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

Marcela SKUHRAVÁ1), Václav SKUHRAVÝ1) & Ayman Khamis ELSAYED2)

1) Bítovská 1227, CZ-140 00 Praha 4, Czech Republic; e-mail: marcela.skuhrava@gmail.com
2) Department of Applied Entomology, Faculty of Agriculture, Alexandria University, 21545, Alexandria, Egypt; e-mail: ayman.khamis77@gmail.com
Corresponding author: marcela.skuhrava@gmail.com

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

Abstract. The known gall midge fauna of Egypt is composed of 48 species belonging to 22 genera. The two most species rich genera are Baldratia Kieffer, 1897, and Dasineura Rondani, 1840, each with six species. Most species are phytophagous and cause galls on various host plants; but Aphidoletes aphidimyza (Rondani, 1847), Diadiplosis donaldi (Harris, 1968), D. hirticornis Felt, 1915, Dicrodiplosis manihoti Harris, 1981 and Feltiella acarisuga (Vallot, 1827) are zoophagous; and Asynapta phragmitis Giraud, 1863, Mycodiplosis coniophaga (Winnertz, 1853) and M. triticina (Barnes, 1936) are mycophagous. Phytophagous species are associated with 37 plant species which belong to ten plant families; 16 species are associated with Chenopodiaceae and six with Tamaricaceae. Usually only one species of gall midges is associated with each host plant species but Atriplex halimus (Chenopodiaceae) hosts four species: Asphondylia punica Marchal, 1897 (= A. conglomerata De Stefani, 1900), Primofavilla aegyptiaca Elsayed, 2014, Stefaniella trinacriae De Stefani, 1900, and S. skuhravae Elsayed, 2014; Anabasis setifera (Chenopodiaceae) two species: Baldratia aegyptiaca Möhn, 1969 and B. desertorum Möhn, 1969; Phragmites australis (Poaceae) two species: Giraudiella inclusa (Frauenfeld, 1862) and Asynapta phragmitis Giraud, 1863; Traganum nudatum (Chenopodiaceae) two species: Baldratia tragani Möhn, 1969 and Stefaniola ventriosa Möhn, 1971; Tamarix spp. (Tamaricaceae) host six species of gall midges. Zoogeographical analysis: most species (75%) are Mediterranean, 10.5% Euro-Asian, 6.2% Holarctic or cosmopolitan, 4.1% Afro-Asian and 4.1% Afrotropical. More than one third (20 species, 41.6%) were found only in Egypt and are restricted to this region on the basis of recent knowledge. Common (shared) species occurring in North African countries indicate their similarity in faunal composition: 9 species are recorded from Egypt and Algeria, and Egypt and Tunisia; 8 species from Egypt and Morocco; 7 from Egypt and Libya. Three species occur in all five North African countries: Baldratia salicorniae Kieffer, 1897, causing galls on Arthrocennum fruticosum, Psectrosema tamaricum (Kieffer, 1912) swellings on Tamarix africana and T. gallica L. and Rhoepalomyia navasi Tavares, 1904 on Artemisia herba-alba and A. judaica. Thirteen species were recorded in Northern Egypt near Alexandria during investigations in the years 2012–2014. Eight species are gall causers associated with various host plants and five species are predators feeding on various arthropods. Three species are new to science, and are described in a separate paper; seven species are recorded in Egypt for the first time; Stefaniella trinacriae De Stefani, 1900 and Schizomyia buboniae (Frauenfeld, 1859) are newly recorded after more than 100 years since their first discovery in Egypt. Drawings and photos of several galls on host plants and recommendations for future research of the family Cecidomyiidae in Egypt are given. Lestodiplosis tamaricis (Kollar, 1858), new combination; larvae are zoophagous in galls caused by Cirrhiphora pharaonana (Kollar, 1858) (Lepidoptera: Tortricidae).

Key words. Faunistics, zoogeography, biogeography, distribution, plant-animal interactions Diptera, Cecidomyiidae, Egypt, North Africa, Mediterranean, Palaearctic Region.
INTRODUCTION

The family Cecidomyiidae (Diptera: Nematocera) is one of the largest families of Diptera. Gagné & Jaschhof (2014) list 6,203 valid species belonging to 736 genera of living and fossil gall midges in the world. The Cecidomyiidae are currently classified under six subfamilies: Catotrichinae, Lestremiinae, Micromyinae, Winnertziinae, Porricondylinae and Cecidomyiinae; the last is the most species rich subfamily. Only the larvae of Cecidomyiinae are able to induce galls on host plants, larvae of other subfamilies are mycophagous or mycosaprophagous. Adults are usually very small, inconspicuous flies but the galls (in Latin: cecidium) that are caused by their larvae on various organs of host plants are strange and striking formation (hence the common name “gall midges). Larvae of some species live free in flower heads or stems of plants without making galls and others are mycophagous or saprophagous. Zoophagous larvae are predators of larvae of other gall midges, of aphids, mites, coccids, or other small arthropods and some of them may be used in biological control of pests. Larvae of some species live as inquilines in galls of other gall midges or other insects. The biology of many species of gall midges caught as adults in nature is completely unknown (Skuhravá 1986, 1997a, Skuhravá et al. 1984a, b, Skuhravá & Skuhravý 2010). In Europe about sixty gall midge species are economically important, of these forty species cause damage to agricultural plants (Darvas et al. 2000) and twenty to forest trees (Skuhravá & Roques 2000). More than 3,100 gall midge species are known in the Palaearctic region (Skuhravá 2006).

Skuhravá (1986) in the Catalogue of Palaearctic Diptera listed 25 species of gall midge known to occur in Egypt up to that time. Since then several new records of gall midge species have been recognised by various researchers. Nevertheless the fauna of the gall midges of Egypt is still poorly known. We hope that our paper will attract the attention of entomologists to this interesting group of insects inducing galls on host plants.

Egypt is a large country. Its territory occupies 1,010,000 km² and represents the westernmost part of the Middle East or Near East (Fig. 1). Egypt is a transcontinental country spanning the northeast corner of Africa and southwest corner of Asia via a land bridge formed by the Sinai Peninsula. Egypt lies at the junction of four biogeographical regions, Irano-Turanian, Mediterranean, Saharo-Sindian and Afrotropical.

Most of its territory lies within the Nile Valley of North Africa and is bordered by the Mediterranean Sea to the north, the Gaza Strip and Israel to the northeast, the Gulf of Aqaba to the east, the Red Sea to the east and south, Sudan to the south and Libya to the west. Apart from the Nile Valley, the majority of Egypt’s landscape is desert, with a few oases scattered about. Winds create prolific sand dunes that peak at more than 100 feet (30 m) high. Egypt includes parts of the Sahara Desert and of the Libyan Desert.

The vegetation of Egypt is not very rich because large areas are covered with deserts where only a few wild plants occur. Richer vegetation may be found along the northern and southern margins, near the oases and drainages and in valleys and along the Nile River. There are very few native trees: Juniperus phoenicea is the only native coniferous tree. About 2,426 plant species are reported to occur in Egypt (Drar & Täckholm 1969, Täckholm 1974). From the biogeographical point of view, Egypt’s spread in North Africa is considered to be a part of the Palaearctic Region (Soós & Papp 1986). Udvardy (1975) includes the Mediterranean North Africa in the Palaearctic Region and considered the southern boundary of the desert vegetation as its boundary in Africa.

The fauna of gall midges of Egypt is poorly known. Only a few researchers from several countries of Europe collected galls on plants, usually during their scientific journeys.

In 1858 Vincenz Kollar (1797–1860), the Austrian zoologist and a member of the Austrian Academy of Sciences and of the Zoological and Botanical Society in Vienna (Austria), described
the species *Cecidomyia tamaricis*. He obtained adults from subglobular galls on *Tamarix articulata*. The galls were found in the surroundings of Cairo (Kollar 1858).

The Austrian naturalist and entomologist Georg Ritter von Frauenfeld (1807–1873) was the first who discovered several galls caused by various causers in Egypt. It was in the course of his round-the-world voyage during 1850. He published results obtained on this journey in a paper (Frauenfeld 1859) where he described and illustrated several galls of gall midges on various plants. In this paper he described the gall midge *Cecydomyia buboniae* (now: *Schizomyia buboniae*) which he reared from the galls on *Deverra tortuosa*. He collected these galls in the area from Cairo up to Suez. Later Kieffer (1909) gave names to four gall midge species the galls of which were discovered and illustrated by Frauenfeld (1859). Kieffer’s descriptions include only the shape of the gall and the host plant species. He did not describe larvae, pupae and adults.

Fig. 1. Egypt with adjacent countries and with main localities where galls of gall midges were collected by various researchers between 1850 and 2013. 1 – Alexandria, 2 – Daqahliyah, 3 – Ismailia, 4 – Cairo, 5 – Giza, 6 – Suez, 7 – Sinai, 8 – Qena, 9 – Dakhla Oasis, 10 – Aswan.
The excellent French botanist and cecidologist C. Houard (1873–1943) contributed importantly to the knowledge of galls in Europe and North Africa and elaborated extensive keys to plant galls of that time (Houard 1908–1909, 1912, 1913, 1922–1923) which remain a good source of knowledge on plant galls up to the present. He discovered several interesting galls of gall midges on plants in the course of his research journeys in North Africa, including Egypt. Another excellent French entomologist J. J. Kieffer (1857–1925) described three gall midge species associated with species of Tamarix (Kieffer 1912).

The Polish botanist and entomologist B. Debski (1874–1927) spent the last ten years of his life in Egypt. He collected galls on various plants and published a paper where he described 96 galls caused by various causers and found mainly in the surroundings of Cairo. The paper includes also descriptions of galls induced by 20 gall midge species (Debski 1918). He described seven gall midge species found in Egypt (Debski 1918, 1922).

The German entomologist E. Möhn (1928–2008) contributed importantly to the knowledge of gall midges in Egypt. He described eight new species of gall midges on the basis of larvae. He obtained these larvae from dry herbarium items which he discovered in several botanical collections of various museums. He gave the names of type localities where galls were found and the date of finding the galls but not the name of the collector. The oldest find of galls on Anabasis articulata described as Stefiola vastita bears the following data: “Sinai, Juni 1832 (Möhn 1966–1971).”

Also several Egyptian entomologists contributed to the knowledge of the gall midge fauna of Egypt: Azab et al. (1965a, b) to the biology of Aphidoletes aphidimyza, Steyskal & El-Bialy (1967) elaborated a list of Egyptian Diptera in which they reported 23 species of the family Cecidomyiidae known to occur in Egypt, Mesbah et al. (1976, 1978), Shoukry et al. (1989), Semida (2006) and El-Serwy (2008) contributed to the occurrence and ecology of several gall midge species.

In this paper we summarize data on gall midges in Egypt, add new records obtained during investigations by Ayman Khamis Elsayed in the surroundings of Alexandria during 2012–2014 and evaluate results from the zoogeographical point of view.

MATERIAL AND METHODS

We gathered data on the occurrence of gall midges in Egypt from articles of various researchers, published over a period of about 150 years, from the middle of 19th century until 2013. Most of the species of gall midges recorded in Egypt were found by collecting galls from different host plants. Some species of gall midges are known only on the basis of the description of galls, others on the basis of larvae and a few on the basis of adults. It will be needful to find galls of described species which are based on galls and try to rear adults. It is a way to verify the identity of the inhabitants of the galls.


RESULTS

At present the known gall midge fauna of Egypt includes 48 species belonging to 22 genera recorded at about 70 localities situated in the Nile Delta and in the Sinai Peninsula (Fig. 1). In the following part we present an annotated list of all gall midge species recorded in Egypt and a list of host plant species with associated gall midge species (Table 1). At the end we evaluate all data obtained in Egypt from the zoogeographical point of view.
<table>
<thead>
<tr>
<th>host plant</th>
<th>species of gall midge</th>
<th>shape of gall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acacia vera</td>
<td>Collula kiefferi</td>
<td>folded leaflets</td>
</tr>
<tr>
<td>Acacia arabica</td>
<td>Resseliella trianguliceps</td>
<td>swelling on branch</td>
</tr>
<tr>
<td>Achillea millefolium</td>
<td>Rhopalomyia millefolii</td>
<td>egg-shaped galls on stems or in inflorescences</td>
</tr>
<tr>
<td>Anabasis articulata</td>
<td>Stefaniola vastita</td>
<td>slight swelling of stem</td>
</tr>
<tr>
<td>Anabasis prostrata</td>
<td>Stefaniola vastita</td>
<td>slight swelling of stem</td>
</tr>
<tr>
<td>Anabasis setifera</td>
<td>Baldratia aegyptica</td>
<td>slight stem swelling</td>
</tr>
<tr>
<td>Artemisia campestris</td>
<td>Rhopalomyia tubifex</td>
<td>tubular galls on leaf axes and stems</td>
</tr>
<tr>
<td>Artemisia herba-alba</td>
<td>Rhopalomyia navasi</td>
<td>large white pubescent galls on stem</td>
</tr>
<tr>
<td>Arthrocnemum fruticosum</td>
<td>Baldratia salicorniae</td>
<td>stem swelling</td>
</tr>
<tr>
<td>Arthrocnemum macrostachyum</td>
<td>Houardiella gracilis</td>
<td>larvae inside stem, any external sign of their presence</td>
</tr>
<tr>
<td>Arundo donax</td>
<td>Lasioptera donacis</td>
<td>larvae inside stem</td>
</tr>
<tr>
<td>Astragalus forskalei</td>
<td>Contarinia forskalei</td>
<td>swollen flower bud</td>
</tr>
<tr>
<td>Atriplex halimus</td>
<td>Asphondylia punica</td>
<td>large galls on stems</td>
</tr>
<tr>
<td>Deverra scoparia</td>
<td>Schizomyia botellus</td>
<td>elongate swelling on stem</td>
</tr>
<tr>
<td>Deverra tortuosa</td>
<td>Schizomyia bubonae</td>
<td>berry-like galls on stems</td>
</tr>
<tr>
<td>Deverra triradiata</td>
<td>Schizomyia botellus</td>
<td>elongate swelling on stem</td>
</tr>
<tr>
<td>Halogeton alepecaruoides</td>
<td>Baldratia halogetoniis</td>
<td>small leaf swelling</td>
</tr>
<tr>
<td>Haloxylon schweinfurthii</td>
<td>Stefaniola unita</td>
<td>hard-walled swelling of stem</td>
</tr>
<tr>
<td>Haloxylon schnittianum</td>
<td>Stefaniola unita</td>
<td>hard-walled swelling of stem</td>
</tr>
<tr>
<td>Lycium arabicum</td>
<td>Contarinia lycii</td>
<td>swollen flower bud</td>
</tr>
<tr>
<td>Phragmites australis</td>
<td>Asynapta phragmitis</td>
<td>larva inside stem</td>
</tr>
<tr>
<td>Salsola vermiculata</td>
<td>Stefaniola gloma</td>
<td>slight swelling of flowering branch</td>
</tr>
<tr>
<td>Senebriera nilotica</td>
<td>Dasineura senebreriae</td>
<td>swelling on stem</td>
</tr>
<tr>
<td>Suaeda monoica</td>
<td>Stefaniola defoliata</td>
<td>larvae inside leaves without external sign</td>
</tr>
<tr>
<td>Suaeda pruinosa</td>
<td>Baldratia karamae</td>
<td>larvae inside leaves without external sign</td>
</tr>
<tr>
<td>Tamarix africana</td>
<td>Psectrosema tamaricinum</td>
<td>small bud galls resembling pine cone</td>
</tr>
<tr>
<td>Tamarix arborea</td>
<td>Psectrosema afferii</td>
<td>small ovoid swelling of young leaf branches</td>
</tr>
<tr>
<td>Tamarix articulata</td>
<td>Lestodiplosis tamaricensis</td>
<td>swelling on twigs</td>
</tr>
<tr>
<td>Tamarix nilotica</td>
<td>Psectrosema debskii</td>
<td>larvae are zoophagous in stem swelling caused by Cirrophora pharaonana (Lepidoptera)</td>
</tr>
<tr>
<td>Tamarix tetragnae</td>
<td>Dasineura tetragnae</td>
<td>swellings on young branches</td>
</tr>
<tr>
<td>Tanacetum vulgare</td>
<td>Rhopalomyia tanacetica</td>
<td>galls on buds, leaves and flower heads</td>
</tr>
<tr>
<td>Traganum nuditum</td>
<td>Baldratia tragani</td>
<td>leaf swellings</td>
</tr>
<tr>
<td>Vachellia nilotica subsp. nilotica (= Mimosa nilotica)</td>
<td>Dasineura mimosae</td>
<td>deformed leaves</td>
</tr>
<tr>
<td>Viola sp.</td>
<td>Dasineura affinis</td>
<td>rolled leaf margin</td>
</tr>
<tr>
<td>Zilla myagoides</td>
<td>Dasineura zillae</td>
<td>deformed flowers</td>
</tr>
<tr>
<td>Zilla spinosa</td>
<td>Dasineura lenkieviciae</td>
<td>swelling on the branch</td>
</tr>
<tr>
<td>Zygophyllum album</td>
<td>Contarinia zygophylli</td>
<td>swollen flower bud</td>
</tr>
</tbody>
</table>
**Annotated list**

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, occurrence in Egypt with names of localities where galls were found in the past and new records, references to authors and distribution.

**Aphidoletes aphidimyza (Rondani, 1847)**

Slightly orange coloured larvae are predators on 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 its synonyms (Harris 1973, Gagné & Jaschhof 2014); one of them is *Cryptobremia aegyptiaca* described very briefly by Kieffer (1912b) from “Nordafrika” without any other details.

Azab et al. (1965a, b) recorded that *A. aphidimyza* is an effective predator on several species of aphids in Egypt.

**Occurrence.** Northern Egypt (Kieffer, 1912, Harris 1973, Azab et al. 1965); Giza (El-Serwy 2008); Alexandria (Elsayed 2014, Elsayed et al. 2014a).

**Distribution.** Holarctic, cosmopolitan (Harris 1973, Skuhravá 1986, Gagné 2004).

**Asphondylia punica** Marchal, 1897

Larvae cause large galls, up to several centimeters long, on the stems of *Atriplex halimus* L. (Chenopodiaceae) (Fig. 17). Such large galls usually include the whole shoot on which all flower buds are changed into small galls, each with one larva. Marchal (1897) discovered small galls on *Atriplex halimus* in Tunisia and described a female, pupa and larva very briefly. Later De Stefani (1900) found large galls in Sicily (Italy) and described a male and female as an independent species. Dorchin et al. (2014) redescribed *Asphondylia punica* and made *A. conglomerata* a junior synonym of *A. punica*.

Elsayed et al. (2014a) recorded two generations per year in Egypt, from the periods of November to April and May to October. The parasitoid complex of both generations were studied by Doğanlar & Elsayed (2013 and 2014).


**Distribution.** Mediterranean; galls were found in the following countries: Italy (Sicily) (De Stefani 1900, Skuhravá et al. 2007), Spain (Skuhravá et al. 1996), Canary Islands (Graham & Gijswijt 1998), Greece (Crete) (Skuhravá & Skuhravý 1997), Libya: Tobruk (leg. Prof. B. Massa, 1998, det. M. Skuhravá, unpubl.), Tunisia: Ben Gardane, 1995 (leg. Dr. M. Boness, det. M. Skuhravá, unpubl.), Debski (1918), Israel: Kalia (leg. Dr. J. Halperin, 1992, det. M. Skuhravá, unpubl.), Egypt (first record).

**Asynapta phragmitis** (Giraud, 1863)

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

**Occurrence.** Egypt: Daqahliyah, Shirbin (El-Serwy 2008).
Distribution. Euro-Asian. It occurs in Europe (UK, the Netherlands, Sweden, Latvia, Poland and Austria); in Asia (Kazakhstan) and in Africa (Egypt) (Skuhravá 1986, Fedotova 2000).

*Baldratia aegyptiaca* Möhn, 1969


Larvae cause one-sided slight swellings on stems of *Anabasis setifera* Moq. (Chenopodiaceae). Inside each gall is a single chamber which is inhabited by a single larva. Pupation takes place in the gall. Möhn (1969: 185) described only the larva. Pupa, male and female are unknown.


Distribution. Mediterranean, known only from Egypt.

*Baldratia desertorum* Möhn, 1969


Larvae cause one-sided slight swellings on stems of *Anabasis setifera* Moq. (Chenopodiaceae). Inside each gall is a single chamber which is inhabited by a single larva. Pupation takes place in the gall. Möhn (1969: 190) described only the larva. Pupa, male and female are unknown.


Distribution. Mediterranean, known only from Egypt.

*Baldratia haloegetonis* Möhn, 1969


Larvae cause slightly paunchy swellings on the leaves of *Halogeton alopecuroides* (Delile) Moq. (Chenopodiaceae). The gall has only one chamber. Pupation takes place in the gall. Möhn (1969: 197) described only the larva. Pupa, male and female are unknown.


Distribution. Mediterranean, known only from Egypt.

*Baldratia karamae* Elsayed et Skuhravá, 2014

*Baldratia karamae* Elsayed et Skuhravá, 2014: 5.

Larvae develop inside leaves of *Suaeda pruinosa* Lange (Chenopodiaceae). Attacked leaves do not show any external signs of infestation except a dark reddish spot (Fig. 19). Inside the leaf is a chamber where a single larva develops. Larvae pupate in galls. Two generations develop per year.

Occurrence. Egypt: Sedi kerer, Abo-Talat and El-Amria districts. Galls were found in 2013, male and female reared and described by A. K. Elsayed (Elsayed et al. 2014a). Larva and pupa are not known.

Distribution. Mediterranean, known to occur only from Egypt (Elsayed et al. 2014a).

*Baldratia salicorniae* Kieffer, 1897

*Baldratia salicorniae* Kieffer, 1897: 7.

*Baldratia hyalina* Kieffer, 1912: 74.

Larvae cause swellings on stems of *Arthrocnemum fruticosum* (L.) Moq. (Syn. *Salicornia fruticosa* L.) (Chenopodiaceae) (Fig. 2). Each larva develops in a single chamber. Only one generation develops in a year. Pupation takes place in the gall, adults emerge from April until the summer.

Occurrence. Egypt: Mehi, 18 August 1891, on *Salicornia lignosa* Woods (Möhn 1969); Alexandria, Abotalat district, 6 February to 14 April 2013, leg. A. K. Elsayed (Fig. 18).
**DISTRIBUTION.** Mediterranean, galls occur relatively abundantly in salt marshes. Galls were found in southern England, Portugal, Spain, France, Italy, former Yugoslavia, Greece, in Morocco, Algeria, Tunisia, Libya, Egypt, Israel, and in the islands of Malforca, Corsica, Sardinia, Sicily, Lefkada and Malta (Škuhravá et al. 1984, Škuhravá et al. 2002).

**Baldratia tragani Möhn, 1969**


Larvae cause slightly paunchy swellings on the leaves of *Traganum nudatum* Delile (Chenopodiaceae). The gall has only one chamber. Pupation takes place in the gall. Möhn (1969: 200) described only the larva. Pupa, male and female are unknown.

**Occurrence.** Egypt: Nouébe, El Hamd, Aswan, 1837 (Möhn 1969).

**Distribution.** Mediterranean, known only from Egypt.

**Collula kiefferi Gagné, 1993**


*Collinia acaciae* Kieffer, 1912: 233.

*Collula kiefferi* Gagné, 1993: 112, replaced name for *Collinia acaciae* Kieffer, 1912.

Kieffer (1909) described very briefly a gall on *Acacia vera* Willd. (Fabaceae): “Deformation of leaflets. Egypt (Frauenfeld 1855). *Perrisia? acaciae* n. sp.” Frauenfeld did not publish a paper in 1850, but in 1859 where he gave a good illustration of the gall (Fig. 3) and noted that galls were found from Cairo to Suez. Later Kieffer (1912: 233) described a female as *Collinia acaciae*.

**Occurrence.** Egypt: Cairo and Suez (Frauenfeld 1859, Debski 1918).

**Distribution.** Mediterranean, known to occur only in Egypt.

**Contarinia forskalei Debski, 1918**

*Contarinia forskalei* Debski, 1918: 21.

Larvae develop in swollen flower buds of *Astragalus forskalei* Boissier (Fabaceae). Debski (1918) described larva and gall. Adults are not known.

**Occurrence.** Egypt: Cairo, Wadi Abou-Zouleiqa, near Hélouan, 26 March 1918 (Debski 1918).

**Distribution.** Mediterranean, known only from Egypt.

**Contarinia lycii Debski, 1918**

*Contarinia lycii* Debski, 1918: 33.

Larvae develop in swollen flower buds of *Lycium arabicum* Schweinfurth (Solanaceae). Debski (1918) described only gall and larva. Adults are unknown.

**Occurrence.** Egypt: Cairo, Wadi-Rished, near Helwan, 20 March 1910 (Debski 1918).

**Distribution.** Mediterranean, known only from Egypt.

**Contarinia zygophylli Debski, 1918**

*Contarinia zygophylli* Debski, 1918: 23.

Larvae develop in swollen flower buds of *Zygophyllum album* L. (Zygophyllaceae). Debski (1918) described larva and gall; adults are unknown (Fig. 4). Fedotova (1990) described adults (and not larvae) of *Contarinia zygophylliflorae*, larvae of which develop in flower bud galls of *Zygophyllum oxiplanum* and other species of *Zygophyllum* in Kazakhstan. Both species may be identical.

**Occurrence.** Egypt: Hélouan, desert near Walda, Cairo, 26 March 1910 (Debski 1918).

**Distribution.** Mediterranean, known only from Egypt.
Figs 2–9. Galls of gall midges found in Egypt. 2 – Stem gall of Baldratia salicorniae on Arthrocnemum fruticosum. 3 – Galls on leaflets of Acacia vera caused by Collula kiefferi, with a detail of one gall. 4 – Flower bud galls on Zygophyllum sp. caused by Contarinia zygophylli. 5 – Flower bud galls on Zilla myagroides caused by Dasineura zillae. 6 – Corn-like galls inside the stem of Phragmites australis caused by Giraudiella inclusa. 7 – Parenchymous galls on leaves of Atriplex halimus caused by Primofavilla aegyptiaca, with cross section of leaf including gall. 8 – Cone-shaped galls on leaf buds of Tamarix africana caused by Psectrosema tamaricinum, with a section of one gall showing a chamber. 9 – Fusiform swelling on stem of Tamarix africana caused by Psectrosema tamaricum, with cross-section of gall. All figures are original drawings taken from publications of Frauenfeld (1859) (Figs 3, 4, 5, 8, 10, 11, 13, 14, 16), of Houard (1908–1909, 1912) (Figs 2, 7, 9, 12, 15) and of Buhr (1964–1965) (Fig. 6).
Dasineura affinis (Kieffer, 1886)
*Cecidomyia affinis* Kieffer, 1886: 330.

At first white, later pale orange coloured larvae produce galls on the young leaves of *Viola reichenbachiana* Jord. ex Boreau (= *V. sylvestris* Lam., *V. sylvatica* Fries) (Violaceae). Leaf margins are rolled up and thickened. Several larvae develop in one roll where they pupate in white cocoons. Two or more generations develop per year (Barnes 1948b).

**Occurrence.** Egypt (El-Zoheiry 1944, on *Viola* sp.).

**Distribution.** Euro-Asian; known to occur in many countries of Europe; it occurs also in Asia (Kazakhstan, Turkey) and in North Africa (Algeria, Egypt) (Skuhravá 1986, Skuhravá et al. 2005, Fedotova 2000).

Dasineura lenkiewicziae (Debski, 1918)
Perrisia Lenkiewicziae Debski, 1918: 18.


Larvae cause swellings on branches of *Zilla spinosa* (L.) (Brassicaceae). Debski (1918) described larva and gall only. Adults are unknown.

**Occurrence.** Egypt: Wadi-Hof, February 1911, leg. Mrs. Lenkiewicz-Dzieslewiska (Debski 1918).

**Distribution.** Mediterranean, known only from Egypt.

Dasineura mimosae (Kieffer, 1909)


Larvae develop in deformed leaves of *Vachellia nilotica* subsp. nilotica (L.) (= *Mimosa nilotica* L.) (Fabaceae). Kieffer (1909) described only the gall and refers to the information of Frauenfeld (1855). He found this gall at Cairo during his research journey. Nothing more is known.

**Occurrence.** Egypt: Cairo (Frauenfeld 1855, Debski 1918).

**Distribution.** Mediterranean, found only in Egypt.

Dasineura senebrieriae (Kieffer, 1909)


Larvae cause large swellings including many chambers on the stems of *Senebriera nilotica* DC. (= *Coronopus niloticus* Delile) (Brassicaceae). Kieffer described the gall only and referred to Frauenfeld (1859). Larvae leave galls and pupate in the soil.

**Occurrence.** Egypt: near the Pyramids of Ghizeh (Frauenfeld 1859).

**Distribution.** Mediterranean, known only from Egypt.

Dasineura tetragynae Debski, 1918
Dasyneura tetragynae Debski, 1918: 28.


Larvae develop in flower buds of *Tamarix tetragyna* Ehrenberg (Tamaricaceae). Attacked flower buds remain closed. Debski (1918) described only the larva. Adults are unknown. Barnes (1948) reported that the larvae are orange and gregarious. Pupation takes place in the soil.

**Occurrence.** Egypt: Hélouan, Cairo, 14 March 1911 (Debski 1918).

**Distribution.** Mediterranean, known only from Egypt.
Dasineura zillae (Kieffer, 1909)
Perrisia zillae Kieffer, 1909: 34.  
Larvae develop in swollen flower buds and deformed flowers of Zilla myagoides Frsk. (Brassicaceae) (Fig. 5). Kieffer (1909) described the gall only with reference to Frauenfeld (1859).  
Occurrence. Egypt: Giza, near the Pyramids (Frauenfeld 1859).  
Distribution. Mediterranean, found only in Egypt.

Diadiplosis donaldi (Harris, 1968)
Ghesquierinia donaldi Harris, 1968: 146.  
Harris (1968) described this species on the basis of adults reared from larvae feeding on coccids Planococcus citri Risso (Hemiptera: Coccoidea) on Dioscorea sp. (Dioscoreaceae).  
Distribution. Afrotropical, known to occur in Nigeria (Harris 1968) and Egypt (new record).

Diadiplosis hirticornis Felt, 1915
Nipponodiplosis hirticornis (Felt 1915): Harris 1968: 460.  
Larvae are predators of pseudococcids Pseudococcus vapor and Planococcus spp. (Hemiptera: Pseudococcidae) (Harris 1968, Gagné & Jaschhof 2014).  
Distribution. Afro-Asian, known to occur in Japan (Yukawa 1971), India (Grover 1979), Yemen (Harris & Harten 2006) and Egypt (new record).

Dicrodiplosis manihoti Harris, 1981
Dicrodiplosis manihoti Harris, 1981: 339.  
Harris (1981) described this species on the basis of specimens reared from larvae feeding as predators in egg masses of Phenacoccus manihoti Matile-Ferrero on Manihot esculenta Cranz (Euphorbiaceae) in Congo and Senegal. Larvae are predators also of Ferrisia virgata and Planococcus citri (Hemiptera: Pseudococcidae) (Gagné & Jaschhof 2014).  
Distribution. Afro-Asian, known to occur in Senegal, Democratic Republic of Congo (Harris 1981), Oman (Abbas 1999), Iran (Skuhravá et al. 2014) and Egypt (first record).

Feltiella acarisuga (Vallot, 1827)
Cedomyia acarisuga Vallot, 1827: 95.  
Therodiplosis persicae Kieffer, 1912: 2.  
Larvae are predators of spider mites (Tetranychidae, Acarina). Larvae occur in colonies of spider mites where they feed on eggs, nymphs and adult spider mites. Several generations develop a year. Full-grown larvae spin a white cocoon where they pupate either on the leaf, or after dropping to the soil (Gagné 1995). It is one of the most effective and widespread natural enemies of spider mites and it is used in biological control.

**Distribution.** It is probably primarily a European species, at present known to be distributed in several continents and considered therefore to be of cosmopolitan distribution (Gagné 2004, 2010, Skuhrová et al. 2010).

**Giraudiella inclusa** (Frauenfeld, 1862)

*Cecidomyia inclusa* Frauenfeld, 1862: 1175.

Solitary whitish or slightly pink coloured larvae produce corn-like, hard woody galls inside the stem of *Phragmites australis* (Cav.) Trin. (Poaceae) (Fig. 6). Two generations develop per year. Larvae hibernate and also pupate in the galls. The biology in central Europe has been studied by Skuhrová & Skuhrový (1981) and Skuhrová et al. (1981).

**Occurrence.** Egypt: Alexandria, El-Sabaheia Research Station (Meshah et al. 1978).

**Distribution.** Euro-Asian: widespread in Europe, found in Iraq, China and northern Egypt; immigrant in eastern USA (Gagné 2010).

**Houardiella gracilis** Dorchin et Freidberg, 2008


Larvae develop in stems of *Arthrocnemum macrostachyum* (Moric.) Moris (*Salicornia macrostachya* Moric.), *Salicornia glauca* Delile, *Arthrocnemum glaucum* (Delile) Ung.-Sternb.) (Chenopodiaceae). Attacked stems do not show any noticeable signs of infestation. Only emergence holes and protruding pupal exuviae reveal the presence of gall midges in the stem after emergence of adults (Fig. 20). A single larva develops in each chamber where it also pupates. Probably only one generation develops per year.


**Distribution.** Mediterranean, known from Israel (Dorchin & Freidberg 2008) and Egypt (first record).

**Lasioptera donacis** Coutin, 2001


Larvae develop in a tunnel made by an undetermined fly (Diptera) in the stem of *Arundo donax* L. (Poaceae).

**Occurrence.** Egypt (El-Serwy 2008).

**Distribution.** Mediterranean, known to occur in southern France, southern Italy, Greece, Malta and Egypt.

**Lestodiplosis tamaricis** (Kollar, 1858), **comb. nov.**

*Cecidomyia tamaricis* Kollar, 1858: 159; Skuhrová 1986: 287; Gagné 2014: 297.

Kollar (1858) described a male and a female of a gall midge obtained from large galls on stems of *Tamarix articulata* Vahl. (Tamaricaceae). Frauenfeld (1859, Tab. VI: 1a, b) gave an illustration of this gall (Fig. 16). The gall is formed of irregular subglobular swelling on the stem (Barnes 1948). Material originated from the type-locality: Egypt, Cairo, but it is not preserved in any collection. Wachtl (1886) noted that this gall may be caused by another species and gall midges were only commensals. Houard (1912) identified the causer of this gall as *Pamene pharaoana* Kollar, 1858 (now: *Cirriphora pharaoana* Kollar, 1858, Lepidoptera: Tortricidae). Because the description of adults of gall midges reared from this gall is very short and based on dry material, it is not possible to solve safely the question to which genus this species belongs. Therefore this
species has been placed in the catalogs among “Unplaced species of Cecidomyiidae“ (Skuhravá 1986: 287, Gagné 2014: 297).

According to the information given in the description of Kollar (1858) on the number of antennal segments (12 in female and 24 in male) and probable feeding habit of larvae (zoophagous on larvae of the gall inducer) it is possible to place this species in the genus *Lestodiplosis* which includes zoophagous gall midges.

**Occurrence.** Egypt: Cairo (Kollar 1858).

**Distribution.** Mediterranean, known only from Egypt.

**Note.** It would be desirable to try to find new material of stem galls on *Tamarix articulata* caused by the tortricid moth *Cirriphora pharaonana* which were found in or near Cairo in 1857 by Kollar (1858) and to try to rear adults of gall midges from these galls.

**Mycediplosis coniophaga** (Winnertz, 1853)

*Cecidomyia coniophaga* Winnertz, 1853: 267.  

Whitish larvae are mycophagous and live in colonies of various rusts, mainly *Phragmidium* sp. (Uredinales, Fungi) associated with various host plants (Nijveldt 1969, Holz 1970).  
**Occurrence.** Egypt (El-Serwy 2008).

**Distribution.** Holarctic; in Europe known to occur in several countries (Skuhravá 1986), in North America in USA and Mexico (Gagné 2010); in Asia: Syria (Lattakia, 2010, material collected by Rehab Al-N akkar, identified by M. Skuhravá, unpublished); North Africa: Egypt.

**Mycediplosis triticina** (Barnes, 1936)

*Hyperdiplosis triticina* Barnes 1936: 275.  
Larvae feed on *Puccinia triticina* (Uredinales, Fungi) on wheat. Barnes (1936) described this species as *Hyperdiplosis triticina*. He received adults from Kenya and from Egypt. Nothing more is known (Barnes 1936).  
**Occurrence.** Egypt: Cairo, obtained from *Puccinia* on wheat, May 1935 (Barnes 1936), Alexandria, Abees region (Mesbah et al. 1976).  
**Distribution.** Afrotropical, known to occur in Kenya Colony (Kiambu) and in Egypt (Cairo and Alexandria).

**Primofavilla aegyptiaca** Elsayed, 2014

Larvae cause galls on leaves of *Atriplex halimus* L. (Chenopodiaceae). Galls are globular, 2-3 mm in diameter and are visible on both leaf surfaces. Houard (1908: 393) gave a drawing of these galls on the basis of findings of De Stefani in Sicily (Fig. 7).  
**Occurrence.** Egypt: El-Amria district, Alexandria, 26 May 2013, 2 females reared from galls on *Atriplex halimus*, collected by A. K. Elsayed (Fig. 21) (Elsayed et al. 2014a).

**Distribution.** Mediterranean, known from Egypt and Italy (Sicily).

**Psectrosema alfieri** Debski, 1922

*Psectrosema alfieri* Debski, 1922: 36.  
Larvae cause slight swellings on twigs of *Tamarix arborea* Bunge (Tamaricaceae). Galls of *P. alfieri* occur on the primary branches which do not fall (Barnes 1948). Debski (1922) described the male, female, pupa and larva. Gagné et al. (1996) gave a redescriptions of adults.  
**Occurrence.** Egypt: Cairo (Debski 1922).  
**Distribution.** Mediterranean, known only from Egypt.
**Psectrosea debskii (Kieffer, 1912)**

*Cecidomyia debskii* Kieffer 1912: 171.

Red larvae cause long swellings on young branches of *Tamarix nilotica* (=*T. articulata* Vahl.) (Tamaricaceae). One larva is in each swelling. The walls of the gall are extremely thin. Galls occur on the tertiary and quaternary branches. These galls die after the emergence of gall midges (Barnes 1948). Kieffer (1912) described the larva, pupa, female and egg. Gagné et al. (1996) also mentioned this species.

**Occurrence.** Egypt: Hélouan, Cairo (Kieffer 1912).

**Distribution.** Mediterranean, known occur only from Egypt.

**Psectrosea tamaricinum (Kieffer, 1909)**

*Perrisia*? *tamaricina* Kieffer, 1909: 30; Houard 1912: 128, No. 229, fig. 267, 268.

Larvae cause small bud galls, resembling closed pine cones, on *Tamarix africana* Poir. (Tamaricaceae). Inside the gall is a chamber where larvae develop (Fig. 8). Kieffer (1909) described the gall very briefly with reference to Frauenfeld (1859) who found galls in the Oasis Tarfa in Egypt and illustrated this gall without naming the gall causer. Gagné et al. (1996) mentioned this species.

**Occurrence.** Egypt: Sinai, Dakhla Oasis and Oasis Tarfa (Frauenfeld 1859).

**Distribution.** Mediterranean, known to occur in Egypt and Libya (Trotter 1915).

**Psectrosea tamaricum (Kieffer, 1912)**

*Oligotrophus tamaricum* Kieffer in Houard, 1912: 126.
*Amblardiella tamaricum* (Kieffer, 1912: 169); Barnes 1931: 271.

Larvae cause small ovoid or fusiform swellings on young leaf branches and on flowering shoots of *Tamarix africana* Poiret, *T. gallica* L. and some other species of *Tamarix* (Tamaricaceae) (Fig. 9). Inside the gall is a large cavity in which the solitary larva pupates. The wall of the gall is thin (Barnes 1948). Kieffer (1912) described the gall and pupa. Barnes (1931) described a male and female, Gagné et al. (1996) a female and pupa.

**Occurrence.** Egypt, locality not given (Frauenfeld 1859).

**Distribution.** Mediterranean, known from Algeria, Morocco, Tunisia, Libya and Egypt.

**Resseliella trianguliceps** (Debski, 1918)

*Thomasia trianguliceps* Debski 1918: 19.

Larvae cause swellings on branches of *Acacia arabica* Willd. var. *nilotica* (Forskal) (Fabaceae). Inside the gall is a cavity where several whitish larvae develop. Debski (1918) described the larva and gall.

**Occurrence.** Egypt: Cairo, Marg, 1915 (Debski 1918).

**Distribution.** Mediterranean, known only from Egypt.

**Rhopalomyia millefolii** (Loew, 1850)

*Cecidomyia millefolioli* Loew, 1850: 37.

Yellow larvae cause egg-shaped or cylindrical galls on stems, especially in the leaf axils, or in inflorescences of *Achillea millefolium* L. (Asteraceae). The galls are oval, fleshy, first green, then
Figs 10-16. Galls of gall midges found in Egypt. 10 – Bud galls of *Rhopalomyia millefolii* on stem of *Achillea* sp. and a section of two galls showing two chambers. 11 – Large gall of *Rhopalomyia navasi* on stems of *Artemisia judaica* and a section of a gall. 12 – A group of tubular galls of *Rhopalomyia tubifex* on stem of *Artemisia campestris* (a), one enlarged gall (b), section of a gall with a small larva at the bottom. 13 – Galls of *Schizomyia botellus* on side shoots of *Deverra* sp. 14 – Group of galls of *Schizomyia bubonae* on stem of *Deverra tortuosa* (a), section of several galls (b). 15 – Swelling on stem of *Atriplex halimus* caused by *Stefaniella trinacrae* (a), gall on leaf stalk (b), section of gall (c). 16 – Gall caused by *Cirriphora pharaonana* (Lepidoptera: Tortricidae) on stem of *Tamarix articulata* (a) from which adults of *Lestodiplosis tamaricis* (Kollar, 1858) were reared; section of the gall (b). All figures are original drawings taken from publications of Frauenfeld (1859) (Figs 10, 11, 13, 14, 16) and of Houard (1908–1909) (Figs 12, 15).
brown and glossy (Fig. 10). Each gall includes a chamber where a solitary larva develops and pupates. Several generations develop per year. Usually two generations develop per year Nijveldt (1969).

**Occurrence.** Egypt, without name of locality (Frauenfeld 1859, Houard 1912).

**Distribution.** Euro-Asian, known to occur in many countries of Europe; in Asia recorded in Armenia, Georgia, Russia (Siberia), Kazakhstan and India; in Northern Africa (Egypt) (Skuhravá 1986, Fedotova 2000, Mirumian 2011, Skuhravá et al. 2013).

**Rhopalomyia navasi** Tavares, 1904


*Misospatha navasi* (Tavares, 1904): Kieffer 1913: 46

Larvae cause large galls, densely white pubescent, on stems of *Artemisia herba-alba* Asso and *A. judaica* L. (Asteraceae). Galls are situated on stem sides. Several chambers occur inside one gall (Fig. 11). In each gall only one larva develops.

**Occurrence.** Egypt, without locality (Frauenfeld, 1859, Houard 1912, on *Artemisia judaica*).

**Distribution.** Mediterranean, found in Spain, Romania, Algeria, Tunisia, Libya and Egypt (Skuhravá 1986).

**Rhopalomyia tanaceticola** (Karsch, 1879)


Orange coloured larvae cause galls on axillary buds, on leaves, in axils of leaves and in flower heads of *Tanacetum vulgare* L. (Asteraceae). Several generations develop per year. Larvae pupate in the galls.

**Occurrence.** Egypt (Semida 2006).

**Distribution.** Euro-Asian, known from many countries of Europe, from Georgia, Kazakhstan and Northern Egypt (Skuhravá 1986, Fedotova 2000, Skuhravá et al. 2013).

**Rhopalomyia tubifex** (Bouché, 1847)

*Cecidomyia tubifex* Bouché, 1847: 144.


White larvae produce tubular galls on leaf axils, stems and flower heads of *Artemisia campestris* L. (Asteraceae) (Fig. 12). Galls are 10–15 mm long. Each gall contains one larva. Two generations develop per year. Larvae pupate in the galls.

**Occurrence.** Egypt (Houard 1916).

**Distribution.** Eurosiberian and sub-Mediterranean, known to occur in many countries of Europe; in Northern Africa: Algeria, Tunisia, Libya, Egypt; in Asia: Georgia and Russia (Siberia) (Skuhravá 1986, Skuhravá et al. 2013).

**Schizomyia botellus** Dorchin et Freidberg 2011

Orange coloured larvae cause elongate or fusiform swellings on stems of *Deverra scoparia* and *Deverra triradiata* (Apiaceae). The galls are formed from axillary buds and may be 2–8 cm long (Fig. 13). Several larvae develop in the central cavity (Dorchin & Freidberg 2011).

**Occurrence.** Egypt. The galls on *Deverra triradiata* were found by Frauenfeld and were drawn by him in his paper (Frauenfeld 1859, Table VI, Fig. 11). Dorchin & Freidberg (2011) found galls caused by this species in Israel, reared adults and described this species.

**Distribution.** Mediterranean, known from Tunisia (galls on *Deverra scoparia*), Egypt (Sinai, Wadi El Raha, on *Deverra triradiata*) and Israel (on *Deverra triradiata*) (Dorchin & Freidberg 2011).

**Schizomyia buboniae** (Frauenfeld, 1859)

*Cecyldomyia buboniae* Frauenfeld, 1859: 325.
*Hormomyia buboniae* (Frauenfeld, 1859); Houard 1909: 767, figs 1088–1089.
*Schizomyia buboniae* (Frauenfeld, 1859); Dorchin & Freidberg 2011: 43.

Larvae cause strange, berry-like galls 1–2.5 cm large on the thin stems of *Deverra tortuosa* (Desf.) DC (*Pituranthus tortuosa* Benth. et Hooker) (Apiaceae). Such galls are composed of 30–60 small, unilocular galls. A single larva develops in each small gall where it also pupates. Only one generation develops per year. Frauenfeld (1859) described the gall and the female and illustrated the gall (Fig. 14). Houard (1908–1909) gave a description of the gall under Nr. 4423 with the reference to Frauenfeld (1859). Dorchin & Freidberg (2011) redescribed male, female, larva and pupa on the basis of specimens deposited in Naturhistorisches Museum, Wien (Vienna, Austria).

**Occurrence.** Egypt: area from Cairo up to Suez (Frauenfeld 1859); Wadi Degla Protected Area (photo of galls on the internet, 2013); Alexandria, Burg El-Arab Dist., March 2014 (A. K. Elsayed, unpublished data) (Fig. 24).

**Distribution.** Mediterranean, found in Morocco, Algeria, Tunisia, Libya, Egypt and Israel (Skuhravá 1986, Dorchin & Freidberg, 2011).

**Stefaniella skuhravae** Elsayed, 2014


Larvae cause small and slight swellings on male floral inflorescences of *Atriplex halimus* L. (Chenopodiaceae) (Fig. 22). The gall consists of a single chamber. One larva develops and pupates in the gall. Pupal exuviae protrude from the hole after emergence of adults.


**Distribution.** Mediterranean, found only in Egypt.

**Stefaniella trinacriae** De Stefani, 1900

*Stefaniella trinacriae* De Stefani, 1900: 8; Skuhravá 1986: 133; Gagné 2004: 257.

Larvae cause fusiform plurilocular swellings of stems of *Atriplex halimus* L. (Chenopodiaceae) of a size of a nut. In the gall there are many chambers, in each chamber one yellow-whitish larva develops (Figs 15, 23). Larvae pupate inside the galls. Two generations develop per year. De Stefani (1900) discovered this species in Sicily (Italy) and described adults and larvae.

**Occurrence.** Egypt: Cairo, Wadi Hof, 30 March 1918 (Debski 1918); Alexandria, Al-Amria district, April to October 2012 and 2013, 16 males and 14 females, leg. A. K. Elsayed (new record) (Fig. 23).
Stefaniola defoliata Dorchin, 2001

A single larva develops inside the leaf of *Suaeda monoica* Forssk. ex Gmelin (Chenopodiaceae) without any external sign of presence. Pupal exuvia protruding from an infested leaf is the only evidence of the leaf inhabitant.

**Occurrence.** Egypt: Sinai (Dorchin 2001).

**Distribution.** Mediterranean, known from Israel and Egypt (Dorchin 2001).

Stefaniola gloma Möhn, 1971

Larvae cause weakly swellings on flowering branch of *Salsola vermiculata* L. and other species of *Salsola* (Chenopodiaceae). One or several long chambers inside the gall. Pupation takes place in the gall.

**Occurrence.** Egypt, Kanai (now: Qena), 19 September 1893, on *Salsola pachoi* Aschers. (Möhn, 1971).

**Distribution.** Mediterranean, known from Spain, Algeria, Syria, Iraq, Israel, Palestine and Egypt.

Stefaniola unita Möhn, 1971

Larvae cause lengthwise-oval, relatively hard-walled swellings on stem of *Haloxylon schweinfurthii* Aschers. and *H. schnittianum* Pomel (Chenopodiaceae). One or two chambers may occur in one gall. Larvae pupate in the gall.

**Occurrence.** Egypt: near Suez, 15 March 1959 (the type locality) (Möhn, 1971).

**Distribution.** Mediterranean, known from Algeria, Tunisia and Egypt.

Stefaniola vastita Möhn, 1971

Larvae cause scarcely visible swellings on the stem of *Anabasis articulata* (Forsk.) Moq. and *A. prostrata* Pomel (Chenopodiaceae). One to four chambers may occur in one gall. Larvae pupate in the gall.

**Occurrence.** Egypt: Sinai, June 1832 and 8 October 1926 (Möhn, 1971).

**Distribution.** Mediterranean, known from Spain, Algeria, Jordan, Egypt.

Stefaniola ventriosa Möhn, 1971

Larvae cause galls on leaves of *Traganum nudatum* Delile (Chenopodiaceae). The gall has one chamber inside. The leaf is paunchy swollen and includes upright, hard-walled chambers where larvae develop and pupate.

**Occurrence.** Egypt: Giza near Cairo, 25 April 1908 (Möhn, 1971).

**Distribution.** Mediterranean, known from Tunisia, Morocco, Israel and Egypt.
DISCUSSION

Number of known species forming present fauna
The known gall midge fauna of Egypt is composed of 48 species belonging to 22 genera. It is not too rich in comparison with four other countries spread along the Mediterranean Sea in North Africa (Table 2). It occupies the position in the middle from the point of view of species richness of gall midge faunas: 92 species are known to occur in Algeria, 51 species in Morocco, 36 species in Tunisia, 15 species in Libya (Skuhravá et al. 1984, Skuhravá 1986, Gagné & Jaschhof 2014).

The two most species rich genera are Baldratia and Dasineura each of them with six gall midge species. These are followed by Steffaniola with five species, Psectrosema and Rhopalomyia each with four species and Contarinia with three species. These findings differ substantially from results that were obtained in the evaluation of species numbers of the main genera of gall midges in Europe (Skuhravá & Skuhravý 2010). Most of the known gall midge species occurring in Egypt are phytophagous and their larvae cause galls on various host plants, five species are zoophagous (Aphidoletes aphidimyza and Feltiella acarisuga, Dicrodiplosis manihoti, Diadiplosis hirticornis and D. donaldi) and three species are mycophagous (Asynapta phragmitis, Mycodiplosis conioraphagha and M. triticina).

Phytophagous species are associated with 37 plant species which belong to ten plant families. About a half of host plant species are herbaceous plants or small shrubs (17 species, 46%), ten species (27%) are shrubs or small trees, eight species (21%) are trees (Tamarix, Acacia, Mimosa) and two species (5%) grasses (Arundo, Phragmites). Most gall midge species (16 species, 33%) are associated with Chenopodiaceae causing various galls, six species with Tamaricaceae, four with Asteraceae, four with Fabaceae, three with Brassicaceae and another three with Poaceae, two with Apiaceae and one species each with Solanaceae, Violaceae and Zygophyllaceae.

Usually only one species of gall midges in Egypt is associated with one host plant species. The saltbush, Atriplex halimus, a shrub of the family Chenopodiaceae which is native to southern Europe and Northern Africa, hosts in Egypt even four gall midge species: Asphondylia punica (= A. conglomerata), Primofavilla aegyptiaca, Stefaniella trinacriae and S. skuhravae. A desert plant, Anabasis setifera, also from Chenopodiaceae, hosts two gall midge species, Baldratia aegyptiaca and B. desertorum.

The reed, Phragmites australis, of the family Poaceae, one of the most widely distributed of all flowering plants, hosts in Egypt two gall midge species and probably other gall midge species living hidden on this host plant will be discovered in the future. A plant of deserts, Traganum nudatum, of the family Chenopodiaceae, also hosts two gall midge species, Baldratia tragani and Stefaniola ventriosa. Five species of tamarisk (Tamarix), shrubs and low trees of the family Tamaricaceae, host six species of gall midges that cause swellings of various shapes on branches and one species develops inside flower buds.

Thirteen species were recorded in Northern Egypt near Alexandria during investigations in the years 2012–2014. Eight species are gall causers and are associated with various host plants and five species are predators feeding on various arthropods. Asphondylia punica, Primofavilla aegyptiaca, Stefaniella skuhravae and Stefaniella trinacriae are associated with Atriplex halimus; Baldratia salicorniae induces galls on Arthrocnemum fruticosum and Schizomyia bubonae on Deverra tortuosa. Larvae of Houardiella gracilis develop in stems of A. macrostachyum and larvae of Baldratia karamae inside leaves of Suaeda pruinosa. Of the zoophagous species, the larvae of Aphidoletes aphidimyza were recorded in the colonies of Aphis nerii and Aphis durantae; larvae of Feltiella acarisuga feeding on Tetranychus spp.; larvae of Diadiplosis donaldi and D. hirticornis preying on Spilococcus juniperi and larvae of Dicrodiplosis manihoti on Phenacoccus gossypii. Three other species are new to science and are described in a separate paper, seven species
Table 2. Fauna of the family Cecidomyiidae of Egypt and common species which occur in five North-African countries

<table>
<thead>
<tr>
<th>species of gall midges</th>
<th>Morocco</th>
<th>Algeria</th>
<th>Tunisia</th>
<th>Libya</th>
<th>Egypt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aphidoletes aphidimyza (Rondani, 1847)</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asphondylia punica Marchal, 1897</td>
<td></td>
<td>+</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asynapta phragmitis (Giraud, 1863)</td>
<td></td>
<td></td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baldratia aegyptiaca Möhn, 1969</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Baldratia desertorum Möhn, 1969</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Baldratia halogenotis Möhn, 1969</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Baldratia karamae Elsayed, Skuhravá, 2014</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Baldratia salicorniae Kieffer, 1897</td>
<td></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Baldratia tragani Möhn, 1969</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Collula kiefferi Gagné, 1993</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Contarinia forskalei Debski, 1918</td>
<td></td>
<td>+</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contarinia lycii Debski, 1918</td>
<td></td>
<td></td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contarinia zygophylli Debski, 1918</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Dasineura affinis (Kieffer, 1886)</td>
<td></td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dasineura lenkiewicziae (Debski, 1918)</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Dasineura mimosae (Kieffer, 1909)</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Dasineura senebrierae (Kieffer, 1909)</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Dasineura tetragnae Debski, 1918</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Dasineura zillae (Kieffer, 1909)</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Diadiplosis donaldi (Harris, 1968)</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Diadiplosis hirticornis Felt 1915</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Dicrodiplosis manihoti Harris 1981</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Feltiella acarisuga (Vallot, 1827)</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Giradiella inclusa (Frauenfeld, 1862)</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Houardiella gracilis Dorchin, Freidberg, 2008</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Lasioptera donacis Coutin, 2001</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Lestodiplosis tamaricis (Kollar, 1858)</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Mycodiplosis coniophaga (Winnertz, 1853)</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Mycodiplosis triticina (Barnes, 1936)</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Primafavilla aegyptiaca Elsayed, 2014</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Psectrosema alfieri Debski, 1922</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Psectrosema debbii (Kieffer, 1912)</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Psectrosema tamaricinum (Kieffer, 1909)</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Psectrosema tamaricum (Kieffer, 1912)</td>
<td></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Reselliella trianguliceps (Debski, 1918)</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Rhopalomyia millefoli (Loew, 1850)</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Rhopalomyia navasi Tavares, 1904</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Rhopalomyia tanacetica (Karsch, 1879)</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Rhopalomyia tubifex (Bouché 1847)</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Schizomyia botellus Dorchin, Freidberg, 2011</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Schizomyia bubonae (Frauenfeld, 1859)</td>
<td></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Stefaniella skahravae Elsayed, 2014</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Stefaniella trinacrae De Stefani, 1900</td>
<td></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Stefaniola defoliata Dorchin, 2001</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Stefaniola gloma Möhn, 1971</td>
<td></td>
<td></td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stefaniola unita Möhn, 1971</td>
<td></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Stefaniola vastita Möhn, 1971</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Stefaniola ventriosa Möhn, 1971</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>number of species of the fauna</td>
<td>51</td>
<td>92</td>
<td>35</td>
<td>15</td>
<td>48</td>
</tr>
<tr>
<td>number of common species</td>
<td>8</td>
<td>9</td>
<td>9</td>
<td>7</td>
<td>–</td>
</tr>
</tbody>
</table>

are recorded in Egypt for the first time and *Stefaniella trinacrae* and *Schizomyia bubonae* are recorded newly after more than 100 years since their first discovery in Egypt.
Geographical distribution

The gall midge species occurring in Egypt may be divided, according to their overall distribution in the world, into five zoogeographic units: Mediterranean, Euro-Asian, Holarctic, Afrotropical and Afro-Asian. Of 48 species of gall midges occurring in Egypt, the majority – 36 (75%) are Mediterranean species and the remaining species belong to other zoogeographical units: three are Holarctic or cosmopolitan, five are Euro-Asian, two Afro-Asian and two Afrotropical species.

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. Some of them occur over greater areas and a few species reach the northern limits of their distribution areas in Central Europe. In such cases they are designated as submediterranean species. In Egypt thirty six species, forming more than one third of all species found there, belong in this group, as for example five species of the genus *Baldratia* and five species of the genus *Dasineura*.

Euro-Asian or Palaearctic 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. Five species (10.5%) found in Egypt belong in this group. *Asynapta phragmitis* living in stems and *Giraudiella inclusa* causing corn-like galls in stems of *Phragmites australis*, *Dasineura affinis* inducing leaf galls on *Viola* spp. and two species of *Rhopalomyia*, namely *R. millefolii* associated with *Achillea millefolium* and *R. tanaceticola* associated with *Tanacetum vulgare*.

All these species occur in Europe abundantly; galls of *Giraudiella inclusa* were discovered also in Iraq and China, and they were found also in eastern North America where this species is considered to be an immigrant (Gagné & Jaschhof 2014). Galls of *Dasineura affinis* were found also in Kazakhstan and Turkey, galls of *Rhopalomyia millefolii* in Armenia, Georgia, Russia (Siberia), Kazakhstan and as far as India, and galls of *R. tanaceticola* in Georgia and Kazakhstan.

Holarctic species occur simultaneously in the Palaearctic and in the Nearctic regions. Three such species (6.2%) occur in Egypt: *Aphidoletes aphidimyza*, *Feltiella acarisuga*, both zoophagous species, and *Mycodiplosis coniophaga*, a mycophagous species.

Afrotropical species occur only in Africa and have not been found in any other parts of the world. Two species belong in this group: *Mycodiplosis triticina*, found in Kenya and Egypt, and *Diadiplosis donaldi* recorded in Nigeria and Egypt.

Afro-Asian species occur in Africa and also in Asia. Two species occurring in Egypt show such type of distribution, both are predators: *Diadiplosis histicornis*, known to occur in Japan, India, Yemen and Egypt, and *Dicrodiplosis manihoti*, in Senegal, Congo, Oman, Iran and Egypt.

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.

Similarity in faunal composition of five North African countries

The similarity or relationships between the fauna of gall midges of Egypt and faunas of four countries situated in North Africa – Morocco, Algeria, Tunisia and Libya may be shown by number of common (or shared) species, that are such species occurring in Egypt and one or more of these countries. The number of common species indicates a similarity in faunal composition: the higher the number of common species means a higher degree of similarity of the faunas. The similarity in composition of the known gall midge fauna in Egypt and faunas of four North African countries is shown in Table 2. 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, the level of knowledge of the country, number of explored localities and the intensity of investigations (Skuhravá & Skuhravý 2010).
The contemporary fauna of gall midges in Egypt including 48 species is not rich. More than one third (20 species, 41.6%) were found only in Egypt and are restricted to this region. The highest number of common species – nine species of gall midges – occurs between Egypt and Algeria and Egypt and Tunisia, eight species common to Egypt and Morocco and seven species common to Egypt and Libya. Three species of gall midges occur in all five North African countries: Baldratia salicorniae, causing swellings on stems of Arthrocnemum fruticosum, Psectrosema tamaricum swellings on young leaf branches and on flowering shoots of Tamarix africana and T. gallica L. and Rhopalomyia navasi inducing large galls on stems of Artemisia herba-alba and A. judaica. These three species of gall midges are the most frequent species of gall midges in North African countries.

Recommendations for future research

He hope that our paper will stimulate students and researchers living mainly in Egypt to investi-
gate in various parts of Egypt with efforts to discover gall midge species and their galls known to occur on various plants in the Mediterranean area. This is very important for zoogeographical and biogeographical studies to discover occurrence of such species and ways of their gradually dispersing and to find how far they have penetrated to the south in Africa using the corridor of the valley of the River Nile. Only a few investigations have been done in Egypt in recent years. It is necessary to search for gall midges in many localities and in various biotopes.

The senior authors have experience that investigations in more localities bring discovery of many unknown gall midge species. For example, they enriched the gall midge fauna in Greece during investigations in years 1994–2010 by about 200 species. They searched for gall midges and their galls at 103 localities spread in the mainland and in several islands. At the beginning of their investigations in 1994 only 19 species of gall midges were known, 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 Egypt could be as rich as the fauna of Algeria which is the richest of five North African countries and includes 92 species. This is the result of intensive investigations of several researchers who contributed to this knowledge in Algeria in the past.

We recommend to prepare a long-termed program of systematic investigations of biodiversity of gall-inducing arthropods and their galls in Egypt, in the Nile Delta and along the Nile Valley and in the northern part along the coast of the Mediterranean Sea with rich vegetation, in national parks and protected nature reservations and other protected areas, in salt marshes, in oases and drainages and in valleys and along the Nile River.

We recommend to use during these investigations the time and area unit collection method developed by the senior authors (Skuhravá & Skuhravý 2010). This involves surveying each selected locality visually by walking through it slowly over a period of at least one 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 short 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 were put in separate small plastic bags. All species that were found were recorded in the protocol and all collected material was prepared. Several specimens of each host plant with galls were preserved as herbarium items, several plants with galls were kept in plastic bags to obtain living larvae, several plants with galls were placed in small emergence cages to obtain adults and finally several galls with larvae were put into vials with 75% alcohol for future morphological studies or for studies of the digestive system of larvae. Such samples taken from various habitats or microhabitats are very important.
It should be useful to search in Egypt for galls on various plants, trees and shrubs, to search for galls on the Egyptian native trees Juniperus phoenicea, on two Salix species recorded in Egypt, Salix tetrasperma and S. mucronata (Al Sherif et al. 2009), on leaves of Olea europea in olive groves, on leaves of Vitis vinifera in vineyards, on trees in orchards and on various agricultural plants in fields, on reed stands (Phragmites australis) growing along various water reservoirs, on trees and shrubs in city parks and on various plants occurring in protected areas and national parks of Egypt with effort to enrich the biodiversity of the family Cecidomyiidae and of other groups of arthropods causing galls on plants in Egypt. It is necessary also to search for galls on leaves of introduced trees and shrubs (Robinia pseudoacacia, Gleditsia triacanthos) and to try to discover alien insect species which are gradually recorded in various parts of Europe and seem to penetrate in further countries (Skuhravá et al. 2010).

It is necessary to try to rear adults of eight species of gall midges that were described on the basis of larvae obtained from dry galls by Möhn (1966–1971) and also of other insufficiently known species described on the basis of galls only.

It would be desirable to try to find new material of stem galls on Tamarix articulata caused by the tortricid moth Cirriphora pharaonana which were found in or near Cairo in 1857 by Kollar (1858) and to try to rear adults of gall midges from these galls.

Acknowledgements

We thank Dr Hedaya H. Karam (Department of Applied Entomology, Faculty of Agriculture, Alexandria University, Alexandria) for identifying Phenacoccus gossypii, the prey of Dicrodiplosis manihoti. We thank Dr Keith Murray Harris (Ripley, Woking, Surrey, UK) for valuable comments on the manuscript and for improvements of the English text and Dr Raymond Gagné (Systematic Entomology Laboratory, National Museum, Washington, D. C., USA) for kindly sending a xerocopy of the paper of Steyskal & El-Bialy (1968).

REFERENCES


MEDITERRANEAN BASIN AND THEIR CHALCIDOID PARASITIDS (HYMENOPTERA: CHALCIDIOIDEA).


ZOOTAXA 3869: 383–396.


ABSTRACT \( \text{Volume of the 8th International Congress of Dipterology, 10–15 August 2014, Potsdam, Germany. Halle (Saale): AMPYX-Verlag, xxvii+440 pp.} \)

EGYP.TIAN JOURNAL OF AGRICULTURAL RESEARCH 86: 2217–2225.

GALL MIDGES (DIPTERA: CECIDOMYIIDAE) EXISTING IN EGYPT.

EGYP.TIAN JOURNAL OF AGRICULTURAL RESEARCH 86: 2217–2225.

GALL MIDGES (DIPTERA: CECIDOMYIIDAE) EXISTING IN EGYPT.

EGYP.TIAN JOURNAL OF AGRICULTURAL RESEARCH 86: 2217–2225.

EGYP.TIAN JOURNAL OF AGRICULTURAL RESEARCH 86: 2217–2225.

EGYP.TIAN JOURNAL OF AGRICULTURAL RESEARCH 86: 2217–2225.


