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Phytophagous gall midges (Diptera: Cecidomyiidae) of Armenia

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Abstract. The gall midge fauna of Armenia currently includes 96 species. They are recorded from 88 localities in Armenia at altitudes ranging from 700 to 2,500 m a. s. l. and are associated with 74 species of plants belonging to 31 plant families. The majority of the gall midges occurring in Armenia are European (35%) and Euro-Siberian (31%) but there are also four Mediterranean, four Holarctic and about 20% Asian-Turanian faunal elements. *Sophoromyia armenica* Mamaev et Mirumian, 1989, causing galls on *Glycyrrhiza glabra* and *Halodiplosis araratica* Mirumian, 1991, causing galls on *Salsola ericoides* are endemic to Armenia. More than 60 species of gall midge are recorded from the Ararat Valley, which is the province with the greatest species richness. *Dasineura bayeri* (Rübsaamen, 1914) (formerly misidentified as *Dasineura sisymbrii* Schrank, 1803) causing galls on *Sisymbrium loeselii* and *Dasyneuriola suaedae* Marikovskij, 1961 causing galls on *Suaeda altissima* are the most frequent gall midge species in Armenia. *Contarinia desertorum* Marikovskij, 1961 causing galls on *Alhagi pseudoalhagi*, *Dasineura rosae* (Bremi, 1847) on various species of *Rosa*, *Spurgia euphorbiae* (Vallot, 1827) on *Euphorbia* and *Sophoromyia armeniaca* Mamaev et Mirumjan, 1989 on *Glycyrrhiza glabra*, occur frequently in Armenia. Galls of *Contarinia craccae* (Loew, 1850) on *Vicia cracca* and *V. sepium*, and those of *Dasineura urticae* (Perris, 1840) on *Urtica dioica* were found at the highest locality, the Village Madina, 2200 m a. s. l. Several species of gall midge are potential pests of agricultural plants but none are currently recorded as pests. *Dasineura bayeri* (Rübsaamen, 1914) associated with *Sisymbrium loeselii* and an undescribed species of *Jaapiella* sp. associated with *Convolvulus arvensis* are used as biological control agents of weeds in Armenia.

Key words. Cecidomyiidae, Diptera, Armenia, Palaearctic region, plant-insect interactions.

INTRODUCTION

The family Cecidomyiidae is the biggest group of insects in the order Diptera. The phytophagous gall midges are included in the subfamily Cecidomyiinae as four tribes: Lasiopterini, Oligotrophini, Asphondyliini, and Cecidomyiini. Phytophagous larvae of these midges induce the formation of galls on various plants. Some of them are serious pests of cultivated plants and forest trees, and several are used in the biological control of weeds.

The world fauna of phytophagous gall midges numbers 5,700 species (Gagné 2004) of which 3,200 occur in the Palaearctic Region and 1,700 in Europe. Gall midges in Western Asia and adjacent countries are poorly studied.

Armenia covering an area of 29,800 km^2 is located in south-western Asia, in the Lesser Caucasus Mountains. It is a mountainous country with fast flowing rivers and few forests. The climate is a highland one with hot summers and cold winters. The mountainous character of the country results in a great variety of local landscapes. The land rises to 4090 m a. s. l. at Mount Aragats and the lowest altitude is 400 m a. s. l. Mount Ararat, which was historically a part of Armenia, the highest mountain in the region, is now located in Turkey. Yerevan, the capital city, is located on a plain surrounded by mountains at altitudes from 900 to 1,300 m a. s. l. From the

biogeographical point of view, Armenia is a part of the Caucasus-Iranian Highlands Province of the Palaearctic region (Udvardy 1975).

The first two gall midges recorded in Armenia were described by Möhn (1971): *Stefaniola excelsa* Möhn, 1971, causing galls on *Aellenia glauca* and *A. subaphylla*, and *Careopalpis* (*Stefaniola*) *harenosa* Möhn, 1971, causing galls on *Kalidium caspicum* and *Halocnemum strobilaceum*. They are cited in the Catalogue of Palaearctic Diptera (Skuhravá 1986) together with a third species, *Contarina onobrychidis* Kieffer, 1895, causing galls on *Onobrychis sativa*, which is recorded in the review of Mamaeva & Mamaev (1981).

In Armenia the systematic study of gall midges started late in the 20th century. Earlier gall midges were occasionally collected by Armenian entomologists, as representatives of harmful insects. The same occurred in neighbouring countries of the South Caucasus, Georgia and Azebaijan. At that time only 24 species were recorded and described for Armenia (Uvarov 1918, Makarian & Avetian 1931, Azarian & Barkhudarian 1940, Ter-Grigorian 1944, Mirzoian 1965, 1970, 1977, Avetian 1952, Alaverdian 1956, Lozovoy 1965, Harutunian 1966, Terterian & Alaverdian 1976, Harutunian 1977, 1989).

As a result of faunistic investigations of phytophagous gall midges in Armenia (Mirumian & Terterian 1988, Mirumian 1990, Mamaev & Mirumian 1990a, 1990b) the list of described species included 92 species (Mirumian 1992). Two new species (*Sophoromya armenica* and *Halodiplosis araratica*) have been recorded (Mamaev & Mirumian 1989, Mirumian 1991) and adults of the species *Dasineura clematidina*, known earlier only from the galls, described for the first time (Mirumian 1993). The data on the biodiversity of these species were summarized by Mirumian & Terterian (1996) and Mirumian (2005).

This article presents results obtained for a part of the world at the crossroads of routes of flora and fauna that have penetrated from Europe and from Asia. I present an annotated list of species of gall midges together with their host plants and occurrence in Armenia, distribution in the Palaearctic region, new records and an analysis of the Armenian gall midge fauna from a zoogeographical point of view.

MATERIAL AND METHODS

The occurrence and distribution of gall midges have been studied by collecting galls containing larvae from host plants at each locality (see below). The method of collecting is described in detail by Mamaev (1968). Identification of galls was based on the species of host plant and morphological analysis of plant damage (gall shape and morphology, their localization on plant parts). Galls gathered from nature were transferred to the laboratory, immersed into dry heat sterilized sand and the adults that emerged were collected and fixed in 70% ethanol. Permanent microscope slides of adults were made (according to Kolomoets et al. 1989) and the morphology of adult insects studied under a microscopic for identification purposes. Microscope slides of adult gall midges and a herbarium of dried host plants with galls are kept in the collection of the Laboratory of Entomology of our Centre. The keys for identification are those of Mamaev (1969) and Mamaeva & Mamaev (1981). The classification used for gall midges was that first proposed by Skuhravá (1986) and revised by Gagné (2004), and for host plants that of Maghakian (1941) and Takhtajyan & Fedorov (1972).

Localities studied

Investigations of gall midges were carried out at 88 localities situated in 9 administrative provinces of Armenia and in the surroundings of the capital, Yerevan (Fig. 1). Provinces are characterized by brief descriptions of the predominant climatic conditions and landscapes in these areas. Galls of gall midges were collected mainly around settlements (villages and towns). The main habitata studied were waste uncultivated ground, roadsides, river canyons, meadows, fields, natural and artificial forests, groups of trees and shrubs, agricultural plantations and pastures.

All the collecting of specimens occurred from April to September. The main collection was gathered in 1987–1990 with new findings added latter.

Ararat and Armavir provinces are situated in the Ararat valley (Fig. 2) in the north-western part of the Mid-Araksian mountainous depression. The Armenian part of the Ararat valley is at altitudes from 800 to 1,100 m a. s. l. It has an arid climate and includes the following types of landscape: desert, semi-desert, dry mountains and steppe. The wild flora of the Ararat valley is mainly xerophylic (Fig. 3a, 3b) (Yablokov-Khndzoryan, 1961, Takhtajyan & Fedorov 1972). As

this valley is the main agricultural area of the country little of the natural landscape remains. A typical landscape of the foothill zone is shown in Fig. 4.

A. Ararat Province (Ararat marz): localities numbered from 1 to 11 are at altitudes of about 800–900 m a. s. l. Semi--desert climate and landscape (with the exception of artificially irrigated agrocenoses). It experiences very hot summers (air temperature in July 40–45^{0}C) and relatively mild winters with a prevalence of temperatures above 0 °C.
1 – Ararat, 820 m a. s. l.; **2** – Armash ponds, 830 m a. s. l.; **3** – Artashat, 828 m a. s. l.; **4** – Aintap, 868 m a. s. l.; **5** – Eraskh, waste fields around railway station, 805 m a. s. l.; **6** –Goravan, red sand semi-desert, 920 m a. s. l.; **7** – Marmarashen, 846 m

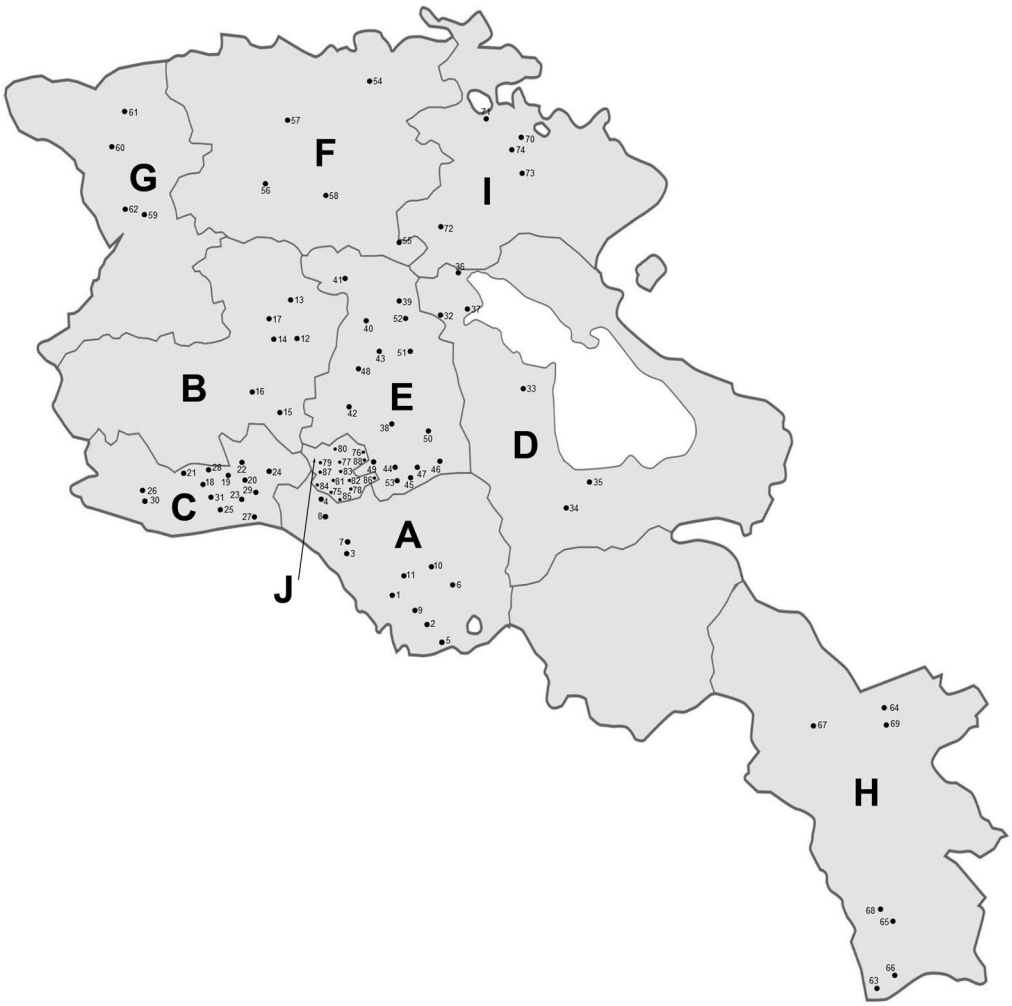


Fig. 1. Map of Armenia showing the localities where midges of the family Cecidomyiidae were collected. Localities are arranged according to administrative provinces: A – Ararat Province, B – Aragatsotn Province, C – Armavir Province, D – Gegharkunik Province, E – Kotayk Province, F – Lori Province, G – Shirak Province, H – Synik Province, I – Tavush Province, J – surroundings of the city Yerevan. For number of localities, see the text.

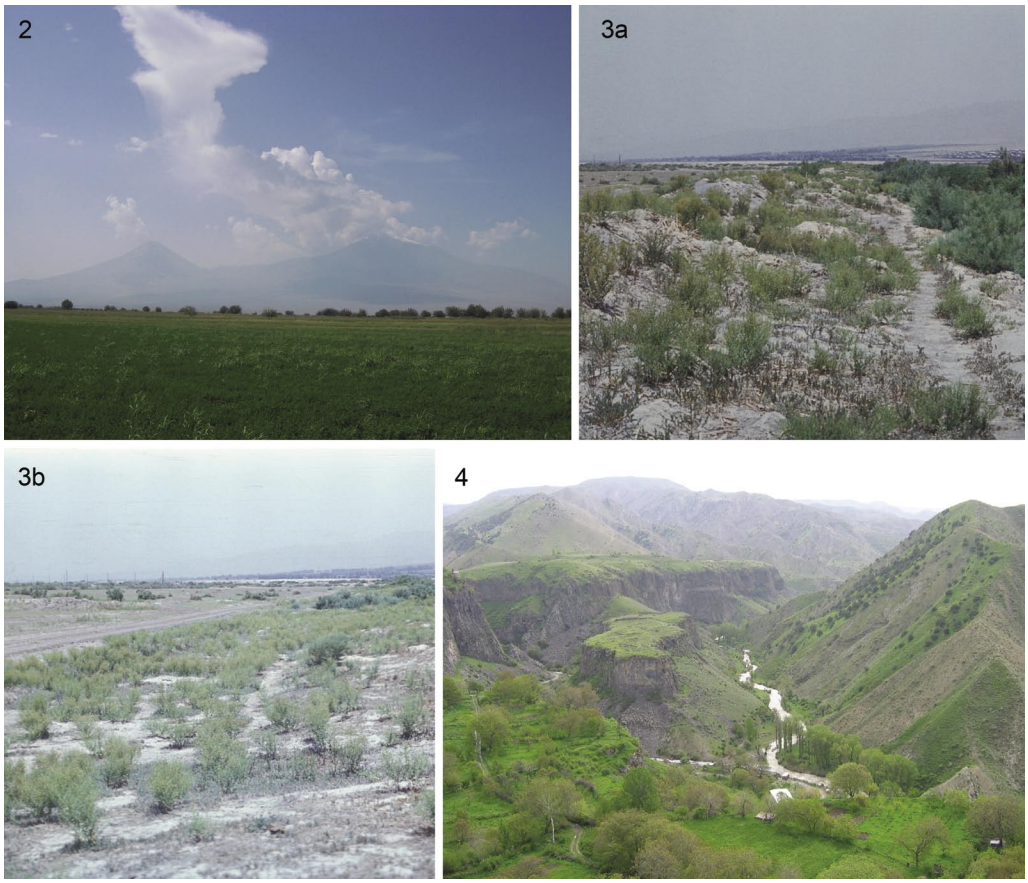
a. s. l.; **8** – Masis, 829 m a. s. l.; **9** – Paruyr Sevak, 840 m a. s. l.; **10** Urtsadzor, semi-desert with *Galigonum polygonoidea* the predominant plant. 900 m a. s. l.; **11** – Vedi, 900 m a. s. l.

B. Aragatsotn Province (Aragatsotn marz): localities numbered from 12 to 17 are at altitudes of about 1,000 to 2,000 m a. s. l. Area of mountainous steppe. The climate at the localities differs and depends on the altitude. Some localities are semi-desert.

12 – Artavan, 1600 m a. s. l.; **13** – Aparan, 2010 m a. s. l.; **14** – Aragats, Mountainous steppe with xerophytic plants, 2005 m a. s. l.; **15** – Ashtarak, 1175 m a. s. l.; **16** – Byurakan, fields, tree and shrub groups, 1450 m a. s. l.; **17** – Tsahkashen, 1975 m a. s. l.

C. Armavir Province (Armavir marz): localities numbered from 18 to 31 are altitudes of about 800–900 m a. s. l. The summere are very hot (air temperature on July till 40–45 °C) and winters relatively mild with a prevalence of temperatures above 0 °C.

18 – Aygerlich, Artificial ponds, semi-desert overgrown by wormwood, discrete groups of trees and shrubs, 880 m a. s. l.; **19** – Aknalich, 848 m a. s. l.; **20** – Aratashen, canyon of the Kasakh river, 847 m a. s. l.; **21** – Armavir, salt halophytic semi-desert, 880 m a. s. l.; **22** – Arshaluys, 920 m a. s. l.; **23** – Artashar, 843 m a. s. l.; **24** – Echmiadzin, agricultural plantations and natural landscapes, 870 m a. s. l.; **25** – Egheknut, 845 m a. s. l.; **26** – Lenughi, 890 m a. s. l.; **27** – Markara, salt halophytic semi-desert, 844 m a. s. l.; **28** – Metsamor, desert overgrown by tamarisk, 834 m a. s. l.; **29** – Taronik, 845 m a. s. l.; **30** – Ushakert, wet salt-marshes, 900 m a. s. l.; **31** – Zartonk, 848 m a. s. l.



Figs 2–4. Types of landscapes in Armenia. 2 – landscape in the Ararat valley; the distance to the Ararat Mountain is about 40 km. 3a, 3b – landscape of salt halophytic semi-desert. 4 – Garni, canyon of the Azat river.

D. Gegharkunik Province (Gegharkunik marz): localities numbered from 32 to 37 are at altitudes of about 1,700 to 2,200 m a. s. l. Includes lake Sevan. Mountainous steppe with mesophylic vegetation. Summers are mild and winters long, cold and snowy.
32 – Gagarin, alpine meadows, 1850 m a. s. l.; **33** – Gavar, alpine meadows, 2000 m a. s. l.; **34** – Madina, 2220 m a. s. l.; **35** – Martuni, 1870 m a. s. l.; **36** – Semenovka, 2100 m a. s. l.; **37** – Sevan, 1900 m a. s. l.

E. Kotayk Province (Kotayk marz): localities numbered from 38 to 53 are at altitudes of about 1,400 to 2,000 m a. s. l. Mountainous steppe. Densely populated area situated near to the capital Yerevan and rich in resorts and satellite towns.
38 – Abovyan, 1450 m a. s. l.; **39** – Aghavnadzor, mountainous forest, 1840 m a. s. l.; **40** – Aghveran resort, 1550 m a. s. l.; **41** – Ankavan resort, 2010 m a. s. l.; **42** – Arzni resort, canyon of Kasakh river, 1360 m a. s. l.; **43** – Bjni, 1550 m a. s. l.; **44** – Dzoraghbyur, 1530 m a. s. l.; **45** – Garni, clay-detrituous slopes on mountains, 1400 m a. s. l.; **46** – Gueghard, 1880 m a. s. l.; **47** – Gokht, 1620 m a. s. l.; **48** – Gyumush, 1150 m a. s. l.; **49** – Jrvezh, 1390 m a. s. l.; **50** – Kamaris, 1525 m a. s. l.; **51** – Solak, 1650 m a. s. l.; **52** – Tsahkadzor resort, 1825 m a. s. l.; **53** – Voghchaberd, 1600 m a. s. l.

F. Lori Province (Lori marz): localities numbered from 54 to 58 are at altitudes of about 1,000 to 1,700 m a. s. l.Mountainous forests, fields, abundant mesophylic vegetation. Mild climate with long summer.
54 – Alaverdi, 1000 m a. s. l.; **55** – Fioletovo, 1700 m a. s. l.; **56** – Spitak, 1550 m a. s. l.; **57** – Stepanavan, 1410 m a. s. l.; **58** – Vanadzor, 1360 m a. s. l.

G. Shirak Province (Shirak marz): localities numbered from 59 to 62 are at altitudes of about 1,500 to 2050 m a. s. l. Harsh climate with long winter. Mountainous steppe, xero-mesophylic vegetation.
59 – Akhuryan, 1545 m a. s. l.; **60** – Amasia, 1870 m a. s. l.; **61** – Ashotsk, 2000 m a. s. l.; **62** – Gyumri, 1550 m a. s. l.

H. Synik Province (Syunik marz): localities numbered from 63 to 69 are altitudes of about 600 to 2000 m a. s. l. Dry climate, mountainous steppe, mountainous forests.
63 – Agarak, roadsides, plantations, 660 m a. s. l.; **64** – Brun, wet sides of drainage channels, 1700 m a. s. l.; **65** – Lichk, 1780 m a. s. l.; **66** – Meghri, orchard, 620 m a. s. l.; **67** – Sisian, steppe, plantations of forage crops, 1600 m a. s. l.; **68** – Tashtun, mountainous forest in the pass, 1950 m a. s. l.; **69** – Vernashen, mesophylic vegetation at the foot of the mountain, 1600 m a. s. l.

I. Tavush Province (Tavush marz): localities numbered from 70 to 74 are at altitudes of about 700 to 1200 m a. s. l. Mountainous forests, meadows, abundant mesophylic vegetation.
70 – Achajur, 760 m a. s. l.; **71** – Acharkut, 740 m a. s. l.; **72** – Dilijan resort, 1220 m a. s. l.; **73** – Ijevan, 750 m a. s. l.; **74** – Makaravank, 725 m a. s. l.

J. Surroundings of Yerevan: localities numbered from 75 to 88 are at altitudes of about 800 to 1400 m a. s. l. Waste ground near to populated city areas.
75 – Aeratsia, 850 m a. s. l.; **76** – Avan-Arinj, 1310 m a. s. l.; **77** – botanic garden, 1240 m a. s. l.; **78** – Erebuni massive, 1065 m a. s. l.; **79** – Hrazdan river canyon, 780 m a. s. l.; **80** – Kanaker district, 1350 m a. s. l.; **81** – "Khimreaktiv" factory, 868 m a. s. l.; **82** – "Nairit" chemical factory. 940 m a. s. l.; **83** – Nork district, 1140 m a. s. l.; **84** – Nubarashen, 980 m a. s. l.; **85** – power electrostation, 830 m a. s. l.; **86** – Tokhmakh, 850 m a. s. l.; **87** – Tsitsernakaberd, 1060 m a. s. l.; **88** – zoo, canyon of the Getar river, 920 m a. s. l.

RESULTS

There is a relatively rich fauna of phytophagous gall midges of the family Cecidomyiidae in Armenia. It consists of 96 species of which seven are in five genera belong to the Lasiopterini, 64 in 21 genera belonging to Oligotrophini, seeven in two genera belonging to Asphondyliini and 18 in seven genera belonging to Cecidomyiini. They are associated with 78 species of host plant belonging to 65 plant genera of 31 families (Table 1). The majority of the gall midges are in the genera *Dasineura* and *Contarinia*. Sixty-four species are associated with herbs, 25 with trees and seven with shrubs. Most (52) of the gall midges emerged from galls on leaves, 24 from galled flowers, 11 from stem galls, five from galled fruit, three are inquilines and only one species damages roots. Two species, *Sophoromyia armenica* Mamaev et Mirumian, 1989, causing galls on *Glycyrrhiza glabra* and *Halodiplosis araratica* Mirumian, 1991, inducing galls on *Salsola ericoides*, described on the basis of material found in Armenia, seem to be endemic to this area and not found in any other country.

As to the frequency of gall midges in Armenia, usually in the course of our investigations a minimum of one to a maximum twenty (location 45) gall midge species were recorded per a locality with an average of 3.02 species per locality. About one half (43 species) of the species of gall midge found in Armenia were recorded only once, i.e. at only one locality, and these are evaluated as scarce. About twenty species were found at two localities and each of the other twenty species was found at three or four localities.

Dasineura bayeri (formerly misidentified as *Dasineura sisymbrii*) causing galls on *Sisymbrium loeselii* is the most frequent gall midge in Armenia. The galls were found at 16 localities situated mainly in Armavir, Kotayk, Lori and Tavush provinces and in the surroundings of Yerevan city at altitudes from 700 to 1,900 m a. s. l. Another very frequent gall midge in Armenia is *Dasyneuriola suaedae* causing galls on *Suaeda altissima*. The galls were found at ten localities in Ararat and Armavir provinces and in surroundings of Yerevan city at altitudes from about 800 to 950 m a. s. l. The four gall midges: *Contarinia desertorum* causing galls on *Alhagi pseudoalhagi*, *Dasineura rosae* on several species of *Rosa*, *Spurgia euphorbiae* on *Euphorbia* and *Sophoromyia armeniaca* on *Glycyrrhiza glabra*, occur frequently in Armenia and are each recorded at eight or seven localities. Galls of two gall midge species, *Contarinia craccae* causing flower bud galls on *Vicia cracca* and *V. sepium*, and *Dasineura urticae* causing galls on *Urtica dioicae*, were found at the highest situated locality – Madina, at an altitude of 2,200 m a. s. l.

ANNOTATED LIST OF SPECIES OF GALL MIDGES

The following data are presented for each species: species name; host plant; morphology of larvae and galls; for some species additional biological data are given; number of localities where the species were found (the localities are shown and numbered on the map depicted in Fig. 1); zoogeographical data. Asterisks (*) before species names indicate new records for Armenia.

***Apiomyia bergenstammi* (Wachtl, 1882)**
Recorded on *Pyrus* sp. (Rosaceae). The orange larvae develop in round yellowish plurilocular galls that develop on leaf buds. There is one generation per year. Locality 21. Distribution: Mediterranean.

***Aschistonyx carpinicolus* Rübsaamen, 1917**
Recorded on *Carpinus betulus* L. (Corylaceae). Galls consist of a fold along the middle rib of apical leaves. Leaf lamina shrinks. Yellow larvae develop within the wrinkled folds of the leaves. Localities 72, 73. Distribution: European.

****Asphondylia hornigi* Wachtl, 1880**
Recorded on *Origanum vulgare* L. (Lamiaceae). Larvae are bright orange coloured and induce inflorescences to enlarge and compact. Flowers turn into tomentous leaves. Pupation occurs in the galls. There are one or two generations per year. Locality 55. Distribution: Euro-Siberian.

***Asphondylia pruniperda* Rondani, 1867**
Asphondylia prunorum Wachtl, 1888
Recorded on *Prunus domestica* L. and *P. spinosa* L. (Rosaceae). Large orange larvae induce flower buds to develop into yellow-green galls surrounded by brown scales. Pupation occurs in the galls. There is one generation per year. Localities 13, 38, 45, 47, 73, 83. Distribution: European.

*** *Asphondylia scrophulariae* Schiner, 1856**
Recorded on buds of *Scrophularia decipiens* Boiss et Kotschy (Scrophulariaceae). Large yellow larvae induce the flower buds to develop into big condensed spherical galls. Pupation occurs in the galls. There is one generation per year. Localities 45, 47. Distribution: Mediterranean.

*** *Asphondylia verbasci* (Vallot, 1827)**
Recorded on *Verbascum* sp. (Scrophulariaceae). Orange coloured larvae induce flowers to develop into large galls. Pupation occurs in the galls. There is one generation per year. Localities 42, 58, 64. Distribution: Mediterranean.

*** *Baldratia terteriani* (Mamaev et Mirumian, 1990)**
Arafavilla terteriani Mamaev et Mirumian, 1990

Recorded on *Suaeda altissima* L. (Pall.) (Chenopodiaceae). Larvae induce 3–5 mm red-yellowish galls of an irregular form on leaves. Pupation occurs in the galls. There are two or three generations per year. Localities 1, 5, 8. Distribution: Asian, Turanian.

***Bremiola onobrychidis* (Bremi, 1847)**
Recorded on *Onobrychis* sp. (Fabaceae). Several orange larvae develop in leaves folded at the mid rib. Pupation occurs in the in soil. Several generations develop per year. Localities 56, 59, 60, 61. Distribution: European.

***Careopalpis harenosa* (Möhn, 1971)**
Stefaniola harenosa Möhn, 1971
Larvae cause swellings on stems of *Kalidium caspicum* L. and *Halocnemum strobilaceum* (Pall.) (Chenopodiaceae). Distribution: Asian, Turanian (Fedotova 2000).

*** *Careopalpis suaedae* (Fedotova, 1983)**
Recorded on *Suaeda altissima* L. (Chenopodiaceae). Orange larvae induce the formation of yellow-green galls (size 3–8 mm) on leaves. Pupation occurs in the galls. Localities 2, 5, 18, 27, 28. Distribution: Asian, Turanian.

*** *Careopalpis suaedicola* Fedotova, 1985**
Recorded on *Suaeda altissima* L. (Pall.) and is an inquiline developing in the galls of *Careopalpis suaedae* (Chenopodiaceae). Localities 2, 5, 18, 27, 28. Distribution: Asian, Turanian.

*** *Clinodiplosis cilicrus* (Kieffer, 1889)**
Recorded on *Trifolium hybridum* L. (Fabaceae) and is an inquiline developing in the galls of *Dasineura leguminicola*, which induces the flowers to develop into brown-black coloured galls. Localities 39, 55, 70. Distribution: Euro-Siberian.

***Contarinia baeri* (Prell, 1931)**
Cecidomyia baeri Prell
Recorded on *Pinus* sp. (Pinaceae). Orange larvae occur in hollows at bases of needles. The needles shorten and curl slightly. Locality 72. Distribution: Euro-Siberian.

*** *Contarinia craccae* (Loew, 1850)**
Contarinia craceae Kieffer, 1897
Recorded on *Vicia cracca* L. and *V. sepium* L. (Fabaceae). Numerous pale-orange and white larvae develop in flower buds. The flower buds swell but do not open, inner organs are deformed and undeveloped. Pupation occurs in soil. There are two generations per year. Locality 34. Distribution: Euro-Siberian.

*** *Contarinia desertorum* Marikovskij, 1961**
Recorded on *Alhagi pseudalhagi* (Bieb.) Desv. (Chenopodiaceae). Numerous whitish larvae induce pod-like galls on the midrib of folded leaves. Galls are compact and a reddish colour (Fig. 5). Pupation occurs in the soil. There are three or four generations per year. Localities 8, 20, 23, 25, 27, 28, 82, 85. Distribution: Asian, Turanian.

*** *Contarinia heraclei* (Rübsaamen, 1889)**
Recorded on *Heracleum* sp. (Apiaceae). White jumping larvae cause leaves to develop crumpled darkened corrugations. Pupation occurs in the soil. There are perhaps two or three generations per year. Locality 64. Distibution: European.
*** *Contarinia lepidii* Kieffer, 1909.**
Recorded on *Lepidium latifolium* L. (Brassicaceae). Primrose coloured larvae develop in condensed flower buds. Pupation occurs in the soil. There are two or three generations per year. Locality 9. Distribution: European. Potential pest.

*** *Contarinia medicaginis* (Kieffer, 1904)**
Recorded on *Medicago sativa* L. (Fabaceae). Pale-orange larvae develop in flower buds, which enlarge and develop a purple colouration. Pupation occurs in the soil. There are several generations per year. Localities 45, 71. Distribution: Euro-Siberian. Pest.

*** *Contarinia molluginis* (Rübsaamen, 1889)**
Recorded on *Galium aparine* L. (Rubiaceae). Yellow larvae develop in clusters of apical leaves. Galls look like tomentous brushes. Pupation occurs in the soil. There are several generations per year. Locality 45. Distribution: Euro-Siberian. Pest.

*** *Contarinia onobrychidis* Kieffer, 1895**
Recorded on *Onobrychis* sp. (Fabaceae). Yellow larvae develop in enlarged flower buds. Pupation occurs in the soil. There are several generations per year. Locality 67. Distribution: Euro-Siberian.

Table 1. List of host plants of gall midges in Armenia

host plant	species of gall midge
Acer laetum	*Dasineura irregularis*
Achillea biebersteinii	*Ozirhincus millefolii*, *Rhopalomyia millefolii*
Aellenia glauca, *A. subaphylla*	*Stefaniola excelsa*
Alhagi pseudalhagi	*Contarinia desertorum*
Anthemis triumfetii	*Rhopalomyia syngenesiae*
Artemisia campestris	*Rhopalomyia campestris*
Artemisia fragrans	*Rhopalomyia artemisiae*, *R. baccarum*, *R. heteropalpis*
Asperula humifusa	*Dasineura asperulae*
Astragalus cicer	*Dasineura* sp. 2
Atriplex tatarica	*Primofavilla initialis*
Berberis vulgaris	*Contarinia* sp.
Camphorosma lessingii	*Pseudokochiomyia camphorosmae*
Carpinus betulus	*Aschistonyx carpinicolus*
Carpinus sp.	*Zygiobia carpini*
Chenopodium album	*Stefaniella hilversidae*
Cirsum obvalatum	*Jaapiella cirsicola*
Clematis orientalis, *C. vitalba*	*Dasineura clematidina*
Convolvulus arvensis	*Jaapiella* sp.
Euphorbia iberica, *E. sequierana*	*Dasineura loewi*
Euphorbia sequierana	*Spurgia euphorbiae*
Fagus sp.	*Hartigiola annulipes*, *Mikiola fagi*, *Phegomyia fagicola*
Filipendula hexapetula, *F. ulmaria*	*Dasineura engstfeldi*
Fraxinus excelsior	*Dasineura acrophila*
Fraxinus excelsior, *F. oxcycarpa*	*Dasineura fraxini*
Fraxinus oxcycarpa	*Dasineura fraxinea*
Galium aparine	*Contarinia molluginis*, *Dasineura aparines*
Glycyrrhiza glabra	*Sophoromyia armenica*
Halocnemum strobilaceum	*Careopalpis harenosa*
Heracleum sp.	*Contarinia heraclei*, *Macrolabis heraclei*
Hypericum perforatum	*Dasineura hyperici*, *Geocrypta braueri*, *Zeuxidiplosis giardi*
Juniperus virginiana	*Etsuhoa* sp.
Kalidium caspicum	*Careopalpis harenosa*
Kochia prostrata	*Pseudokochiomyia mesasiatica*, *P. vicina*
Lactuca orientalis	*Cystiphora taraxaci*
Lotus caucasicus	*Jaapiella loticola*
Lathyrus cyaneus, *L. pallescens*	*Geocrypta heterophylli*
Lathyrus miniatus	*Dasineura fairmairei*
Lathyrus miniatus, *L. rotundifolius*	*Jaapiella volvens*
Lepidium latifolium	*Contarinia lepidii*
Malus domestica	*Dasineura mali*
Medicago sativa	*Contarinia medicaginis*, *Jaapiella medicaginis*
Melandrium album	*Contarinia steini*
Melilotus officinalis	*Dasineura* sp. 3
Nepeta mussini	*Dasineura* sp.1
Onobrychis sp.	*Bremiola onobrychidis*, *Contarinia onobrychidis*
Origanum vulgare	*Asphondylia hornigi*
Papaver argemone	*Dasineura papaveris*
Pinus sp.	*Contarinia baeri*
Polygonum amphibium	*Wachtliella persicariae*
Prunus divaricata	*Dasineura tortrix*
Prunus domestica, *P. spinosa*	*Asphondylia pruniperda*
Pyrus sp.	*Apiomyia bergenstammi*, *Contarinia pyrivora*
Quercus iberica	*Macrodiplosis pustularis*
Ranunculus arvensis	*Dasineura traili*

Table 1. (continued)

host plant	species of gall midge
Rhamnus pallasii	*Contarinia rhamni*
Rosa canina, *R. corymbifera*, *R. obtusifolia*	*Dasineura rosae*
Rubia tinctorum	*Jaapiella rubiae*
Salix alba	*Rabdophaga marginemtorquens*, *R. terminalis*
Salix excelsa	*Rabdophaga rosaria*, *R. terminalis*
Salix sp.	*Rabdophaga saliciperda*, *R. salicis*
Salix triandra	*Rabdophaga gemmicolata*, *R. heterobia*, *R. iteobia*, *R. terminalis*
Salsola ericoides	*Halodiplosis araratica*
Scrophularia decipiens	*Asphondylia scrophulariae*
Sisymbrium loeselii	*Dasineura bayeri*
Spiraea hypericifolia	*Tavolgomyia karelini*
Suaeda altissima	*Baldratia terteriani*, *Careopalpis suaedae*, *C. suaedicola* *Dasyneuriola suaedae*
Symphytum asperum	*Dasineura foliumcrispans*
Tamarix meyeri	*Psectrosema* sp.
Tamarix ramosissima	*Psectrosema barbatum*, *Psectrosema dentipes*
Thalictrum minus	*Jaapiella thalictri*
Thymus kotschyanus, *T. ratiflorus*	*Janetiella thymi*
Trifolium bordzilovskii	*Dasineura leguminicola*
Trifolium bordzilovski, *T. fragiferum*	*Dasineura trifolii*
Trifolium fragiferum	*Dasineura gentneri*
Trifolium hybridum	*Clinodiplosis cilicrus*
Triticum sp.	*Contarinia tritici*
Triticum vulgare	*Mayetiola destructor*
Urtica dioica	*Dasineura urticae*
Verbascum sp.	*Asphondylia verbasci*
Vicia cracca	*Contarinia craccae*, *Dasineura spadicea*, *D. viciae*
Vicia sepium	*Contarinia craccae*
Zygophyllum fabago	*Contarinia zygophylliflorae*

***Contarinia pyrivora* (Riley, 1886)**
Recorded on *Pyrus* sp. (Rosaceae). Larvae induce corrugation and darkening of fruit. Pupation occurs in the soil. Locality 44. Distribution: European.

*** *Contarinia rhamni* (Rübsaamen, 1892)**
Recorded on *Rhamnus pallasii* Fisch et C. A. May (Rhamnaceae). Yellow larvae damage flower buds. Galls are reddish. Pupation occurs in the soil. There are two generations per year. Locality 10. Distribution: European

*** *Contarinia steini* (Karch, 1881)**
Recorded on *Melandrium album* L. (Caryophyllaceae). Pale-yellow larvae induce flower buds to become deformed and blacken. Pupation occurs in the soil. There are two or three generations per year. Localities 40, 45, 88. Distribution: European.

***Contarinia tritici* (Kirby, 1798)**
Recorded on *Triticum* sp. (Poaceae). Yellow larvae develop in flowers and feed on ripening seed. Pupation occurs in the soil. Locality 84. Distribution: Holarctic, cosmopolitan. Pest.

*** *Contarinia zygophylliflorae* Fedotova, 1990**
Recorded on *Zygophyllum fabago* L. (Zygophyllaceae). Numerous white larvae develop in enlarged and condensed flower buds. Pupation occurs in the soil. There are three generations per year. Localities 11, 85. Distribution: Asian, Turanian.

*** *Cantarinia* sp.**
Recorded on *Berberis vulgaris* L. (Berberidaceae). Numerous pale-yellow jumping larvae develop in swollen barrel-like fruits. Larvae pupate in soil. Locality 39.

*** *Cystiphora taraxaci* (Kieffer, 1888)**
Recorded on *Lactuca orientalis* (Boiss.) Boiss. (Asteraceae). Little orange larvae develop in parenchymatous galls on leaves. Galls have a transparent envelop. There is only one larva per a gall. Pupation occurs in the soil. There are one or two generations per year. Locality 45. Distribution: European.

***Dasineura acrophila* (Winnertz, 1853)**
Recorded on *Fraxinus excelsior* L. (Oleaceae). Whitish larvae develop in condensed podded leaves having a reddish tint. There is one generation per year. Localities 44, 72. Distribution: European, North Africa.

*** *Dasineura aparines* (Kieffer, 1889)**
Recorded on *Galium aparine* L. (Rubiaceae). Bright orange larvae develop in pisiform spongy reddish multi-chambered galls on stems, nodes and pedicles. There are two generations per year. Larvae pupate in the soil. Localities 30, 32, 45, 78, 83. Distribution: Euro-Siberian.

*** *Dasineura asperulae* (Löw, 1875)**
Recorded on *Asperula humifusa* (Bieb.) Bess. (Rubiaceae). Bright orange-red larvae form spongy whitish-red galls in flowers. Pupation occurs in the soil. There is one generation per year. Locality 45. Distribution: European, Kazakhstan.

*** *Dasineura bayeri* (Rübsaamen, 1914)**
The midge causing the galls on *Sisymbrium loeselii* was previously misidentified as *Dasineura sisymbrii* (Schrank, 1803) on the basis of the identification key in Kolomoets et al. (1989). Recorded on *Sisymbrium loeselii* L. (Brassicaceae). Numerous white larvae develop in flowers turning them into spongy greyish multi-chambered galls. Sometimes galls form in internodes. Larvae pupate and construct a cocoon in galls. There are three or four generations per year. Localities 19, 20, 22, 25, 26, 29, 45, 46, 47, 48, 53, 57, 58, 72, 74, 83. Distibution: European.

Figs 5–6. Typical galls induced by gall midges in Armenia. 5 – Galls of *Contarinia desertorum* Marikovskij, 1961 on leaves of *Alhagi pseudalhagi*. 6 – Buds of *Suaeda altissima* galled by *Dasineuriola suaedae* Marikovskij, 1961. 7 – Buds of *Salsola ericoides* galled by *Halodiplosis araratica* Mirumian, 1991. 8 – Galls of *Sophoromyia armenica* Mamaev & Mirumian 1989 on leaves of *Glycyrrhiza glabra*.

*** *Dasineura clematidina* (Kieffer, 1913)**
Recorded on *Clematis vitalba* L. and *C. orientalis* L. (Rubiaceae). Numerous little white larvae develop in flower buds inducing them to develop into yellow-green galls. Pupation occurs in the soil. There are one or two generations per year. Localities 45, 86. Distribution: European.

***Dasineura engstfeldi* (Rübsaamen, 1889)**
Recorded on *Filipendula hexapetula* Gilib. and *F. ulmaria* L. (Rosaceae). Pink larvae induce chondroid bulge like galls along the midrib on the underside of leaves. There is one generation per year. Localities 37, 39. Distribution: European.

*** *Dasineura fairmairei* (Kieffer, 1896)**
Recorded on *Lathyrus miniatus* Bieb. ex Stev. (Fabaceae). White, white-orange or white-pink larvae develop in flowers. Pink-purple petals become brown. Inner parts of flowers become deformed. Pupation occurs in the soil. Locality 39. Distribution: Euro-Siberian.

*** *Dasineura foliumcrispans* (Rübsaamen, 1889)**
Recorded on *Symphytum asperum* Lepech. (Boraginaceae). Orange and white larvae develop on apical leaves inducing them to darken and corrugate. Pupation occurs in the soil. Locality 71. Distribution: European.

*** *Dasineura fraxinea* Kieffer, 1907**
Recorded on *Fraxinus oxcycarpa* Willd. (Oleaceae). White larvae develop in parenchymatous tissue of round galls that develop on both sides of leaves. Larvae burrow out of the galls and pupate in the soil. The abandoned galls become brown and dry out. Locality 39. Distribution: European.

*** *Dasineura fraxini* (Bremi, 1847)**
Recorded on *Fraxinus excelsior* L. and *F. oxcycarpa* L. (Oleaceae). Orange larvae develop in pocket-like folds along the middle rib of leaves. The affected area condenses and is a paler colour. Galls are sometimes partitioned. Pupation occurs in the soil. There is one generation per year. Locality 87. Distribution: European.

*** *Dasineura gentneri* (Pritchard, 1953)**
Recorded on *Trifolium fragiferum* L. (Fabaceae). Yellowish-orange larvae develop in flowers. Larvae pupate in the soil or in flower heads. There are two or three generations per year. Locality 39. Distribution: Euro-Siberian.

*** *Dasineura hyperici* (Bremi, 1847)**
Recorded on *Hypericum perforatum* L. (Hypericaceae). Numerous white larvae develop in darkened blotched galls formed from closed leaves growing at the apices of stems and of laterals. Pupation occurs in the soil. There are two or three generations per year. Localities 39, 64. Distribution: European.
***Dasineura irregularis* (Bremi, 1847)**
Cecidomyia acercrispans Kieffer, 1888
Recorded on *Acer laetum* L. (Aceraceae). White larvae develop in young apical leaves. Pupation occurs in the soil. Locality 77. Distribution: European. Potential pest.

*** *Dasineura leguminicola* (Lintner, 1879)**
Recorded on *Trifolium bordzilovskii* L. (Fabaceae). Orange larvae develop in flowers, which become deformed and brown. Pupation occurs in the soil. There are two or three generations per year. Locality 39. Distribution: Euro-Siberian.

*** *Dasineura loewi* (Mik, 1882)**
Recorded on *Euphorbia seguierana* Neck. (Euphorbiaceae). Large orange larvae develop in fruit transforming them into hard, lignificated galls. Elongated galls are covered with contracted shiny partitions. Pupation occurs in the soil. Locality 86. Distribution: European.

***Dasineura mali* (Kieffer, 1904)**
Recorded on *Malus domestica* Borkh. (Rosaceae). Orange larvae induce the edges of leaves to roll onto upper leaf surface. Rolls condense and become red. Pupation occurs in the soil. There are two generations per year. Localities 23, 40, 44. Distribution: Holarctic.

*** *Dasineura papaveris* (Winnertz, 1853)**
Recorded by us on *Papaver argemone* L. (Papaveraceae). Numerous pink larvae develop in seed capsules and feed on the seeds. Capsules are covered with black spots. Pupation occurs in the soil. There are two generations per year. Localities 33, 37, 44, 51. Distribution: Euro-Asian, occurring up to Israel.

***Dasineura rosae* (Bremi, 1847)**
Cecidomyia rosarum Hardy, 1850,
Wachtliella rosarum (Hardy, 1850)
Recorded on *Rosa canina* L., *R. corymbifera* Borkh. and *R. obtusifolia* Desv. (Rosaceae). A multitude of orange larvae develop in apical leaves folded along the midrib. The middle part of a gall swells, condenses and develops a wine-red colouration. Larvae pupate in the soil. There are three or four generations per year. Localities 13, 45, 47, 62, 72, 73, 77, 83. Distribution: Euro-Siberian.

*** *Dasineura spadicea* Rübsaamen, 1917**
Recorded on *Vicia cracca* L. (Fabaceae). Light-orange larvae develop in leaves folded along the mid rib. The affected leaves become thicker and bend. Pupation occurs in the soil. There are two or three generations per year. Localities 32, 69. Distribution: European.

*** *Dasineura tortrix* (Löw, 1877)**
Recorded on *Prunus divaricata* Ledeb. (Rosaceae). Whitish larvae develop in spindle-like apical galls formed from shrunken and blackened leaves. Pupation occurs in the soil. There is one generation per year. Locality 45. Distribution: European. Potential pest.

*** *Dasineura trailli* (Kieffer, 1909)**
Recorded on *Ranunculus arvensis* L. (Ranunculaceae). White larvae develop in flower buds inducing them to compress and increase in size. Galls darken and die. Pupation occurs in the soil. Locality 70. Distibution: Euro-Siberian, Holarctic. Pest.

*** *Dasineura trifolii* (Löw, 1874)**
Recorded on *Trifolium bordzilovskii* L. and *T. fragiferum* L. (Fabaceae). Several orange larvae develop in leaves that fold along the midrib. The affected parts of a leaf become swollen and a red colour. Some of the larvae form spotty white cocoons in the galls, others pupate in the soil. There are two or three generations per year. Localities 32, 52, 88. Distribution: Euro-Siberian, Secondarily Holarctic.

*** *Dasineura urticae* (Perris, 1840)**
Recorded on *Urtica dioica* L. (Urticaceae). White larvae develop in white pulpy round or irregular shaped one-chambered galls that they induce on leaves, stems or flowers. Larvae leave the galls through a gap in apical side of a gall and pupate in the soil. There are three or four generations per year. Localities 34, 35, 37, 45, 47. Distribution: Euro-Siberian.

*** *Dasineura viciae* (Kieffer 1888)**
Recorded on *Vicia cracca* L. (Fabaceae). Light orange, sometimes white larvae develop in apical leaves folded along the mid rib. Leaves are induced to compact and cluster. Larvae pupate in the soil. There are two or more generations per year. Localities 12, 32, 64, 70. Distribution: Euro-Siberian.

*** *Dasineura* sp. 1**
Recorded on *Nepeta mussini* C.Koch (Lamiaceae). Five or six orange larvae develop in apical leaves that they induced to form compact clusters. Larvae live between leaves. Larvae pupate in the soil. There are several generations per year. Locality 45.

*** *Dasineura* sp. 2**
Recorded on *Astragalus cicer* L. (Fabaceae). White larvae induce young apical leaves to fold along the midrib and compact. Pupation occurs in the soil. Locality 16.

*** *Dasineura* sp. 3**
Recorded on *Melilotus officinalis* Desr. (Fabaceae). Orange larvae induce leaves to roll along the midrib. Galls are compact and pale. Pupation occurs in the soil. There are two or three generations per year. Locality 32. Distibution: Euro-Siberian.

*** *Dasyneuriola suaedae* Marikovskij, 1961**
Recorded on *Suaeda altissima* L. (Pall.) (Chenopodiaceae). A few orange larvae develop in spherical thin-walled one--chamber galls formed from leaf buds (Fig. 6). Larvae pupate in the galls forming white cocoons. There are two or three generations per year. After the imagoes leave, the empty galls are populated by *Careopalpis suaedicola*. Localities 1, 2, 5, 8, 18, 24, 27, 28, 82, 85. Distribution: Asian, Turanian.

*** *Etsuhoa* sp.**
Recorded on *Juniperus virginiana* L., *J. polycarpos* C. Koch. and *J. foetidissima* L. (Cupressaceae). One orange barrel--shaped larva develops in a chamber within a bud gall that develops at the tip of a shoot. Pupation occurs in galls. There is one generation per year. Locality 77. Distribution: Euro-Siberian, Holarctic.

*** *Geocrypta braueri* (Handlirsch, 1884)**
Recorded on *Hypericum perforatum* L. (Hypericaceae). The white larvae occur in cone-shaped galls that are pink to redish and develop on the underground parts of its host plant. They pupate in the galls. Locality 68. Distribution: European.

*** *Geocrypta heterophylli* (Rübsaamen, 1914)**
Recorded on *Lathyrus cyaneus* L. and *L. pallescens* (Bieb.) C. Koch. (Fabaceae). Large orange larvae develop in galls consisting of rolled apical and mature leaves. Galls are a juicy, light green or reddish colour. There are two generations per year. Larvae pupate in the soil. Localities 32, 39, 40, 69. Distribution: European.

*** *Halodiplosis araratica* Mirumian, 1991**
Recorded on *Salsola ericoides* Bieb. (Chenopodiaceae). A single orange coloured barrel-shaped larva develops in each polythalamous carnose downy gemmaceous leaf gall (Fig. 7). Pupation occurs in the galls. There is one generation per year. Locality 10 (holotype, male), 11. Distribution: Asian, Turanian.

***Hartigiola annulipes* (Hartig, 1839)**
Recorded on *Fagus* sp. (Fagaceae). A single larva develops in a cylindrical leaf gall that is covered with long hair. There is one generation per year. Localities 54, 72. Distribution: European.

*** *Jaapiella cirsiicola* (Rübsaamen, 1915)**
Recorded on *Cirsium obvalatum* L. (Asteraceae). Numerous orange larvae develop in flower heads between hairs. Inflorescences blacken. There are two or three generations per year. Locality 55. Distribution: European.

*** *Jaapiella loticola* (Rübsaamen, 1889)**
Recorded on *Lotus caucasicus* Kuprian. ex Juz. (Fabaceae). Large orange larvae develop on apical leaves that roll into a tube. Pupation occurs in the soil. There are two or three generations per year. Localities 63, 65. Distribution: Euro-Siberian.

*** *Jaapiella medicaginis* (Rübsaamen, 1912)**
Recorded on *Medicago sativa* L. (Fabaceae). Pink-orange larvae induce leaves to fold along the midrib. Galls are reddish. Larvae pupate in the soil or in galls where they form white cocoons. Localities 32, 39. Distribution: Euro-Siberian. Potential pest.

*** *Jaapiella rubiae* Fedotova, 1987**
Recorded on *Rubia tinctorum* L. (Rubiaceae). Yellow larvae develop in fruits that become hard and dark. Pupation occurs in the soil. There are two generations per year. Locality 79. Distribution: Euro-Siberian.

*** *Jaapiella thalictri* (Rübsaamen, 1895)**
Recorded on *Thalictrum minus* L. (Ranunculaceae). Red larvae develop in clusters of leaves or suckers. Pupation occurs in the galls where the larvae form white cocoons. There are two generations per year. Localities 45, 46. Distribution: Euro-Siberian.

*** *Jaapiella volvens* Rübsaamen, 1917**
Recorded on *Lathyrus rotundifolius* Willd. and *L. miniatus* Bieb. ex Stev. (Fabaceae). Large red larvae develop in rolled edges of leaves. Both young and mature leaves form juicy condensed galls. Pupation occurs in the soil. There are two or three generations per year. Localities 13, 36, 40, 70. Distribution: European.

*** *Jaapiella* sp.**
Recorded on *Convolvulus arvensis* L. (Convolvulaceae). Numerous pink larvae develop in closed flower and leaf buds that swell and condense, and are covered in a white envelop. Sometimes galls form from shortened and condensed apical leaves. Pupation occurs in the soil. Localities 4, 7, 10, 11, 29, 81. This species is used for the biological control of the weed *Convolvulus arvensis* L. (Convolvulaceae) (Mirumian 2006).

*** *Janetiella thymi* (Kieffer, 1888)**
Recorded on *Thymus kotschyanus* Boiss. et Hohen. and *T. ratiflorus* L. (Lamiaceae). Orange larvae construct oval elongated galls from condensed leaves the edges of which enclose a chamber. Sometimes galls form on flowers. Larvae pupate in the soil. There are two or three generations per year. Localities 13, 14, 39, 50, 64. Distribution: Euro-Siberian.

***Macrodiplosis pustularis* (Bremi, 1817)**
Diplosis dryobia F.Löw, 1877
Recorded on *Quercus iberica* Stev. (Fagaceae). White larvae form galls by inducing the edges of leaves to roll towards the lower leaf surface. The galls are not swollen. There is one generation per year. Locality 72. Distribution: European.

***Macrolabis heraclei* (Kathenbach, 1862)**
Recorded on *Heracleum* sp. (Apiaceae). Locality 64. Distibution: European.

***Mayetiola destructor* (Say, 1817)**
Recorded on *Triticum vulgare* Vill. (Poaceae). Larvae develop on the upper surface of leaves and the shoot growth zone, and suppress ear formation. There are two generations per year. Localities: 3, 4, 5, 21, 23, 24, 25, 26. Distribution: Holarctic.

***Mikiola fagi* (Hartig, 1839)**
Recorded on *Fagus* sp. (Fagaceae). White larvae develop in egg-shaped galls along ribs on the upper surface of leaves. Pupation occurs in the soil. Localities 72, 73. Distribution: European. Potential pest.

*** *Ozirhincus millefolii* (Wachtl, 1884)**
Recorded on *Achillea biebersteinii* Afan. (Asteraceae). Small orange larvae develop in inflorescences. Larvae pupate in galls. There are one or two generations per year. Localities 45, 47. Distribution: Euro-Siberian, Holarctic.

***Phegomyia fagicola* (Kieffer, 1901)**
Recorded on *Fagus* sp. (Fagaceae). Larvae cause galls that take the form of a swollen fold along lateral veins of the leaves. Localities 72, 73. Distribution: European.

*** *Primofavilla initialis* Mamaev, 1972**
Recorded on *Atriplex tatarica* L. (Chenopodiaceae). Pale-orange larvae develop in white felty galls on leaves, sometimes on stems and inflorescences. Galls contain only one larva. Pupation occurs in the soil. There are one or two generations per year. Locality 45. Distribution: Asian, Turanian.

***Psectrosema barbatum* (Marikovskij, 1961)**
Isosandalum barbatum Marikovskij, 1961
Recorded on *Tamarix ramosissima* Ledeb. (Tamaricaceae). Larvae develop in spindle-shaped galls on branches. Pupation occurs in the galls. It is likely there are two or three generations per year. Localities 3, 21, 77. Distribution: Asian, Turanian.

*** *Psectrosema dentipes* (Marikovskij, 1961)**
Recorded on *Tamarix ramosissima* Ledeb. and *T. meyeri* Boiss. (Tamaricaceae). Orange larvae develop in yellow-red nodules situated on stems, which distort the stem. Pupation occurs in the galls. There are two generations per year. Localities 23, 25, 28, 31. Distribution: Asian, Turanian.

*** *Psectrosema* sp.**
Recorded on *Tamarix ramosissima* Ledeb and *T. meyeri* Boiss (Tamaricaceae). Orange larvae induce formation of knobly elongated wine red galls on apical leaves. Gall scales form a chamber in which the larva develops. Pupation occurs in the galls. There are two generations per year. Localities 22, 26, 28, 31. Distribution: Asian and Turanian.

*** *Pseudokochiomyia camphorosmae* Fedotova, 1984**
Recorded on *Camphorosma lessingii* Litv. (Chenopodiaceae). Red-orange larvae develop in galls on stems. Stems become thicker, shorter and bend. Sometimes rosettes form at the tops of stems. Pupation occurs in the galls. There are two generations per year. Locality 27. Distribution: Asian, Turanian.

*** *Pseudokochiomyia mesasiatica* Taranov et Fedotova, 1982**
Recorded on *Kochia prostrata* (L.) Schrad. (Chenopodiaceae). Bright orange larvae induce apical and lateral buds on stems to develop into round plain galls. Pupation occurs in the galls. There are usually two generations per year. Localities 42, 87. Distribution: Asian, Turanian.

*** *Pseudokochiomyia vicina* Marikovskij, 1961**
Recorded on *Kochia prostrata* (L.) Schrad. (Chenopodiaceae). Bright orange larvae induce leaf buds to develop into brownish or whitish galls. Pupation occurs in the galls. There are two generations per year. Localities 6, 42, 79, 88. Distribution: Asian, Turanian.

*** *Rabdophaga gemmicolata* Gagné, 2004** (as a new name for *Bremiolina gemmicola* Mamaev et Mirumian, 1990).
Recorded on *Salix triandra* L. (Salicaceae). Galls are deformed enlarged and darkened young leaf buds. Gall base (adjacent to rind) is swollen. Orange larva develops in gall chamber. Adults leave galls in early spring through an opening at the base of the gall. There is one generation per year. Locality 20. Distribution: Euro-Siberian.

***Rabdophaga heterobia* (Loew, 1850)**
Recorded on *Salix triandra* L. (Salicaceae). In spring small orange larvae develop in numerous chambers of galls formed from amentums. In summer larvae induce the formation of rosettes of leaves at the tips of shoots, the so called "willow roses". Pupation occurs in galls. Localities 3, 10, 11, 17, 41, 84. Distribution: Euro-Siberian.

*** *Rabdophaga iteobia* (Kieffer, 1890)**
Recorded on *Salix triandra* L. (Salicaceae). Orange larvae develop in dense tomentous rosettes at the apices of shoots. Sometimes galls are covered with brown scales. Pupation occurs in the galls. There is one generation per year. Localities 10, 76, 84. Distribution: Euro-Siberian.

*** *Rabdophaga marginemtorquens* (Bremi, 1847)**
Cecidomyia marginemtorquens Bremi, 1847
Dasineura marginemtorquens (Bremi, 1847)
Recorded on *Salix alba* L. (Salicaceae). Small pale-orange larvae induce leaves to roll towards the under surface. Rolled leaf edges become compact and are a paler colour. Pupation occurs in white cocoons in the galls. There are three generations per year. Locality 41. Distribution: Euro-Siberian.

*** *Rabdophaga rosaria* (Loew, 1850)**
Recorded on *Salix excelsa* S. G. Gmel. (Salicaceae). Larvae develop in galls formed from apical stem buds. There is one orange barrel-like larva per a gall. Pupation and hibernation occur in the galls. Localities 65, 66. Distribution: Euro-Siberian.

***Rabdophaga saliciperda* (Dufour, 1841)**
Recorded on *Salix* sp. (Salicaceae). Orange larvae induce roundish elongated swellings on branches. The rind around the galls dies. Pupation occurs in the galls. There is one generation per year. Localities 1, 13, 15, 37, 38, 63. Distribution: Euro-Siberian.

***Rabdophaga salicis* (Schrank, 1803)**
Recorded on *Salix* sp. (Salicaceae). Reddish-yellow larvae induce round protruding multi-chambered galls on branches. Localities 1, 61, 72, 73, 76. Distribution: Euro-Siberian.

*** *Rabdophaga terminalis* (Loew, 1850)**
Recorded on *Salix alba* L., *S. triandra* L and *S. excelsa* S. G.Gmel (Salicaceae). Reddish-orange larvae induce spindle--like galls on apical leaves. Pupation occurs in the galls. There are two or three generations per year. Localities 10, 20, 47, 79. Distribution: Euro-Siberian.

*** *Rhopalomyia artemisiae* (Bouché, 1834)**
Recorded on *Artemisia fragrans* Willd. (Asteraceae). Small orange larvae induce the lower flower buds to form ball-like galls that are multi-chambered. One larva develops in a chamber. Pupation occurs in the galls. There are two generations per year. Locality 10. Distribution: Submediterranean.
*** *Rhopalomyia baccarum* (Wachtl, 1883)**
Recorded on *Artemisia fragrans* Willd. (Asteraceae). Roundish berry-like green galls are induced on stems and sometimes on the upper parts of roots. One pink larva per a gall. Pupation occurs in the galls. There are two or three generations per year. Localities 30, 31, 42. Distribution: Euro-Siberian.

*** *Rhopalomyia campestris* (Rübsaamen, 1915)**
Misospatha campestris Rübsaamen, 1915
Recorded on *Artemisia campestris* L. (Asteraceae). Pale-orange larvae induce leaves to develop in multi-chamber apical roundish galls. There are two or three generations per year. Localities 24, 26, 75, 83. Distribution: European.

*** *Rhopalomyia heteropalpis* (Marikovskij in Marikovskij et Moiseeva, 1964)**
Recorded on *Artemisia fragrans* Willd. (Asteraceae). Pinkish-orange larvae develop in white or brown multi-chamber galls formed from stem buds. Sometimes several galls grow together. There are two or three generations per year. Localities 10, 19, 22, 25, 42. Distribution: Asian, Turanian.

*** *Rhopalomyia millefolii* (Loew, 1850)**
Recorded on *Achillea biebersteinii* Afan. (Asteraceae). Orange larvae develop in wine red barrel-like tooth-edged galls on stems. Sometimes galls grow together forming clusters. Multi-chambered galls contain from one to five larvae. There are two generations per year. Localities 30, 45, 47. Distribution: Euro-Siberian.

*** *Rhopalomyia syngenesiae* (Loew, 1850)**
Recorded on *Anthemis triumfetii* L. (All.) (Asteraceae). Orange larvae deform flowers. Bases of inflorescences become hard, flowers darken. There are 2 or 3 generations per year. Locality 55. Distribution: European.

*** *Sophoromyia armenica* Mamaev et Mirumian, 1989**
Recorded on *Glycyrrhiza glabra* L. (Fabaceae). Numerous white larvae develop in leaves, which fold and close up along their edges. Leaves become compact and yellow (Fig. 8). Larvae pupate in the soil. There are two or three generations per year. Localities 6, 10, 42, 45, 49 (holotype, male), 82, 85.

*** *Spurgia euphorbiae* (Vallot, 1827)**
Cecidomyia subpatula Bremi, 1847
Recorded on *Euphorbia iberica* Boiss. and *E. sequierana* Neck. (Euphorbiaceae). Large orange larvae induce the formation of spindle-shaped galls on shrunken and condensed apical leaves. Some of the larvae pupate in the galls forming white cocoons, others pupate in the soil. There are two or three generations per year. Localities 13, 32, 39, 40, 43, 45, 64, 86. Distribution: European or Euro-Siberian.

*** *Stefaniella hilversidae* Mamaev, 1972**
Recorded on *Chenopodium album* L. (Chenopodiaceae). Small orange larvae develop in white felty galls of irregular shape situated on leaves, leafstalks and stems. Larvae pupate in the galls. There is one generation per year. Locality 80. Distribution: Asian, Turanian.

***Stefaniola excelsa* Möhn, 1971**
Larvae induce galls on fruit or stems of *Aellenia glauca* (Bieb.) and *A. subaphylla* (C.A.M.) (Chenopodiaceae). Locality by Möhn (1971): "Maman, Armenien/UdSSR" (the modern name of Maman is Jrarat, Kotayk Province, about 1700 m a. s. l.)". Distribution: Asian, Turanian (Fedotova, 2000).

*** *Tavolgomyia karelini* (Fedotova, 1982)**
Wachtliella karelini Fedotova, 1982
Recorded on *Spiraea hypericifolia* L. (Rosaceae). Yellowish larvae develop in red-wine coloured galls formed by rolling leaf edges. There are two generations per year. Localities 12, 13. Distribution: Asian, Turanian.

*** *Wachtliella persicariae* (Linnaeus, 1767)**
Recorded on *Polygonum amphibium* L. (Polygonaceae). Numerous reddish-orange larvae form crimson galls by inducing the edges of leaves to roll downwards. Pupation occurs mainly in the galls, with a few larvae pupating in the soil. There are three generations per year. Localities 12, 18, 39. Distribution: European.

*** *Zeuxidiplosis giardi* (Kieffer, 1896)**
Recorded on *Hypericum perforatum* L. (Hypericaceae). Orange larvae form compact one-chamber light-coloured galls from apical leaves on the main and lateral shoots. Some of the larvae pupate in the galls, others in the soil. There are two or three generations per year. Localities 64, 69. Distribution: European.

***Zygiobia carpini* (Loew, 1874)**
Recorded on *Carpinus* sp. (Betulaceae). White larvae develop in galls consisting of slight swellings on lower surface of leaves. Leaves deform and bended along the midrib. Locality 72. Distribution: European.

ZOOGEOGRAPHY

The present fauna of phytophagous gall midges in Armenia includes 96 species. Two of them, *Sophoromyia armenica* Mamaev et Mirumian, 1989, and *Halodiplosis araratica* Mirumian, 1991, which were discovered in Armenia, may be endemic to Armenia as so far they have not been found in any other country.

The majority of the gall midges in Armenia are European (35%) or Euro-Siberian species (31%), four are Mediterranean, four are Holarctic and about 20% are Asian-Turanian species.

European and Euro-Siberian species have their main distribution areas in the western part of the Palaearctic region and reach up into Armenia, which is situated on the Caucasus mountain complex forming the boundary between Europe and Asia. In Armenia, for example, the following European gall midges occur: *Mikiola fagi*, *Hartigiola annulipes* and *Phegomyia fagicola*, which are associated with *Fagus*, *Dasineura acrophila*, *D. fraxini* and *D. fraxinea* induce galls on *Fraxinus*, and *Macrodiplosis pustularis* induces galls on *Quercus*. Similarly in Armenia several Euro-Siberian species such as *Rabdophaga saliciperda*, *R. rosaria* and *R. salicis* induce galls on various species of *Salix*. Occurrence of Euro-Siberian gall midges in Armenia is connected with the mountainous character of Armenia and the relatively high altitudes of the localities studied (over 800 m a. s. l.). On the other hand, this is probably the reason why only four Mediterranean species occur here, viz. *Apiomyia bergenstammi* inducing galls on *Pyrus*, *Asphondylia scrophulariae* on *Scrophularia*, *Asphondylia verbasci* on *Verbascum* and *Rhopalomyia artemisiae* on *Artemisia*.

Also the group of so called Asian-Turanian faunal elements in the gall midge fauna of Armenia is relatively rich. These species have their main distribution areas in semi-deserts of Central Asia in the area between the Aral and Caspian Seas and extend from there up to Armenia. The following species belong to this group: *Careopalpis suaedae*, *C. suaedicola* and *Dasyneuriola suaedae* associated with *Suaeda altissima*, *Contarinia desertorum* with *Alhagi pseudalhagi*, *Contarinia zygophylliflorae* with *Zygophyllum fabago*, *Primofavilla initialis* with *Atriplex tatarica*, *Psectrosema barbatum* and *P. dentipes* with *Tamarix ramosissima*, *Pseudokochiomyia camphorosmae* with *Camphorosma*, *P. mesasiatica* and *P. vicina* with *Kochia prostrata*, *Rhopalomyia heteropalpis* with *Artemisia fragrans*, *Stefaniella hilversidae* with *Chenopodium album* and *Tavolgomyia karelini* with *Spiraea hypericifolia*.

The analysis of the distribution of gall midges in Armenia indicates they are most abundant in the Ararat valley (Ararat province, localities 1 to 11; Armavir province, localities 18 to 31; surroundings of Yerevan sity, localities 75 to 88). More than 60 species, i.e. about two thirds of all the species found, were recorded in this area. They are mainly Irano-Turaninan (16.7%) and Euro-Kazakhstanian (15.6%) species. The comparison of the gall midge fauna of Armenia with that of neighbouring countries revealed that 75 species of gall midge were earlier recorded in Turkey (Skuhravá et al. 2005, Skuhravá & Skuhravý 2009) and 35 in countries in the South Caucasus (Georgia and Azerbaijan) and Iran (Skuhravá 1986). Some of these species occur in Armenia and others are likely to occur here. It is noteworthy that the gall midge fauna of is unexpectedly species rich for such a small country as Armenia. For comparison, there are only 39 species recorded for Uzbekistan, 72 for Turkmenistan (Beknazarova 1983) and 300 for the European part of the former USSR (Kolomoets at al. 1989). The high biodiversity of Armenian gall midge fauna is possibly associated with the greater range of landscapes.

ECONOMIC IMPORTANCE

Phytophagous gall midges are known to seriously damage plants by adversely affecting their normal growth, development and reproduction. There are no records of gall midge larvae significantly damaging cultivated plants in Armenia. During the course of our long-term study galls were rarely observed on cultivated plants whereas they are abundant on various weeds.

In particular, the phytophagous gall midge *Jaapiella* sp. is associated only with bindweed *Convolvulus arvensis* L. and another species, *Dasineura bayeri* Rubs., is a monophagous parasite of sisymbrium, *Sisymbrium loeselii* L. Both these plants are frequently occurring weeds of agricultural crops in the Ararat valley and farmers find it difficult to control these weeds. Thus, gall midges could be used to control these weeds (Mirumian 2006). Parts of weeds bearing galls were collected from wild biocenoses and transferred to vegetable crops. Over a period of two years (2003–2004) the gall midges introduced into crops produced viable, stable populations and effectively suppressed the growth of weeds. This biological method of weed control is easy to apply and inexpensive, and may be successfully applied if mono- and oligo-phagous parasites of weeds are available.

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