

Gall midges (Diptera: Cecidomyiidae) of Iran: annotated list and zoogeographical analysis

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Received 16 June 2014; accepted 5 December 2014
Published 22 December 2014

Abstract. The known gall midge fauna of Iran is composed of 61 species belonging to 33 genera. Thirty six species were recorded for the first time in northern Iran during investigations in the years 2007–2014. The two most species rich genera are *Dasineura* Rondani, 1840 with eight species and *Stefaniola* Kieffer, 1913 with six species. Most species are phytophagous and cause galls on various host plants; but *Aphidoletes aphidimyza* (Rondani, 1847), *Diadiplosis* sp., *Dicrodiplosis manihoti* Harris, 1981, *Endaphis perfida* (Kieffer, 1896), *Feltiella acarisuga* (Vallot, 1827), *Lestodiplosis heterobiae* Barnes, 1928 and *Lestodiplosis* sp. are zoophagous; and *Camptodiplosis boleti* Kieffer, 1901, *Clinodiplosis cilicrus* (Kieffer, 1889), *Mycodiplosis plasmoparae* Rübsaamen, 1906, *Asynapta phragmitis* Giraud, 1863, *Campylomyza flavipes* Meigen, 1818, and *Micromyza lucorum* Rondani, 1840, are mycophagous. An annotated list of all species of gall midges and a list of host plants and associated with gall midges are given. Phytophagous species of gall midges are associated with 50 plant species which belong to fifteen plant families; 15 species are associated with Chenopodiaceae, eight species with Salicaceae and seven species with Asteraceae. Usually only one or two species of gall midges are associated with each host plant species, but *Haloxylon ammodendron* (Chenopodiaceae) hosts four species: *Baldratia przewalskii* Marikovskij, 1955, *Stefaniola deformans* (Marikovskij, 1953), *S. furtiva* (Marikovskij, 1953), and *S. gigas* (Marikovskij, 1953); *Salix caprea* (Salicaceae) also hosts four species: *Iteomyia capreae* (Winnertz, 1853), *Rabdophaga nervorum* (Kieffer, 1895), *Rabdophaga rosaria* (Loew, 1850) and *Macrolabis saliceti* (Loew, 1850). Zoogeography: most species (43%) are Asian-Turanian, followed by Palaearctic (Euro-Asian) (28%), European (11.4%), Euro-Siberian (3.2%), Mediterranean (3.2%), Holarctic (8%), Afro-Asian (1.6%) and Oriental (Indomalayan) (1.6%). Common (shared) species occurring in Iran and adjacent countries indicate their similarity in faunal composition: 25 common species are recorded from Iran and Kazakhstan, 17 species from Iran and Armenia, 16 species from Iran and Turkey, 15 species from Iran and Georgia and 8 species from Iran and Turkmenistan. Biogeography: the representatives of three biogeographical regions meet in Iran: most species of gall midges belong to the Palaearctic region; *Dicrodiplosis manihoti* Harris, 1981, predator of coccids, is representative of the Afro-Asian region, and *Procontarinia mangiferae* (Felt, 1911), causing galls on leaves of *Mangifera indica*, of the Oriental region. *Jaapiella ivannikovi* Fedotova, 1985, causing galls on *Acroptilon repens* is used for biological control of this noxious weed in continental states of USA.

Key words. Faunistics, zoogeography, biogeography, distribution, plant-animal interactions, Diptera, Cecidomyiidae, Iran, Western Asia, Palaearctic Region.

INTRODUCTION

The Cecidomyiidae are one of the most species rich families of Diptera. Gagné & Jaschhof (2014) list 6,203 species in 736 genera of living and fossil gall midges in the world. In total, 3,113 species in 344 genera are described for the Palaearctic Region with about 1,800 species in 270 genera for Europe (Skuhrová 2006). Based on modern taxonomical studies there are five subfamilies in the family Cecidomyiidae, i. e. Cecidomyiinae, Lestremiinae s. str, Micromyinae, Porricondylinae s. str. and Winnertziinae.

Adults of gall midges are usually only 0.5–3 mm long and rarely reach lengths of 8 mm. They have long antennae, relatively large wings with reduced venation and long legs. Larvae have on the ventral side of the prothoracic segment a sternal spatula, a sclerotised organ, which is unique to the family and important for identification at the specific level. Larvae of gall midges are phytophagous, mycetophagous or saprophagous. Some larvae are zoophagous. Larvae of phytophagous species cause galls (Latin: cecidium) on various organs of host plants (hence the common name “gall midges”) or live free within flower heads or stems of plants and do not induce galls. Several species are serious pests of cultivated plants and forest trees but, on the other hand, several phytophagous species are used in the biological control of weeds. Zoophagous larvae are predators of other gall midges, aphids, mites, coccids, or other small arthropods. Some of them are used in the biological control of pests. Mycophagous and saprophagous larvae are associated

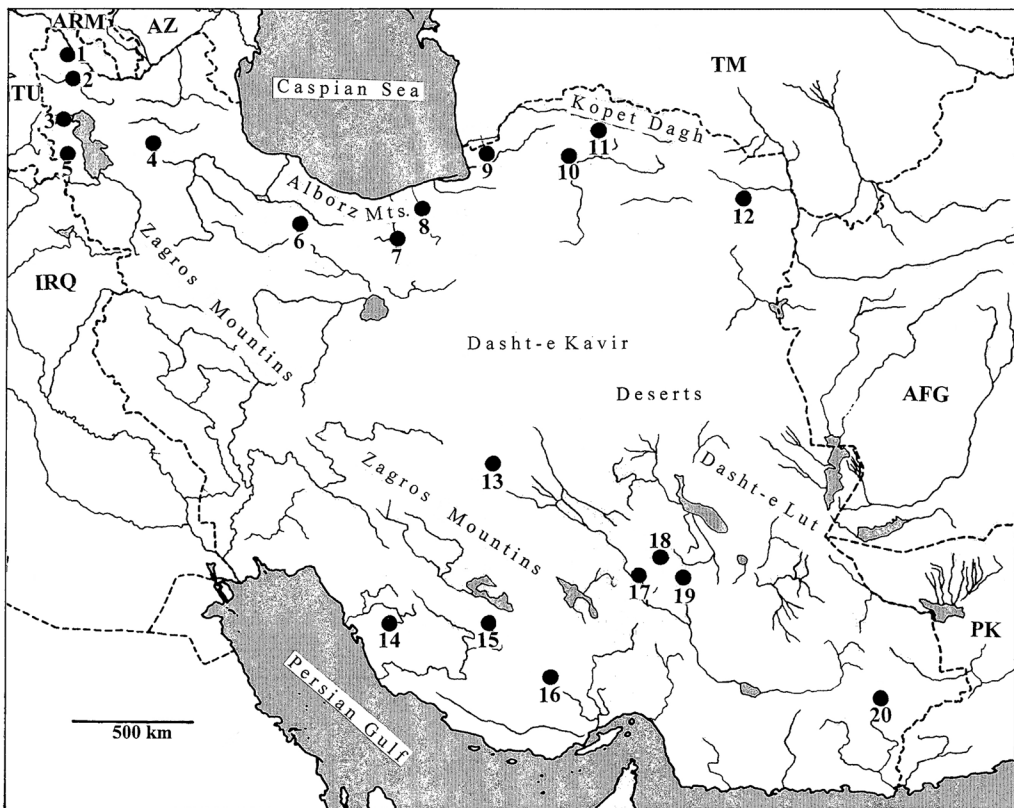


Fig. 1. Iran, showing main geographical features and main localities or areas where galls or adults of gall midges were collected by various researchers and with localities where recent investigations were carried out in the years 2007–2014. 1 – Saatloo Poplar Research Station, 2 – Khoy, 3 – Shīrū Kandī (Qasemlū valley), 4 – Tabriz, 5 – Urmia, 6 – Qazvin, 7 – Tehran, 8 – Amol, 9 – Aliabad Katol, 10 – Joghatay, 11 – Bojnurd, 12 – Mashhad, 13 – Yazd, 14 – Dascht-e Arzan, near Shiraz, 15 – Jahrom, 16 – Darab, 17 – Rayin near Kerman, 18 – Kerman, 19 – Kuh-e Hasar (Hāsār), 20 – Bampur. Abbreviations used for adjacent countries: AFG – Afghanistan, ARM – Armenia, AZ – Azerbaijan, IRQ – Iraq, PK – Pakistan, TM – Turkmenistan, TU – Turkey.

with fungi. The life span of an adult is very short, generally only a few hours or up to five days at the most (Skuhrová et al. 1984).

The gall midge fauna of Iran is poorly known although the first galls caused by gall midges were discovered and collected there by unknown travellers and collectors, mainly botanists, who searched, in the latter half of the 19th century, for various interesting plant species occurring in Iran. Möhn (1969) used larvae that he obtained from dry galls preserved in some collections of plant galls and described eight gall midge species from Iran (Möhn 1966–1971).

Several Iranian researchers working at universities or in research institutes in Iran contributed to the knowledge of gall midges. Farahbakhsh (1961) gave a pest of cereals, *Contarinia tritici*, in the checklist of important insects and other enemies of plants and agricultural products in Iran. Anonymous (1981) recorded occurrence of *Resseliella oculiperda* and Abai (1984) included three gall midge species in the list of pests of forest trees and shrubs of Iran (*Dasineura acrophila*, *D. fraxini* and *Mikiola fagi*).

Skuhrová (1986) summarized scattered information on gall midges occurring in Iran in the *Catalogue of Palaearctic Diptera*. She recorded nine gall midge species known at that time from Iran.

Later Asadeh et al. (1991) recorded *Dicrodiplosis manihoti*, a predator of *Pseudococcus* spp. and Askari (1993) a species of the genus *Procontarinia* as a new pest of mango trees in southern Iran. Abdul Razzagh (1993) first recorded *Campylomyza praecox* Kieffer (of the family Lestremiinae) in Iran; this species is considered as *nomen dubium* (Jaschhof 1998, Gagné 2010, Gagné & Jaschhof 2014). Hashemi Khabir et al. (2012) first reported the willow gall midge, *Rabdophaga heterobia*, from Iran, Karimpour & Skuhrová (2012) recorded three gall midge species (*Contarinia desertorum*, *Cystiphora sonchi* and *Dasineura rosae*) and Joghataie et al. (2014) reported five gall midge species firstly recorded from Iran. Tabadkani et al. (2012) studied the predatory gall midge, *Aphidoletes aphidimyza*, and its population in Iran.

Since 2007 Younes Karimpour started his research on gall midges and their galls in the northwestern part of Iran, found several interesting galls and was successful in rearing adults. He asked Marcela Skuhrová for identification of gathered material. In 2009 Younes Karimpour made a search in agricultural literature in Iran and found several species cited by several authors as occurring in Iran. In 2012 Hussein Sadeghi asked for identification of some specimens of gall midges obtained mainly by catching in traps exposed in various fields in northeastern Iran.

In this paper we summarize knowledge on gall midges of Iran, add new records obtained during investigations by Y. Karimpour, H. Sadeghi, Ali Gol and M. Joghataie in northern Iran in the period from 2007 to 2014, and evaluate the gall midge fauna of Iran from the zoogeographical point of view.

STUDY AREA

Iran is located in southwest Asia and borders the Caspian Sea in the north and the Persian Gulf and Gulf of Oman in the south. Iran occupies an area of 1,648,000 km² and shares its boundary with Armenia, Azerbaijan and Turkmenistan in the north, Afghanistan and Pakistan in the east, Iraq and Turkey in the west (Fig. 1). Iran consists of rugged, mountainous rims surrounding high interior basins. The main mountain chain is the Zagros Mountains, a series of parallel ridges interspersed with plains that bisect the country from northwest to southeast. Many peaks in the Zagros Mountains exceed 3,000 m a. s. l., and in the south-central region of the country there are at least five peaks that are over 4,000 metres. The highest point is the Volcanic Mount Damavand, 5,610 m a. s. l. and the lowest point lies at the Caspian Sea, –28 metres. The center of Iran consists of several closed basins. The eastern part of the plateau is covered by two salt deserts. Iran has an arid climate. More than one-tenth of the country is afforested. The most extensive forests are spread on the mountain slopes rising from the Caspian Sea, with stands of *Quercus*, *Fraxinus*, *Ulmus* and *Cupressus*.

The vegetation of Iran is rich in the northern and northwestern areas and humid regions but in arid areas, in deserts and semideserts in central and southern parts with low precipitation and high evaporation is very low. The flora of Iran

includes 6417 plant species belonging to 1215 genera of 167 families of vascular plants. Many plant genera include only one species but some of them contain at least 800 species (for example *Astragalus*). About 1810 plant species are endemic to Iran (Ghahreman & Attar 1999, Ghahreman 2006). Richness of Iranian plant flora including many endemic species and diversity of biotopes occurring in Iran are good presumptions for the occurrence of gall midges and their galls.

From the biogeographical point of view, Iran spread in southwest Asia, is considered to be a part of the Palaearctic Region (Soós & Papp 1986). Udvardy (1975) includes the northern and western part of Iran in the Caucaso-Iranian Highlands Biogeographical Province, the central part to Anatolian-Iranian Desert and the southern part to Iranian Desert Biogeographical Provinces.

MATERIAL AND METHODS

We gathered data on the occurrence of gall midges in Iran from articles of various researchers published from the middle of the 20th century until 2013. The German dipterologist E. Möhn was the first to contribute importantly to the knowledge of the Iranian fauna. He published a study on larvae of Cecidomyiidae in which he recorded the occurrence of twelve species of gall midges found in Iran and he described eight of them as new species (Möhn 1966–1971). Most of the species of gall midges recorded in Iran were found by collecting galls from different host plants. In recent years young entomologists started to study gall midges and have used other methods.

They used traps of various types which were installed in fields for several weeks or used a hand net for sweeping vegetation in field crops. Adults obtained using these methods were preserved in 75% ethanol. Host plants with galls were brought from nature to the laboratory and placed in rearing cages. Emergence of adults was checked every day. Emerged adults were put in vials with 75% ethanol for future identification and studies. A part of emerged adults was mounted on microscope slides using Hoyer's mounting medium. Galls on host plants were photographed and a sample of the dry host plants with galls (herbarium) was preserved as voucher specimens in collections of the authors.

Galls of gall midges were collected in three areas of Iran: in the surroundings of Urmia, 1330 m a. s. l. (West Azerbaijan Province) in north-western Iran, in Aliabad Katol, 98 m a. s. l. (Golestan Province) near the Caspian Sea and in the surroundings of Joghatay, 1340 m a. s. l. (Khorasan Province) in northern Iran (Fig. 1).

Identification of gall midge galls is based on the keys of Buhr (1964–1965), Houard (1908–1909, 1912, 1913, 1922–1923) and Skuhrová (2011b). Identification of gall midge larvae is based on Möhn (1955, 1966–1971) and of adults on the keys to genera of Skuhrová (1997a). The nomenclature of gall midge species is based on Gagné (2004, 2010) and Gagné & Jaschhof (2014). The economic importance of gall midges was assessed based on information given in Barnes (1946–1956), Nijveldt (1969), Skuhrový & Skuhrová (1993, 1996), Darvas et al. (2000) and Skuhrová & Roques (2000) and zoogeographical analysis on Skuhrová (1987, 1997).

Character of distribution areas of species is based on data gathered by Skuhrová (1986) and her subsequent publications, and is broadened using new data on occurrence obtained in Asia – in Kazakhstan (Fedotova 2000), Turkey (Skuhrová et al. 2005), Armenia (Mirumian 2011) and in Georgia (Skuhrová et al. 2013).

Adults, larvae and pupae of gall midges are deposited in the collection of gall midges of Marcela Skuhrová in Praha, Czech Republic. Galls of gall midges (voucher specimens) and documentation of photos is deposited at the Department of Plant Protection, Faculty of Agriculture, Ferdowsi University of Mashhad, and at Natural History Museum of Urmia University, Urmia, Iran.

RESULTS

At present the known gall midge fauna of Iran is composed of 61 species belonging to 33 genera. Gall midges were recorded at about twenty localities spread over the territory of Iran, mainly in its northern part (Fig. 1). Thirty six species were recorded for the first time at several localities in northern Iran during investigations in the years 2007–2014. In the following part we present an annotated list of all gall midge species recorded in Iran and a list of host plant species with associated gall midge species (Table 1). Then we evaluate from the zoogeographical point of view all data obtained in Iran.

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 gall, host plant species and family, occurrence at localities

in Iran, date of collection of recent findings, references and distribution in the Palaearctic region, mainly in adjacent countries and in Georgia and Kazakhstan where intensive investigations of gall midge faunas have been carried out in recent years.

Subfamily Cecidomyiinae

***Aphidoletes aphidimyza* (Rondani, 1847)**

Cecidomyia aphidimyza Rondani, 1847: 443.

Slightly orange coloured larvae are predators of many species of aphids (Hemiptera: Aphididae) on various host plants. They are used for biological control of aphids. This widespread species has been described under many names which are now considered to be synonyms (Harris 1973, Gagné & Jaschhof 2014). The biology of *A. aphidimyza* was summarized and confirmed by Harris (1973).

OCCURRENCE. Eastern Iran, North Khorasan Province, Bojnurd (Tabadkani et al. 2012).

DISTRIBUTION. Holarctic, cosmopolitan (Harris 1973, Skuhravá 1986, Gagné 2004); recently recorded also from Kazakhstan, Georgia, Turkey and Iran.

***Asphondylia anatolica* Skuhravá, 1998**

Asphondylia anatolica Skuhravá, 1998: Skuhravá & Çam 1998: 218.

Larvae cause large terminal stem galls on *Astragalus lagopoides* Lam. (Syn. *Astragalus lagurus* Willd.) (Fabaceae). About 10–15 larvae develop in one complex gall. Each larva forms one gall, the wall of which is covered with mycelium inside. Larvae pupate in the galls. Only one generation develops a year.

OCCURRENCE. North-eastern Iran: Khorasan Province, Joghatay, 1382 m a. s. l., 4 May 2012, 2 ♀♀ reared from galls on *Astragalus* sp.; leg. M. Joghataie. First record from Iran.

DISTRIBUTION. Asian-Turanian, known to occur in northern Turkey, Syria (Skuhravá & Cam 1998) and Iran.

***Baldratia aelleni* Möhn, 1969**

Baldratia aelleni Möhn, 1969: 172.

Larvae cause one-chambered galls on *Suaeda microphylla* Pall. (Chenopodiaceae). Attacked leaves are swollen at the tip forming one-chambered galls. Larvae pupate in the galls. Type locality: Simin-Dascht, Zentral Elburs, Iran, 4 September 1948, leg. Manoutcheri & P. Aellen. Möhn gave the specific name of this gall midge species after a botanist P. Aellen, Basel, Switzerland, who specialized in the study of the family Chenopodiaceae. Möhn (1969: 172) described only the larva. Pupa, male and female are unknown.

OCCURRENCE. Iran, Simin-Dascht (Möhn 1969).

DISTRIBUTION. Asian-Turanian, known only from Iran.

***Baldratia anabasis* Möhn, 1969**

Baldratia anabasis Möhn, 1969: 179.

Larvae cause ellipsoid swellings on *Anabasis aphylla* L. and *A. salsa* (C. A. M.) Benth. (Chenopodiaceae). The gall has only one-chamber and is situated on one side of the stem. One generation develops per year. Larvae pupate in the galls. Type locality: Kuh-Häsär, Province Kerman/Persien. Holotype: Larva. Möhn (1969: 179) described only the larva. Pupa, male and female are unknown.

OCCURRENCE. South-East Iran, Kerman Province, Kuh-e Hasar (as Häsär) (Möhn 1969).

DISTRIBUTION. Asian-Turanian, known from Iran and Kazakhstan.

Table 1. Host plants and associated species of gall midges in Iran

host plant species	gall midge species	attacked plant organ
<i>Acer pseudoplatanus</i>	<i>Dasineura irregularis</i> <i>Dasineura</i> sp. 2	leaves wrinkled, curled and rolled upwards inquiline
<i>Acroptilon repens</i> (<i>A. picris</i>)	<i>Jaapiella ivannikovi</i>	leaf rosette on stem tip
<i>Aellenia glauca</i>	<i>Stefaniola excelsa</i> <i>Stefaniola fructua</i> <i>Stefaniola spinosa</i>	fruit gall, stem swelling fruit gall, stem swelling fruit, stem, leaf galls
<i>Aellenia cinerascens</i>	<i>Stefaniola fructua</i>	fruit gall, stem swelling
<i>Aellenia subaphylla</i>	<i>Stefaniola excelsa</i> <i>Stefaniola spinosa</i>	fruit gall, stem swelling fruit, stem, leaf galls
<i>Alhagi pseudalhagi</i>	<i>Contarinia desertorum</i>	folded leaflets
<i>Anabasis aphylla</i>	<i>Baldratia anabasis</i> <i>Baldratia similis</i>	stem gall stem gall
<i>Anabasis haussknechti</i>	<i>Baldratia similis</i>	stem gall
<i>Anabasis salsa</i>	<i>Baldratia anabasis</i> <i>Baldratia similis</i>	stem gall stem gall
<i>Anabasis setifera</i>	<i>Baldratia kermanensis</i>	stem gall
Apiaceae	<i>Lasioptera carophila</i>	swelling at the point of insertion of umbellules
<i>Artemisia scoparia</i>	<i>Rhopalomyia botryosa</i>	swollen flower buds accumulate on stem
<i>Artemisia herba-alba</i>	<i>Rhopalomyia hispanica</i> <i>Rhopalomyia navasi</i>	small globular bud galls large globular stem galls, white pubescent
<i>Artemisia</i> sp.	<i>Rhopalomyia efreмовi</i> <i>Rhopalomyia monogynasphaera</i>	spindle stem swellings rounded galls on shoot
<i>Astragalus lagopoides</i> (<i>A. lagurus</i>)	<i>Asphondylia anatolica</i>	large terminal stem galls
<i>Bassia prostrata</i> (= <i>Kochia prostrata</i>)	<i>Kochiomyia kochiae</i>	globular bud galls on stems
<i>Carpinus betulus</i>	<i>Zygiobia carpini</i> <i>Lestodiplosis</i> sp.	swellings along leaf midvein; zoophagous
<i>Cephalaria microcephala</i>	<i>Janetiella</i> sp.	globular swelling at vegetative tip
<i>Citrus</i> sp.	<i>Dicrodiplosis manihoti</i>	zoophagous on Pseudococcidae
<i>Echinophora orientalis</i>	<i>Contarinia</i> sp.	swollen flower stalks
<i>Euphorbia boissieriana</i>	<i>Dasineura euphorbium</i> <i>Dasineura</i> sp. 1	swollen fruit or flower green pointed gall on stem tip
<i>Fagus sylvatica</i>	<i>Mikiola fagi</i>	pointed smooth leaf galls
<i>Fraxinus excelsior</i>	<i>Dasineura acrophila</i> <i>Dasineura fraxini</i>	folded leaflet swollen midvein of leaflet
<i>Halocnemum strobilaceum</i>	<i>Careopalpis harenosa</i>	stem gall
<i>Haloxydon ammodendron</i>	<i>Baldratia przewalskii</i> <i>Stefaniola deformans</i> <i>Stefaniola furtiva</i> <i>Stefaniola gigas</i>	stem gall branch gall swelling of internodium stem swelling
<i>Haloxydon aphyllum</i>	<i>Stefaniola deformans</i> <i>Stefaniola furtiva</i> <i>Stefaniola gigas</i>	branch gall swelling of internodium stem swelling
<i>Haloxydon elegans</i>	<i>Baldratia przewalskii</i> <i>Stefaniola deformans</i>	stem gall branch gall
<i>Haloxydon multiflorum</i>	<i>Baldratia przewalskii</i> <i>Stefaniola deformans</i>	stem gall branch gall
<i>Haloxydon persicum</i>	<i>Baldratia przewalskii</i>	stem gall
<i>Haloxydon recurvum</i>	<i>Baldratia przewalskii</i>	stem gall
<i>Hippomaranthrum</i> sp.	<i>Lasioptera umbelliferarum</i>	stem gall, leaf stalk gall
<i>Juniperus</i> sp.	<i>Dicrodiplosis manihoti</i>	zoophagous on Pseudococcidae
<i>Kalidium caspicum</i>	<i>Careopalpis harenosa</i>	stem gall
<i>Malcolmia africana</i> (<i>Hesperis africana</i> , <i>Strigosella africana</i>)	<i>Brassomyia strigosellae</i>	leaf bud galls

host plant species	gall midge species	attacked plant organ
<i>Mangifera indica</i>	<i>Procontarinia mangiferae</i>	pustule leaf galls, swellings on tips and inflorescences
<i>Morus</i> sp.	<i>Diadiplosis</i> sp.	both zoophagous on Pseudococcidae
	<i>Dicrodiplosis manihoti</i>	
<i>Rosa canina</i> , <i>Rosa</i> sp.	<i>Dasineura rosae</i>	folded leaflets
	<i>Resseliella oculiperda</i>	larvae in places of grafting
<i>Salix aegyptica</i>	<i>Iteomyia capreae</i>	small leaf galls
<i>Salix caprea</i>	<i>Iteomyia capreae</i>	small leaf galls
	<i>Rabdophaga nervorum</i>	swelling on leaf midvein
	<i>Rabdophaga rosaria</i>	large rosette leaf gall
<i>Salix fragilis</i>	<i>Rabdophaga terminalis</i>	spindle gall on tip
	<i>Macrolabis saliceti</i>	inquiline
<i>Salix triandra</i> (<i>S. amygdalina</i>)	<i>Rabdophaga heterobia</i>	swollen male catkins; small leaf rosettes
	<i>Lestodiplosis heterobiae</i>	zoophagous
<i>Salix</i> sp.	<i>Rabdophaga salicis</i>	swelling of shoot
	<i>Rabdophaga terminalis</i>	spindle leaf gall at shoot tip
<i>Salsola dendroides</i>	<i>Halodiplosis araratica</i>	leaf bud gall
<i>Sisymbrium loeselii</i>	<i>Dasineura bayeri</i>	large spongy stem gall
<i>Sonchus oleraceus</i> , <i>S. arvensis</i>	<i>Cystiphora sonchi</i>	pustule galls on leaves
<i>Suaeda microphylla</i>	<i>Baldratia aelleni</i>	leaf gall
<i>Triticum vulgare</i>	<i>Contarinia tritici</i>	spikelets in flower
<i>Vitis vinifera</i>	<i>Mycodiplosis plasmoparae</i>	mycophagous

***Baldratia kermanensis* Möhn, 1969**

Baldratia kermanensis Möhn, 1969: 183.

Larvae cause strongly formed swellings on both sides of the stem of *Anabasis setifera* Moq. (Chenopodiaceae). Only one chamber is inside the gall. Larvae pupate in the galls. Type locality: Kerman, Südost Persien/Iran, 29 September 1892. Holotype: larva. Paratypes: larvae. Möhn (1969: 183) described only the larva. Pupa, male and female are unknown.

OCCURRENCE. South-East Iran, Kerman Province: Kerman (Möhn 1969).

DISTRIBUTION. Asian-Turanian, known from Iran and Kazakhstan.

***Baldratia przewalskii* Marikovskij, 1955**

Baldratia przewalskii Marikovskij, 1955: 310.

Larvae cause one-chambered galls, hardly visible, usually on one side on the internodes of various species of the genus *Haloxylon* (Chenopodiaceae). One generation develops a year. Larvae pupate in the galls. Adults emerge in April and May. Marikovskij (1955) described male and female of this species based on material collected in Kazakhstan. Möhn (1969: 173) described the larva. Host plants: *H. ammodendron*, *H. persicum*, *H. multiflorum*, *H. elegans*, *H. recurvum*.

OCCURRENCE. Sistan and Baluchestan Province, Bampur, 22 April 1951, on *Haloxylon persicum* (Möhn (1969)).

DISTRIBUTION. Asian-Turanian, known from Turkmenistan, Kazakhstan, China, Afghanistan and Iran.

***Baldratia similis* Möhn, 1969**

Baldratia similis Möhn, 1969: 286.

Larvae cause ovoid, strong swellings on the stem of *Anabasis aphylla* L., *A. haussknechti* Bunge and *A. salsa* (C. A. M.) Benth. (Chenopodiaceae). Only one chamber is in each gall. Larvae pupate in the galls. Type locality: Iran: Rayin near Kerman, 13 August 1892; collector is not given. Möhn (1969: 286) described only the larva. Male and female are unknown.

OCCURRENCE. Kerman Province, Rayin near Kerman (Möhn (1969: 186).

DISTRIBUTION. Asian-Turanian, known from Iran, Syria and southern Russia (Sarepta, near Volgograd, August 1878).

***Brassomyia strigosellae* Fedotova, 1994**

Brassomyia strigosellae Fedotova 1994: 125.

Larvae cause leaf bud galls on *Malcolmia africana* (L.) R. Br. (= *Hesperis africana*, *Strigosella africana*) (Brassicaceae) (Fig. 2).

OCCURRENCE. Northern Iran: Azerbaijan-e Gharbi Province, Urmia, vicinity of Tāzehkand-e Qāterchi village, 1330 m a. s. l., 30 April 2007, galls; 11 May 2007, adults, leg. Y. Karimpour. First records from Iran.

NOTE. The host plant *Malcolmia africana* (African mustard) is an annual plant from the Mediterranean which has naturalized elsewhere, including much of western North America, and is invasive in Nevada and Utah. It has recently been shown to be only distantly related to *Malcolmia* proper and has been reclassified in the genus *Strigosella*.

REFERENCE. Fedotova (1994, 2000).

DISTRIBUTION. Asian-Turanian; known from Kazakhstan, Turkmenistan and Iran.

***Camptodiplosis boleti* (Kieffer, 1901)**

Mycodiplosis boleti Kieffer, 1901: 28.

Mycodiplosis poriae Rübsaamen, 1912: 99.

Larvae are mycophagous. They develop in various species of fungi. KIEFFER (1901) found a single female ovipositing on *Boletus confluens* (now correctly *Albatrellus confluens*) (Albatrellaceae).

OCCURRENCE. North-eastern Iran: Golestan Province, Aliabad Katol, 140 m a. s. l., 4 October 2012, 1 ♂, leg. Ali Gol. First record from Iran (Gol et al. in press).

DISTRIBUTION. Euro-Asian; in Europe known to occur in France, Germany, England, Russia (Yakovlev 1994), Czech and Slovak Republics (Skuhrová 2004); Asia: Iran.

***Careopalpis harenosa* (Möhn, 1971)**

Stefaniola harenosa Möhn, 1971: 241.

Larvae cause galls on *Kalidium caspicum* (Linné) Ung.-Sternb. and *Halocnemum strobilaceum* (Pall.) Bieb. (Chenopodiaceae). Galls are partly rounded, partly prolonged-rounded swellings on stems. Galls are either with one chamber, or more frequently with more chambers. Galls have relatively thin walls, but tubular galls may have hard walls. Larvae pupate in the galls. Möhn (1971) described this species based on the larva collected in Azerbaijan (Baku). Male and female are unknown.

OCCURRENCE. Iran, without locality, on *Kalidium caspicum* (Möhn 1971: 241).

DISTRIBUTION. Asian-Turanian, known to occur in Armenia, Azerbaijan, Turkmenistan, Uzbekistan, Kazakhstan; Russia (Astrachan near Caspian Sea) and Iran.

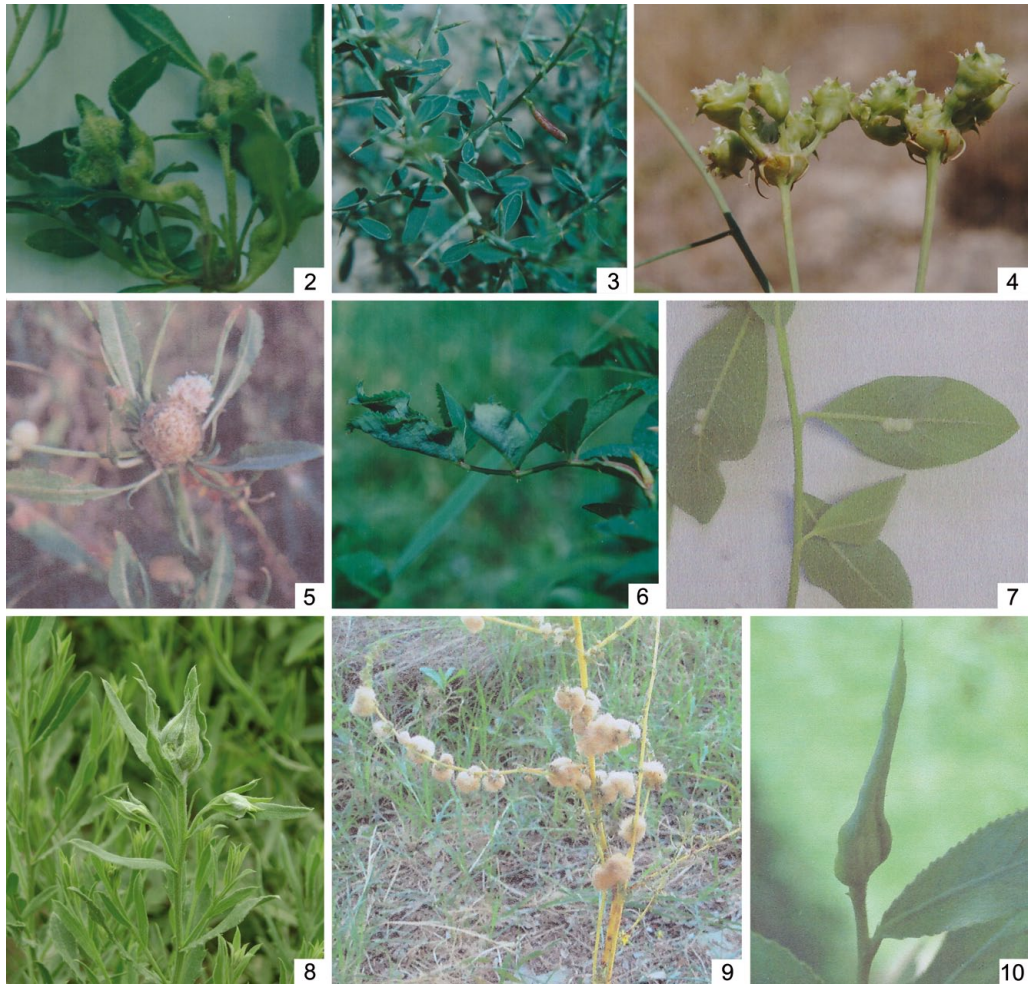
***Clinodiplosis cilicrus* (Kieffer, 1889)**

Diplosis cilicrus Kieffer, 1889: 152.

Larvae are phytosaprophagous and develop in decaying plant matter of various plant species belonging to different plant families. Females lay their eggs on plant tissue, which becomes dry or processes of decay start to develop. Larvae hatch from eggs and develop in such tissues (Skuhrová 1973). She demonstrated on the basis of extensive experiments and analysis of morphological characters of larvae and adults that the species of the genus *Clinodiplosis* Kieffer, 1894 are not

specifically bound to their host plants. On the basis of these studies and analyses she synonymized 34 species under *Clinodiplosis cilicrus*.

OCCURRENCE. Northeastern Iran: Joghatay, 1362 m a. s. l., 7–8 May 2012, 2 ♀♀, hand netting on *Hordeum*; 17 May 2012, light trap, 1 ♀; leg. M. Joghataie. First records from Iran.



Figs 2–10. Galls of gall midges found in Iran. 2 – leaf bud galls on *Malcolmia africana* caused by *Brassomyia strigosellae*. 3 – pod-like gall on leaf of *Alhagi pseudalhagi* caused by *Contarinia desertorum*. 4 – swellings on flower stalks of *Echinophora orientalis* caused by *Contarinia* sp. 5 – globular swelling at vegetative tips of *Cephalaria microcephala* caused by *Janetiella* sp. 6 – folded leaflet galls on *Rosa* sp. caused by *Dasineura rosae*. 7 – small rounded galls on leaf of *Salix aegyptiaca* caused by *Iteomyia capreae*. 8 – leaf bud galls on *Acroptilon repens* caused by *Jaapiella ivannikovi*. 9 – globular galls on *Bassia prostrata* caused by *Kochiomyia kochiae*. 10 – spindle leaf bud galls on *Salix* sp. caused by *Rabdophaga terminalis*. Photos by Y. Karimpour.

DISTRIBUTION. Euro-Asian, known to occur in many countries of Europe and in Siberia (Skuhrová 1973); Asia: Turkey, Armenia, Kazakhstan and Iran.

***Contarinia desertorum* Marikovskij, 1961**

Contarinia desertorum Marikovskij, 1961: 48.

Whitish larvae cause pod-like galls on leaves of *Alhagi pseudalhagi* (Bieb.) Desv. (Fabaceae) (Fig. 3). This species was described by Marikovskij (1961) from Kazakhstan. He reared adults from leaf galls on *Alhagi pseudalhagi* found in a desert in Kzyl-Orda Region in southern Kazakhstan. Galls were found also in Armenia by Mirumian (2011) and in Georgia (Skuhrová et al. 2013).

OCCURRENCE. Northern Iran, Azerbaijan-e Gharbi Province, Urmia, vicinity of Tāzehkand-e Qāterchi village, 1335 m a. s. l., 2–12 July 2009, 12 ♀♀, 8 ♂♂, reared from galls on *Alhagi pseudoalhagi* (Fabaceae) (Karimpour & Skuhrová 2012).

DISTRIBUTION. Asian-Turanian: known to occur in Kazakhstan, Armenia, Georgia and Iran.

***Contarinia tritici* (Kirby, 1798)**

Tipula tritici Kirby, 1798: 232.

Lemon or golden yellow gregarious larvae develop in spikelets of flower clusters of *Triticum vulgare* L. (Poaceae). It is an inconspicuous and often overlooked, but serious pest of wheat. One main generation develops per year but it may develop a numerically small partial second generation. *C. tritici* is a serious pest of wheat in Europe (Darvas et al. 2000).

OCCURRENCE. Tehran Province: Tehran (Farahbakhsh 1961).

DISTRIBUTION. Holarctic, cosmopolitan; Asia: Georgia, Armenia and Iran.

***Contarinia* sp.**

Larvae cause swellings on flower stalks of *Echinophora orientalis* Hedge & Lamond (Apiaceae) (Fig. 4). This is an undescribed species. It will be described in a separate article.

OCCURRENCE. Northern Iran: Azerbaijan-e Gharbi Province, Urmia, vicinity of Kelisā Kandi, 1600 m a. s. l., 1 September 2008, galls, larvae, leg. Y. Karimpour. First record from Iran.

DISTRIBUTION. Asian-Turanian, known to occur only in Iran.

***Cystiphora sonchi* (Vallot, 1827)**

Cecidomyia sonchi: Bremi, 1847: 19.

Yellow-whitish larvae cause pustule galls on the leaves of *Sonchus oleraceus* L. and *S. arvensis* L. (Asteraceae). Two or more generations develop per year. Some larvae pupates in galls, others in the soil. Larvae hibernate in the soil.

OCCURRENCE. Northern Iran, Azerbaijan-e Gharbi Province, Khoy vicinity of Pīrkandī village, 1055 m a. s. l., 15 September 2009, leg. Y. Karimpour (Karimpour & Skuhrová 2012).

DISTRIBUTION. Euro-Asian, known to occur in many countries of Europe (Skuhrová 1986); introduced into Canada for biological control (Peschen et al. 1989); Asia: Turkey, Georgia, Kazakhstan, and Iran.

***Dasineura acrophila* (Winnertz, 1853)**

Cecidomyia acrophila Winnertz, 1853: 233.

White larvae live gregariously and produce galls on leaflets of *Fraxinus excelsior* L. (Oleaceae). The attacked leaflet is folded upwards along the mid-vein, each part becomes thickened and both parts form together a large cavity in which larvae develop. Usually all leaflets on young shoots are attacked. Only one generation develops per year. Larvae hibernate in the soil.

OCCURRENCE. north provinces of Iran (Abai 1984).

DISTRIBUTION. European, known to occur in many countries of Europe, extending to south-western Asia (Georgia, Armenia and northern Iran), and also to North Africa (Algeria).

***Dasineura bayeri* (Rübsaamen, 1914)**

Dasineura bayeri Rübsaamen, 1914: 104.

Larvae cause galls on *Sisymbrium loeselii* L. (Brassicaceae). Numerous white larvae develop in flowers turning them into spongy greyish multi-chambered galls. Sometimes galls are formed in internodes. Larvae spin cocoons and pupate in the galls. Three or four generations develop per year.

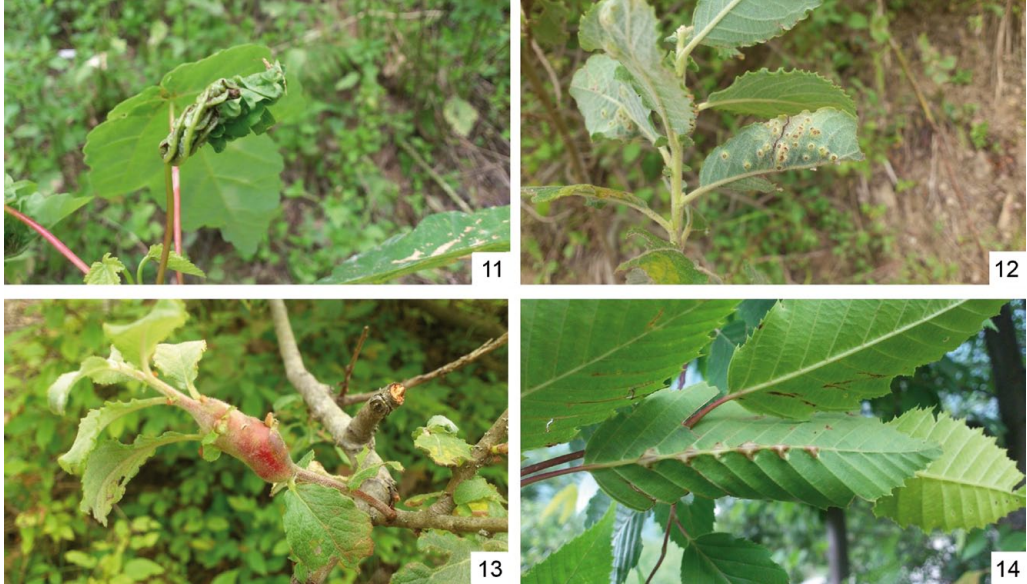
OCCURRENCE. Northern Iran, Azerbaijan-e Gharbi Province, Urmia, vicinity of Tāzehkand-e Qāterchi, 1335 m a. s. l., and Khoy vicinity of Pirkandi village, 1055 m a. s. l., 12–17 June 2010, 2 ♂♂, 3 ♀♀, leg. Y. Karimpour. First record from Iran.

DISTRIBUTION. Euro-Asian; in Europe it was recorded in 11 countries; in Asia it occurs in Armenia, Georgia, Turkey and northern Iran.

***Dasineura euphorbiarum* (Kieffer, 1909)**

Perrisia euphorbiarum Kieffer, 1909: 7.

Larvae develop in fruits of *Euphorbia boissieriana* (Woronow) Prokh. (Euphorbiaceae). Kieffer (1909) described *Dasineura euphorbiarum* from the fruits of *Euphorbia cyparissias* L. Fedotova (2000) did not include any species associated with fruits of *Euphorbia*. We use Kieffer's name for the species developing in fruits of *Euphorbia boissieriana*.



Figs 11–14. Galls of gall midges found in Iran. 11 – wrinkled folded leaf of *Acer pseudoplatanus* caused by *Dasineura irregularis*. 12 – small hemispherical galls on the leaves of *Salix* sp. caused by *Iteomyia capreae*. 13 – large spherical plurilocular swelling on a branch of *Salix* sp. caused by *Rabdophaga salicis*. 14 – swellings along the median vein on leaf of *Carpinus betulus* caused by *Zygiobia carpini*. Photos by Ali Gol.

OCCURRENCE. Northern Iran: Azerbaijan-e Gharbi Province, Urmia, vicinity of Tāzehkand-e Qāterchi, 1335 m a. s. l., 10–15 June 2007, galls, leg. Y. Karimpour. First record from Iran.
DISTRIBUTION. Euro-Asian; galls were also found in Georgia (Skuhrová et al. 2013).

***Dasineura fraxini* (Brems, 1847)**

Cecidomyia fraxini Brems, 1847: 18.

Orange larvae cause swellings of the mid-vein on the leaflets of *Fraxinus excelsior* L. (Oleaceae). Usually one generation, rarely two generations develop per year. Larvae hibernate and pupate in the soil. It is evaluated as a minor pest in Europe (Skuhrová & Roques 2000).

OCCURRENCE. Golestan, central and northern provinces of Iran (Abai 1984).

DISTRIBUTION. European, known to occur in many countries of Europe, extending to south-western Asia, found in Georgia, Armenia and northern Iran, and also in North Africa (Algeria).

***Dasineura irregularis* (Brems, 1847)**

Cecidomyia irregularis Brems, 1847: 30.

Cecidomyia acererispans Kieffer, 1888: 266.

White larvae cause galls on leaves of *Acer pseudoplatanus* L. (Aceraceae). The leaves are wrinkled, curled and rolled upwards and their veins are hypertrophied and slightly swollen (Fig. 11). Two generations develop per year. Larvae pupate in the soil. *D. irregularis* may be locally and occasionally a major pest of young maple trees grown in forest nurseries or in hedges (Skuhrová & Roques 2000).

OCCURRENCE. Northeastern Iran: Golestan Province, Aliabad Katol, 140 m a. s. l., 26 August 2013, galls, 1 ♂, leg. Ali Gol. First record from Iran (Gol et al. in press).

DISTRIBUTION. European, known to occur in many countries of Europe, extending to southwestern Asia (Armenia, Georgia and northern Iran).

***Dasineura rosae* (Brems, 1847)**

Cecidomyia rosae Brems, 1847: 27.

Cecidomyia rosarum Hardy, 1850: 186.

Wachtliella rosarum (Hardy, 1850): auctororum.

Orange coloured larvae cause galls on leaflets of *Rosa canina* L. and other species of *Rosa* (Rosaceae). The attacked leaflet is folded upwards along the midvein and swollen, forming a chamber where larvae develop (Fig. 6). Several generations develop per year. Full-grown larvae leave galls and fall to the soil where they pupate.

OCCURRENCE. Northern Iran, Azerbaijan-e Gharbi Province, Urmia, vicinity of Shīrū Kandī village (Qasemlū valley), 1420 m a. s. l., 5–12 June 2009, galls, adults (Karimpour & Skuhrová 2012).

DISTRIBUTION. Euro-Siberian, known to occur in 31 countries of Europe, found in Siberia and extending to the Far East; found in Kazakhstan, Georgia, Armenia, Turkey and northern Iran.

***Dasineura* sp. 1**

Larvae cause green pointed galls on stem tips of *Euphorbia boissieriana* (Euphorbiaceae).

OCCURRENCE. Northern Iran, Azerbaijan-e Gharbi Province, Urmia, vicinity of Shirū Kandi village (Qasemlū valley), 1420 m a. s. l., 23 June 2009, galls; Urmia, vicinity of Tāzehkand-e Qāterchi village, 5 August 2010, galls, leg. Y. Karimpour. First record from Iran.

DISTRIBUTION. Asian, Iranian.

***Dasineura* sp. 2**

One male was reared from leaf galls caused by *Dasineura irregularis* (Brems, 1847) on *Acer pseudoplatanus* L. (Aceraceae). Larvae of this species lived in the galls as inquiline.

OCCURRENCE. Northeastern Iran: Golestan Province, Aliabad Katol, 140 m a. s. l., 26 August 2013, 1 ♂, leg. Ali Gol. First record from Iran.
DISTRIBUTION. Asian, Iranian.

***Diadiplosis* sp.**

Adults were reared from colonies of *Pseudococcus comstocki* (Hemiptera: Pseudococcidae) on branches of *Morus* sp. (Moraceae).

OCCURRENCE. Iran: East Azerbaijan Province: Tabriz, 1350 m a. s. l., 2011: 3 ♂♂, 1 ♀♀, leg. Nayer Jafari. Adults were sent by Dr. B. Gharali to M. S. for identification. Adults are seriously damaged and identification based on such material is not possible. First record from Iran.

DISTRIBUTION. Asian, Iranian.

***Dicrodiplosis manihoti* Harris, 1981**

Dicrodiplosis manihoti Harris, 1981: 339.

Larvae are predators on various species of coccids (Hemiptera: Pseudococcidae).

OCCURRENCE. Northern Iran, Tehran Province: Tehran, 1100 m a. s. l., 1 June 2005, 8 ♂♂, 8 ♀♀, reared from *Planococcus vovae* on *Juniperus* sp. (Cupressaceae), leg. by Ali Ameri, identified by M. Skuhrová; southern Iran, Fars Province, Darab, 1100 m a. s. l., 17 July 2005, 1♂, 5 ♀♀, reared from *Nipaecoccus viridis* (Newstead, 1894) on *Citrus* sp., leg. by M. Fallahzadeh, identified by M. Skuhrová; Fars Province, Jahrom, 1024 m a. s. l., 8 July 2005, 6 ♂♂, 9 ♀♀, reared from *Maconellicoccus hirsutus* (Green) on *Morus* sp. (Moraceae), leg. by M. Fallahzadeh, identified by M. Skuhrová.

REFERENCE. Asadeh & Mosaddegh (1991).

DISTRIBUTION. Afro-Asian; known to occur in Africa (Senegal and Congo) and in Asia (Oman, Yemen and Iran).

***Endaphis perfida* Kieffer, 1896**

Endaphis perfida Kieffer, 1896: 383.

Larvae are endoparasitoids of aphids *Drepanosiphum platanooides* Schrank (Aphidae, Homoptera) on *Acer pseudoplatanus* L. (Aceraceae) (Kieffer 1896).

OCCURRENCE. Razavi Khorasan Province, Kashmar, 1063 m a. s. l., 2 October 2011, 2 ♂♂, 5 ♀♀, reared from *Aphis punicae* Pass (Hemiptera: Aphididae), leg. H. Sadeghi.

DISTRIBUTION. European, known from UK, France and European part of Russia; first record in Asia – in Iran (Sadeghi et al. 2012).

***Feltiella acarisuga* (Vallot, 1827)**

Cedomyia (sic!) *acarisuga* Vallot, 1827: 95.

Feltiella tetranychii Rübsaamen, 1910: 285.

Therodiplosis persicae Kieffer, 1912: 2.

Larvae feed as predators on red spider mites (Acarina: Tetranychidae). Several generations develop a year. Full-grown larvae spin a white cocoon either on the leaf, or drop to the soil where they pupate. This species is used in biological control of red spider mites.

REFERENCE. Gagné (1995, 2004), Abe et al. (2011).

OCCURRENCE. Iran, Razavi Khorasan Province: Zoshk (Mashhad), 1680 m a. s. l., 9 July 2012, reared from *Tetranychus turkestanii* Ugarov et Nikolskij, 1937 on *Lactuca virosa*, leg. H. Sadeghi, identified by M. Skuhrová (Hornamand et al. 2014). First record from Iran.

DISTRIBUTION. cosmopolitan; it is a widespread species occurring mainly in the Palearctic and Nearctic Regions but known to occur also in other parts of the world (Gagné 1995); Turkey and Iran.

***Halodiplosis araratica* Mirumian, 1991**

Halodiplosis araratica Mirumian, 1991: 45.

A single orange coloured larva develops in leaf bud gall on *Salsola dendroides* Pall. (Chenopodiaceae). Larvae pupate in the galls. Only one generation develops per year.

OCCURRENCE. Iran, Mazandaran Province, Amol (Delarostagh), 20 April 2010, galls, leg. H. Barimani. First record from Iran.

DISTRIBUTION. Asian-Turanian, known to occur in Armenia (Mirumian 2011) and Iran.

***Iteomyia capreae* (Winnertz, 1853)**

Cecidomyia capreae Winnertz, 1853: 291.

At first white, then orange, at maturity red larvae produce small hemispherical galls on the leaves of *Salix caprea* L., *S. aurita* L. and its hybrids and relatives (Salicaceae). The circular opening is on the lower surface of the leaf (Figs 7, 12). Each gall includes one larva. When full-grown, larvae leave galls, drop to the soil where they hibernate. One generation develops per year.

OCCURRENCE. Iran, West Azerbaijan Province, Urmia, 1330 m a. s. l., 15 October 2009: galls situated on the main vein of the leaf of *Salix aegyptica*, leg. Y. Karimpour; North-east Iran: Golestan Province, Aliabad Katol, 140 m a. s. l., 13 September 2013, galls on leaves of *Salix caprea* L., leg. Ali Gol. First records from Iran (Gol et al. in press).

DISTRIBUTION. Euro-Siberian, known to occur in many countries of Europe, extending to Asia – Turkey, Georgia, Kazakhstan, Iran, China and Japan.

***Jaapiella ivannikovi* Fedotova 1985**

Jaapiella ivannikovi Fedotova, 1985: 37.

Pink coloured larvae cause terminal leaf rosettes on stem tips of *Acroptilon repens* (L.) DC (Syn. *Centaurea repens* L.; *Acroptilon picris* (Pallas ex Willdenow) C. A. Meyer; *Centaurea picris* Pallas ex Willdenow; *Rhaponticum repens* (L.) Hidalgo) (Asteraceae) (Fig. 8). Since 2009 *Jaapiella ivannikovi* has been used for biological control of Russian Knapweed (*Acroptilon repens*), noxious weed in the continental states of USA (Firko 2009).

OCCURRENCE. Northern Iran, West Azerbaijan-e Gharbi Province, Urmia, vicinity of Tāzehkand-e Qāterchi village, 1330 m a. s. l., 12–15 July 2012, 5 ♂♂, 10 ♀♀, leg. Y. Karimpour. First record from Iran.

DISTRIBUTION. Asian-Turanian, known to occur in Kazakhstan and Iran.

***Janetiella* sp.**

Larvae develop in globular galls at vegetative tips of *Cephalaria microcephala* Boiss. (Dipsacaceae) covered with whitish hairs (Fig. 5). It is an undescribed species. It will be described in a separate article.

OCCURRENCE. Iran: West Azerbaijan Province, Urmia, 12 July 2009, galls on *Cephalaria microcephala*, leg. Y. Karimpour. First record from Iran.

DISTRIBUTION. Asian-Turanian.

***Kochiomyia kochiae* (Kieffer, 1909)**

Rhopalomyia koehliae Kieffer, 1909: 12.

Misopatha kochiae: Kieffer 1913: 46: justified emendation of *R. koehliae*.

Larvae cause large globular bud galls on *Bassia prostrata* (= *Kochia prostrata* L.) (Chenopodiaceae), densely covered with white hairs (Fig. 9). Larvae pupate in the galls. Two generations develop per year.

OCCURRENCE. Iran, Mazandaran Province, Amol (Baledeh), 21 August 2010, galls, leg. H. Barimani; Azerbaijan-e Gharbi Province, Urmia, vicinity of Band village, 1400 m a. s. l., 20 August 2012, galls, leg. Y. Karipour. First records from Iran.

DISTRIBUTION. Euro-Asian, Pontic-Pannonian, known to occur in Europe: in southern Spain, southern France, Hungary, Bulgaria, Romania, Moldova, southern Russia (Kuban River), Serbia, Ukraine (Crimea), northern Turkey, western Turkmenistan and northern Iran (Skuhrová & Skuhrový 2010, Fig. 23, map).

***Lasioptera carophila* Löw, 1874**

Lasioptera carophila 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. It is a polyphagous species and uses various host plant species and genera of Apiaceae for its development in various parts of its distribution area (Skuhrová 2011b).

OCCURRENCE. Northeastern Iran: Joghatay, 1362 m a. s. l., 19 May 2012, 1 ♀, light trap, host plant not given; leg. M. Joghataie. First record from Iran.

DISTRIBUTION. Euro-Asian, widespread in Europe, south-western Asia and North Africa; known to occur in 34 countries of Europe (Skuhrová 2011b); in North Africa (Morocco, Algeria); in Asia: Turkey, Georgia, Israel, Iraq and Iran.

***Lasioptera umbelliferarum* Kieffer, 1909**

Lasioptera umbelliferarum Kieffer, 1909b: 28.

Larvae cause elongated-rounded swellings on stems and leaf-stalks of species of the genus *Hippomarathrum* (Apiaceae). Each gall consists of many chambers that are covered with mycelium inside. Larvae pupate in the galls. Rübsaamen (1895: 459) gave *Seseli* as the host plant but Möhn (1968: 120) found it only on *Hippomarathrum*. Dorchin & Freidberg (2011) redescribed this species and designated a neotype. They reared adults from galls on *Bilacunaria*, a genus that is closely related to *Seseli*, and *Hippomarathrum*.

OCCURRENCE. Azerbaijan Province, Iran (without locality, Möhn 1968: 123).

DISTRIBUTION. Euro-Asian and Irano-Turanian; known to occur in southern Italy (Sicily), southern Russia (Dagestan), Georgia, Azerbaijan, Iran and Israel.

***Lestodiplosis heterobiae* Barnes, 1928**

Lestodiplosis heterobiae Barnes, 1928: 70.

Larvae were described by Barnes (1928) as predators of larvae of *Rabdophaga heterobia* (Loew, 1850) in galls on *Salix triandra* L. (= *Salix amygdalina* L.) (Salicaceae) in England.

OCCURRENCE. North-eastern Iran: Golestan Province, Aliabad Katol, 10 September 2013, 1 ♂, reared from galls of *Rabdophaga rosaria* on *Salix caprea* L. (Salicaceae), leg. Ali Gol. First record from Iran (Gol et al. in press).

DISTRIBUTION. Euro-Asian, found in England, the Netherlands (Skuhrová 1986) and Iran.

***Lestodiplosis* sp.**

One male was reared from the galls of *Zygiobia carpini* (Löw, 1874) on *Carpinus betulus* L. (Corylaceae).

OCCURRENCE. North-eastern Iran: Golestan Province, Aliabad Katol, 140 m a. s. l., 7 August 2013, 1 ♂, leg. Ali Gol. First record from Iran.

DISTRIBUTION. Asian, found only in Iran.

***Macrolabis saliceti* (Loew, 1850)**

Cecidomyia saliceti Loew, 1850a: 37.

Cecidomyia saliceti: Winnertz 1853: 244.

Reddish-yellow larvae live as inquilines in galls of *Rabdophaga terminalis* (LOEW) on *Salix fragilis* L. (Salicaceae).

OCCURRENCE. Iran: West Azerbaijan Province, Urmia, 1330 m a. s. l., 15 June 2009, 2 ♀♀, reared from galls on *Salix caprea*, leg. Y. Karimpour. First record from Iran.

DISTRIBUTION. Euro-Asian, known to occur in Poland, Germany, Norway, European Russia and Iran.

***Mikiola fagi* (Hartig, 1839)**

Cecidomyia fagi Hartig, 1839: 641.

Solitary white larvae produce large, smooth (hairless) hard galls, pointed at the tip, on the leaves of *Fagus sylvatica* L. (Fagaceae). Inside each gall is one large chamber. Only one generation occurs a year. Full-grown larvae close the opening at the base of the gall by spinning a lid. In autumn the galls separate from leaves and drop to the ground where they remain in the leaf litter until spring of the next year. Larvae hibernate inside galls and pupate there. Occasionally it is a serious pest of young trees in submountain and mountain zones of Central Europe (Skuhrová & Roques 2000).

OCCURRENCE. Iran, Caspian Sea area (Abai 1984).

DISTRIBUTION. European, known to occur in many countries and extending to Caucasus, Armenia, Georgia, Turkey and Iran.

***Mycodiplosis plasmoparae* Rübsaamen, 1906**

Mycodiplosis plasmoparae Rübsaamen, 1906: 234.

Isodiplosis involuta Rübsaamen, 1910: 287.

Isodiplosis deuteria Milne, 1960: 100.

Rübsaamen (1906) reared adults from mycophagous larvae feeding on *Plasmopara viticola* (*Perenospora viticola*) (Perenosporales) on leaves of *Vitis vinifera* L. (Vitaceae) in Germany.

OCCURRENCE. North-eastern Iran: Golestan Province, Aliabad Katol, 140 m a. s. l., 25 August 2013, 1 ♂, reared from galls on *Carpinus betulus* L. (Corylaceae), leg. Ali Gol. First record from Iran (Gol et al. in press).

DISTRIBUTION. European; in Europe known to occur in UK, the Netherlands, Germany, Czech Republic, Russia (European part) and Sweden; in Asia – only in Iran.

***Procontarinia mangiferae* (Felt, 1911)**

Erosomyia mangiferae Felt, 1911: 49.

Procontarinia mangiferae (Felt, 1911).

Mangodiplosis mangiferae Tavares, 1918: 48.

Rhabdophaga mangiferae Mani, 1938: 331.

Erosomyia indica Grover & Prasad, 1966: 7 (all after Gagné 2004: 225).

Larvae cause blister galls on very young leaves of *Mangifera indica* (Anacardiaceae) (Felt 1911) and swellings on growing tips and inflorescences (Gagné, 1994: 147). Later he gave a new synonymy and combination of this species (Gagné 2004: 225). Askari (1993) first recorded the occurrence of this species in Iran (as *Procontarinia* sp.) and later described the biology of this pest in detail (Pezhman & Askari 2004).

OCCURRENCE. Iran: Hormozgan Province (Askari 1993, Pezhman & Askari 2004).

DISTRIBUTION. Oriental; known to occur in India (here native) and Réunion (Indian Ocean); immigrant in St. Lucia, St. Vincent, Trinidad (in the Caribbean) and in Brazil (South America) (Gagné 2004); Iran (immigrant).

***Rabdophaga heterobia* (Loew, 1850)**

Cecidomyia heterobia Loew, 1850: 35.

Several orange-red larvae cause galls on *Salix triandra* L. (= *S. amygdalina* L.) (Salicaceae). Two generations develop per year. Larvae of hibernating generation develop in deformed and swollen male catkins where they also pupate. Larvae of the summer generation develop in small rosettes of hairy leaves at the extremities of the shoots or in swollen lateral buds or lateral rosettes. Barnes (1949) made extensive experiments with host plant range and found that *R. heterobia* (Loew) is specifically associated with *Salix triandra*. Similar galls on *Salix repens*, *S. purpurea* and other species of *Salix* cited in the literature and summarized by Houard (1908–1909) as food plants are caused by another species of the genus *Rabdophaga*.

OCCURRENCE. West Azarbaijan province, Saatloo Poplar Research Station, 2006–2007, various species of *Salix* (Hashemi Khabir et al. 2012).

DISTRIBUTION. Euro-Asian; in Europe known to occur in 21 countries, in Asia in Turkey, Armenia, Iran and Japan). The distribution extends to Turkey, Georgia, Armenia, Kazakhstan and Iran.

***Rabdophaga nervorum* (Kieffer, 1895)**

Dichelomyia nervorum Kieffer, 1895: clxxiv.

Dichelomyia noduli Rübbsaamen, 1895: 177.

Red-yellow larvae develop in spindle-shaped swellings of the midvein on the leaf of *Salix caprea* L. and *S. aurita* L. (Salicaceae). Each swelling contains only one larva. It pupates in the gall. Only one generation develops a year.

OCCURRENCE. North-eastern Iran: Golestan Province, Aliabad Katol, 140 m a. s. l., 28 August 2013, galls on *Salix caprea*, collected by Ali Gol. First record from Iran (Gol et al. in press).

DISTRIBUTION. Euro-Asian; known from 12 countries of Europe; Asia: Kazakhstan and Iran.

***Rabdophaga rosaria* (Loew, 1850)**

Cecidomyia rosaria Loew, 1850: 35.

Cecidomyia cinerearum Hardy, 1850.

A single orange red larva causes a large rosette leaf gall on terminal or lateral buds of *Salix alba* L. and related species of *Salix* (Salicaceae). One generation develops per year. Hibernation and pupation takes place in the gall.

OCCURRENCE. North-eastern Iran: Golestan Province, Aliabad Katol, 140 m a. s. l., 10 October 2013, galls on *Salix caprea* L. (Salicaceae), leg. Ali Gol. First record from Iran (Gol et al. in press).

DISTRIBUTION. Euro-Asian; known from 18 countries of Europe; Asia: Turkey, Armenia, Kazakhstan, Iran; Japan, Korea, China.

***Rabdophaga salicis* (Schrank, 1803)**

Tipula salicis Schrank, 1803: 69.

Orange coloured larvae cause obvious, woody, fusiform or spherical, plurilocular swellings on the branches of *Salix cinerea* L., *S. aurita* L. and *S. caprea* L. (Salicaceae) (Fig. 13). One generation develops per year. Larvae hibernate and pupate in the gall.

OCCURRENCE. North-eastern Iran: Joghatay, 1382 m a. s. l., 7 September 2012, swelling on the shoot of *Salix* sp. with a chamber including one dead larva inside; leg. M. Joghataie; Aliabad Katol, 140 m a. s. l., 4 October 2012, 1 ♂, leg. Ali Gol. First records from Iran (Joghataie et al. 2014).

DISTRIBUTION. Euro-Asian; known from 20 countries of Europe; Asia: Turkey, Armenia, Kazakhstan, Iran, China, Korea, Japan; Africa: Algeria.

***Rabdophaga terminalis* (Loew, 1850)**

Cecidomyia terminalis Loew, 1850: 35.

Orange or reddish larvae live gregariously in spindle galls formed by terminal leaves of *Salix fragilis* L. and *S. alba* L. (Salicaceae). Terminal leaves remain curled, folded and crinkled (Fig. 10). The growth of the shoot is stopped and side shoots develop. Terminal parts of the shoot turns black and dies. Two or more generations develop per year. Larvae pupate partly in the galls, partly in the soil.

OCCURRENCE. Iran, West Azerbaijan Province, Urmia, 1330 m a. s. l., June 2009, galls on *Salix* sp., leg. Y. Karimpour. First record from Iran.

DISTRIBUTION. Euro-Asian, known from 21 countries of Europe; Asia: Turkey, Georgia, Armenia, Kazakhstan, Iran and Japan.

***Resseliella oculiperda* (Rübsaamen, 1893)**

Diplosis oculiperda Rübsaamen, 1893: 161.

Pink to red larvae live between bud grafts and the stock of cultivated *Rosa*-species and fruit trees, above all of *Pyrus communis* L. and *Malus sylvestris* Mill. (Rosaceae). The larvae feed on the sap between the two layers of cambium. Two or three generations develop per year. Larvae pupate in the soil. It is classed as a locally serious pest, especially on apples and roses (Darvas et al. 2000).

OCCURRENCE. Iran: Khuzestan Province (Anonymous 1981).

DISTRIBUTION. European, known from 11 countries; and from Iran.

***Rhopalomyia botryosa* Fedotova, 1984**

Rhopalomyia botryosa Fedotova, 1984: 34.

Larvae cause galls on stems of *Artemisia scoparia* Waldst. et Kit. (Asteraceae). Galls are composed of swollen flower buds and accumulate on stems and on shortened shoots.

OCCURRENCE. Iran, Mazandaran Province, Amol (Baledeh, Asbchar), 6 September 2010, galls, leg. H. Barimani. First record from Iran.

DISTRIBUTION. Asian-Turanian, known from Kazakhstan and Iran.

***Rhopalomyia efremovi* (Fedotova, 1999)**

Dracunculomyia efremovi Fedotova, 1999: 1189.

Rhopalomyia efremovi (Fedotova, 1999): Gagné 2004: 242.

Larvae cause spindle swellings on stems of *Artemisia dracunculus* L. (Asteraceae).

OCCURRENCE. North-eastern Iran: Kalateh Ghorban Ali (Joghatay), 1362 m a. s. l., 18 May 2012, spindle swelling of a part of side shoot of *Artemisia* sp., 15 mm long, 10 mm broad, inside with a chamber; outer walls of the gall are smooth; without larvae when collected; leg. M. Joghataie. First record from Iran (Joghataie et al. 2014).

DISTRIBUTION. Asian-Turanian, known to occur in Kazakhstan and Iran.

***Rhopalomyia hispanica* Tavares, 1904**

Rhopalomyia hispanica Tavares, 1904: 295.

Larvae cause globular or pitcher-shaped bud galls on *Artemisia herba-alba* Asso (Asteraceae), inside with a small ovoid inner gall forming a chamber where one larva develops and also pupates. The gall is small, elongate, 7 mm long, 4 mm broad, densely covered with short setae and has thin walls.

OCCURRENCE. Iran, Yazd Province, 25 March 2011 galls, 9 April 2011, 2 ♂♂, 9 ♀♀, 3 pupal exuviae, leg. A. Mohammadi. First record from Iran.

DISTRIBUTION. Euro-Asian, recorded only from Spain (Skuhravá et al. 2006) and Iran.

***Rhopalomyia monogynasphaera* (Fedotova, 1999)**

Navasiella monogynasphaera Fedotova, 1999: 658.

Rhopalomyia monogynasphaera Fedotova, 1999: Gagné 2004: 245

Larvae cause rounded galls on shoots of *Artemisia monogyna* (Asteraceae). Fedotova (1999) found these galls in Karakum Desert and described adults under the genus name *Navasiella* Tavares, 1919. Gagné (2004) synonymized all genera established by Fedotova under the genus *Rhopalomyia* Rübsaamen, 1892.

OCCURRENCE. North-eastern Iran, Kalateh Ghorban Ali (Joghatay), 1362 m a. s. l., 18 May 2012, rounded gall on thin shoot of *Artemisia* sp., 8–10 mm in diameter, composed of woollen fibres; leg. M. Joghataie. First record from Iran (Joghataie et al. 2014).

DISTRIBUTION. Asian-Turanian; found in Kazakhstan and Iran.

***Rhopalomyia navasi* Tavares, 1904**

Rhopalomyia navasi Tavares, 1904: 296.

Misopatha navasi (Tavares, 1904): Kieffer 1913: 46 (Genera Insectorum).

Eudictyomyia navasi (Tavares, 1904): Tavares 1920: 55 (redescription).

Rhopalomyia navasi Tavares, 1904: 296; Gagné 1975: 483; Skuhravá 1986: 194; Gagné 2004: 246; 2010: 361; Gagné & Jaschhof 2014: 325.

Larvae cause very nice, densely white pubescent, galls on *Artemisia herba-alba* Asso and *A. incana* (L.) Druce (Asteraceae). Galls are situated on stem sides. Several chambers occur inside each gall. Only one larva develops in each chamber where it also pupates.

OCCURRENCE. Iran, Yazd Province, 25 March 2011, galls, 9 April 2011, 3 ♂♂, 6 ♀♀, 4 pupal exuviae, leg. A. Mohammadi. First record from Iran.

DISTRIBUTION. Euro-Asian and Mediterranean, known to occur in Spain, Romania, Morocco, Algeria, Tunisia, Libya, Egypt, Syria and Iran.

***Stefaniola deformans* (Marikovskij, 1953)**

Haloxylonomyia deformans Marikovskij, 1953: 333.

Stefaniola deformans (Marikovskij, 1953): Möhn 1971: 212.

Larvae cause spindle galls on two or three-year old branches of *Haloxylon ammodendron* (C. A. M.) Bunge, *H. aphyllum* (Minkv.), *H. elegans* and *H. multiflorum* Bunge (Chenopodiaceae). Galls have hard walls and are black inside. Each gall has only one chamber. Larvae hibernate in galls where they pupate in the spring. Adults emerge in May. One generation develops per year.

OCCURRENCE. Persien (now: Iran, without locality), 1847–1849, on *Haloxylon elegans* (Möhn 1971: 213).

DISTRIBUTION. Asian-Turanian; known to occur in Kazakhstan, Turkmenistan, Uzbekistan, Afghanistan and Iran.

***Stefaniola excelsa* Möhn, 1971**

Stefaniola excelsa Möhn, 1971: 235.

Larvae cause fruit galls and swellings on stems of *Aellenia glauca* (Bieb.) and *A. subaphylla* (C. A. M.) (Chenopodiaceae). Attacked fruits have many elongated chambers inside. Swellings on stems also have elongated chambers. The species was described based on the material (holotype larva) originating from Armenia. Male and female are unknown.

OCCURRENCE. Tehran Province: Ravendeh near Keredi, 18 September 1948; Rud Shar, southwards of Teheran, 2 November 1948; Darga-Yi Namak, 26 November 1948 (Möhn 1971).

DISTRIBUTION. Asian-Turanian; known to occur in Armenia, Kazakhstan, Turkmenistan, Uzbekistan and Iran.

***Stefaniola fructua* Möhn, 1971**

Stefaniola fructua Möhn, 1971: 234.

Larvae cause fruit galls and stem swellings on *Aellenia glauca* (Bieb.) and stem swellings on *Aellenia cinerascens* (Moq.) Aellen (Chenopodiaceae). Fruit galls have many isolated chambers inside and galls on stems have elongated chambers. Pupation takes place in the gall. Type locality: Tal des Hableh-Rud, Zentral-Elburs/Iran. Male and female are unknown.

OCCURRENCE. Iran, Alburz Province, Tal des Hableh-Rud, Zentral-Elburs; Shahabad, 3 August 1940; Keredj, Zentral-Elburs, 18 September 1948 (Möhn 1971: 234).

DISTRIBUTION. Asian-Turanian; known to occur in Kazakhstan, Turkmenistan, Azerbaijan and Iran.

***Stefaniola furtiva* (Marikovskij, 1953)**

Haloxylonomyia furtiva Marikovskij, 1953: 338.

Stefaniola furtiva (Marikovskij, 1953): Möhn 1971: 228.

Larvae cause hardly visible swellings on internodes of green stems of *Haloxylon ammodendron* (C. A. M.) Bunge and *H. aphyllum* (Mink) Iljin (Chenopodiaceae). In each gall there are one to four chambers which are situated laterally, not in the centre of the gall. Larvae pupate in the galls. Marikovskij (1953) described this species based on adults collected in Kazakhstan and Möhn (1971) described and illustrated morphological characters of the larva.

OCCURRENCE. Iran: Province Yazd, Bāmbis, 27 March 1892; Khorasan Province, Tabas, 26 November 1963 (Möhn 1971: 228).

DISTRIBUTION. Asian-Turanian; known to occur in Kazakhstan, Turkmenistan and Iran.

***Stefaniola gigas* (Marikovskij, 1953)**

Haloxylonomyia gigas Marikovskij, 1953: 336.

Stefaniola gigas Marikovskij, 1953: Möhn 1971: 221.

Larvae cause rounded swellings of average 3–8 mm on one-year=old, green branches of *Haloxylon ammodendron* (C. A. M.) Bunge and *H. aphyllum* (Minkv.) Iljin. (Chenopodiaceae). Swollen parts include one to four isolated chambers. Larvae hibernate in galls and pupate there in the spring. Adults emerge in May. One generation develops a year. Marikovskij (1953) described this species based on adults from Kazakhstan and Möhn (1971: 221) described the larva from Iran.

OCCURRENCE. Iran (Gagné 2004: 206, Möhn 1971: 221).

DISTRIBUTION. Asian-Turanian; known to occur in Kazakhstan, Turkmenistan, Uzbekistan, Mongolia and Iran.

***Stefaniola spinosa* Möhn, 1971**

Stefaniola spinosa Möhn, 1971: 236.

Larvae cause galls on fruits, stems and leaves of *Aellenia glauca* (Bieb.) and *A. subaphylla* (C. A. M.) (Chenopodiaceae). Fruits are slightly swollen. Attacked fruits and fruit bases have elongated chambers inside where larvae develop. Larvae pupate in the galls.

Möhn (1971: 236) described a larva of this species from the type locality Sharad-Bustan in Iran. Male and female are unknown.

OCCURRENCE. Iran: Alburz Province, Sharad-Bustan; Keredj, Zentral-Elburs, 18 September; Tal des Hableh/Rud, Zentral Elburs, 31 August 1948; Damghan/Jemnan, 30 June 1937 (Möhn 1971: 236).

DISTRIBUTION. Asian-Turanian; known to occur in Iraq and Iran.

***Zygiobia carpini* (Löw, 1874)**

Cecidomyia carpini F. Löw, 1874: 322.

White larvae produce swellings along the median vein and side veins of the leaves of *Carpinus betulus* L. (Corylaceae) (Fig. 14). Each swelling contains one larva. In autumn the larvae leave the galls and hibernate in the soil. One generation develops per year.

OCCURRENCE. Northeastern Iran: Golestan Province, Aliabad Katol, 140 m a. s. l., 26 September 2013, galls on the leaf of *Carpinus betulus* L. (Corylaceae), leg. Ali Gol. First record from Iran (Gol et al. in press).

DISTRIBUTION. Euro-Asian, known to occur in 22 countries of Europe; Asia: Turkey, Armenia, Georgia and Iran.

Subfamily Porricondylinae

***Asynapta phragmitis* (Giraud, 1863)**

Cecidomyia phragmitis Giraud, 1863: 1260.

Ruebsaamenia harundinea Marikovskij 1961: 44.

Larvae live in stems of *Phragmites australis* L. (Poaceae), usually in association with larvae of *Lipara lucens* (Meigen, 1830) (Diptera: Chloropidae) (Panelius 1965).

OCCURRENCE. West Azerbaijan Province, Urmia, 1330 m a. s. l., May 2011, 1 ♂, 2 ♀♀, leg. Y. Karimpour. First record for Iran.

DISTRIBUTION. Euro-Asian. It occurs in Europe (UK, the Netherlands, Sweden, Latvia, Poland and Austria); in Asia (Kazakhstan) (Skuhravá 1986, Fedotova 2000), in Africa (Egypt) (Skuhravá et al. 2014) and in Iran.

Subfamily Micromyinae

***Campylomyza flavipes* Meigen, 1818**

Campylomyza flavipes Meigen, 1818: 102.

Adults fly in forests, and in meadows, pastures and fields from lowlands up to mountains, in spring and in autumn. Larvae are mycophagous or mycosaprophagous.

OCCURRENCE. North-eastern Iran, Khorasan Province, Joghatay, 1362 m a. s. l., 4 August 2012, 3 ♂♂, 2 ♀♀; caught in corn and alfalfa fields; leg. M. Joghataie. First record for Iran (Joghataie et al. 2014).

DISTRIBUTION. Holarctic; adults occur in various environments (Jaschhof 1998).

***Micromya lucorum* Rondani, 1840**

Micromya lucorum Rondani, 1840: 23.

Adults fly in forests, and in meadows, pastures and fields. Larvae are mycophagous or sapromycophagous (Jaschhof 1998).

OCCURRENCE. North-eastern Iran, Khorasan Province, Joghatay, 1362 m a. s. l., 12 July 2012, 3 ♂, caught on corn field; leg. M. Joghataie. It is the first record for Iran (Joghataie et al. 2014).

DISTRIBUTION. Holarctic (Jaschhof 1998).

DISCUSSION

Number of known species forming present fauna

The known gall midge fauna of Iran is composed of 61 species belonging to 33 genera. Five species are identified only to the genus level: one species to *Contarinia*, two species to *Dasineura*,

Table 2. Fauna of the family Cecidomyiidae of Iran and species which also occur in seven adjacent countries, in Georgia and Kazakhstan, and in Germany and the Czech Republic. Abbreviations used: AFG – Afghanistan, ARM – Armenia, AZ – Azerbaijan, CZ – Czech Republic, D – Germany, GE – Georgia, IR – Iran, IRQ – Iraq, KZ – Kazakhstan, PK – Pakistan, TM – Turkmenistan, TU – Turkey

species of gall midges	country												
	IR	AZ	ARM	TR	IRQ	TM	AFG	PK	GE	KZ	D	CZ	
<i>Aphidoletes aphidimyza</i> Rondani, 1847	+			+					+	+	+	+	
<i>Asphondylia anatolica</i> Skuhravá, 1998	+			+									
<i>Asynapta phragmitis</i> (Giraud, 1863)	+												
<i>Baldratia aelleni</i> Möhn, 1969	+												
<i>Baldratia anabasis</i> Möhn, 1969	+									+			
<i>Baldratia kermanensis</i> Möhn, 1969	+									+			
<i>Baldratia przewalskii</i> Mar., 1955	+					+				+			
<i>Baldratia similis</i> Möhn, 1969	+												
<i>Brassomyia strigosellae</i> Fedotova 1994	+					+				+			
<i>Campylomyza flavipes</i> Meigen, 1818	+										+	+	
<i>Camptodiplosis boleti</i> Kieffer, 1901	+										+	+	
<i>Careopalpis harenosa</i> (Möhn, 1971)	+	+	+			+				+			
<i>Clinodiplois cilicrus</i> (Kieffer, 1889)	+		+	+						+	+	+	
<i>Contarinia desertorum</i> Mar., 1961	+		+							+			
<i>Contarinia tritici</i> (Kirby, 1798)	+		+						+		+	+	
<i>Contarinia</i> sp. (<i>Echinophora orientalis</i>)	+												
<i>Cystiphora sonchi</i> (Vallot, 1827)	+			+					+	+	+	+	
<i>Dasineura acrophila</i> (Winnertz, 1853)			+						+		+	+	
<i>Dasineura bayeri</i> Rübsaamen, 1914)	+		+	+					+		+	+	
<i>Dasineura euphorbiarum</i> (Kieffer, 1909)	+												
<i>Dasineura fraxini</i> (Bremi, 1847)	+		+						+		+	+	
<i>Dasineura irregularis</i> (Bremi, 1847)	+		+						+		+	+	
<i>Dasineura rosae</i> (Bremi, 1847)	+		+	+					+	+	+	+	
<i>Dasineura</i> sp.1 (<i>Euphorbia boissieriana</i>)	+												
<i>Dasineura</i> sp. 2 (<i>Acer pseudoplatanus</i>)	+												
<i>Diadiplosis</i> sp.	+												
<i>Dicrodiplosis manihoti</i> Harris, 1981	+												
<i>Endaphis perfida</i> (Kieffer, 1896)	+												
<i>Feltiella acarisuga</i> (Vallot, 1827)	+			+							+	+	
<i>Halodiplosis araratica</i> Mirumian, 1991	+		+										
<i>Iteomyia capreae</i> (Winnertz, 1853)	+			+					+	+	+	+	
<i>Jaapiella ivannikovi</i> Fedotova, 1985	+									+			
<i>Janetiella</i> sp. (<i>Cephalaria</i>)	+												
<i>Kochiomyia kochiae</i> (Kieffer, 1909)	+			+									
<i>Lasioptera carophila</i> Löw, 1874	+			+					+		+	+	
<i>Lasioptera umbelliferarum</i> Kffr, 1909	+	+							+				
<i>Lestodiplosis heterobiae</i> Barnes, 1928	+												
<i>Lestodiplosis</i> sp. (<i>Carpinus betulus</i>)	+												
<i>Macrolabis saliceti</i> (Loew, 1850)	+										+	+	
<i>Mikiola fagi</i> (Hartig, 1839)	+		+	+					+		+	+	
<i>Micromya lucorum</i> Rondani, 1840	+										+	+	
<i>Mycodiplosis plasmoparae</i> Rübs., 1906	+										+	+	
<i>Procontarinia mangiferae</i> (Felt, 1911)	+												
<i>Rabdophaga heterobia</i> (Loew, 1850)	+		+	+					+	+	+	+	
<i>Rabdophaga nervorum</i> (Kieffer, 1895)	+									+	+		
<i>Rabdophaga rosaria</i> (Loew, 1850)	+		+	+						+	+	+	
<i>Rabdophaga salicis</i> (Schrank, 1503)	+		+	+						+	+	+	
<i>Rabdophaga terminalis</i> (Loew, 1850)	+		+	+					+	+	+	+	
<i>Resseliella oculiperda</i> (Rübs., 1893)	+										+	+	
<i>Rhopalomyia botryosa</i> Fedotova 1984	+									+			
<i>Rhopalomyia efremovi</i> Fedotova, 1999	+									+			

species of gall midges	country											
	IR	AZ	ARM	TR	IRQ	TM	AFG	PK	GE	KZ	D	CZ
<i>Rhopalomyia hispanica</i> Tavares, 1904	+											
<i>Rhopalomyia monogynasphaera</i> Fedotova, 1999+										+		
<i>Rhopalomyia navasi</i> Tavares, 1904	+											
<i>Stefaniola deformans</i> (Mar., 1953)	+					+	+			+		
<i>Stefaniola excelsa</i> Möhn, 1971	+		+			+				+		
<i>Stefaniola fructua</i> Möhn, 1971	+	+				+				+		
<i>Stefaniola furtiva</i> (Marikovskij, 1953)	+					+				+		
<i>Stefaniola gigas</i> (Marikovskij, 1953)	+					+				+		
<i>Stefaniola spinosa</i> Möhn, 1971	+				+							
<i>Zygiobia carpini</i> (Löw, 1874)	+		+	+					+		+	+
number of species of the fauna	61	11	96	116	9	205	6	10	123	819	686	559
number of shared (common) species		3	17	16	1	8	1	0	15	25	25	24

one species to *Janetiella* and one species to *Diadiplosis*. It is necessary to obtain better material for identification of these species. Gall midges are associated with 50 host plant species which belong to fifteen plant families (Table 1).

In Iran the number of recorded gall midge species increased importantly in two periods: in the second half of the twentieth century when the occurrences of twelve species were given by Möhn (1966–1971) and in the first decade of the 21st century when intensive investigations were carried out in northern part of the country that resulted in the discovery of thirty six species new to the Iranian fauna (Karimpour & Skuhrová 2012, Sadeghi et al. 2012, Gol et al. in press, Joghataie et al 2014).

The number of species in the Iranian gall midge fauna is not high at present in comparison with seven adjacent countries (Table 2). It occupies a position in the middle from the point of view of species richness of gall midge faunas: 205 species are known to occur in Turkmenistan, 116 species in Turkey, 96 species in Armenia, 11 species in Azerbaijan, ten species in Pakistan, nine species in Iraq and six species in Afghanistan. These records mainly reflect the limited extent to which Cecidomyiidae have been studied in these countries and it seems certain that many more are yet to be discovered and recorded. Therefore, these numbers cannot be taken as absolute measures of species richness.

Species richness of gall midges is influenced mainly by geographic and altitudinal position of the areas under study that are associated with changing climatic variables, including sunshine, temperature and rainfall; by biotic factors, i.e. mainly by the type of vegetation cover and composition of natural vegetation; and by factors involving various human activities, and also by the number of investigations, by selection of suitable sites for collection and by ability, experience, knowledge and enthusiasm of researchers (Skuhrová & Skuhrový 2010).

It is necessary to appreciate the progress in the studies of gall midges in Iran in the last thirty years. In 1986 only nine species of gall midges were known (Skuhrová 1986, Skuhrová et al. 1984), and in 2014, after about thirty years, the species number increased nearly seven times, up to 61 species. This progress was influenced mainly by the interest of several researchers working at universities in northern Iran. Thirty six species are recorded for the first time in northern Iran, mainly in the surroundings of Urmia and Mashhad during investigations in the years 2007–2014 (Karimpour & Skuhrová 2012, Sadeghi et al. 2012, Joghataie et al. 2014, Gol et al. in press).

The known Iranian fauna of gall midges is composed mostly of phytophagous species (48 species, 79%) causing galls on various host plants, of 7 zoophagous species (11%) and 6 mycophagous

species (10%). Larvae of *Aphidoletes aphidimyza*, *Diadiplosis* sp., *Dicrodiplosis manihoti*, *Endaphis perfida*, *Feltiella acarisuga*, *Lestodiplosis heterobiae* and *Lestodiplosis* sp. are zoophagous and attack various small arthropods; larvae of *Camptodiplosis boleti*, *Clinodiplosis cilicrus*, *Mycodiplosis plasmoparae*, *Asynapta phragmitis*, *Campylomyza flavipes* and *Micromyza lucorum* are mycophagous or sapro-mycophagous and feed on various fungi.

The two most species rich genera are *Dasineura* with 8 species and *Stefaniola* with 6 species, followed by *Baldratia*, *Rabdophaga* and *Rhopalomyia*, each with 5 species, *Contarinia* with 3 species, *Lasioptera* and *Lestodiplosis* with 2 species; each of the remaining genera includes only one species.

Zoogeography

The gall midge species occurring in Iran may be divided, according to their overall distribution in the world, into eight zoogeographic units: Asian-Turanian, Palaearctic (Euro-Asian), European, Euro-Siberian, Mediterranean, Holarctic, Afro-Asian and Oriental (Indomalayan).

Asian-Turanian species have their main distribution area in semi-deserts of Central Asia, in the area between the Aral and Caspian Seas, mainly in Kazakhstan, and extend from there up to Armenia, Georgia, Azerbaijan and the northern part of Iran. In Iran most species – twenty six (43%) – belong in this group: six species of *Stefaniola* and five species of *Baldratia*, *Careopalpis harenosa*, *Halodiplosis araratica*, all causing galls on various species and genera of Chenopodiaceae, three species of *Rhopalomyia* (*R. botryosa*, *R. efremovi*, *R. monogynasphaera*), inducing galls on host plants of Asteraceae, and other species associated with host plants of various plant families. *Jaapiella ivannikovi* causing galls on *Acroptilon repens* is used for biological control of Russian Knapweed (*Acroptilon repens*), a serious weed in the continental states of USA (Firko 2009).

Palaearctic or Euro-Asian species inhabit Europe or the Eurosiberian subregion and occur also in Asia, at least in one of the other Palaearctic subregions, i.e. Central Asian or East Palaearctic subregions. In Iran 17 species (28%) belong in this group. Typical representatives of this group are five species of the genus *Rabdophaga* associated with various species of *Salix*, *Lasioptera carophila* causing galls on various genera of Apiaceae, *Dasineura bayeri* inducing galls on *Sisymbrium loeselii* and *Kochiomyia kochiae* causing galls on *Bassia prostrata* (*Kochia prostrata*). All these species occur in Europe abundantly and their distribution area reaches to Asia.

European species occur only in Europe and are considered to have their centres of origin in Europe. They may reach marginal parts of Asia. In Iran 7 species (11.4%) belong in this group. Five of them are associated with trees and shrubs: *Dasineura acrophila* and *D. fraxini* causing galls on leaves of *Fraxinus excelsior*, *Dasineura irregularis* galls on *Acer pseudoplatanus*, *Mikiola fagi* galls of *Fagus sylvatica*, *Resseliella oculiperda* associated with cultivated *Rosa*-species and fruit trees, mycophagous species *Mycodiplosis plasmoparae* and zoophagous species *Endaphis perfida*.

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. In Iran only two species (3.2%) belong in this group: *Iteomyia capreae* causing galls on leaves of *Salix caprea* and *Dasineura rosae* inducing galls on leaflets of various species of *Rosa*.

Mediterranean species have centres of origin in the Mediterranean area. They occur along the shores of the Mediterranean and are associated with Mediterranean host plants. Only two species (3.2%) of this group occur in Iran: *Rhopalomyia navasi* and *Rhopalomyia hispanica*, both causing galls on *Artemisia herba-alba*.

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 Iran five species (8%) belong in this group: *Contarinia tritici* associated with cereals, two zoophagous species *Aphidoletes aphidimyza* and *Feltiella acarisuga*, and two mycophagous species *Campylomyza flavipes* and *Micromyza lucorum*.

Afro-Asian species occur in Africa and also in Asia. In Iran only one species belongs in this group – *Dicrodiplosis manihoti* larvae of which are predators on various species of coccids (Hemiptera: Pseudococcidae). *D. manihoti* is known from Africa (Senegal, Congo, Egypt) and from Asia (Oman and Iran).

Oriental (Indomalayan) species occur in south-eastern Asia, i.e. in India and Asia south of the Himalayan–Tibetan Mountains. In Iran only one species of gall midge occurs – *Procontarinia mangiferae* causing blister galls on leaves and swellings on growing tips and inflorescences of *Mangifera indica*, the plant species native to India.

Similarity of faunas

The similarity or relationships in composition of the gall midge fauna of Iran and seven adjacent countries – Azerbaijan, Armenia, Turkey, Iraq, Turkmenistan, Afghanistan and Pakistan, and two not immediately adjacent but relatively closely situated countries – Georgia and Kazakhstan, is shown in Table 2 and Fig. 15. The similarity may be shown by number of common (or shared) species, that are such species occurring in two adjacent or closely situated countries. The number

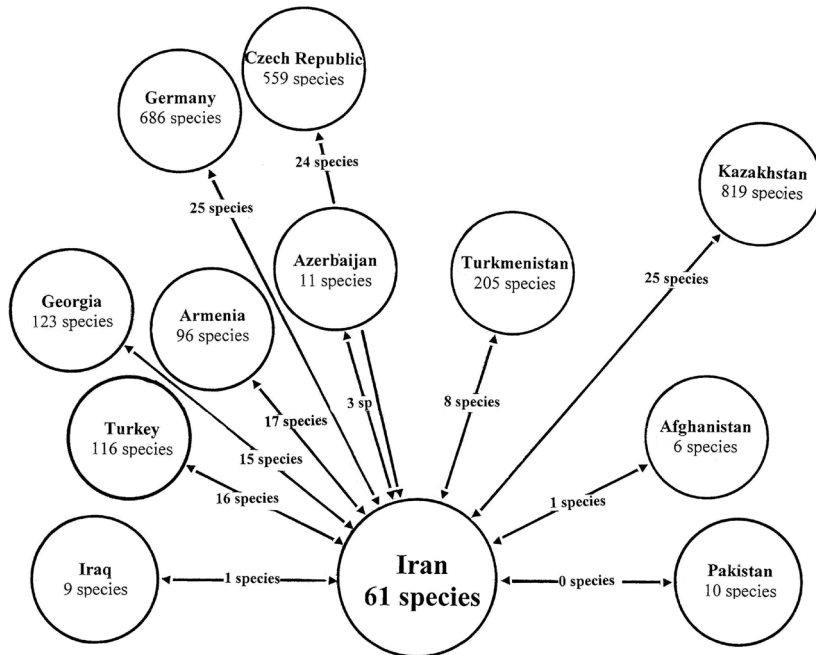


Fig. 15. Similarity in the composition of the gall midge fauna of Iran, to adjacent and some other countries, shown as numbers of shared species.

of common species indicates a similarity of areas and of faunal composition: the higher the number of common species means a higher degree of similarity of the areas and faunas.

It is necessary to emphasize that the number of common species is influenced mainly by the geographical position of the country, country area size, species number of gall midge fauna and by the level of knowledge of the country, including large numbers of explored localities (Skuhrová & Skuhrový 2010).

We compared species of the Iranian fauna with gall midge species known from seven countries adjacent to Iran and with slightly more distant countries, Georgia and Kazakhstan, faunas of which are relatively well known. Not all countries adjacent to Iran are well explored, which is evident from the very low species numbers of Azerbaijan, Iraq, Afghanistan and Pakistan (Table 3). It is clear that country area size is not so important: in Pakistan, at the third place after area size with 803,940 km², has been recorded only ten species of gall midges. On the other hand, in Armenia with an area of 29,800 km² 96 species have been recorded due to the intensive investigations of Mirumian (2011).

The highest number of shared species – 25 species of gall midges – occurs between Iran and Kazakhstan, 16 species between Iran and Armenia and also 16 species between Iran and Turkey, 15 species between Iran and Georgia and eight species between Iran and Turkmenistan. Only three species occur between Iran and Azerbaijan, one species between Iran and Iraq and also Iran and Afghanistan, and no shared species was recorded between Iran and Pakistan. The reason of such low and of absence of shared species is probably connected with the fact that these countries are poorly explored.

A relatively large number of shared species (25) occur between Iran and Kazakhstan, spread in Central Asia. It is influenced mainly by the fact that Kazakhstan is a very large country with various landscape types and its gall midge fauna includes a large number – 819 species. Some shared species are associated with host plants occurring in desert and semidesert areas of this country and have reached to Iran along the Caspian Sea or from Turkmenistan.

Also a relatively high number of shared species (15 and 16) were recorded between Iran and three countries – Georgia, Turkey and Armenia – where intensive investigations were carried out in several last years.

In addition, we compared the composition of the gall midge fauna of Iran with faunas of two European countries, their faunas are well explored: Germany with 686 recorded species (Skuhrová et al. 2014) and the Czech Republic with 559 recorded species (Skuhrová 2009). We found that 25 shared species of gall midges occur between Iran and Germany and 24 species between Iran and the Czech Republic. These species usually occupy large distribution areas in Europe where they occur abundantly and reach up to Caucasus and to the shore of Caspian Sea and up to northern part of Iran.

Knowledge of the geographical distribution of many species of gall midges gradually broadens and it is possible to define them with more precision on the basis of new information and records obtained during investigations in previously little studied areas and countries.

Results obtained in northern Iran during several recent years enrich importantly our knowledge of the Iranian fauna and distribution of gall midge species and extend our knowledge that has been traditionally based mainly on the findings obtained in Europe where investigations of gall midges have a long tradition (Skuhrová & Skuhrový 2010, Skuhrová et al. 2014).

Biogeography

The territory of Iran is composed of two large biogeographical provinces: the Caucaso-Iranian Highlands Province, which includes the northern and western parts of Iran, and the Iranian Desert Province including central and southern parts of Iran (Udvardy 1975, Djamali et al. 2011).

Table 3. Number of species and number of shared species with Iran in gall midge faunas of several countries of Asia arranged by land areas in comparison with two countries of Europe

country	area size in km ²	No. species	No. shared species	reference
Asia				
Kazakhstan	2,717,300	819	25	Fedotova 2000
Iran	1,648,100	61		
Pakistan	803,900	10	0	Gagné & Jaschhof 2010
Turkey	783,500	116	16	Skuhrová & Skuhrový 2014
Afghanistan	652,200	6	1	Skuhrová 1986
Turkmenistan	488,100	205	8	Fedotova 2000
Iraq	437,100	9	1	Skuhrová 1986
Azerbaijan	86,600	11	3	Skuhrová 1986
Georgia	69,700	123	15	Skuhrová et al. 2013
Armenia	29,800	96	17	Mirumian 2011
Europe				
Germany	357,000	686	25	Skuhrová et al. 2014
Czech Republic	78,800	559	24	Skuhrová 1986, 2009

Gall midges and their galls were collected and recorded at about twenty localities or areas which are not evenly distributed over the territory of Iran (Fig. 1). Twelve localities are situated in the Caucaso-Iranian Highlands Province and eight in the Iranian Desert Province, or at its marginal parts. Unfortunately, the names of localities in the literature are not given for many species, often it is given only as “in Iran”. Temperate forests with various tree species of *Quercus*, *Fraxinus*, *Ulmus*, *Acer* and *Salix* occur in the Caucaso-Iranian Highlands Province and salt deserts without plants in the Iranian Desert Province.

Of sixty one species of gall midges known to occur in Iran at present, forty six species were found in the Caucaso-Iranian Highlands Province, mainly in the most northern part, and only fifteen species in the semidesert areas of the extensive Iranian Desert Province.

The highest number – 14 species of gall midges – was recorded in the north-western part of Iran, at Urmia and its surroundings (at altitudes of 1330 m a. s. l., in West Azerbaijan Province), 9 species at Aliabad Katol near the Caspian Sea (98 – 140 m a. s. l., in Golestan Province) and 7 species at Joghatay (1340 – 1362 m a. s. l., in Khorasan Province). Most of these gall midges are European species associated with trees, mainly with *Salix* spp., *Carpinus*, *Acer*, *Fraxinus* and *Rosa* and their localities in Iran are situated at boundaries of their distribution areas in marginal part of the Palearctic Region.

Galls of fourteen species of gall midges were found at eight localities situated at marginal parts of Iranian Deserts: five species of *Baldratia* (*B. aelleni*, *B. anabasis*, *B. kermalensis*, *B. przewalskii*, *B. similis*) causing galls on various species of *Anabasis*, *Haloxylon* and *Suaeda*, *Careopalpis harenosa* inducing galls on *Kalidium capsicum*, six species of *Stefaniola* (*S. deformans*, *S. excelsa*, *S. fructua*, *S. furtiva*, *S. gigas* and *S. spinosa*) inducing galls on *Aellenia glauca* and *Haloxylon ammodendron* (all associated with the plant family of Chenopodiaceae), and two species of *Rhopalomyia* (*R. navasi* and *R. hispanica*) causing galls on *Artemisia herba-alba* (Asteraceae). In addition, one zoophagous species *Dicrodiplosis manihoti*, a predator of various coccids, was recorded at several localities in southern parts of Iran.

Analysis of the composition of faunal elements in the family Cecidomyiidae known to occur in Iran at present has shown that various representatives of faunal elements meet here. Iran lies on the crossroad of three biogeographical regions: Afro-tropical, Palearctic and Oriental. In the

gall midge fauna of Iran the representatives belonging to various parts of the Palaearctic region prevail distinctly. They meet here with *Dicrodiplosis manihoti*, a representative of the Afro-Asian fauna, and with *Procontarinia mangiferae*, a representative of the Oriental fauna. It may be supposed that future investigations will bring other interesting discoveries.

Relation to host plants

Phytophagous gall midges of Iran are associated with 50 host plant species which belong to fifteen plant families (Table 1). Most of these gall midges – 15 species – are associated with Chenopodiaceae. They belong mainly to two genera – *Baldratia* and *Stefaniola*. Eight species belonging mainly to the genus *Rabdophaga* are associated with Salicaceae, seven species – mainly of *Rhopalomyia* – with Asteraceae, three species with Apiaceae; two species with six other plant families (Aceraceae, Brassicaceae, Euphorbiaceae, Oleaceae, Poaceae, Rosaceae) and one species of gall midges with five families (Anacardiaceae, Corylaceae, Dipsacaceae, Fabaceae, Fagaceae).

About one fifth of host plants are trees, and the remainder are shrubs and herbaceous plants. The trees - *Acer pseudoplatanus*, *Carpinus betulus*, *Fagus sylvatica*, *Fraxinus excelsior* and several species of *Salix* – host several gall midge species that occur only in the northern part of Iran.

Usually only one or two species of gall midges are associated with each host plant species, but *Haloxyton ammodendron* (Chenopodiaceae) hosts 4 species: *Baldratia przewalskii*, *Stefaniola deformans*, *S. furtiva* and *S. gigas*; *Salix caprea* (Salicaceae) hosts 3 species: *Iteomyia capreae*, *Rabdophaga nervorum* and *Rabdophaga rosaria*.

Richness of Iranian plant flora including 6417 plant species and diversity of biotopes occurring in Iran are good indications for the occurrence of gall midges and their galls which may be discovered in the future.

Recommendations for future research

We hope that our paper will stimulate students and researchers living in Iran to investigate gall midges and their galls in various parts of the country with efforts to record the occurrence of gall midges that are known to occur in adjacent and also in distant countries and to discover new species on various plants. This is very important for zoogeographical and biogeographical studies. Although some investigations have been initiated in recent years, it will be necessary to carry out further systematic research in different habitats of the country.

The senior author has experience that investigations in more localities bring discovery of many unrecorded and also of unknown gall midge species. For example, the gall midge fauna in Greece has been enriched during investigations in the years 1994–2010 by about 200 species. The investigations were made at 103 localities spread over the mainland and in several islands. At the beginning of investigations in Greece in 1994 only 19 species of gall midges were known, but at the end of investigations in 2010 the fauna of gall midges of Greece included at least 215 species with several species new to science (Skuhravá & Skuhravý 2010, Skuhravá 2011).

We suppose that the fauna of gall midges in Iran could be increased if intensive investigations at many localities are carried out, especially in the northern part of the country, along the Caspian Sea, in lower parts of mountains and in valleys of various rivers, in national parks and protected areas. It will be useful to search also in semi-desert areas in the southern part of the country where gall midges known to occur in similar localities may be found, such as in Kazakhstan where Fedotova (2000) discovered many new species. We recommend preparation of a long-term program of systematic investigations of the biodiversity of gall-inducing arthropods and their galls in Iran.

We also recommend use during these investigations the time and area unit collection method developed by Skuhravá & Skuhravý (2010). This involves surveying each selected locality visually by walking through it slowly over a period of at least one and up to three hours. Researchers walk

through various biotopes at the locality and search for gall midge galls and collect them on herbs, shrubs and trees and examine visually buds, leaves, flowers, fruits and stems of herbaceous plants, shrubs and trees. The altitude and characteristics of biotopes are noted. All findings are recorded, including notes about the local abundance of species. During excursions, several specimens of each host plant with galls are put into separate small plastic bags. All species that are found are recorded in the protocol and all collected material is prepared. Several specimens of each host plant with galls are preserved as herbarium items, several plants with galls are kept in plastic bags to obtain living larvae, several plants with galls are placed in small emergence cages to obtain adults and finally several galls with larvae are put into vials with 75 % alcohol for future morphological studies. Such samples taken from various habitats or microhabitats are very important.

Acknowledgements

We thank Dr Babak Gharali, Department of Entomology, Research Center for Agriculture and Natural Resources, Gha-zvin, and Dr Abbas Mohammadi-Khoramabadi, Department of Plant Production, College of Agriculture and Natural Resources of Darab, Shiraz University, Darab, Fars, for sending galls on *Artemisia herba-alba* and adults of *Diadiplosis* sp. obtained from *Pseudococcus comstocki* (Pseudococcidae). We are grateful to Hassan Barimani Varandi, Natural Resources Department, Agricultural and Natural Resources Research Centre of Mazandaran, Sari, for galls of three gall midge species collected in Iran in 2010 that we received for identification from Dr Lyudmila Mirumian, Scientific Centre of Zoology and Hydroecology, Armenian National Academy of Sciences, Yerevan, Armenia. We thank Dr. Keith Murray Harris (Ripley, Woking, Surrey, England) for valuable comments on the first version of the manuscript and for improvements of the English text.

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