Acta Soc. Zool. Bohem. **80**: 165–195, 2016
ISSN 1211-376X

Gall midges (Diptera: Cecidomyiidae) of south-western Turkey

Marcela Skuhravá & Václav Skuhravý

Bítovská 1227/9, CZ–140 00 Praha 4, Czech Republic; e-mail: marcela.skuhrava@gmail.com

Received 28 July 2015; *accepted 14 January 2016*
Published 8 September 2016

Abstract. Altogether 55 species of the family Cecidomyiidae were found at 36 localities in three areas in south-western Turkey during investigations in 2011–2013. Localities were situated at altitudes from sea level up to 1,100 m a. s. l. at Kizilagac in the Bodrum area. 44 species were found at 18 localities in the Alanya area, 32 species at 13 localities in the Bodrum area and 20 species at 5 localities in the Kemer area. Until 2005 only 71 species of gall midges were known to occur in Turkey. 37 species are reported from Turkey for the first time. We enriched the fauna of Turkey for 37 species and the fauna of gall midges of Turkey includes 118 species. All results are evaluated using methods of zoogeographical analysis. It is based on 226 recent records. Annotated list of gall midge species and list of host plants associated with gall midges are given. *Asphondylia celsiae* Kieffer, 1909, syn. nov., is synonymized with *Asphondylia verbasci* (Vallot, 1827).

Key words. Distribution, zoogeography, frequency, species richness, economic importance, plant-insect interactions, Cecidomyiidae, Diptera, Turkey, Palaearctic region.

INTRODUCTION

Although Turkey is a large country with various plant communities, the fauna of gall midges is not very rich because only a few researchers have carried out systematic faunal investigations. In addition, the territory has been explored very unevenly. Most species of gall midges were recorded in the western part of Turkey: in the Marmara and Aegean Regions and around large cities where several universities and research institutes occur: around Bursa, Istambul and Izmir, and around Ankara in the Central Anatolia Region. Only a few species of gall midges were found at localities scattered over the Black Sea Region and over the Mediterranean Region.

In 2005 the first summary of gall midge species occurring in Turkey was published where 71 gall midge species were given on the basis of results of investigations of previous researchers (Skuhravá et al. 2005). Since that time three new species have been discovered and described – *Lasioptera oleicola*, *Janetiella potentillogemmae* and *Celticecis caucasicae* (Doğanlar et al. 2011, Skuhravá et al. 2011, Gagné & Doğanlar 2013), two species – *Cystiphora sonchi* and *Dasineura gleditchiae* – have been recorded as newly recorded members of the Turkish fauna (Bayram et al. 2005) and the identity of one species (*Lasioptera* sp. on tomato) is being investigated Cilbircioglu & Unal (2008) and Unal & Akkuzu (2009) published a review of gall midges associated with forest trees in Turkey based on data given in the article of Skuhravá et al. (2005) without adding any new data.

The relatively low number of gall midge species known to occur in the territory of Turkey led us to decide to try to improve the level of knowledge of gall midge fauna of Turkey using our collecting method and to obtain comparable data for our zoogeographical studies.

In this paper we present results of our investigations carried out at 36 localities situated in the Mediterranean Region in surroundings of Alanya and Kemer in the Antalya Province and in surroundings of Bodrum in the Muğla Province in the course of three consecutive years – in 2011, 2012 and 2013.

MATERIAL AND METHODS

The investigations of occurrence and distribution of gall midges have been implemented by means of a uniform method, by collecting galls on host plants at each locality by the time/area collecting method. This method is described in detail in Skuhravá & Skuhravý (1997, 2010b). In brief: two researchers carefully search for galls slowly walking in natural habitats over a distance of about one kilometer in the course of two or three hours.

Identification of galls is based on the keys of Houard (1908–1913, 1922–1923) and of Skuhravá (2011a), identification of larvae on Möhn (1955), of adults on Skuhravá (1997a), nomenclature of gall midge species is based on Skuhravá (1986, 1989) and Gagné & Jaschhof (2014). Nomenclature of host plants is based on Tutin et al. (1964–1980), Davis & Güner (2000), Pils (2006) and *The Plant List* (2013). Data about gall midges gathered during these investigations were analysed and evaluated from the zoogeographical point of view using methods described by Skuhravá (1987, 1994a, b, 1997b) and Skuhravá & Skuhravý (2010b).

Galls of gall midges (voucher specimens), larvae, pupae and adults are deposited in the collection of Marcela Skuhravá in Praha, Czech Republic.

STUDY AREAS

Alanya, located at coordinates 36° 33' N, 32° 00' E, is a city and a component district of the Antalya Province situated in the southern part of Turkey along the Mediterranean Sea (Fig. 1). The region is covered mainly by mountainous terrain. Some mountains exceed 2,500 meters. About 60% of the region is covered with pine forest and Mediterranean plant vegetation. The foothills of the mountains are covered in the typical Mediterranean maquis. Higher parts are formed of oak and pine forests. Climate of Alanya is typical Mediterranean, with hot summer months rainless but very humid. In May 2011 we investigated eighteen localities at Alanya and its surroundings.

Kemer, located at coordinates 36° 36' N, 30° 33' E, is a small town in Antalya Province, about 40 km south of the city of Antalya (Fig. 2). It is situated on the Gulf of Antalya. The coast has the typical Mediterranean hot, dry weather and warm sea. In the neighbourhood the Olympos, Beydaglari National Park, is situated with unique fauna and flora. In June 2013 we investigated five localities at Kemer and its surroundings.

Bodrum, located at coordinates 37° 02' N, 27° 26' E, is a district and port city in the Muğla Province in the southwestern Aegean Region on the southern coast of Bodrum Peninsula and is surrounded by the Aegean Sea (Fig. 3). Bodrum area has a Mediterranean climate with hot and humid summers and mild and sunny winters, with average temperatures 34 °C in summer and 15 °C in winter. It can be divided into two parts. The southwestern part is a rocky highland covered mainly with garrigues and the north-eastern part is covered with forests consisting mainly of *Pinus halepensis*, *Quercus coccifera*, *Q. ilex*, *Olea europaea*, *Laurus nobilis*, *Phillyrea* and several species of *Cistus* and many other trees and shrubs and herbaceous plants. In June 2012 we investigated thirteen localities in the surroundings of Bodrum.

LOCALITIES EXAMINED

They are arranged into three parts according to investigations carried out in the years 2011, 2012 and 2013. The following data are given for each locality: the name of locality, its altitude, short ecological characteristics, data of investigations and, at the end in parentheses, the number of the locality, indicating its position on the map.

Alanya Area (Fig. 1)

Alanya (castle), 260 m a. s. l.: extensive ruins of the castle and fortifications, located on a rocky cliff high over the Alanya city; 29 May 2011 (17).

Alanya (cemetery), 20 m a. s. l.: *Pinus halepensis*, *Myrtus communis*, *Rosmarinus officinalis*; 25 May 2011 (18).

Ali Efendi Neukii, 250 m a. s. l.: dried stands along the path on the hill-side near Kargicak with *Erica arborea*, *Quercus cerris*, *Calicotome* sp. and *Tamarix* sp.; 28 May 2011 (15).

Ali Efendi Deresi, 300 m a. s. l.: stands along the brook, with *Morus*, *Alnus*, *Laurus*, *Platanus*, *Fraxinus ornus*; 28 May 2011 (16).

Asmaca, 700 m a. s. l.: stands near the dried brook, *Rubus* and *Calicotome*; 27 May 2011 (7).

Asmasekil, 300 m a. s. l.: orchards with *Olea europaea*, *Phlomis*, *Quercus coccifera*, *Cercis*, *Myrtus communis*, *Calicotome*; 30 May 2011 (2).

Bademagaci, 200 m a. s. l.: stands on the hill-side of deep valley in the mountains; 27 May 2011 (8).

Bektas, 250 m a. s. l.: xerotherm stands *along* the road with *Ceratonia siliqua*, *Calicotome*, *Myrtus communis*, *Quercus coccifera*; 25 May 2011 (4).

Degirmendere, 500 m a. s. l.: dry forest, stony hill-side; 26 May 2011 (9).

Dinek, 1000 m a. s. l.: xerotherm locality with *Calicotome* and *Cistus*; 30 May 2011 (5).

Elikesik, 100 m a. s. l.: stands with *Pinus halepensis*, *Cistus* sp., *Myrtus communis*, *Olea europaea*, *Quercus coccifera*, *Erica arborescens*; 30 May 2011 (1).
Gillioglu Germesi (dry forest), 750 m a. s. l.: dry forest with *Pinus halepensis* and *Erica arborea*; 26 May 2011 (10).
Gillioglu Germesi (road), 800 m a. s. l.: stands along the road with *Pinus halepensis*, *Quercus ilex*, *Q. coccifera* and *Phlomis*; 26 May 2011 (11).
Kadipinari, 500 m a. s. l.: stands in the valley of the Oba river, orchards with *Citrus* sp., *Pyrus* sp., *Olea europaea*, *Ficus* sp.; 26 May 2011 (6).
Kargicak Gay, 5 m a. s. l.: estuary of the Oba river into the sea, covered with sand with stands of *Arundo donax* and *Tamarix* sp.; 28 May 2011 (13).
Kizilcasehir, 100 m a. s. l.: stands in valley of a brook with *Pinus halepensis* and *Quercus cerris*; 27 May 2011 (12).
Pasakoy, 512 m a. s. l.: stands along the road in mountains with *Pinus halepensis*, *Coronilla emerus* and *Phillyrea*sp.; 30 May 2011 (3).
Pargali, 200 m a. s. l.: ford across the brook with *Platanus* sp., *Eucalyptus* sp., *Quercus cerris* and *Q. ilex*; 28 May 2011 (14).

Bodrum Area (Fig. 2)
Akcalan, 900 m a. s. l.: forest with *Pinus halepensis*, *Cupressus* sp. and *Cistus* sp.; 6 June 2012 (2).
Bitez (hill), 20 m a. s. l.: small hill near the village with *Laurus nobilis*, *Citrus* sp., *Vitis vinifera*, *Quercus coccifera* and *Olea europaea*; 2 June 2012 (4).
Bitez (river bed), 3–10 m a. s. l.: stands along the dry river bed and shrubs and ruderal plants along gardens and orchards; 7 June 2012 (5).
Bitez (rocks), 10 m a. s. l.: group of rocks near the sea with *Quercus coccifera*, *Pistacia terebrintus*, *P. lentiscus*, *Quercus ilex*, *Capparis spinosa*, *Vitis vinifera*; 5 June 2012 (6).
Camlik (forest), 300 m a. s. l.: forest with *Pinus halepensis*, *Quercus coccifera*, *Phillyrea* sp., *Cistus* sp.; 4 June 2010 (13).
Camlik (steppe), 500 m a. s. l.: dry steppe with *Calicotome* sp. and *Spartium junceum*; dry forest with *Pinus halepensis*; 4 June 2012 (12).
Göltürkbükü, 10 m a. s. l.: forest with *Pinus halepensis*, *Quercus coccifera*, *Calicotome*; 3 June 2012 (8).
Kadicalesi, 700 m a. s. l.: stands with *Pyrus pyraster*, *Laurus nobilis*, *Quercus coccifera*; 6 June 2012 (1).

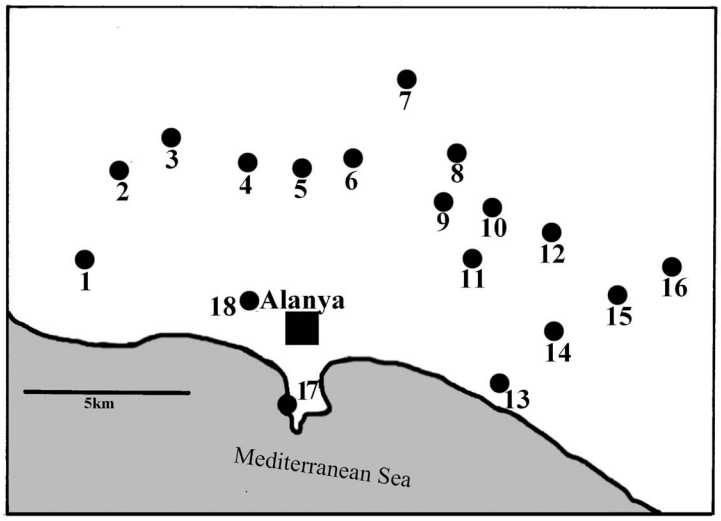


Fig. 1. Alanya area in south-western Turkey with localities where investigations of the family Cecidomyiidae were carried out in 2011: 1 – Elikesik, 2 – Asmasekil, 3 – Pasakoy, 4 – Bektas, 5 – Dinek, 6 – Kadipinari, 7 – Asmaca, 8 – Bademagaci, 9 – Degirmendere, 10 – Gillioglu Germesi, dry forest, 11 – Gillioglu Germesi, 12 – Oba Gayi, Kizilcasehir, 13 – Kargicak Gay, 14 – Pargali Nah, 15 – Ali Efendi Neukii, 16 – Ali Efendi Deresi, 17 – Alanya, castle, 18 – Alanya, cemetery.

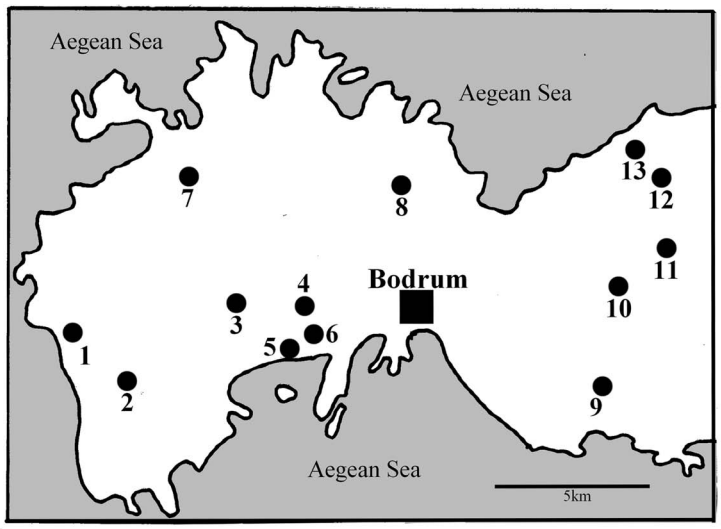


Fig. 2. Bodrum area in south-western Turkey with localities where investigations of the family Cecidomyiidae were carried out in 2012: 1 – Kadicalesi, 2 – Akcalan, 3 – Ortakent, 4 – Bitez (hill), 5 – Bitez (river bed), 6 – Bitez (rocks), 7 – Yalikavak, 8 – Göltürkbükü, 9 – Yali, 10 – Kizilagac (forest), 11 – Kizilagac, 12 – Camlik (steppe), 13 – Camlik (forest).

Kizilagac, 1,000 m a. s. l.: forest with *Pinus halepensis*, *Pistacia*, *Juniperus phoenicea*, *Quercus coccifera* and *Phillyrea*; 4 June 2012 (11).

Kizilagac (forest), 1,100 m a. s. l.: forest locality at higher altitude, near the dried brook; 4 June 2012 (10).

Ortakent, 25 m a. s. l.: stands along a brook with *Populus* sp., *Eucalyptus* sp., *Pistacia* sp., *Olea europaea*, *Capparis spinosa*, *Rubus* sp.; 6 June 2012 (3).

Yali, 40 m a. s. l.: stands along the dry river bed, orchards with *Ficus carica* and *Olea europaea*, *Ceratonia siliqua*, *Phillyrea* sp.; 3 June 2012 (9).

Yalikavak, 120 m a. s. l.: stand with *Quercus coccifera*, *Calicotome*, *Spartium junceum*; 3 June 2012 (7).

Kemer Area (Fig. 3)

Kemer (seaside), 5 m a. s. l.: shrubs and cultivated plants along the path on the seaside; 1 June 2013 (1).

Aslanbucak, 20 m a. s. l.: stands near a small village near Kemer, at dry river bed, with *Pinus halepensis*, *Ceratonia* sp., *Platanus* sp., *Quercus coccifera*, *Coronilla emerus*, *Capparis spinosa*, *Phillyrea* sp., *Rubus* sp., *Calicotome* sp.; 2 June 2013 (2).

Kecili, 30 m a. s. l.: stands along dry river bed, all green parts of trees and shrubs were grazed down by goats, *Erica arborea*, *Rubus* sp., *Olea europaea*, *Capparis spinosa*; 3 June 2013 (3).

Tekirova, 350 m a. s. l.: locality on the hill-side of the Tahtali mountains, with sporadic trees and shrubs, with *Quercus coccifera*, *Phillyrea* sp., *Phlomis* sp.; 5 June 2013 (5).

Phaselis, 10–20 m a. s. l.: city and port, with the hill-side covered with forest formed mainly from *Pinus halepensis*, *Ptelea* sp., *Quercus coccifera*, *Rubus* sp., *Smilax* sp., *Myrtus* sp., *Thymus* sp.; 5 June 2013 (4).

RESULTS

During investigations in 2011, 2012 and 2013 at 36 localities in three areas in south-western Turkey, 55 species of the family Cecidomyiidae were found of which 37 species are the first records from Turkey. In 2011, 44 species were found at 18 localities in the Alanya area, in 2012, 32 species at 13 localities in the Bodrum area and in 2013, 20 species at five localities in the Kemer area. We gathered 226 records on the occurrence of gall midges in the areas under study.

In the following part we provide an annotated list of gall midge species where occurrence of each species is given separately for each part under study. We included in this list also six species of gall midges that were not recorded in the course of our investigations but were described or identified after publication of a paper by Skuhravá et al. (2005) and are the first records from Turkey. At the end we provide the list of host plants associated with species of gall midges (Table 1).

ANNOTATED LIST OF GALL MIDGE SPECIES

The following data are given for each species: species name, author and date of description, synonyms (if any), short description of the biology (if known), shape of the gall, host plant species and family, data on occurrence in Alanya, Bodrum and Kemer areas. At the end it is given the category of distribution in the Palaearctic region.

Aphidoletes aphidimyza (Rondani, 1847)

Cecidomyia aphidimyza Rondani, 1847: 443.

Larvae feed predaciously on various species of aphids. They are used in biological control. Several generations develop per year.

Occurrence. Alanya: Alanya (cemetery), on aphids developing on stems, leaves and inflorescences of *Sonchus* sp. (Asteraceae). – Bodrum: Ortakent, among aphids developing on *Spartium junceum* L. (Fabaceae). – Kemer: Kemer (seaside), larvae in aphid colony on terminal shoot of *Robinia pseudoacacia* (Fabaceae).

Distribution. Holarctic.

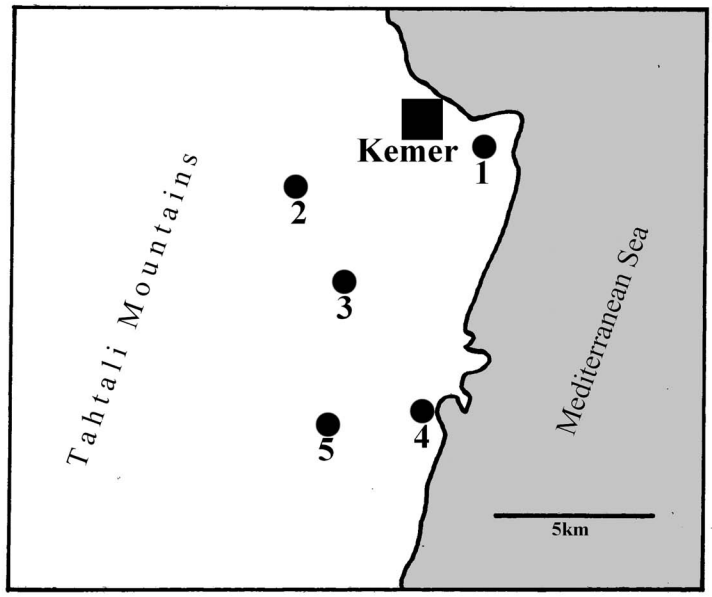


Fig. 3. Kemer area in south-western Turkey with localities where investigations of the family Cecidomyiidae were carried out in 2013: 1 – Kemer (seaside), 2 – Aslanbucak, 3 – Kecili, 4 – Phaselis, 5 – Tekirova.

Apiomyia bergenstammi (Wachtl, 1882)

Hormomyia bergenstammi Wachtl, 1882: 289.

Larvae cause woody, plurilocular galls on twigs of *Pyrus communis* L. (Rosaceae) (Fig. 4). The species is distributed mostly in the eastern Mediterranean, mainly in Greece, where the species develops on *Pyrus communis*, but also on its probable original host plant *Pyrus pyraster* (L.) Burgsd. This species caused serious damage on pears in Hatay Province where its parasitoids were studied by Doganlar & Yigit (2005).
Occurrence. Alanya: Alanya (castle), Kadipinari.
Distribution. Mediterranean.

Arnoldiola tympanifex (Kieffer, 1909)

Arnoldia tympanifex Kieffer, 1909: 22.

Larvae develop in small pustule galls on leaves of *Quercus ilex* L. and *Q. coccifera* L. (Fagaceae). Only one generation develops per year.
Occurrence. Alanya: Elikesik, Gillioglu, Germesi (road). – The first records from Turkey.
Distribution. Mediterranean.

Arthrocnodax vitis Rübsaamen, 1895

Arthrocnodax vitis Rübsaamen, 1895: 189.

Larvae are predators on the gall mite *Colomerus vitis* (Pagenstecher, 1857) (Acarida: Eriophyidae) which causes erineum and galls on the leaves of *Vitis vinifera* L. (Vitaceae).
Occurrence. Bodrum: Bitez (river bed), Bitez (hill). – The first records from Turkey.
Distribution. Mediteranean.

Asphondylia calycotomae Kieffer, 1912

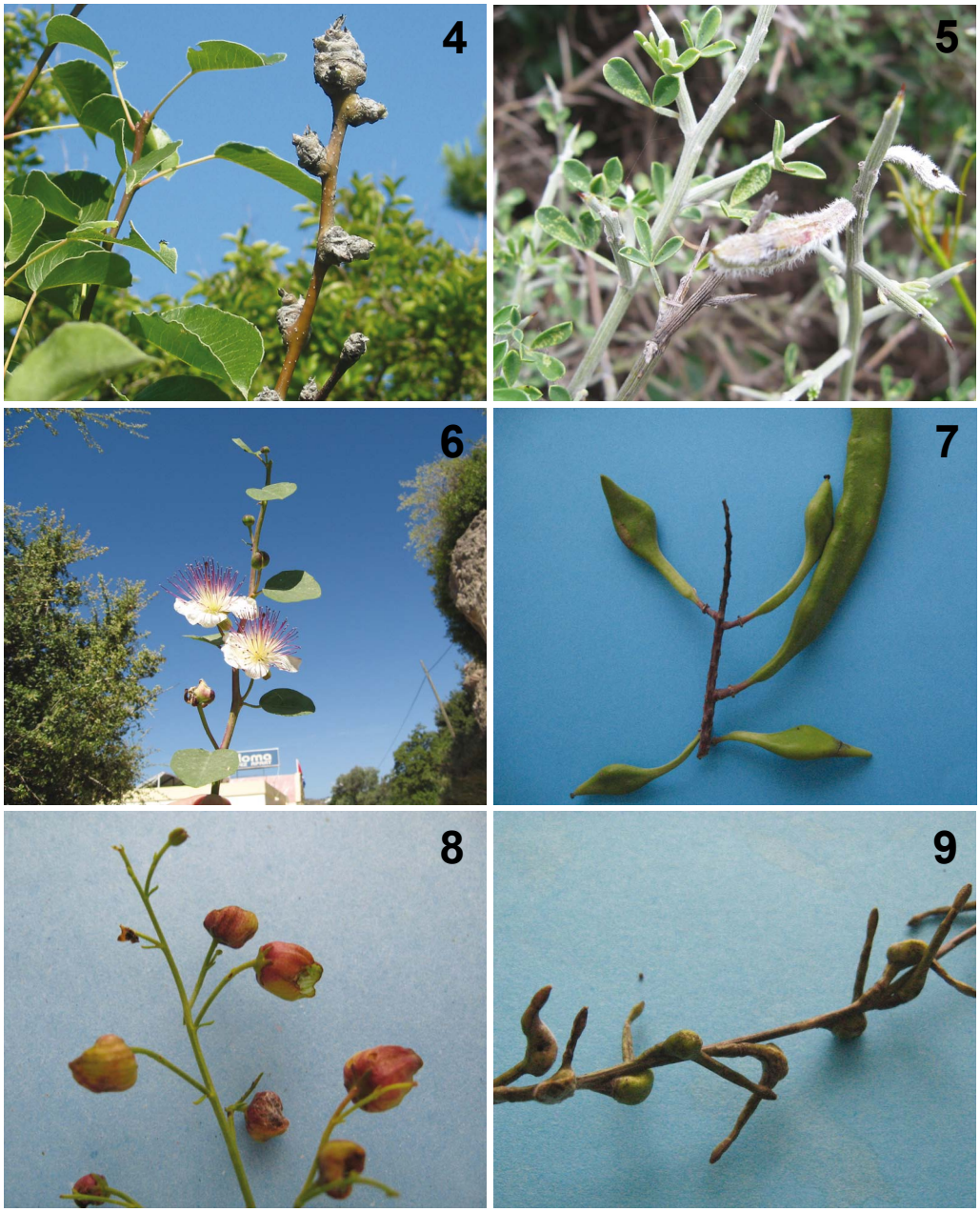
Asphondylia calycotomae Kieffer, 1912: 107.

Solitary larva develops in swollen leaf bud (hibernationg generation) or in swollen fruit (summer generation) of *Calicotome villosa* (Poir.) Link (Fabaceae) (Fig. 5). The cavity is lined with fungus. Two generations develop per year.
Occurrence. Alanya: Ali Efedri Neukii, Ali Efedri Deresi, Asmaka, Asmasekil, Bademagaci, Bektas, Degirmendere, Dinek, Gillioglu Germesi (dry forest), Kargicak Gay, Pargali. – Bodrum: Bitez (rocks), Yalikavak, Göltürkbükü, Camlic (steppe), Kizilagac (forest), Kizilagac (brook), Yali. – Kemer: Aslanbucak. – The first records from Turkey.
Distribution. Mediterranean.

Asphondylia capparis Rübsaamen, 1893

Asphondylia capparis Rübsaamen, 1893: 363.

Larvae develop in flower buds of *Capparis spinosa* L. (Capparidaceae) that are malformed, hypertrophied and remain shut (Fig. 6). In each flower bud several larvae develop, each larva in a chamber where it also pupates. Many overlapping generations develop per year. Darvas et al. (2000) evaluate this species as a minor pest of caper.
Occurrence. Bodrum: Ortakent, Akcalan, Bitez (river bed), Bitez (hill), Bitez (rocks). – Kemer: Aslanbucak, Kecili. – The first records from Turkey.
Distribution. Mediterranean.



Figs 4–9. Galls of gall midges on various host plants. 4 – woody galls of *Apiomyia bergenstammi* on twigs of *Pyrus communis*. 5 – galls of *Asphondylia calycotomae* on pods of *Calicotome* sp. 6 – gall of *Asphondylia capparis* on flower bud (under) of *Capparis spinosa*. 7 – malformed pods of *Ceratonia siliqua* after attack of *Asphondylia gennadii* (in upper part), in the centre one long unattacked pod. 8 – flower bud galls on *Scrophularia canina* caused by *Asphondylia scrophulariae*. 9 – deformed siliquas of *Diplotaxis tenuifolia* after attack of *Asphondylia stefanii*.

Asphondylia coronillae (Vallot, 1829)

Cecidomyia coronillae Vallot, 1829: 112.

Larvae develop in swollen buds or deformed pods of *Hippocrepis emerus* (L.) Lassen (= *Coronilla emerus* Boiss. et Spruner) (Fabaceae). Two generations develop per year.
Occurrence. Alanya: Degirmendere, Gillioglu Germesi (road), Pasakoy. – Kemer: Aslanbucak. – The first records from Turkey.
Distribution. Mediterranean.

Asphondylia gennadii (Marchal, 1904)

Schizomyia gennadii Marchal, 1904: 272.

Marchal (1904) described this species very briefly based on material sent to him from Cyprus by P. Gennadius. Larvae develop in pods of *Ceratonia siliqua* L. (Fabaceae) and cause them to be misshapen, attacked fruits remain small and become brown (Fig. 7). It is a pest of carob causing a disease called "brachycarpia". Gagné & Orphanides (1992) considered *A. gennadii* to be a polyphagous species with alternation of host plant species.
Occurrence. Alanya: Bektas. – Bodrum: Bitez (rocks). – Kemer: Kemer (village).
Distribution. Mediterranean.

Asphondylia massalongoi Rübsaamen, 1893

Asphondylia massalongoi Rübsaamen, 1893: 163.

A solitary larva develops inside a swollen flower bud of *Ajuga chamaepitys* Schreb. (Lamiaceae). Two generations develop per year.
Occurrence. Alanya: Gillioglu Germesi (road). – The first record from Turkey.
Distribution. Mediterranean.

Asphondylia scrophulariae Schiner, 1856

Asphondylia scrophulariae Schiner, 1856: 220.

A solitary larva develops inside a swollen flower bud of *Scrophularia canina* L. (Scrophulariaceae) (Fig. 8). Two generations develop per year.
Occurrence. Alanya: Alanya (castle), galls on *Scrophularia* sp., Bademagaci. – Bodrum: Yalikavak, Camlic (steppe), Yali. – The first records from Turkey.
Distribution. Mediterranean.

Asphondylia stefanii Kieffer, 1898

Asphondylia stefanii Kieffer, 1898: 59.

A solitary larva develops in deformed siliquas of *Diplotaxis tenuifolia* (L.) DC and some other related species of Brassicaceae (Fig. 9). Two generations develop per year.
Occurrence. Bodrum: Akcalan, Kadikalesi, Bitez (rocks). – Kemer: Kemer, Aslanbucak. – The first records from Turkey.
Distribution. Mediterranean.

Asphondylia verbasci (Vallot, 1827)

Asphondylia verbasci Vallot, 1827: 92
Asphondylia celsiae Kieffer, 1909: 6, **syn. nov.**

Larvae develop in swollen flower buds of *Verbascum sinuatum* L. and other species of *Verbascum* (Scrophulariaceae). Several generations develop a year. Kieffer (1909) described *A. celsiae* very

briefly: "Swollen flowers on *Celsia orientalis* L." This plant species is now considered to be a synonym of *Verbascum orientale* (L.) All. Both species of *Asphondylia* cause galls of the same shape on *Verbascum* spp. and no differences were given. Therefore, *A. celsiae* Kieffer, 1909 is a synonym of *A. verbasci* (Vallot, 1827).
Occurrence. Bodrum: Bitez (hill), Ortakent, Akcalan, Yalikavak. – Kemer: Aslanbucak.
Distribution. Mediterranean and sub-Mediterranean, covering a wide area (Skuhravá 1987).

Asynapta furcifer Barnes, 1932

Asynapta furcifer Barnes, 1932: 51.

Larvae cause small hollow discoloured patches on fruits of *Olea europaea* L. (Oleaceae).
Occurrence. Hatay Province: Dokuzdal, Altınözü, 2011, 22 males, 25 females, reared from olive fruits, leg. M. Doğanlar. – The first record from Turkey.
Distribution. Mediterranean.

Bayeriola thymicola (Kieffer, 1888)

Cecidomyia thymicola Kieffer, 1888: 102.

Red larvae produce terminal or axillary rosette galls on *Thymus serpyllum* L. (Lamiaceae). Two generations develop per year.
Occurrence. Kemer: Phaselis; galls were found on *Thymus* sp. – The first record from Turkey.
Distribution. European, Mediterranean.

Braueriella phillyreae (F. Löw, 1877)

Diplosis phillyreae F. Löw, 1877: 13.

Larvae cause pustule galls on leaves of *Phillyrea angustifolia* L. (Oleaceae) (Fig. 13).
Occurrence. Alanya: Asmasekil, Elikesik, Kadipinari, Pasakoy. – Bodrum: Camlik (forest), Kizilagac (forest), Kizilagac (brook), Yali. – Kemer: Aslanbucak, Tekirova in the Tahtali Mountains, Phaselis. – The first records from Turkey.
Distribution. Mediterranean.

Celticecis caucasicae Gagné, 2013

Celticecis caucasicae Gagné, 2013: 311.

Larvae cause galls on leaves of *Celtis caucasica* Willd. (Cannabaceae). The gall is conspicuous on both sides of leaf: a blister covered with short white hairs is on the underside, a concave depression covered with dense white fibers on the upperside. The larval chamber uniquely remains open at its apex until sealed by the pupal cocoon (Gagné & Doğanlar 2013).
Occurrence. Southern Turkey: Hatay Province: Hanyolu, Antakya, March 2012, 5 males, 5 females, leg. M. Doğanlar. – The first record from Turkey.
Distribution. Asian.

Clinodiplosis cilicrus (Kieffer, 1889)

Diplosis cilicrus Kieffer, 1889: 152.

Larvae are phytosaprophagous and develop in various decaying plant matter.
Occurrence. Alanya: Alanya (cemetery), larvae in flower heads of *Centaurea* sp. (Asteraceae). – Kemer: Kemer (seaside), larvae among faded flowers of *Rosa* sp. (Rosaceae). – Hatay Province: Dokuzdal, 20 October 2011, one larva found during dissection of fruits of *Olea europaea*, leg. M. Doğanlar. – The first records from Turkey.
Distribution. Eurosiberian, Asian.

***Contarinia baeri* (Prell, 1931)**

Cecidomyia baeri Prell, 1931: 36.

Yellow larvae live free between a pair of needles of *Pinus sylvestris* L. (Pinaceae). Damaged needles of full length are sharply bent at the base and hanging down obliquely. Only one generation develops a year. Larvae hibernate in the soil. This species is a minor pest in Europe (Skuhravá & Roques 2000).
Occurrence. Alanya: Bademagaci, Gillioglu Germesi (road). – The first record from Turkey.
Distribution. Eurosiberian; immigrant into Canada (New Brunswick), USA (Michigan, Pennsylvania).

***Contarinia craccae* (Loew, 1850)**

Cecidomyia craccae Loew 1850: 22.

Larvae develop in swollen unopened flower buds of *Vicia cracca* L. (Fabaceae). One or two generations develop per year.
Occurrence. Alanya: Bektas, Pargali. – Bodrum: Yalicavak. – The first records from Turkey.
Distribution. Eurosiberian.

***Contarinia nasturtii* (Kieffer, 1888)**

Diplosis nasturtii Kieffer 1888: 263.

Yellowish "jumping" larvae develop in several types of damage on several host plant species and genera of the family Brassicaceae. Full-grown larvae are lemon-yellow, while immature ones are yellowish-white. Two or three generations develop per year.
Occurrence. Alanya: Bademagaci, in swollen flower buds of *Sisymbrium loeselii* L.
Distribution. European.

***Contarinia pruniflorum* Coutin et Rambier, 1955**

Contarinia pruniflorum Coutin et Rambier, 1955: 106.

Larvae develop in flower buds of *Prunus spinosa* L. and *P. mahaleb* L. and other *Prunus* species (Rosaceae). Attacked buds do not continue in their development. Important damage caused by this species on *Prunus armeniaca* L. was observed during the period 1999-2001 in southern France (Pierre & Chauvin-Buthaud 2001).
Occurrence. Malatya Province in Eastern Anatolia on *Prunus armeniaca* during 2012–2014 (Doganlar et al. 2014, Kaplan 2014).
Distribution. A Mediterranean species, occurrs in southern Europe and in south-western Asia.

***Contarinia pyrivora* (Riley, 1886)**

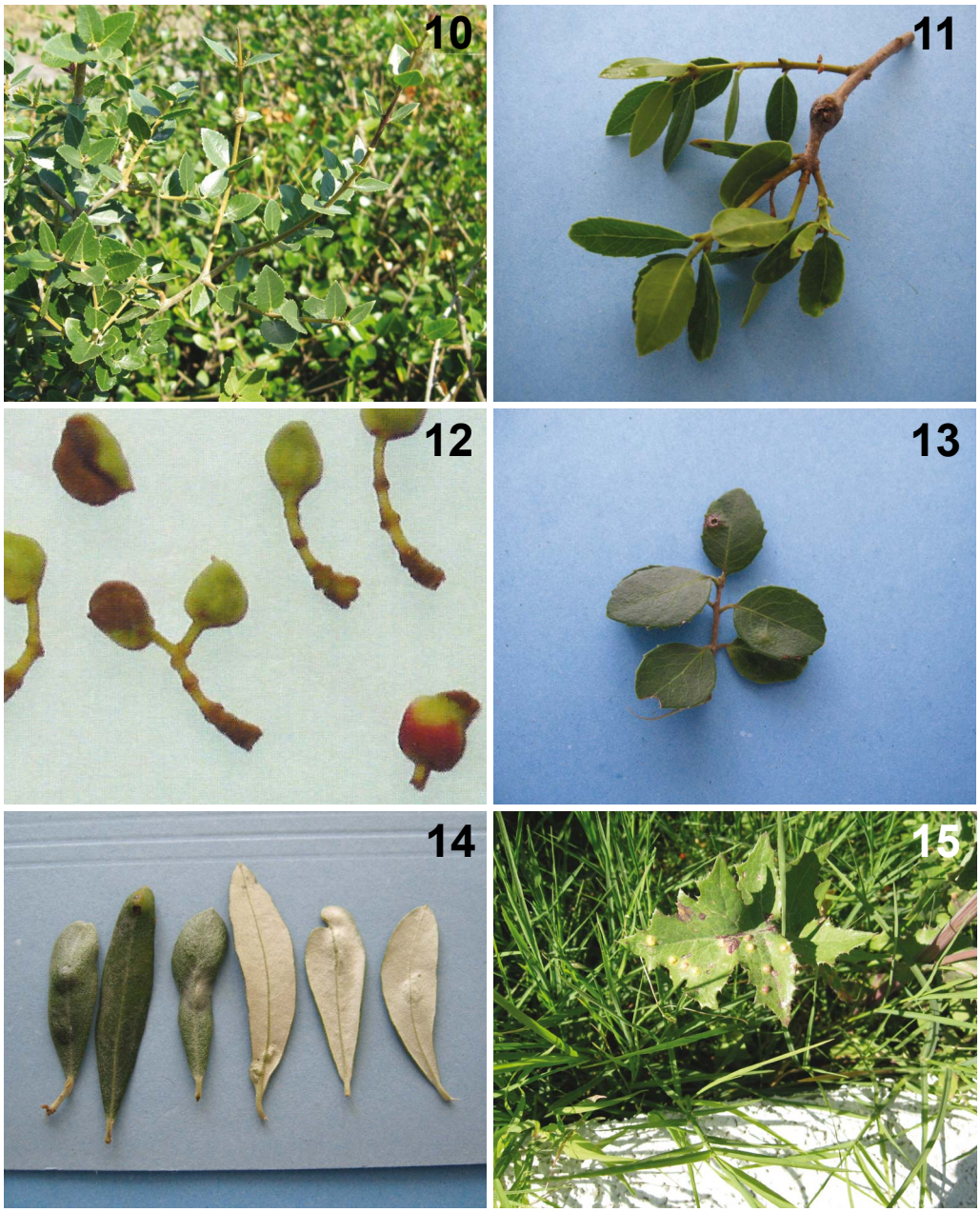
Diplosis pyrivora Riley, 1886: 283.

Larvae develop in young fruits of pears *Pyrus communis* L. (Rosaceae) which are malformed and remain small. Only one generation develops per year. It is a major pest of pears in Europe (Darvas et al. 2000).
Occurrence. Bodrum: Kadikalesi, Yalikavak.
Distribution. European, secondarily Holarctic and cosmopolitan.

***Contarinia quercicola* (Rübsaamen, 1899)**

Diplosis quercicola Rübsaamen, 1899: 599.

Larvae live in enlarged leaf buds of *Quercus cerris* L. (Fagaceae) (Fig. 16). Two generations develop per year.



Figs 10–15. Galls of gall midges on various host plants. 10–13. Galls on the shrub of *Phillyrea angustifolia.* 10 – stem gall of *Dasineura rufescens* in nature. 11 – the same gall as in Fig. 10 in detail. 12 – fruit galls caused by *Probruggmanniella phillyreae*. 13 – leaf galls caused by *Braueriella phillyreae*. 14 – galls of *Dasineura oleae* on leaves of *Olea europaea*. 15 – pustule galls of *Cystiphora sonchi* on leaves of *Sonchus oleraceus.*

Occurrence. Alanya: Elikesik, Kizilcasehir, Pargali. – Bodrum: Yali, Bitez (hill). – The first records from Turkey.
Distribution. Mediterranean.

Contarinia subulifex Kieffer, 1897

Contarinia subulifex Kieffer, 1897: 15.

Yellow larvae cause horn-like bent galls on the upper leaf surface of *Quercus cerris* L. (Fagaceae) (Fig.17). Only one generation develops per year.
Occurrence. Alanya: Ali Efedri Neukii, Elikesik, Kizilcasehir, Pargali. – The first records from Turkey.
Distribution. Mediterranean.

Contarinia tragopogonis Kieffer, 1909

Contarinia tragopogonis Kieffer, 1909: 30.

Whitish larvae live free among the achenes of the faded flower heads of *Tragopogon* sp. (Asteraceae). Two generations develop per year.
Occurrence. Alanya: Alanya (cemetery), Bademagaci, Kadipinari. – Bodrum: Bitez (hill), Göltürkbükü. – The first records from Turkey.
Distribution. European.

Contarinia sp.

One or two small white larvae develop between the pair of the youngest leaves of *Quercus ilex* L. (Fagaceae). When fully developed, larvae leave galls and enter the soil. Damage occurs only on young oak shrubs. Damaged leaves dry and fall off after the larvae have left.
Occurrence. Alanya: Alanya (castle), Pargali. – Bodrum: Kadikalesi.
Distribution. Mediterranean.

Cystiphora sonchi (Vallot, 1827)

Cecidomyia sonchi Vallot 1827: 94.

Larvae cause pustule galls on leaves of *Sonchus* sp. (Asteraceae) (Fig. 15). Two or three generations develop per year.
Occurrence. Alanya: Kizilcasehir. - Bodrum: Kadikalesi, Bitez (rocks). – Kemer: Kemer, Aslanbucak, Kecili, Tekirova in the Tahtali Mountains.
Distribution. Euro-Asian, known to occur in many countries of Europe (Skuhravá 1986); introduced in Canada for biological control (Peschken et al. 1989); Asia: Siberia, Turkey, Georgia, Kazakhstan and Iran (Skuhravá et al. 2014).

Dasineura bayeri Rübsaamen, 1914

Dasyneura bayeri Rübsaamen, 1914: 104.

Larvae produce densely haired galls at the vegetative tips of *Sisymbrium loeselii* L. (Brassicaceae). Two generations develop per year.
Occurrence. Alanya: Alanya (cemetery), Kargicak Gay. – Bodrum: Akcalan, Kadikalesi. – The first records from Turkey.
Distribution. Euro-Asian; in Europe it was recorded in 11 countries; in Asia it occurs in Armenia, Georgia, Turkey and northern Iran.

***Dasineura crataegi* (Winnertz, 1853)**

Cecidomyia crataegi Winnertz, 1853: 228.

Larvae live in terminal leaf rosette galls at tips of branches of *Crataegus monogyna* Jacq. (Rosaceae). Two generations develop per year.
Occurrence. Alanya: Kadipinari.
Distribution. European.

***Dasineura ericaescopariae* (Dufour, 1837)**

Cecidomyia ericaescopariae Dufour, 1837: 87.

Larvae cause large galls on vegetative tips of *Erica scoparia* L. and *Erica arborea* L. (Ericaceae). Only one generation develops per year.
Occurrence. Alanya: Elikesik. – The first record from Turkey.
Distribution. Mediterranean.

***Dasineura oleae* (Angelini, 1831)**

Corethra oleae Angelini, 1831: 31.

Larvae cause slight, indefinite, elongate swellings on the leaves of *Olea europaea* L. (Oleaceae) (Fig.14). A single larva inhabits a gall where it also pupates. One or two generations develop a year. Darvas et al. (2000) evaluated *D. oleae* as a pest of olive trees in the Mediterranean and Doganlar et al. (2011) reported this species as a new pest in Turkey. Doganlar (2011) studied parasitoids of *D. oleae*.
Occurrence. Alanya: Alanya (cemetery), Asmasekil, Elikesik, Kadipinari. – Bodrum: Bitez (river bed), Bitez (hill), Bitez (rocks), Ortakent, Yalikavak, Göltürkbükü, Kizilagac (brook), Yali. – Kemer: Kecili.
Distribution. Mediterranean.

***Dasineura papaveris* (Winnertz, 1853)**

Cecidomyia papaveris Winnertz, 1853: 229.

Reddish yellow larvae develop in the seed capsules of *Papaver rhoeas* L. and *P. dubium* L. (Papaveraceae). Two or three generations develop per year.
Occurrence. Alanya: Elikesik. – Bodrum: Bitez (river bed), Bitez (hill), Yalikavak. – Kemer: Kecili. – The first records from Turkey.
Distribution. Euro-Asian.

***Dasineura plicatrix* (Loew, 1850)**

Cecidomyia plicatrix Loew, 1850: 36.

Larvae cause galls formed by contorted and twisted young leaves of *Rubus caesius* L. and other *Rubus* species (Rosaceae). Two or three generations develop per year. Larvae pupate in the soil.
Occurrence. Alanya: Alanya (castle), Alanya (cemetery), Ali Efedri Neukii, Ali Efedri Deresi, Aamaka, Asmasekil, Bademagaci, Degirmendere, Dinek, Elikesik, Gillioglu Germesi (road), Kadipinari, Kargicak Gay, Kizilcasehir, Pargali. – Bodrum: Alcalan, Ortakent, Bitez (river bed), Bitez (hill). – Kemer: Aslanbucak, Kecili, Phaselis. – The first records from Turkey.
Distribution. European, extending over a large area as far as North Africa. Galls of this species has been recently confirmed from North America – in southwestern British Columbia (Sinclair et al. 2009).

Dasineura pteridis (Müller, 1871)

Cecidomyia pteridis Müller, 1871: 100.
Cecidomyia filicina Kieffer, 1889: 191.

Larvae cause galls on margins of leaflets of *Pteridium aquilinum* (L.) Kuhn (Dennstaedtiaceae). Only one generation develops per year. Larvae hibernate in the soil where they pupate in the spring.
Occurrence. Alanya: Gillioglu Germesi (road). – The first record from Turkey.
Distribution. Eurosiberian.

Dasineura pyri (Bouché, 1847)

Cecidomyia pyri Bouché, 1847: 144.

Larvae develop in rolled leaf margins of *Pyrus communis* L. (Rosaceae). Two generations develop per year.
Occurrence. Alanya: Alanya (castle). – Bodrum: Bitez (hill). – The first record from Turkey.
Distribution. Holarctic.

Dasineura rosae (Bremi, 1847)

Cecidomyia rosae Bremi 1847: 27.
Wachtliella rosarum (Hardy, 1850): auctorum.

Orange coloured larvae live gregariously in swollen, pod-like folded leaflets of *Rosa canina* L. and other species of the genus *Rosa* (Rosaceae). Two generations develop per year.
Occurrence. Bodrum: Kadikalesi.
Distribution. Eurosiberian.

Dasineura rufescens (De Stefani, 1898)

Perrisia rufescens De Stefani, 1898: 9.

Larvae cause globular or fusiform swellings on branches of *Phillyrea angustifolia* L. (Oleaceae), usually on ramifying branches (Fig. 11). Only one generation develops per year.
Occurrence. Alanya: Asmasekil, Pasakoy. – Bodrum: Bitez (river bed), Camlik (forest), Kizilagac (forest), Kizilagac (brook), Yali. – Kemer: Aslanbucak, Tekirova in the Tahtali Mountains.
Distribution. Mediterranean.

Dasineura tubularis (Kieffer, 1909)

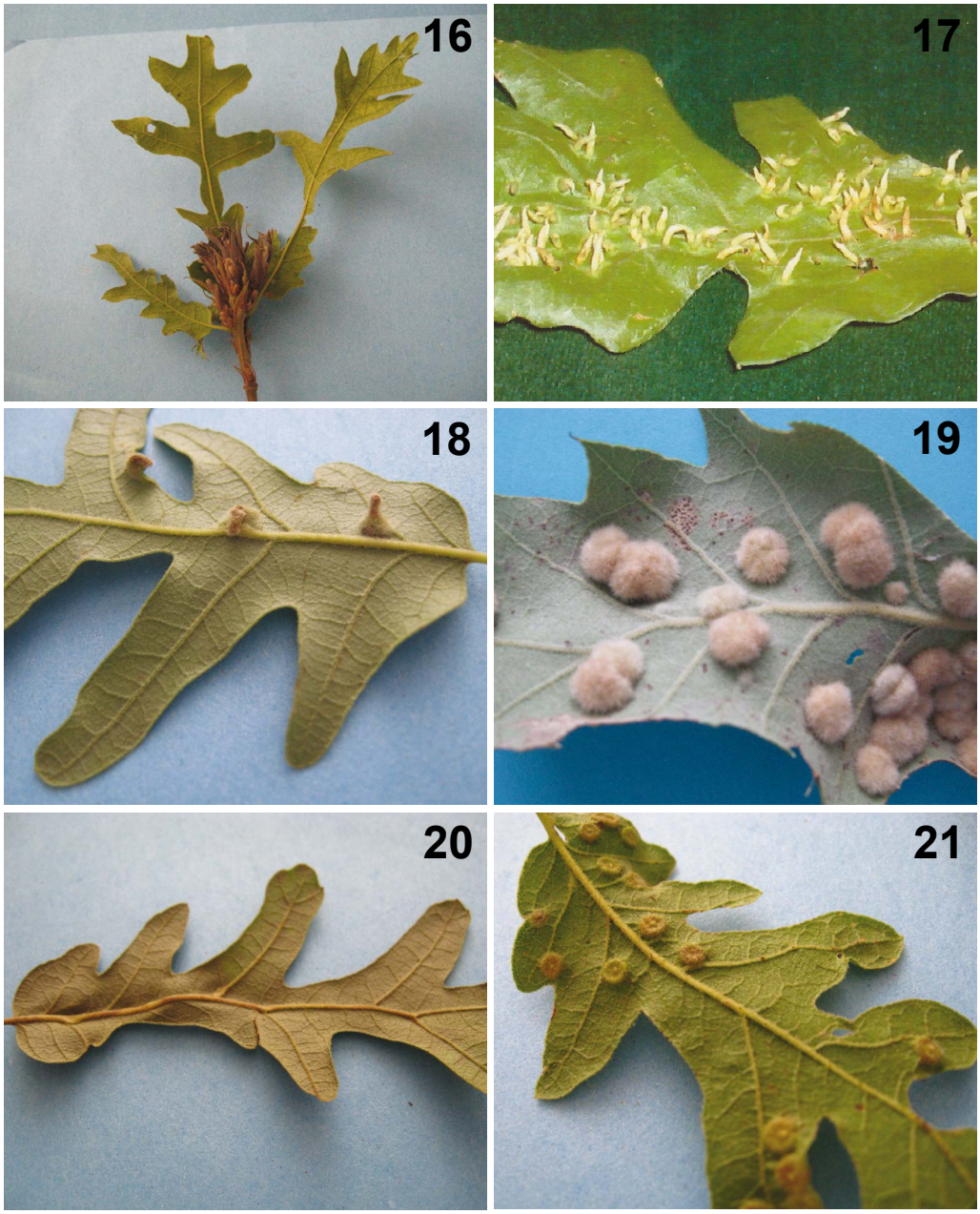
Perrisia tubularis Kieffer, 1909: 22.

Larvae cause galls on leaves of *Quercus cerris* L. (Fagaceae). The gall is hemispherical on the upper side and tubular on the lower side of the leaf (Fig. 18). Only one generation develops per year.
Occurrence. Alanya: Ali Efedri Neukii, Elikesik, Kizilcasehir, Pargali. – The first records from Turkey.
Distribution. Mediterranean.

Dasineura turionum (Kieffer et Trotter, 1904)

Perrisia turionum Kieffer et Trotter, 1904: 7.

Larvae live under the scale-shaped and swollen young leaves on very young early growths on shoots of *Asparagus aphyllus* L. (Liliaceae). Attacked plants are later irregularly deformed forming a cluster of malformed stems and branches. Usually two generations develop per year. Larvae pupate in the soil.



Figs 16–21. Galls of gall midges on *Quercus cerris*. 16 – enlarged leaf bud caused by *Contarinia quercicola*. 17 – horn-like bent galls on upper leaf side induced by *Contarinia subulifex*. 18 – tubular part of galls on lower leaf side caused by *Dasineura tubularis*. 19 – discoid or hemispherical formations densely white haired on the lower leaf side induced by *Dryomyia circinans*. 20 – small swellings of the middle leaf vein caused by *Janetia nervicola*. 21 – small discoid formations, densely haired, on the lower leaf side, induced by *Janetia homocera*; a small pointed tooth in the middle of each disc.

Occurrence. Alanya: Alanya (castle), Kadipinari. – Bodrum: Bitez (river bed), Bitez (rocks), Ortakent, Göltürkbütü, Kizilagac (forest), Yali. – The first records from Turkey.
Distribution. Mediterranean.

***Dasineura viciae* (Kieffer, 1888)**

Cecidomyia viciae Kieffer, 1888: 105.

White larvae live gregariously in pod-like folded and hypertrophied leaflets of *Vicia sepium* L. (Fabaceae). Two generations develop per year.
Occurrence. Bodrum: Yalikavak, Yali.
Distribution. Eurosiberian.

***Dryomyia circinans* (Giraud, 1861)**

Cecidomyia circinans Giraud, 1861: 475.

Larvae cause galls on leaves of *Quercus cerris* L. (Fagaceae). The gall consists of a disc covered with white hairs on the lower leaf side and an opening with circular elevation on the upper side (Fig. 19). Only one larva develops in each gall. Only one generation develops per year.
Occurrence. Alanya: Elikesik, Kizilcasehir, Pargali. – Bodrum: Bitez (river bed), Bitez (hill).
Distribution. Mediterranean, reaching up to Central Europe.

***Gephyraulus diplotaxis* (Solinas, 1982)**

Paragephyraulus diplotaxis Solinas, 1982: 320.

Larvae cause flower bud galls on *Diplotaxis muralis* D.C. and related species (Brassicaceae).
Occurrence. Bodrum: Kadikalesi, Bitez (rocks), on *Diplotaxis*. – The first records from Turkey.
Distribution. Mediterranean.

***Jaapiella hypochoeridis* Sylvén, 1998**

Jaapiella hypochoeridis Sylvén, 1998: 252.

Pink-orange coloured larvae develop in flower heads of *Hypochoeris radicata* L. (Asteraceae) without causing any malformation. Two generations develop per year.
Occurrence. Alanya: Ali Efedri Neukii, Gillioglu Germesi (road). – The first record from Turkey.
Distribution. European.

***Janetia cerris* (Kollar, 1850)**

Lasioptera cerris Kollar, 1850: 49.

Orange-red larvae cause small galls on leaves of *Quercus cerris* L. (Fagaceae). The gall is conical on the upper leaf side and disc-shaped, densely haired, on the lower side. Only one larva develops in a gall. Only one generation develops per year.
Occurrence. Alanya: Ali Efedri Neukii, Elikesik, Kizilcasehir, Pargali. – Bodrum: Bitez (hill), Bitez (rocks), Yalikavak, Yali.
Distribution. Mediterranean.

***Janetia homocera* (F. Löw, 1877)**

Cecidomyia homocera F. Löw, 1877: 7.

Red larvae cause galls on leaves of *Quercus cerris* L. (Fagaceae). The gall is circular and flat on the upper leaf side and disc-shaped, densely haired, on the lower side. Both parts of the gall have a small pointed tooth at the tip (Fig. 21). Only one generation develops per year.

Occurrence. Alanya: Elikesik, Kizilcasehir, Pargali. – The first records from Turkey.
Distribution. Mediterranean.

Janetia nervicola (Kieffer, 1909)

Arnoldia nervicola Kieffer, 1909: 21.

White larvae cause swellings of the middle or lateral veins on the leaves of *Quercus cerris* L. (Fagaceae) (Fig. 20). Only one generation develops per year.
Occurrence. Alanya: Elikesik, Pargali. – Bodrum: Kadikalesi, Bitez (hill). – The first records from Turkey.
Distribution. Mediterranean.

Janetia szepligetii Kieffer, 1896

Janetia szepligetii Kieffer, 1896: 236.

Larvae cause small pustule galls on leaves of *Quercus cerris* L. (Fagaceae). Only one generation develops per year.
Occurrence. Alanya: Ali Efedri Neukii, Elikesik, Kizilcasehir, Pargali.
Distribution. Mediterranean.

Janetiella onosmae Skuhravá, 2011

Janetiella onosmae Skuhravá, 2011: 282.

Larvae cause leaf bud galls on vegetative tips of *Onosma* sp. (Boraginaceae). This species was described on the basis of material found in southern Greece (Skuhravá 2011). Two generations develop per year.
Occurrence. Alanya: Dinek. – The first record from Turkey.
Distribution. Mediterranean.

Janetiella potentillogemmae Skuhravá, 2011

Janetiella potentillogemmae Skuhravá, 2011: 299.

Several larvae develop together in leaf bud gall on *Potentilla recta* L. (Rosaceae). Subsequent development of galls on lateral buds prevents the formation of side shoots with new inflorescences. Only one generation develops per year. Each larva spins a cocoon in which it hibernates in the gall and pupates in the spring of the following year. This species is considered as a candidate for biological control of *Potentilla recta* in North America (Skuhravá et al. 2011).
Occurrence. Western Turkey: Kütahya Province, Dumlupınar, 10 May 2008, one male, three females, one larva, 11 pupae, leg. F. Turanli. – The first record from Turkey.
Distribution. West-Asian.

Kochiomyia kochiae (Kieffer, 1909)

Rhopalomyia koehliae Kieffer, 1909b: 12.

Larvae cause globular bud galls on *Bassia prostrata* (L.) Beck (= *Kochia prostrata* L.) (Chenopodiaceae). Galls are densely covered with white hairs. Several chambers occur inside one gall. Only one larva develops inside the gall where it also hibernates and pupates in the spring of the next year. Only one generation develops per year.
Occurrence. northern Turkey: Amasya, in the Black Sea Region (Houard 1906, as Cécidomyide). We identified this gall as being caused by *Kochiomyia kochiae*.
Distribution. Euro-Asian; the galls were recently found also in Iran (Skuhravá et al. 2014).

Lasioptera carophila F. Löw, 1874

Lasioptera carophila F. Löw, 1874: 149.

A solitary orange coloured larva causes a swelling at the point of insertion of umbellules in inflorescences of many species and genera of Apiaceae. Two generations develop per year. Larvae hibernate and pupate in the galls.

Occurrence. Bodrum: Bitez (rocks).

Distribution. *Lasioptera carophila* occurs on various species of Apiaceae and is spread from Europe up to North Africa and western Asia.

Lasioptera eryngii (Vallot, 1829)

Cecidomyia eryngii Vallot, 1829: 114.

Larvae cause plurilocular swellings on stems, leaf petioles and main leaf veins of *Eryngium campestre* L. (Apiaceae). The walls of chambers are covered with fungal mycelium. Larvae pupate in galls. Two generations develop per year.

Occurrence. Şanlıurfa Province, 19 May 2013, 5 females, 5 males, reared from galls on *Eryngium campestre*, leg. C. Özaslan. – Second record from Turkey.

Distribution. Mediterranean. Galls occur abundantly in southern Europe and markedly less frequently in the north (Skuhravá 1986, 1987). In the Czech Republic situated in central Europe *L. eryngii* is rare and therefore included in the red list of endangered species (Skuhravá 2005). In Turkey the galls of *L. eryngii* were recorded for the first time in 2003 at Taşlıçiftlik, Tokat, in northern Turkey (Skuhravá et al. 2005). After nine years the galls were recorded in the Şanlıurfa Province in southeastern Turkey in a relatively high population level. It seems that *L. eryngii is* extending its distribution to the east.

Lasioptera oleicola Skuhravá, 2011

Lasioptera oleicola Skuhravá, 2011: 268.

Larvae live as inquilines in the galls of *Dasineura oleae* (Angelini) on leaves of *Olea europaea* L. (Oleaceae). Only one generation develops per year. Larvae develop and hibernate in the galls on olive leaves where they pupate in the spring. Larvae do not spin cocoons. Adults of *L. oleicola* were reared from leaf galls together with adults of *Dasineura oleae*.

Occurrence. Southern Turkey, Hatay Province: Vakıflı, Samandağ and Center of Antakya. – The first records from Turkey.

Lasioptera sp.

Larvae live in groups inside the stems of tomato (*Solanum lycopersicum* Lam.) (Solanaceae) and cucumber (*Cucumis sativus* L.) (Cucurbitaceae). The damage occurs at the base of cut leaves or in wounds on the stem. The area damaged by the insect can be recognized externally by its dark grey colour, and its length may extend to more than 5 cm. The larvae feed internally and cause decomposition of the plant tissue, which becomes hollowed out and turns black. The damaged tissue is covered by fungal mycelium. At first the damage was observed in Greece, at Trifylia in western Peloponnese in 2001 by D. Perdikis (Perdikis et al. 2011).

Occurrence. Western Turkey, Mugla Province: Fethiye, 10 April 2013, 3 females, reared from larvae developing on tomato, leg. Tulin Kilic (sent by kindness of Eddy Dijkstra); – Izmir Province: Bornova, 2013, several adults, leg. Tulin Kilic; – southern Turkey, Antalya Province: Kumluca, 15 January 2013, larvae on tomato, several adults emerged in laboratory, leg. M. Portakaldali and N. Topakci; – Mersin Province: Erdemli: 20 May 2014, larva, adults reared from larvae on tomato,

leg. Hasan Deda Büyüköztürk; – south-eastern Turkey, Adana Province: Adana: 15 January 2013, larva, adults emerged from tomato, leg. Mustafa Portakaldali. – The first records from Turkey.
Distribution. Southern Europe (Greece) and western Asia.

Mycodiplosis melampsorae (Rübsaamen, 1889)

Diplosis melampsorae Rübsaamen, 1889: 46.

Larvae are mycophagous and feed on the uredospores of *Melampsora salicina* Desm. (Uredinales, Fungi) occurring on various host plants. Two generations develop per year.
Occurrence. Alanya: Alanya (cemetery), in flowerheads of *Centaurea* sp. (Asteraceae). – The first record from Turkey.
Distribution. Eurosiberian.

Myricomyia mediterranea (F. Löw, 1885)

Diplosis mediterranea F. Löw, 1885: 485.

Larvae cause small rosette galls on twigs of *Erica arborea* L. and related species (Ericaceae). In the middle of each gall is a small chamber containing one larva. Only one generation develops per year. Larvae hibernate in galls where they pupate in the spring of the following year.
Occurrence. Alanya: Elikesik. – Kemer: Kecili. – The first record from Turkey.
Distribution. Mediterranean.

Odinadiplosis amygdali (Anagnostopoulos, 1929)

Cecidomyia amygdali Anagnostopoulos, 1929: 123.

Larvae develop inside buds of *Prunus amygdalus* Stokes (Rosaceae) and cause multiplication of buds and malformation on twigs. Only one generation develops a year. It is an important pest of almond and peach in the Mediterranean area (Darvas et al. 2000).
Occurrence. Doganlar (2012) reported this species as a pest in the Hatay Province in southern Turkey.
Distribution. It is a south-European and a Mediterranean species known to occur in Greece, Turkey, Lebanon and Afghanistan and recently recorded in southern Italy (Calabria), and on the islands of Crete, Corfu and Malta (Skuhravá & Skuhravý 1997, 2002, 2006, 2010a).

Ozirhincus anthemidis (Rübsaamen, 1915)

Clinorrhyncha anthemidis Rübsaamen, 1915: 561.

Solitary larva develops in the achene in the flower head of *Anthemis* sp. (Asteraceae). Two generations develop per year. Larvae pupate inside the achenes.
Occurrence. Alanya: Elikesik (one female emerged from flower head). – Bodrum: Bitez (hill), Ortakent. – Kemer: Kemer (seaside).
Distribution. European.

Phlomidiomyia pustularis Skuhravá, 2011

Phlomidiomyia pustularis Skuhravá, 2011: 266.

Larvae cause flat blister galls on leaves of *Phlomis fruticosa* L. (Lamiaceae). Galls are visible on both sides. A chamber is inside the gall. Several generations develop in the course of one vegetative season.
Occurrence. Kemer: Phaselis, on *Phlomis sp.* – The first record from Turkey.
Distribution. Mediterraenan, known only from Greece and Turkey.

***Phyllodiplosis cocciferae* (Tavares, 1902)**

Contarinia cocciferae Tavares, 1902: 72.

Larvae live in swollen leaf buds of *Quercus coccifera* L. (Fagaceae) and were found also on *Q. ilex* L. and *Q. suber* L. One generation develops per year. Hibernation takes place in the soil.
Occurrence. Alanya: Elikesik. – Bodrum: Bitez (hill), Bitez (rocks), Camlik (forest), Kadakalesi, Göltürkbükü, Kizilagac (forest), Kizilagac (brook), Yali. – Kemer: Tekirova in the Tahtali Mountains, Phaselis. – The first records from Turkey.
Distribution. Mediterranean.

***Piranea spartii* Janezic, 1990**

Piranea spartii Janezic, 1990: 29.

Orange coloured larvae live in dry flower buds of *Spartium junceum* L. (Fabaceae). Only one generation develops per year.
Occurrence. Bodrum: Ortakent, Akcalan, Yalikavak, Camlik (steppe). – The first record from Turkey.
Distribution. Mediterranean.

***Probruggmanniella phillyreae* (Tavares, 1907)**

Schizomyia phillyreae Tavares, 1907: 52.

Larvae develop in swollen fruits of *Phillyrea angustifolia* L. (Oleaceae) (Fig. 12). Only one generation develops per year. Larvae pupate in the galls.
Occurrence. Alanya: Asmasekil, Pasakoy. – Bodrum: Kizilagac (brook), Camlik (forest). – Kemer: Tekirova in the Tahtali Mountains.
Distribution. Mediterranean.

***Wachtliella ericina* (F. Löw, 1885)**

Cecidomyia ericina F. Löw, 1885: 484.

Orange-reddish larvae produce small rosette galls on the growing tips of *Erica* sp. (Ericaceae). Only one generation develops per year.
Occurrence. Alanya: Elikesik, Kizilcasehir.
Distribution. Mediterranean.

***Trotteria* sp.**

Rose coloured larvae were found in galls of *Asphondylia scrophulariae* (Scrophulariaceae) on *Scrophularia* sp. (Scrophulariaceae). They are probably inquilines in galls of the causer.
Occurrence. Alanya: Bademagaci. – The first record from Turkey.
Distribution. Mediterranean.

EVALUATION OF RESULTS

Fauna of gall midges of south-western Turkey

During investigations in 2011, 2012 and 2013 at 36 localities in three areas in south-western Turkey, we found 55 species of the family Cecidomyiidae of which 37 species are the first records from Turkey.

In 2011 in Alanya area we found 44 gall midge species at 18 localities situated from sea level up to 1,000 m a. s. l. at Dinek. At individual localities two to nineteen species were found, with an average of 6.1 species per locality. Elikesik, situated at an elevation of about 100 m a. s. l., with

Table 1. Host plants and associated species of gall midges

host plant species	gall midge species
Ajuga chamaepitys	*Asphondylia massalongoi*
	Ozirhincus anthemidis
Apiaceae	*Lasioptera carophila*
Asparagus aphyllus	*Dasineura turionum*
Bassia prostrata (= *Kochia prostrata*)	*Kochiomyia kochiae*
Calicotome villosa	*Asphondylia calycotomae*
Capparis spinosa	*Asphondylia capparis*
Celtis caucasica	*Celticecis caucasicae*
Centaurea sp.	*Clinodiplosis cilicrus*
	Mycodiplosis melampsorae
Ceratonia siliqua	*Asphondylia gennadii*
Crataegus monogyna	*Dasineura crataegi*
Diplotaxis sp	*Asphondylia stefanii*
	Gephyraulus diplotaxis
Erica arborea	*Dasineura ericaescopariae*
	Myricomyia mediterranea
	Wachtliella ericina
Eryngium campestre	*Lasioptera eryngii*
Gleditsia triacanthos	*Dasineura gleditchiae*
Hippocrepis emerus (= *Coronilla emeroides*)	*Asphondylia coronillae*
Hypochoeris radicata	*Jaapiella hypochoeridis*
Olea europaea	*Asynapta furcifer*, mycophagous
	Dasineura oleae
	Lasioptera oleicola, inquiline
	Clinodiplosis cilicrus, mycophagous
Onosma sp.	*Janetiella onosmae*
Papaver rhoeas	*Dasineura papaveris*
Phillyrea angustifolia	*Braueriella phillyreae*
	Dasineura rufescens
	Probruggmanniella phillyreae
Phlomis sp.	*Phlomidiomyia pustularis*
Pinus sp.	*Contarinia baeri*
Potentilla recta	*Janetiella potentillogemmae*
Prunus amygdalus	*Odinadiplosis amygdali*
Prunus armeniaca	*Contarinia pruniflorum*
Pteridium aquilinum	*Dasineura pteridis*
Pyrus communis	*Apiomyia bergenstammi*
	Contarinia pyrivora
	Dasineura pyri
Quercus cerris	*Contarinia quercicola*
	Contarinia subulifex
	Dasineura tubularis
	Dryomyia circinans
	Janetia cerris
	Janetia homocera
	Janetia nervicola
	Janetia szepligetii
Quercus coccifera	*Arnoldiola tympanifex*
	Phyllodiplosis cocciferae
Quercus ilex	*Arnoldiola tympanifex*
	Contarinia sp.
Robinia pseudoacacia	*Aphidoletes aphidimyza*, zoophagous
Rosa sp.	*Dasineura rosae*
	Clinodiplosis cilicrus, mycophagous

Table 1. (continued)

host plant species	gall midge species
Rubus sp.	*Dasineura plicatrix*
Scrophularia sp.	*Asphondylia scrophulariae*
	Trotteria sp., inquiline
Sisymbrium loeselii	*Contarinia nasturtii*
	Dasineura bayeri
Solanum lycopersicum	*Lasioptera* sp.
Sonchus asper	*Aphidoletes aphidimyza*, zoophagous
	Cystiphora sonchi
Spartium junceum	*Piranea spartii*
	Aphidoletes aphidimyza, zoophagous
Thymus sp.	*Bayeriola thymicola*
Tragopogon sp.	*Contariia tragopogonis*
Verbascum sp.	*Asphondylia verbasci*
Vicia sepium, *V. cracca*	*Contarinia craccae*
	Dasineura viciae
Vitis vinifera	*Arthrocnodax vitis*, zoophagous

diverse trees and shrubs, where the galls of 19 species of gall midges were found, is the locality with the highest species number found at one locality during the three-years of investigations in south-western Turkey.

In 2012 in Bodrum area we found 32 gall midge species at 13 localities situated from sea level up to 1000 m a. s. l. at Kizilagac. At individual localities four to ten species were found, with an average of 6.5 species per locality.

In 2013 in Kemer area we found 20 species at five localities situated from sea level up to 200 m a. s. l. at Tahtali. At individual localities five to nine species were found, with an average of 6.4 species per locality.

The average species number of gall midges per locality found in Alanya (6.1), Bodrum (6.5) and Kemer areas (6.4) are similar and relatively low. It reflects the fact that gall midges are not abundant in the nature of these areas. If we compare these numbers with average gall midge species numbers of some islands in the Mediterranean Sea that we explored in the past, it is similar to the average species number found in Rhodos (7) and is higher than was found for Cyprus (3.1) but it is much lower than in Corfu, the gall-midge-species richest island with an average 12.6 species per locality (Skuhravá & Skuhravý 1997, 2002, 2004a, b, Skuhravá et al. 2002).

On the whole, gall midges occur in the Mediterranean area rarely, usually forming only small islands in the nature, sometimes they are restricted even to one host plant specimen, to one tree, shrub or herbaceous plant. The fauna of gall midges in the Mediterranean is significantly poorer in comparison with the fauna of gall midges of other countries in Europe (Skuhravá & Skuhravý 2010b).

Environmental conditions of the Mediterranean area are not favourable for development of gall midges. Only a short spring time with sufficient rainfall is suitable for development of gall midge populations and most of them cause galls on various host plants. The limiting factor for their development is a very long summer period without rainfall and with high temperature causing drying off and withering of host plants. It may result in mortality in most species of gall midge populations which develop inside galls on host plants or in the soil where they may survive a part of their developmental cycle in the stage of larvae.

New members of gall midge fauna of Turkey

The following 37 species are reported from Turkey for the first time: *Arnoldiola tympanifex*, *Arthrocnodax vitis*, *Asphondylia calycotomae*, *A. capparis*, *A. coronillae*, *A. massalongoi*, *A. scrophulariae*, *A. stefanii*, *Asynapta furcifer*, *Bayeriola thymicola*, *Braueriella phillyreae*, *Clinodiplosis cilicrus*, *Contarinia baeri*, *C. craccae*, *C. quercicola*, *C. subulifex*, *C. tragopogonis*, *Dasineura bayeri*, *D. ericaescopariae*, *D. papaveris*, *D. plicatrix*, *D. pteridis*, *D. pyri*, *D. tubularis*, *D. turionum*, *Gephyraulus diplotaxis*, *Jaapiella hypochoeridis*, *Janetia homocera*, *J. nervicola*, *Janetiella onosmae*, *Mycodiplosis melampsorae*, *Myricomyia mediterranea*, *Phlomidiomyia pustularis*, *Phyllodiplosis cocciferae*, *Piranea spartii*, and two species identified to the genus level only*: Contarinia* sp. causing galls on *Quercus ilex* and *Trotteria* sp. developing in galls of *Asphondylia scrophulariae*.

Number of gall midge species of Turkish fauna

In 2005 the gall midge fauna of Turkey included 71 species (Skuhravá et al. 2005). During investigations in 2011, 2012 and 2013 we enriched the Turkish fauna for 37 species. In the period from 2005 to 2015 three species of gall midges were described as new to science on the basis of specimens found in Turkey, viz. *Celticecis caucasiae*, *Janetiella potentillogemmae* and *Lasioptera oleicola* (Skuhravá 2011, Skuhravá et al. 2011, Gagné & Doğanlar 2013), and three species were firstly recorded from various other areas of Turkey, viz. *Asynapta furcifer*, *Contarinia pruniflorum* and *Lasioptera* sp. reared from damaged stems of tomato (*Solanum lycopersicum*). At present the fauna of gall midges of Turkey includes 118 species.

Species richness and comparison with adjacent countries

Turkey is surrounded on three sides by seas, by the Black Sea in the north, by the Marmar and Aegean Seas in the west and by the Mediterranean Sea in the south, and is bordered by eight countries: by Bulgaria to the northwest, by Greece and its islands to the west; by Georgia to the northeast; by Armenia, Azerbaijan and Iran to the east; by Iraq and Syria to the southeast. The island of Cyprus is situated in the Mediterranean Sea about 75 km to the south.

The gall midge fauna of Turkey including 118 known species may be evaluated as intermediately rich in comparison with the species richness of gall midges in adjacent countries where investigations of gall midges have been done and comparable data are available: 240 species in Bulgaria (Skuhravá et al. 1991), 235 species in Greece (Skuhravá & Skuhravý 1997, 2006, 2009, 2011, 2015), 123 species in Georgia (Skuhravá et al. 2013) and 96 species in Armenia (Mirumjan 2011). The known fauna of gall midges of Iran was increased by new records of many species during recent years as a result of investigations of researchers and students at several universities and now includes 61 species (Skuhravá et al. 2014). The faunas of the remaining adjacent countries are poorly known: only 14 species are known in Syria, 11 species in Azerbaijan and 9 species in Iraq (Skuhravá 1986). In contrast, 30 species of gall midges are known to occur in the island of Cyprus where faunal investigations were made in 1997 by Skuhravá & Skuhravý (2004).

We suppose that further investigations of gall midges in other part of Turkey will reveal other species of gall midges. We expect that Turkish colleagues will follow our effort to increase knowledge of the gall midge fauna of Turkey in other parts of the country which seem to be very interesting in composition of vegetation where may be hidden interesting and probably also undescribed gall midge species new to science.

Turkey has an important position at the crossroads of Europe and Asia where floral and faunal geoelements meet together and some species of plants and animals may enter from Europe into Asia. This may be shown also on Cecidomyiidae. For example, *Dasineura plicatrix* causing leaf galls on various species of *Rubus*, reported recently from Turkey for the first time, is broadly

spread throughout Europe. The fact that we found galls of *D. plicatrix* so abundantly in Turkey during our investigations in 2011, 2012 and 2013 means that the galls of this species have been present in Turkey, probably unobserved, for several years and its populations has enlarged to a high degree up to the present stage.

Zoogeography

The gall midge fauna of south-western Turkey may be divided into five groups on the basis of zoogeographical analysis, according to the occurrence of species in the Palaearctic region. It is formed mainly of Mediterranean elements (64%) and smaller parts belonging to Eurosiberian (11%), and Euroasian (11%), European (9%) and Holarctic elements (5%).

Mediterranean species are associated with Mediterranean host plants that have centres of origin in the Mediterranean area. In south-western Turkey thirty five species belong in this group: eight species of the genus *Asphondylia*; *Dasineura oleae* associated with *Olea europaea*; *Dasineura ericaescopariae*, *Myricomyia mediterranea* and *Wachtliella ericina* causing galls on *Erica arborea*; *Braueriella phillyreae*, *Dasineura rufescens* and *Probruggmanniella phillyreae* associated with *Phillyrea media*; *Dasineura turionum* larvae of which cause galls on *Asparagus acutifolius*, and eight species associated with *Quercus cerris* five of which are first records from Turkey. Species of gall midges associated with *Quercus cerris* (called Turkish Oak), the oak native to southern Europe and Asia Minor, occupy large distribution areas, together with their host plant, extending from south-eastern Europe and the Mediterranean region up to the marginal part of Central Europe – to the southern part of the Czech and Slovak Republics (Skuhravý & Skuhravá 1971).

European species are associated with European host plant species that have centres of origin in Europe. They may reach marginal parts of Asia. In south-western Turkey five species belonging in this group were recorded: *Contarinia nasturtii*, *C. tragopogonis*, *Dasineura crataegi*, *D. plicatrix* and *Jaapiella hypochoeridis. Dasineura plicatrix* is a typical representative of European species. It occupies a large distribution area from Britain and Portugal in Western Europe to Greece in Eastern Europe, to Algeria in northern Africa and recently it was recorded in Turkey in western Asia.

Euro-Siberian species inhabit the Euro-Siberian subregion of the Palaearctic region. They have centres of origin in Europe where they occur, usually abundantly, and extend at least to Western Siberia, with some of them reaching to Central Siberia and only a few reaching to Eastern Siberia and to the most eastern part of the Palaearctic Region, to the Far East. They may also reach marginal parts of Asia. In south-western Turkey six species belong in this group: *Clinodiplosis cilicrus*, *Contarinia baeri*, *C. craccae*, *Dasineura pteridis*, *D. viciae* and *Mycodiplosis melampsorae.*

Euro-Asian or **Palaearctic species** inhabit Europe or the Eurosiberian subregion and also occur in Asia, at least in one of the other Palaearctic subregions, i.e. Central Asian or East Palaearctic subregions and may reach marginal parts of western Asia. In south-western Turkey six species were recorded that belong in this group: *Cystiphora sonchi*, *Dasineura bayeri*, *D. rosae*, *D. papaveris*, *Kochiomyia kochiae* and *Lasioptera carophila.*

Cystiphora sonchi, inducing parenchymatous leaf galls on *Sonchus*, occurs in many countries of Europe and its galls were found in several countries of Asia – in Turkey, Georgia, Kazakhstan and northern Iran (Skuhravá et al. 2014). It has been introduced into Canada for biological control (Peschken et al. 1989).

Dasineura rosae, causing leaf galls on various species of *Rosa*, occurs abundantly in Europe, it was also found in Siberia and in the Far East. Galls were recorded in Kazakhstan, Georgia, Armenia, Turkey and northern Iran. The host plants of this gall midge – various species of the genus *Rosa* – are native to Asia, North America and northwest Africa. It may be assumed that galls of this species will be found in the future along with its host plant in the whole distribution area.

Holarctic species occur in both the Palaearctic and the Nearctic regions. Most Holarctic species are primarily of European origin and a number of species have been transported accidentally from Europe into North America with their host plants. In south-western Turkey three species belong in this group: *Aphidoletes aphidimyza*, *Contarinia pyrivora* and *Dasineura pyri.* The origin of *Aphidoletes aphidimyza* is not known. *Contarinia pyrivora* and *Dasineura pyri* are probably Eurosiberian species and have been accidentally transferred to North America and later to other regions of the world with their host plants or with seedlings with soil where larvae of both species hibernate and spend a part of their life cycle.

Frequency

The basis for such analysis is the number of localities at which a particular species was found (i.e. number of records), without regarding the local abundance of the species. Of 55 gall midge species found in south-western Turkey, twelve species of gall midges (22%) were recorded only once, i.e. each of them at only one locality. They may be considered to be very rare in the area under study. Eleven species (20%) of which each was found only twice, i.e. at two localities, may be considered to be rare. Twenty three species of which seven were recorded at three, eight species at four and eight species at five localities, are considered to be moderately frequent. Seven species of which two were recorded at seven localities, two species at eight localities one species at eight localities and two species at eleven localities are evaluated as frequent. Two other species, *Dasineura oleae* causing galls on leaves of *Olea europaea* was recorded at 13 localities, and *Asphondylia calycotomae* inducing galls on pods of *Calicotome villosa* found at 19 localities, occur very frequently. *Dasineura plicatrix* causing galls on leaves of *Rubus* sp. recorded at 22 localities is the most frequent species in south-western Turkey. Both these species are also the most abundant species in Greece and its islands (Skuhravá & Skuhravý 2006, 2011).

Relations to host plants

Gall midges found in south-western Turkey during 2011–2013 are associated with 44 host plant species belonging to 20 plant families (Table 1). Twenty host plants are herbaceous plants and sixteen are trees and shrubs. Eleven species of gall midges are associated with Fagaceae, eight species with Fabaceae and Rosaceae, seven species with Asteraceae, six with Oleaceae, four with Brassicaceae, three with Ericaceae, Lamiaceae and Scrophulariaceae, and each of the remaining eleven species of gall midges with one plant family (Apiaceae, Boraginaceae, Cannabaceae, Capparidaceae, Chenopodiaceae, Dennstaedtiaceae, Liliaceae, Papaveraceae, Pinaceae, Solanaceae and Vitaceae).

Quercus cerris is the host plant with the highest number of associated species of gall midges (8 species), followed by *Phillyrea media*, *Erica arborea* and *Pyrus communis*, each of them associated with three species of gall midges.

Economic importance

The gall midges that occur on cultivated plants in fields, in gardens and fruit orchards and in forests in Turkey do not have such importance as they have in central and southern Europe. Usually their occurrence is not so high and their importance cannot be compared with the same gall midge species in Europe where they sometimes occur as serious pests.

Larvae of gall midges may develop in flower and leaf buds, stems, leaves, fruits and pods or other organs of host plants that are important in agriculture and in forestry. The importance of some gall midge species can fluctuate over the years from minimal up to outbreak.

During several recent years six species of gall midges occurred as pests in Turkey. Some of them occurred abruptly and caused harm to their host plant for a short time and then their importance decreased to a minimum. The importance of other gall midges injurious to agricultural crops de-

creased but their larvae may remain hidden in the soil in fields and it is necessary to be watchful. It is necessary to evaluate all these species as potential pests, mainly in agriculture.

Larvae of *Apiomyia bergenstammi* cause woody, plurilocular galls on twigs of *Pyrus communis*. This species is distributed mostly in the eastern Mediterranean, mainly in Greece. Serious damage on pears was observed in Hatay Province several years ago. The parasitoids associated with this gall midges were studied by Doganlar & Yigit (2005). Deformed twigs were found at two localities in Alanya Province in 2011.

Larvae of *Asphondylia gennadii* develop in pods of carob tree (*Ceratonia siliqua*) and cause their deformation. Attacked fruits remain small and become brown. Deformed fruits on carob trees were recorded in all three areas under study.

Larvae of *Contarinia pruniflorum* develop in flower buds of various species of *Prunus*. Attacked buds do not continue in the development. Damaged flower buds of apricot (*Prunus armeniaca*) were found by M. Kaplan in southeastern Turkey at Diyarbakır in the Diyarbakır Province in 2014 where this species caused local damage in apricot orchards.

Larvae of *Dasineura oleae* cause slight, indefinite, elongate swellings on the leaves of olive trees (*Olea europaea*). A single larva inhabits each gall where it also pupates. If this species occurs in large amounts, attacked leaves fall off and defoliation resulted in loss of ability to produce flower buds and fruits in the following year. *D. oleae* causing significant reduction or loss of yield of olive fruits is a serious pest of olive tree. Doganlar et al. (2011) reported this species as a new pest in Turkey. Galls of this species were found frequently in the three areas under study.

Larvae of *Odinadiplosis amygdali* cause multiplication of buds and malformation on twigs of *Prunus amygdalus*. This pest appeared and caused damage in the western part of Turkey for several years in the first half of the 20th century (Yargıç 1948, Alkan 1952). Recently the damage was observed in Hatay Province in the southern part of Turkey (Doganlar 2012).

A serious pest of tomatoes appeared in Turkey in 2011. Larvae of an undescribed species of *Lasioptera* live in groups inside the stems of tomato (*Solanum lycopersicum*) at the base of cut leaves or in wounds on the stem. They cause decomposition of the plant tissue resulting in necrosis, breaking of stems and reduction in fruit production. At first the damage was observed in Greece (Perdikis et al. 2011). In 2013 serious damage on tomatoes was observed in greenhouses of five areas in southern Turkey. At the present we are trying to resolve the identity of this species.

SUMMARY

This study summarises the results of investigations carried out at 36 localities in three areas in south-western Turkey in three subsequent years 2011, 2012 and 2013. Altogether 55 species of the family Cecidomyiidae were found. 44 species were found at 18 localities in the Alanya area, 32 species at 13 localities in the Bodrum area and 20 species at 5 localities in the Kemer area. We gathered 226 records of occurrence of gall midges in these three areas.

New members of Turkish fauna. The following 37 species are reported from Turkey for the first time and are new members of Turkish fauna: *Arnoldiola tympanifex*, *Arthrocnodax vitis*, *Asphondylia calycotomae*, *A. capparis*, *A. coronillae*, *A. massalongoi*, *A. scrophulariae*, *A. stefanii*, *Asynapta furcifer*, *Bayeriola thymicola*, *Braueriella phillyreae*, *Clinodiplosis cilicrus*, *Contarinia baeri*, *C. craccae*, *C. quercicola*, *C. subulifex*, *C. tragopogonis*, *Dasineura bayeri*, *D. ericaescopariae*, *D. papaveris*, *D. plicatrix*, *D. pteridis*, *D. pyri*, *D. tubularis*, *D. turionum*, *Gephyraulus diplotaxis*, *Jaapiella hypochoeridis*, *Janetia homocera*, *J. nervicola*, *Janetiella onosmae*, *Mycodiplosis melampsorae*, *Myricomyia mediterranea*, *Phlomidiomyia pustularis*, *Phyllodiplosis cocciferae*, *Piranea spartii*, and two species identified to the genus level only: *Contarinia* sp. causing galls

on *Quercus ilex* and *Trotteria* sp. developing in galls of *Asphondylia scrophulariae*. The known fauna of gall midges of Turkey includes 118 species.

Species richness. In 2005 the gall midge fauna of Turkey included 71 species (Skuhravá et al. 2005). During investigations in 2011, 2012 and 2013 we enriched the Turkish fauna for 37 species. The gall midge fauna of Turkey including 118 known species may be evaluated as intermediately rich in comparison with the species richness of gall midges in adjacent countries. The average species number of gall midges per locality found in Alanya (6.1), Bodrum (6.5) and Kemer areas (6.4) are similar and relatively low.

Frequency. *Dasineura plicatrix* causing galls on leaves of *Rubus* sp. recorded at 22 localities is the most frequent species in south-western Turkey. *Asphondylia calycotomae* inducing galls on pods of *Calicotome villosa* recorded at 19 localities, and *Dasineura oleae* causing galls on leaves of *Olea europaea* recorded at 13 localities, occur very frequently. Other species of gall midges occur frequently, 20% are rare and 22% are very rare, each recorded at only one locality.

Geographic Distribution. in south-western Turkey 64% of gall midge species are Mediterranean, 11% Eurosiberian, 11% Euroasian, 9% European and 5% Holarctic. *Dasineura oleae* is a typical representative of Mediterranean species, *Dasineura plicatrix* of European species, *Dasineura pteridis* of Euro-Siberian species and *Cystiphora sonchi* of Euro-Asian or Palaearctic species and *Contarinia pyrivora* and *Dasineura pyri* of Holarctic species.

Plant – animal interactions. Gall midges are associated with 44 host plant species belonging to 20 plant families. Twenty host plants are herbaceous plants and sixteen are trees and shrubs. *Quercus cerris* is associated with 8 species of gall midges and is the host plant with the highest number of associated species.

Economic importance: Six species are pests of agricultural plants in Turkey: *Apiomyia bergenstammi* on *Pyrus communis*; *Asphondylia gennadii* on *Ceratonia siliqua*; *Contarinia pruniflorum* on *Prunus armeniaca*; *Dasineura oleae* on *Olea europaea*; *Odinadiplosis amygdali* on *Prunus amygdalus*; *Lasioptera* sp. on tomato plants (*Solanum lycopersicum*).

Acknowledgements

We thank Prof. Mikdat Doğanlar from Mustafa Kemal University, Agriculture Faculty, Plant Protection Department, Antakya, Hatay, Turkey, for sending us adults of *Asynapta furcifer* reared from fruits of *Olea europea*, and for his wish for this species to be included in our article. We thank Mustafa Portakaldali and Hasan Deda Büyüköztürk from the Biological Control Research Station, Adana, for sending adults and larvae obtained from attacked tomato plants, and Cumali Özaslan**,** University of Dicle Faculty of Agriculture**,** Department of Plant Protection**,** Diyarbakir, Turkey, for sending adults reared from galls on *Eryngium campestre* for identification. We thank our granddaughter Jana Vaněčková for prepapring maps and graphs using computer techniques. We would like to express our thanks to Dr Keith Murray Harris (Ripley, Woking, Surrey, England) for valuable comments on the manuscript and for improvements of the English text.

REFERENCES

Alkan B. 1952: Türkiyenin Zoosesid (Zoocecid)'leri (kökeni hayvansal Bitki urları) üzerinde çalışmalar [Turkish plant galls (products of plants caused by animals)]. *Üniversitesi Ziraat Fakültesi Yıllığı*, *Ankara* **2–3**: 185–225; **4**: 259–291 (in Turkish).

Anagnostopoulos P. T. 1929: Blastomanie de l'amandier. *Revue de Pathologie Végétale et d'Entomologie Agricole* **16**: 168–177.

Angelini B. 1831: Degli insetti nocivi all'ulivo nella provincia Veronese. Memoria I. *Atti e Memoriae della Accademia di Agricoltura, Scienze e Lettere di Verona* **12**: 295–323.

Barnes H. F. 1932a: A new saprophytic gall midge, Asynapta furcifer sp. n., on olives. *Bollettino del Laboratorio di Zoologia Generale e Agraria della R. Istituto Superiore d'Agricoltura in Portici* **26**: 51–53.

Barnes H. F. 1932b: Notes on Cecidomyidae. *Annals and Magazine of Natural History*, *Tenth Series* **9**: 475–484.
Bayram S. & Skuhravá M. 2004: New records of Cecidomyiidae (Diptera) from Turkey. *Journal of the Entomological Research Society* **6**: 9–13.
Bayram S., Skuhravá M. & Cobanoglu S. 2005: Cystiphora sonchi (Vallot, 1827) and Dasineura gleditchiae (Osten Sacken, 1866) (Diptera: Cecidomyiidae), two new records from Turkey. *Turkish Journal of Entomology* **29**: 247–254.
Bevan W. 1918: *Annual Report*, *1917–18*. *Report of the Director of Agriculture*. Cyprus, 21 pp.
Bouché P. F. 1847: Beiträge zur Kenntniss der Insekten-Larven. *Stettiner Entomologische Zeitung* **8**: 142–146.
Bremi J. J. 1847: Beitraege zu einer Monographie der Gallmücken, Cecidomyia Meigen. *Neue Denkschrift der Allgemeinen Schweizerischen Gesellschaft für die Gesammten Naturwissenschaften* **9**: 1–71.
Cilbircioglu C. & Unal S. 2008: Gall midges (Diptera, Cecidomyiidae) in forest trees of Turkey. *Journal of Agricultural and Urban Entomology* **25**: 13–23.
Coutin R. & Katlabi H. 1986: Cecidomyiidae. 95–113. In: Arambourg Y. (ed.): *Traite d'Entomologie Oleicole.* Madrid: Conseil Oleicole International, 210 pp.
Coutin R. & Rambier A. 1955: Description d'une nouvelle cécidomyie sur les fleurs des Prunus: Contarinia pruniflorum n. sp. et ses principaux caractères biologiques (Dipt., Itonididae). *Bulletin de la Société Entomologique de France* **60**: 104–110.
Darvas B., Skuhravá M. & Andersen A. 2000: Agricultural dipteran pests of the Palaearctic region. Pp.: 565–650. In: Papp L. & Darvas B. (eds.): *Contributions to a Manual of Palaearctic Diptera* (*With Special Reference to Flies of Economic Importance*). *Volume 1*. *General and Applied Dipterology*. Budapest: Science Herald, 978 pp.
Davis P. H. & Güner A. 2000: *Flora of Turkey and the East Aegean Inlands*. *Volume 11*. Edinburgh: Edinburgh University Press, 65 pp.
Del Guercio G. 1910: Intorno a due nemici nuovi dell'olivo. *Redia* **6**: 282–297.
Del Guercio G. 1918: La cecidomia delle carubbe (Eumarchalia gennadiosi (March.) Del Guercio. *Agricoltura Coloniale* **12**: 287–297.
De Stefani T. 1898: *Note sopra due zoocecidii della Phyllirea variabilis Timb*. Palermo: Tipografia D. Puccio, 15 pp.
Doğanlar M. 2011: Parasitoids complex of the olive leaf gall midges, Dasineura oleae (Angelini 1831) and Lasioptera oleicola Skuhravá, 2011 (Diptera: Cecidomyiidae) in Hatay Turkey, with description of new genus and species from Tetrastichinae (Hymenoptera: Eulophidae). *Journal of Turkish Entomology* **35**: 245–264.
Doğanlar M. 2012: Almond bud gall midge, Odinadiplosis amygdali (Anagnostopoulos) (Diptera: Cecidomyiidae), parasitoid complex and economic importance in Hatay province. *Türkiye Entomoloji Bülteni* **2**: 233–242.
Doğanlar M., Sertkaya E. & Skuhravá M. 2011: Pest status of olive leaf gall midge *Dasineura oleae* (Angelini, 1831), description of Lasioptera oleicola Skuhravá sp. new (Diptera: Cecidomyiidae) and effectiveness of parasitoids on their populations in Hatay Turkey. *Journal of Turkish Entomology* **35**: 265–284.
Doğanlar M. & Yiğit A. 2005: Parasitoids of Apiomyia bergenstammi (Wachtl) (Diptera, Cecidomyiidae), a new pest on pears, in Hatay province, Turkey. *Journal of Applied Entomology* **129**: 118–120.
Doğanlar M, Yiğit T., Aslan A. & Karakaş H. B. 2014: First record of the apricot flower midge, Contarinia pruniflorum Coutin &Rambier (Diptera: Cecidomyiidae) in Malatya Province, Turkey. *Munis Entomology and Zoology Journal* **9**: 765–769.
Dufour L. 1837: Mémoire sur une galle de la bruyère a balais et sur les insectes qui l'habitent. *Annales de la Société Entomologique de France* **6**: 83–91.
Gagné R. J. & Doğanlar M. 2013: A new species of Celticecis (Diptera: Cecidomyiidae) on Celtis caucasica (Cannabaceae) from Turkey. *Proceedings of the Entomological Society of Washington* **115**: 311–315.
Gagné R. J. & Jaschhof M. 2014: *A Catalog of the Cecidomyiidae* (*Diptera*) *of the World. 3rd Edition*. *Digital Version 2*. Washington, D.C.: U.S. Department of Agriculture & U.S. National Museum, 493 pp.
Giraud J. 1861: Fragments entomologiques. *Verhandlungen der Kaiserlich-königlichen Zoologisch-botanischen Gesellschaft in Wien* **11**: 445–498.
Hardy J. 1850: On the effects produced by some insects, etc. upon plants. A*nnals and Magazine of Natural History*, *Second Series* **6**: 182–188.
Houard C. 1906: Glanures cécidologiques. *Marcellia* **5**: 65–69.
Houard C. 1908–1909: *Les Zoocécidies des Plantes d'Europe et du Bassin de la Méditerranée. Volume 1 & 2*. Paris: A. Hermann et Fils, 1247 pp.
Houard C. 1909–1913. *Les Zoocécidies des Plantes d'Europe et du Bassin de la Méditerranée. Volume 3*. *Supplement*. Paris: A. Hermann et Fils, 1248–1560 pp.
Houard C. 1922–1923: *Les Zoocécidies des Plantes d'Afrique*, *d'Asie et d'Océanie*. *Volume 1 & 2*. Paris: J. Hermann, 1056 pp.
Janezic F. 1990: Piranea spartii gen. n. sp. n. (Diptera, Cecidomyiidae) in the closed flowers of Spartium junceum L. *Biološki Vestnik* **38**: 29–33.

Kaplan M. 2014: A new pest: Contarinia pruniflorum Coutin & Rambier (Diptera: Cecidomyiidae) on apricot (Prunus armeniaca) in Malatya Province, Turkey. *Munis Entomology & Zoology* **9**: 947–949.
Kieffer J. J. 1888a: Ueber Gallmücken und Mückengallen. *Verhandlungen der Kaiserlich-königlichen Zoologisch-botanischen Gesellschaft in Wien* **38**: 95–114.
Kieffer J. J. 1888b: Beiträge zur Kenntniss der Gallmücken. *Entomologische Nachrichten* **14**: 262–268.
Kieffer J. J. 1889: Neue Beiträge zur Kenntniss der Gallmücken. I. Beschreibung neuer Gallmücken. *Entomologische Nachrichten* **15**: 149–156.
Kieffer J. J. 1896: Diagnose de deux espèces nouvelles de cécidomyies [Dipt.]. *Bulletin de la Société Entomologique de France* **1896**: 236–237.
Kieffer J. J. 1897: *Meine Antwort an den Herrn Zeichenlehrer Rübsaamen und an den Herrn Dozenten Dr. F. Karsch nebst Beschreibung neuer Gallmücken*. Trier, 21 pp.
Kieffer J. J. 1898: Zoocécidies d'Europe. *Miscellanea Entomologica* **6**: 57–64.
Kieffer J. J. 1909: Contributions à la connaissance des insectes gallicoles. *Bulletin de la Société d'Histoire Naturelle de Metz* **3**(2): 1–35.
Kieffer J. J. & A. Trotter A. 1904: Cécidomyes nouvelles d'Italie. *Marcellia* **3**: 64–65.
Kollar V. 1850: Naturgeschichte der Zerr-Eichen-Saummücke (Lasioptera Cerris), eines schädlichen Forstinsectes. *Denkschriften der Kaiserlichen Akademie der Wissenschaften* **1**: 347–350.
Loew H. 1850: Dipterologische Beiträge. IV. *Öffentliches Kaiser Friedrich-Wilhelms Gymnasium zu Posen* **1850**: 1–40.
Löw F. 1874: Beiträge zur Kenntniss der Gallmücken. *Verhandlungen der Kaiserlich-königlichen Zoologisch-botanischen Gesellschaft in Wien* **24**: 143–162.
Löw F. 1877: Ueber Gallmücken. *Verhandlungen der Kaiserlich-königlichen Zoologisch-botanischen Gesellschaft in Wien* **27**: 1–38.
Löw F. 1885: Beiträge zur Naturgeschichte der gallenerzeugenden Cecidomyiden. *Verhandlungen der Kaiserlich-königlichen Zoologisch-botanischen Gesellschaft in Wien* **35**: 483–510.
Marchal P. 1904: Diagnose d'une cécidomyie nouvelle vivant sur le caroubier [Dipt.]. *Bulletin de la Société Entomologique de France* **1904**: 272.
Mirumian L. 2011: Phytophagous gall midges (Diptera: Cecidomyiidae) of Armenia. *Acta Sociatis Zoologicae Bohemicae* **75**: 87–106.
Möhn E. 1955: Beiträge zur Systematik der Larven der Itonididae (= Cecidomyiidae, Diptera). 1. Teil: Porricondylinae und Itonidinae Mitteleuropas. *Zoologica*, *Stuttgart* **38**(105): 1–247.
Müller A. 1871: On a Cecidomyia forming galls on Pteris aquilina. *Entomologist's Monthly Magazine* **8**: 99–100.
Perdikis D., Lykouressis D., Paraskevopoulos A. & Harris K. M. 2011: A new insect pest, Lasioptera sp. (Diptera: Cecidomyiidae), on tomato and cucumer crops in glasshouses in Greece. *OEPP/EPPO Bulletin* **41**: 442–444.
Peschken D. P., McClay A. S., Derby J. L. & De Clerck R. 1989: Cystiphora sonchi (Bremi) (Diptera: Cecidomyiidae), a new biological agent esteblished on the weed perennial sow-thistle (Sonchus arvensis L.) (Compositae) in Canada. *Canadian Entomologist* **121**: 781–791.
Pierre E. & Chauvin-Buthaud B. 2001: A new pest in the south of France. A midge which gives cause for concern on apricot blossom [Contarinia pruniflorum]. *Phytoma* **541**: 38–39.
Pils G. 2006: *Flowers of Turkey.* A *Photo Guide. 4153 Photos*. Linz: G. Pils, 408 pp.
Prell H. 1931: Die nadelknickende Kieferngallmücke (Cecidomyia Baeri n. sp.), ein verbreiteter neuer Kiefernschädling. *Tharandter Forstlichen Jahrbücher* **82**: 36–52.
Riley C. V. 1886: Diplosis pyrivora. *Report of the Commissioner of Agriculture* **1885**: 283.
Rondani C. 1847: Osservazioni sopra parecchie specie di esapodi afidicidi e sui loro nemici. *Società Agraria e Accademia delle Scienze dell'Istituto di Bologna*, *Nuovi Annali delle Scienze Naturali e Rendiconto* **2**(8): 337–351, 432–448.
Rübsaamen E. H. 1889: Ueber Gallmücken und Gallen aus der Umgebung von Seigen. *Berliner Entomologische Zeitschrift* **33**: 43–70.
Rübsaamen E. H. 1893: Vorläufige Beschreibung neuer Cecidomyiden. *Entomologische Nachrichten* **19**: 161–166.
Rübsaamen E. H. 1894: Eine neue Gallmücke, Asphondylia capparis n. sp. *Berliner Entomologische Zeitschrift* **38**: 363–366.
Rübsaamen E. H. 1895: Ueber Cecidomyiden. *Wiener Entomologische Zeitung* **14**: 181–193.
Rübsaamen E. H. 1899a: Mitteilungen über neue und bekannte Gallen aus Europa, Asien, Afrika und Amerika. *Entomologische Nachrichten* **25**(15–18): 225–282.
Rübsaamen E. H. 1899b: Ueber die Lebensweise der Cecidomyiden. (Drittes Stück und Schluss.). *Biologisches Centralblatt* **19**: 593–607.
Rübsaamen E. H. 1914: Cecidomyidenstudien III. *Marcellia* **13**: 88–114.
Rübsaamen E. H. 1915: Cecidomyidenstudien IV. Revision der deutschen Oligotropharien und Lasiopterarien nebst Beschreibung neuer Arten. *Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin* **1915**: 485–567.

Schiner J. R. 1856: Ammerkungen zu dem im Bande V, pag. 13 dieser Verhandlungen abgedruckten Aufsatze Frauenfeld's: Beitrag zur Insecten-Geschichte. *Verhandlungen der Zoologisch-botanischen Vereins in Wien* **6**: 215–224.
Sinclair B. J., Mann J., Elmhirst J., Grogan T., Ashekian C. & Hueppelsheuser T. 2009: Dasineura plicatrix (Diptera: Cecidomyiidae): a recent introduction into North America. *Canadian Entomologist* 141: 397–400.
Skuhravá M. 1986: Family: Cecidomyiidae. Pp.: 72–297. In: Soós Á. & Papp L. (eds): *Catalogue of Palaearctic Diptera. Volume 4*. Budapest: Hungarian Academy of Sciences, Akadémiai Kiadó and Amsterdam: Elsevier, 441 pp.
Skuhravá M. 1987: Analysis of areas of distribution of some Palaearctic gall midge species (Cecidomyiidae, Diptera). *Cecidologia Internationale* **8**: 1–48.
Skuhravá M. 1989: Taxonomic changes and records in Palaearctic Cecidomyiidae (Diptera). *Acta Entomologica Bohemoslovaca* **86**: 202–233.
Skuhravá M. 1994a: The zoogeography of gall midges (Cecidomyiidae, Diptera) of the Czech Republic. I. Evaluation of the faunistic researches in the 1855–1990 period. *Acta Societatis Zoologicae Bohemicae* **57**[1993]: 211–293.
Skuhravá M. 1994b: The zoogeography of gall midges (Cecidomyiidae, Diptera) of the Czech Republic. II. Review of gall midge species including zoogeographical diagnoses. *Acta Societatis Zoologicae Bohemicae* **58**: 41–88.
Skuhravá M. 1997a: Family Cecidomyiidae. Pp.: 71–204. In: Papp L. & Darvas B. (eds): *Contribution to a Manual of Palaearctic Diptera*. *Volume 2*. *Nematocera and Lower Brachycera.* Budapest: Science Herald, 592 pp.
Skuhravá M. 1997b: Gall midges (Diptera, Cecidomyiidae) of the Czech and Slovak Republics as members of zoogeographical units in the Palaearctic Region. *Folia Facultatis Scientiarium Naturalium Universitatis Masarykianae Brunensis*, *Biologica* **95:** 149–171.
Skuhravá M. 2005: Cecidomyiidae (Bejlomorkovití). Pp.: 255–258. In: Farkač J., Král D. & Škorpík M. (eds): *Červený seznam ohrožených druhů České republiky*. *Bezobratlí* [*Red List of Threatened Species in the Czech Republic. Invertebrates*]. Praha: Agentura ochrany přírody a krajiny ČR, 760 pp (in Czech).
Skuhravá M. 2009: Cecidomyiidae Macquart, 1838. In: Jedlička L., Kúdela M. & Stloukalová V. (eds): *Checklist of Diptera of the Czech Republic and Slovakia. Electronic Version 2*. URL: zoology.fns.uniba.sk/diptera2009
Skuhravá M. 2011: *Galls of Gall Midges in the Palaearctic Region. Key for Identification of Gall Causers on Plants and Fungi*. Unpubl. Report. Prague, 600 pp.
Skuhravá M., Bayram S., Cam H., Tezcan S. & Can P. 2005: Gall midges (Cecidomyiidae, Diptera) of Turkey. *Turkish Journal of Entomology* **29**: 17–34.
Skuhravá M., Grosskopf G., Schaffner U. & Turanli F. 2011: A new gall midge species Janetiella potentillogemmae sp. nov. (Diptera: Cecidomyiidae), causing galls on Potentilla recta (Rosaceae) in western Turkey, a candidate for biological weed control. *Acta Societatis Zoologicae Bohemicae* **75**: 297–306.
Skuhravá M., Karimpour Y., Sadeghi H., Ali Gol & Joghataie M. 2014: Gall midges (Diptera: Cecidomyiidae) of Iran – annotated list and zoogeographical analysis. *Acta Societatis Zoologicae Bohemicae* **78**: 269–301.
Skuhravá M. & Skuhravý V. 1997: Gall midges (Diptera: Cecidomyiidae) of Greece. *Entomologica*, *Bari* **31**: 7–68.
Skuhravá M., Skuhravý V. & Ebejer M. 2002: Gall midges (Cecidomyiidae, Diptera) of Malta. *Entomologica*, *Bari* **36**: 25–43.
Skuhravá M. & Skuhravý V. 2004: Gall midges (Diptera: Cecidomyiidae) of Cyprus. In: *Dipterologica bohemoslovaca. Volume 11*. *Folia Facultatis Scientiarum Naturalium Universitatis Masarykianae Brunensis*, *Biologia* **109**: 265–283.
Skuhravá M. & Skuhravý V. 2006: Gall midge (Diptera: Cecidomyiidae) of the islands Corfu and Samos (Greece). *Acta Universitatis Carolinae – Biologica* **50**: 109–123.
Skuhravá M. & Skuhravý V. 2009: Gall midges (Diptera: Cecidomyiidae) of the Olympos Mountains (northern Greece). *Acta Sociatatis Zoologicae Bohemicae* **72**[2008]: 227–244.
Skuhravá M. & Skuhravý V. 2010a: Gall midges (Cecidomyiidae, Diptera) of Calabria, southern Italy. *Acta Societatis Zoologicae Bohemicae* **73**[2009]: 65–76.
Skuhravá M. & Skuhravý V. 2010b: Species richness of gall midges (Diptera, Cecidomyiidae) in Europe (West Palaearctic): biogeography and coevolution with host plants. *Acta Societatis Zoologicae Bohemicae* **73**[2009]: 87–156.
Skuhravá M. & Skuhravý V. 2011: Gall midges (Diptera: Cecidomyiidae) of three Greek islands: Lefkada, Rhodos and Zakynthos. *Acta Societatis Zoologicae Bohemicae* **75**: 113–132.
Skuhravá M. & Skuhravý V. 2015: Gall midges (Diptera: Cecidomyiidae) of Greece – summary of investigations of 1994–2010 and zoogeographical analysis. *Acta Societatis Zoologicae Bohemicae* **79**: 127–163.
Skuhravá M., Skuhravý V. & Brewer J. W. 1984: Biology of gall midges. Pp.: 169–222. In: Ananthakrishnan T. N. (ed.): *Biology of Gall Insects.* New Delhi, Bombay, Calcutta & Oxford: IBH Publishing Company, 362 pp.
Skuhravá M., Skuhravý V., Dončev K. D. & Dimitrova B. D. 1991: Gall midges (Cecidomyiidae, Diptera) of Bulgaria. I. Faunistic researches in the 1978–1987 period. *Acta Zoologica Bulgarica* **42**: 3–26.
Skuhravá M., Skuhravý V. & Buhr H. J. 2013: Gall midges (Diptera: Cecidomyiidae) of Georgia. *Acta Societatis Zoologicae Bohemicae* **77**: 99–137.
Skuhravý V. & Skuhravá M. 1971: Die Gallmücken (Diptera, Cecidomyiidae) an Zerreiche (Quercus cerris L.). *Marcellia* **37**: 75–101.

Solinas M. 1982: Studi sui Ditteri Cecidomiidi. IV. Paragephyraulus diplotaxis n. gen., n. sp. *Memorie della Società Entomologica Italiana* **60**: 315–334.
Sylvén E. & Lindberg B. 1998: Morphometric analyses of Palaearctic Dasineura and Jaapiella species (Diptera: Cecidomyiidae, Oligotrophini), developing in flower heads of Asteraceae, with description of four new species. *Entomologica Scandinavica* **29**: 241–265.
Tavares J. S. 1902: As zoocecidias portuguezas: enumeração das especies até agora encontradas em Portugal e descripção de dezesete novas. *Annaes de Sciencias Naturaes* **7**: 15–108.
Tavares J. S. 1907: Diagnose de trois cécidomyes nouvelles. *Bulletin de la Société Portugaise des Sciences Naturelles* **1**: 50–54.
The Plant List 2013: *The Plant List***.** *Version 1.1*. URL: www.theplantlist.org [accessed 1 January 2015].
Tutin T. G., Heywood V. H., Burges N. A., Valentine D. H., Walters S. M. & Webb A. A. 1964–1980: *Flora Europaea. Volume 1 – Volume 5*. Cambridge: Cambridge University Press, 428 pp (Volume 1 – 1964), 420 pp (Volume 2 – 1968), 370 pp (Volume 3 – 1972), 505 pp (Volume 4 – 1976), 510 pp (Volume 5 – 1980).
Unal S. & Akkuzu E. 2009: Forest gall midge fauna (Diptera: Cecidomyiidae) of Turkey. *Research Journal of Agriculture and Biological Sciences* **5**: 915–922.
Vallot J. N. 1827: Compte rendu des travaux de l'Académie des Sciences, Arts et Belles-Lettres de Dijon. *Mémoires de l'Académie des Sciences*, *Arts et Belles-Lettres de Dijon* **1827**: 39–112.
Vallot J. N. 1829: Galles et fausses galles. *Mémoires de Académie des Sciences*, *Arts et Belles-Lettres de Dijon* **1829**: 107–116.
Wachtl F. A. 1882: Beiträge zur Kenntniss der gallenerzeugenden Insekten Europas. *Wiener Entomologische Zeitung* **1**: 289–293.
Winnertz J. 1853: Beitrag zu einer Monographie der Gallmücken. *Linnaea Entomologica* **8**: 154–322.
Yargiç S. 1948: Badem tomurcuk gal sineği (Odinodiplosis amygdali) [Almonf bud gall midge (Odinodiplosis amygdali)]. *Mahsul Hekimi* **1**(4): 10–12.