the tree native to southeastern Europe and southwestern Asia, is the host plant for five gall midge species: *Dasineura thomasiana*, *Dasineura tiliae*, *Didymomyia tiliacea*, *Physemocercis hartigi* and an undescribed species of *Macrolabis*.

Economic importance

Among the gall midges occurring in Greece there are several species which can cause injury to their host plants. The designation of species as agricultural pests is based on references to their harmfulness in the applied entomological literature (Darvas et al. 2000, Skuhravá & Roques 2000). The damage done by some species depends mainly on the number of occurring gall midge species and on the plant organs that are attacked, on the atmospheric conditions and on the incidence of parasitoids that may reduce the population density of the pest. We classified the pests into four groups (Skuhravá & Skuhravý 1993, 1996). In the first group belong the gall midge species causing dying off of the host plants, in the second group the species causing important restriction of the assimilation surface of the host plant organs leading to the stoppage of the growth, in the third group the species causing less important reduction of the assimilation surface and in the fourth group the species occurring abundantly but not causing important damage to their host plant.

In Greece 19 species of gall midges are associated with 15 species of agricultural plants and one forest tree (Table 4). Nine species of gall midges that were mentioned as pests of cultivated plants in Greece in the past were reviewed by Skuhravá & Skuhravý (1997a). During several recent years five species of gall midges were recorded as new pests in Greece. We included in the table also several other species of gall midges associated with agricultural plants that we recorded in larger amounts during our investigations in Greece. Such species may be classified as **potential pest**. They may not develop into pests but it is necessary to be alert because they may change into pests when environmental conditions change and give them favourable conditions for their multiplication and local increasing of population density.

Four species of gall midges are pests at present : *Dasineura oleae* on olive tree, *Contarinia pruniflorum* on apricots, *Lasioptera* sp. on tomato and *Asphondylia coridothymi* on conehead

Table 4. Species of gall midges injurious to agricultural plants and forest trees in Greece

host plant	species of gall midge	past occurrence	references	occurrence 1997–2015
<i>Abies cephalonica</i> , Greek fir	<i>Resseliella piceae</i>	1970, Parnis	Kailidis & Georgevits (1972)	2015, Mt. Parnitha, outbreak
<i>Ceratonia siliqua</i> , carob tree	<i>Asphondylia gemnadii</i>	1975, Crete	Orphanides (1975)	3 records
<i>Cucumis sativus</i> , cucumber	<i>Lasioptera</i> sp.		Perdikis et al. (2011)	2011, Trifylia
<i>Medicago sativa</i> , alfalfa	<i>Contarinia medicaginis</i>	1971, Sperchias	Stavrakis & Lampbakopoulos (1971)	1 record
<i>Olea europaea</i> , olive tree	<i>Dasineura oleae</i>	1962	Féron & d'Aguiar (1962)	48 records
	<i>Dasineura oleae</i>			2010, Crete
<i>Prunus armeniaca</i> , apricot	<i>Lasioptera berlesiana</i>	1939	Koronéos (1939)	2012, 2013 outbreak
	<i>Resseliella oleisuga</i>	1974, Crete	Argyriou & Marakis (1974)	3 records
<i>Prunus amygdalus</i> (<i>P. dulcis</i>), almond	<i>Contarinia pruniflorum</i>			6 records
<i>Prunus domestica</i> , plum	<i>Odinadiplosis amygdali</i>	1929, Athens	Anagnostopoulos (1929)	1 record
	<i>Dasineura tortrix</i>			12 records
<i>Pyrus communis</i> , pear	<i>Putoniella pruni</i>			23 records
	<i>Aptomyia bergenstammi</i>	1936, Xylokastron	Isaakides (1936)	8 records
<i>Rubus idaeus</i> , <i>R. caesius</i> , raspberry	<i>Contarinia pyrivora</i>			26 records
	<i>Dasineura pyri</i>			21 records
<i>Solanum lycopersicum</i> , tomato	<i>Dasineura plicatrix</i>			21 records
	<i>Lasioptera</i> sp.			45 records
<i>Triticum durum</i> , wheat	<i>Haplodiplosis marginata</i>	1930, Thessalia	Deligeorgidis et al. (2012)	2011, Trifylia
	<i>Mayetiola destructor</i>		Cavadas (1930)	western Macedonia 2009, 2010
<i>Thymus capitatus</i> , conehead thyme	<i>Asphondylia coridothymi</i>	2007–2008	Deligeorgidis et al. (2012)	western Macedonia 2009, 2010
<i>Vitis vinifera</i> , grapes	<i>Vitisella oenophila</i>	1948, 1949	Malagaris (2011)	12 records
			Barnes (1948, 1949)	0

thyme. Fourteen species of gall midges may be noted as potential pests of agricultural plants. Currently they are in low population density but their amount should be monitored because they may change into pests.

Dasineura oleae is the most serious pest in Greece in recent years. Larvae cause slight, indefinite, elongate swellings on the leaves of *Olea europaea*. In the past it occurred over the whole territory of Greece at a relatively low level and has not been considered a pest of olive trees. In recent years its occurrence gradually increased and in 2010 an outbreak was recorded in Crete which resulted in defoliation of trees and reduced number of fruits (Simoglou et al. 2012, Perdikis et al. 2013). The increasing occurrence of *D. oleae* was recorded also in Turkey where it caused significant reduction or loss of yield of olive fruits and *D. oleae* was declared as a serious pest of olive trees (Doganlar et al. 2011). It is interesting that the galls of *D. oleae* were intercepted in Britain at Gatwick Airport, West Sussex, on March 27th 1996 (Malumphy 2010), far from the area of its native occurrence. We recorded *D. oleae* at 48 localities during our investigations. It is one of the two most frequent species of gall midges in Greece.

Contarinia pruniflorum is also a serious pest in recent years. Larvae of this species develop in flower buds of *Prunus spinosa*, *P. mahaleb* and *P. armenica*. In Greece this species causes injury to apricots (*Prunus armeniaca*). Infested flower buds remain closed and do not produce fruits. Tsagarakis & Mitsopoulus (2007) firstly recorded galls of this species on apricots in Greece in 2006. They observed that the damage on flower buds of apricots caused by *C. pruniflorum* reached 60–65% in orchards in the area of Korinthos at that time. Kyttariolou & Tsagarakis (2013) studied the biology and population density of *C. pruniflorum* in different apricot varieties. This species remains a serious pest in Greece in recent years, similarly as it is in Turkey (Doganlar et al. 2014).

Lasioptera sp. Larvae of this undescribed species live in groups inside the stems of tomato (*Solanum lycopersicum*) and cucumber (*Cucumis sativus*) mainly at the base of cut leaves or in wounds on stems. Larvae cause decomposition of plant tissue and necroses, attacked stems break and fruit production reduces. The damage was observed firstly at Trifylia in western Peloponnesus in 2011 by D. Perdikis (Perdikis et al. 2011). Damage caused by this species was recorded also on tomatoes in greenhouses at several localities in southern Turkey.

Asphondylia coridothymi is a pest of conehead thyme (*Thymus (Coridothymus) capitatus*). Larvae change flower buds into galls and prevent the development of seed not only in the attacked flower buds but also in adjacent flowers in the same inflorescence which results in the loss of seed (Malagaris 2011). Galls of *A. coridothymi* were recorded in the islands Samos and Lefkada and near Athens and Galaxidi in the mainland of Greece. This species may be designated as a local pest.

Resseliella piceae as a pest of *Abies cephalonica* in Greece firstly occurred in 1970 (Kailidis & Georgevits 1972). An outbreak and serious damage of fir seeds higher than that of *Dioryctria abietella* and *Ernobius abietis* was recorded on the Mount Parnitha near Athens in 2015. *Abies cephalonica* is a tree native to the mountains of Greece and a threatened species, so the outbreak of *R. piceae* is very dangerous (P. Petrakis, personal comm.).

Three species associated with *Pyrus communis* are potential pests in Greece. They occur frequently over the whole territory of Greece and it would be necessary to follow and monitor their population density: *Contarinia pyrivora* damaging fruits of pear and misshapen and enlarged fruitlets, *Apiomyia bergenthami* causing woody, plurilocular galls on twigs, and *Dasineura pyri* inducing curled and rolled leaf margins mainly on young trees. We also observed frequently the galls of *Dasineura tortrix* on young trees of plum (*Prunus domestica*) and galls of *Dasineura plicatrix* on *Rubus* sp. Both species may contribute to decrease of harvest of their host plants.

Only two of four gall midge species that are pests of cereals in Central Europe occur in Greece: *Mayetiola destructor* and *Haplodiplosis marginata*. Recently their occurrence was recorded

in western Macedonia by Deligeorgidis et al. (2012). Two other species associated with wheat - *Contarinia tritici*, larvae of which develop in spikelets, and *Sitodiplosis mosellana*, larvae of which damage developing grains of wheat – have not been recorded in Greece yet. Larvae of both species live hidden in the wheat ears, they are inconspicuous and often overlooked, but they may change into serious pests of wheat and may cause crop losses.

SUMMARY

This study summarises the results of investigations of gall midges carried out in Greece in the period from 1994 to 2010. Investigations were conducted at 116 localities situated in the Greek mainland, the Peloponnese peninsula and six islands at altitudes from sea level up to 1,100 m a. s. l. at Karpenisi in Central Greece in the southern part of the Pindus Mountains. At present the fauna of gall midges in Greece includes 235 species in 80 genera. Of them 213 are valid species and 22 species, still undescribed, are identified to the genus level. The subfamily Cecidomyiinae includes 224 species in 71 genera, Porricondyliinae 2 species in one genus, Porricondyliinae 2 species in one genus, Lestremiinae 3 species in 3 genera and Micromyiinae 6 species in 5 genera. In Greece the two most speciose genera are *Dasineura* with 37 species and *Contarinia* with 27 species, followed by *Asphondylia* with 22 species and *Lasioptera* with 10 species. Zoogeographical analysis is based on 1,157 records, of which 40 were obtained by earlier researchers and 1,117 records of the present authors. Until 1996 only 20 species were known to occur in Greece and adjacent islands. We enriched the faunal list of Greece by adding 206 species. Results of our investigations are summarized in three lists: list of species; occurrence and distribution; host plants and associated gall midges. All results are evaluated using methods of zoogeographical analysis.

Species richness. The gall midge fauna of Greece including 235 species may be evaluated as rich in comparison with the gall midge fauna of adjacent countries and countries around the Mediterranean Sea from which comparable data are available: Albania (20 species), Macedonia (147 species), Bulgaria (240 species), Turkey (118 species), Spain (240 species), but it is not so rich as the fauna of gall midges of Italy (324 species) and France (668 species).

The average species number per locality determined from the whole territory of Greece is 9.4. Of islands, Corfu has the highest average species number 12.6, followed by Crete 9.2 and Lefkada 9.0. The lowest average species number 7.0 was counted for Rhodos. The average species number per locality of the whole of Greece 9.4 is relatively low in comparison with average species numbers in other countries in Europe: Bulgaria (14), Switzerland (16.7), South Tyrol (15), Austria (17), Slovakia (19.5), the Czech Republic (26) and Hungary (29). The higher average species numbers of these countries correspond to the geographical position in Central Europe with diverse and rich vegetation.

Biodiversity of gall midges in Greece including 235 species may be evaluated as good and reasonable and corresponding to the environmental conditions of the Mediterranean area with hot and dry weather and prevalence of sclerophyllous vegetation. Thirteen species of gall midges were described from specimens discovered in Greece during period 1882 to 2011.

The discovery of a new genus and several new species confirm the theory of biodiversity hot-spots that Greece as a part of the Mediterranean Basin is one of the biogeographic regions with a significant reservoir of biodiversity. At individual localities from 3 to 21 species of gall midges were recorded. Apsalos, 506 m a. s. l. in north-western Greece was the most species rich locality where galls of 21 species were recorded, followed by the locality Agios Dimitrios, 150 m a. s. l. in island Corfu where galls of 20 species were recorded. On average 9.4 species occur per locality. During our investigations we also discovered galls on several host plants which were caused by undescribed species of gall midges.

Density of gall midges occurring in an area of 1000 km² calculated for the whole territory of Greece is 62.1 species. Such value may be evaluated as proportional to natural conditions and the method of research. It is comparable with density calculated for Macedonia (66.1), Bosnia and Herzegovina (63.3) but is lower than in Bulgaria (74.1). The species density does not depend on the size of the area but it is much more influenced by the number of localities that were examined in the area under study. For example, the density of gall midges in the Czech Republic is 189.2 species per 1000 km². The highest species density (60.3) was found for the Greek mainland and for the island of Corfu (56.3), the low species density in Crete (22.3) and the lowest species density for the island of Zakynthos (17.5).

Frequency. All species recorded in Greece are divided into six frequency groups according to number of localities or records. 148 species (63%) found at only one or two localities occur very rarely; 43 species (18%) recorded at three, four or five localities occur rarely; 19 species (8%) recorded at 6 to 12 localities occur moderately frequently; 17 species (7%) recorded at 13 to 26 localities occur frequently; 7 species (3%) recorded at 27 to 54 localities occur very frequently: *Phlomidiomyia pustularis* causing galls on leaves of *Phlomis fruticosa* was recorded at 27 localities; *Lasioptera carophila* at 32 localities, *Asphondylia calycotomae* at 33, *Phyllodiplosis cocciferae* at 35, *Asphondylia verbasci* at 40, *Dasineura plicatrix* at 45 and *Dasineura oleae* at 48 localities. *Dasineura turionum* causing galls on *Asparagus aphyllus* recorded at 55 localities is the most frequently recorded species in Greece.

Altitudinal distribution of gall midges recorded in Greece is based on average species numbers counted for altitudinal belts by 100 meters from sea level up to the highest locality near Karpenisi, 1,100 m a. s. l. In the thermomediterranean zone the highest average species number of gall midges (9.9) occurs in the lowest belt (0–400 m a. s. l.), in the mesomediterranean zone the highest average species number (11.5) occurs in the belt between 500–600 m a. s. l. The average species number falls with increasing altitude and at altitude of 1,100 m a. s. l. only one species was found – *Oligotrophus juniperinus* causing galls on *Juniperus communis*. Altitudinal distribution of species of gall midges in Greece corresponds to the altitudinal distribution found in other countries of Europe where systematic faunal investigations have been done.

Geographical distribution. Gall midge species occurring in Greece are divided according to their overall distribution in the Palaearctic region or in the world into six zoogeographical or biogeographical units. Most species – 97 species (41%) are Mediterranean, 70 species (29%) European, 44 species (19%) Eurosiberian, 21 species (9%) Holarctic species. *Giraudiella inclusa* causing galls in stems of *Phragmites australis* is the only Euro-Asian species.

Dasineura gleditchiae inducing leaf galls on *Gleditsia triacanthos* and *Obolodiplosis robiniae* causing leaf galls on *Robinia pseudoacacia* are Nearctic species, immigrants from North America and alien species in Europe.

Plant-animal interactions. Gall midges are associated with 148 host plant species belonging to 41 plant families: 64% are herbs, 36% trees and shrubs. 25 species of gall midges are associated with Fabaceae, 23 species with Fagaceae, 20 species with Rosaceae and 19 species with Asteraceae. *Quercus* is the host plant genus with the highest number of gall midge species: twenty species belonging to various genera are associated with seven species of *Quercus*. Of these *Quercus cerris* hosts 8 species of gall midges; *Quercus ilex*, *Olea europaea* and *Erica arborea* host 4 species. 31% of gall midge species cause galls on leaves of host plants, 28.7% on leaf buds, 14.8% on stems, 13.8% on flower buds and 11.3% on fruits.

Economic importance. 19 species of gall midges are associated with 15 species of agricultural plants and one forest tree. 9 species were mentioned as pests of cultivated plants in the past. Five species were recorded as new pests in recent years: *Dasineura oleae* on *Olea europaea*; *Contarinia pruniflorum* on *Prunus armeniaca*; *Lasioptera* sp. on *Solanum lycopersicum* and

Cucumis sativus; *Asphondylia coridothymi* on *Thymus capitatus*; *Resseliella piceae*, a pest of seed in cones of *Abies cephalonica*. Fourteen species of gall midges may be counted as potential pests of agricultural plants.

Acknowledgements

We thank Dr Panos V. Petrakis, Laboratory of Forest Entomology, Institut for Mediterranean Forest Ecosystems, Athens, Greece, for sending material of *Resseliella piceae* for identification and for his information about the outbreak caused by this insect. We are grateful to our grand-daughter Jana Vaněčková for her help in preparing computer versions of graphs and map. We thank Dr K. M. Harris, Ripley, Woking, Surrey, UK, for valuable comments and for the correction of the text of our manuscript. We also thank the journal reviewers for their careful reading and valuable comments on our article.

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