Gall midges (Diptera: Cecidomyiidae) of South Tyrol (Italy) - summary of results and zoogeographical analysis

Gallmücken (Diptera: Cecidomyiidae) Südtirols – zusammenfassende Resultate und zoogeographische Analyse

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Abstract

At present the gall midge fauna of South Tyrol includes 311 species in 68 genera. A total of 271 species are valid and 40 species, still undescribed, are identified to the generic level. Investigations were carried out at 124 localities at altitides from 250 m a.s.l. at Salurn to 2581 m a.s.l. at Schaubachhütte in the Ortler Range during the period 1999-2009. Zoogeographical analysis is based on 2150 records, of which 200 were obtained by earlier researchers and 1950 records of the present authors. Until 1996 only 24 species were known to occur in South Tyrol. We enriched the faunal list of South Tyrol by adding 287 species and the faunal list of Italy by 114 species. A list of gall midge species and a list of host plants attacked by gall midges are given. Diversity ranged from 3 to 36 species at a single locality. On average we determined 15 species to occur per locality in South Tyrol. Species number declines with increasing elevation. Density is high at 189 species per 1000 km^2. South Tyrol is one of the best explored areas of the world for galls of Cecidomyiidae. Frequency of occurrence: 49% species occur very rarely, 21% rarely, 17% moderately frequently, 9% frequently, 4% very frequently. *Iteomyia capreae* is the most frequently recorded species in South Tyrol. Horizontal occurrence of each species found in South Tyrol is shown in the map. Vertical occurrence: 97 species occur in the colline zone, 60 species in the submontane, 216 species in the montane, 104 species in the sub-Alpine and 33 species in the Alpine zone. *Rhopalomyia luetkemuelleri* and *Jaapiella alpina* were found in the subnivale zone at altitudes of 2700 m a.s.l. We recognize 16 types of vertical occurrence of gall midges species in South Tyrol. Few species occur in the narrow altitudinal span of one zone (monozonal species), most species occur in two, three or more altitudinal zones (polyzonal species). Geographical distribution: 68% are European, 25% Eurosiberian, 3,5% Mediterranean and sub-Mediterranean, 3,5% Holarctic and only one, *Dasineura bistortae*, is an Euro-Asian species. *Dasineura gleditchiae* and *Obolodiplosis robiniae* are Nearctic species, immigrants from North America and alien species to Europe. Of 24 species that are classified as threatened, 5 species are known to become regionally extinct, 12 species critically endangered and 7 species endangered. Gall midges are associated with 221 host plant species belonging to 48 plant families: 68% are herbs, 20% trees and 12% shrubs. *Populus tremula, Quercus pubescens, Salix caprea* and *S. purpurea* are host plants with the highest number of associated gall midge species, each of them hosts seven species. 33% of gall midges cause galls on leaves of trees and shrubs, 25% on leaf buds, 25% on flower buds, 8% on fruits and 7% develop in stems. Economic importance: 13 gall midge species are potential pests in agriculture and forestry.

Key words: Diptera, Cecidomyiidae, faunistics, zoogeography, distribution, economic importance, plant-animal relationships, alien species, threatened species, South Tyrol, Alto Adige, Italy, Europe, Palaearctic Region

1. Introduction

Up to 1996 only 24 gall midge species were known to occur in South Tyrol. That was the reason why Dr. Klaus Hellrigl, a member of the Editorial Board of the journal *Gredleriana,* in 1999 addressed Dr. Leo Unterholzner, the Director of of the Museum of Natural History in South Tyrol in Bozen, with a proposal to invite us for investigations of gall midges with the aim to enrich the relatively low species number of this family in South Tyrol. We accepted the invitation with pleasure and our successful cooperation lasted for more than 10 years. In the period 1999-2009 we undertook nine research journeys and investigated gall midges at 124 localities in various parts of South Tyrol. Partial results of our investigations were published after each research visit in each part of South Tyrol (Skuhravá et al. 2001, 2002, Skuhravá, Skuhravý 2003, 2005a, 2005b, 2006, 2007, 2009b; results of investigations in the two last parts are in press). Summary results of these investigations are given in the present article.

Gall midges comprising the family Cecidomyiidae are one of the most species rich families of Diptera. The family is composed of three subfamilies: Lestremiinae, Porricondylinae and Cecidomyiinae. Adults are usually small flies, minute to medium-sized (0.5-3.0 mm), rarely up to 8 mm, very fine and fragile, usually dark in colour, sometimes with a grey, yellow or reddish coloured abdomen. The head bears large holoptic eyes in both sexes. Antennae consist of 6 to 40, usually 12 or 14, flagellomeres, covered with microtrichia and whorls of long setae and circumfila plus other sensoria. Wing veins are reduced in number, usually with only three or four long veins present. Legs are usually long and the first tarsomere (metatarsus) is much shorter than the second tarsomere, except in Lestremiinae. The larvae have a spatula sternalis on the ventral side of the prothoracic segment, a sclerotised organ, which is unique to the family and important for identification at generic and specific levels. On the basis of larval feeding habits, gall midges may be divided into three biological groups: phytophagous, mycophagous (including saprophagous), and zoophagous. Many phytophagous larvae are gall makers, inducing galls on various plants whilst some live free in flower heads or in the stems of plants without forming galls. Several species are serious pests of cultivated plants and forest trees but, on the other hand, several phytophagous species are used in the biological control of weeds. Zoophagous larvae are predators of other gall midges, aphids, mites, coccids, or other small arthropods. Some of them are used in the biological control of pests. Mycophagous and saprophagous larvae are associated with fungi. The life span of an adult is very short, only a few hours or five days at the most (Skuhravá 1997a).

Altogether 5700 gall midge species are known to occur in the world (Gagné 2004) of which about 3200 occur in the Palaearctic Region and 1800 in Europe (Skuhravá 1986, 2006a). (Figs. 1, 2, 3).

Fig. 1:
Adult female gall midge, *Obolodiplosis robiniae*.
Natural size 5 mm.
Photo: G. Csóka.

Fig. 2:
Galls of *Iteomyia capreae* on leaves of *Salix caprea*, the most frequently recorded species in South Tyrol.

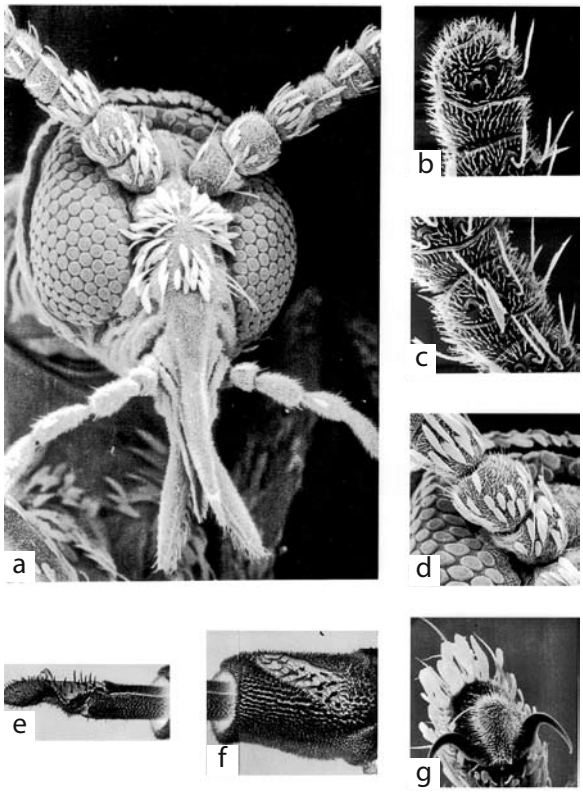


Fig. 3:
Morphological characters of a gall midge, *Ozirhincus tanaceti*, scanning electron microscope images:
a - head of female in frontal view;
b - terminal part of male antenna;
c - middle part ;
d - basal part;
e - terminal part of ovipositor;
f - 8th abdominal segment;
g - terminal part of fore leg showing a pair of claws with pubescent empodium in the middle and with scales protecting the end of the leg.

2. History

The first reliable data from South Tyrol, within its present boundary, dealing with gall midges were published in the second half of the 19th century by Pokorny (1887). Among 400 species of Diptera belonging to various families and occurring in Tyrol he recorded two gall midge species, *Hormomyia producta* and *Diplosis pini* (now: *Planetella producta* and *Cecidomyia pini*). Before the end of the 19th century two natural historians, F. Thomas and K. W. Dalla Torre, contributed importantly to the knowledge of gall-causing insects and mites of Alpine countries, i.e. of Switzerland, Austria, Liechtenstein and Italy.

Friedrich Thomas (1840-1918) is the pioneer of cecidological studies in Alpine countries. He was a teacher in Ohrdruf in Thüringen, Germany. He travelled often into the mountains in the Alpine zone of Central Europe, and collected galls caused by various animals. He published several papers devoted to this problem and is the author of the Latin term "cecidium" for galls (Thomas 1878, 1892a, 1892b, 1893).
Karl Wilhelm Dalla Torre (1850-1928), was one of the best experts of fauna and flora in the Tyrol of his time. Originally he was a teacher at secondary schools in Eger (Hungary), then in Linz and finally in Innsbruck (Austria). He started his research work on collecting galls in Tyrol with the aim of gathering data on the occurrence of gall causing animals in Tyrol. He published many scientific articles and also three important contributions (Dalla Torre 1892, 1894, 1896) where he summarized not only his own rich data on gall causing animals found in Tyrol but also all data of earlier researchers and collectors.
After the death of these two researchers the interest in gall-causing organisms, their galls and occurrence sank and the lack of interest continued for nearly a hundred years. In the 20th century Klaus Hellrigl initiated a large project directed at summarizing knowledge of the fauna of South Tyrol which led to the publication of an extensive book "*Die Tierwelt Südtirols*" (Hellrigl 1996). Among 1600 species of Diptera known to occur in South Tyrol he listed 24 species of the family Cecidomyiidae of which the occurrence in South Tyrol was documented and another 65 gall midge species of which the occurrence seemed likely from their known distributional pattern. He endeavoured to improve knowledge of the gall midge fauna in South Tyrol and, therefore, he recommended to the leadership of the Natural Museum in Bozen an invitation to the present authors to investigate gall midges. He accompanied us in 1999 and 2001 during several excursions and we invited him to be the co-author of our articles (Skuhravá et al. 2001, 2002). Later he contributed to the gall midge faunistics with several of his own records (Hellrigl 2004, 2007). He recorded the occurrence of 43 gall midge species at 70 localities mainly in the surroundings of Brixen and in Gadertaler Dolomiten.

3. Study area

South Tyrol, the Province of Bolzano-Bozen (Südtirol, Alto Adige), is an autonomous province of Italy. It is situated in central Europe and in the western part of the Palaearctic Region. It occupies an area of 7,400 km² and is located at the northernmost point in Italy. The region is renowned for its mountains, such as the Dolomites, which form a significant section of the Alps. The province is bordered by Austria to the east and north, by Switzerland to the west and by the Italian provinces of Belluno, Trento and Sondrio to the southeast, south, and southwest, respectively. The highest peak is the Ortler, 3,905 meters, the highest peak in the Eastern Alps. The climate of South Tyrol is temperate in its southern part, but it changes with increasing altitude to humid continental, and in Alpine valleys to subarctic and in the highlands above 1700 meters may have an Alpine tundra climate. About 85% of the surface is situated above 1000 meters. Vegetation changes distinctly with increasing elevation (Noirfalise 1987). The broadleaf forests change gradually into coniferous forests in the mountains, and above the timberline there are alpine meadows and pastures. The timberline runs between 1900-2200 meters.

Areas with poor lichen cover change into a nival zone of perpetual ice and snow. The vegetation of the lower altitudinal belts is rich in species composition and many plant species may be host plants of gall midges. Udvardy (1972) includes South Tyrol in the Central European Highlands Province of the western part of the Palaearctic Realm. Tutin et al. (1964), based on the geographical distribution of plants, considered South Tyrol to be a part of Central Europe.

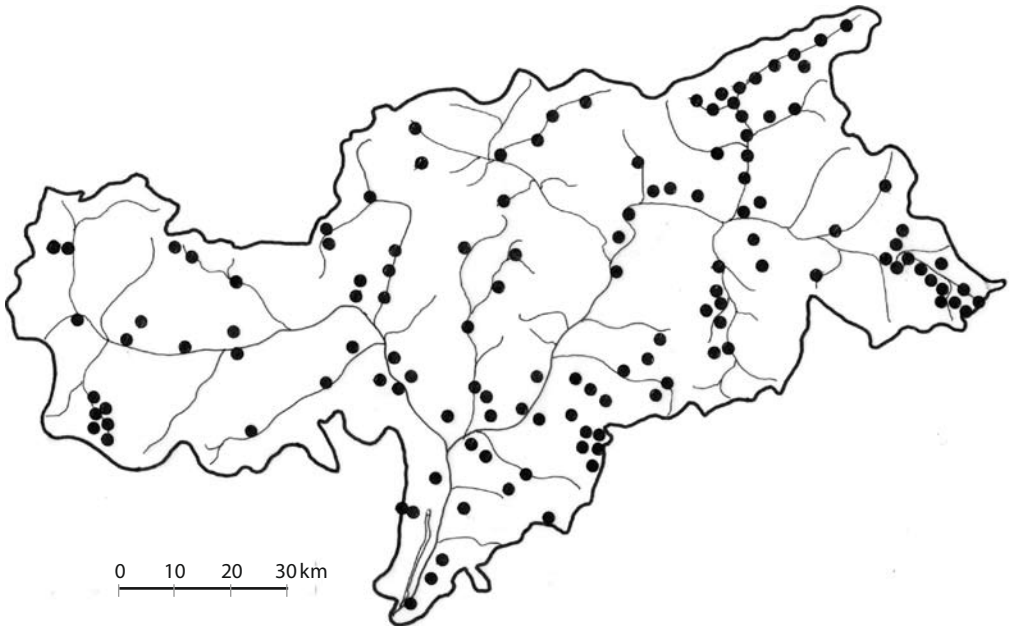
4. Material and methods

The list of 311 gall midge species that were found in the territory of South Tyrol since 1887 up to the present (2009) represents about 2150 individual records of the occurrence of gall midges at localities in South Tyrol and provides the basis for this zoogeographical study. Of them, about 200 records (10%) were obtained by earlier researchers (20 by Thomas, 30 by Dalla Torre, 3 by Pokorny, 140 by Hellrigl), and 1950 records (90%) are results of investigations by the present authors.
Our investigations were carried out during 1999-2009 at 124 localities distributed through the territory of the whole South Tyrol as far as possible equally situated in all parts and all altitudinal zones. We investigated the occurrence of gall midges at the lowest situated locality at Salurn, 250 m a.s.l. in the most southern part of South Tyrol up to the highest, at the Schaubachhütte, 2581 m a.s.l., in the Ortler Range. Each record means the finding of one gall midge species at one locality. Distribution of localities in South Tyrol where we investigated gall midges is given in Fig. 4 and a review of investigations in Table 1.

Table 1: Review of investigations of M. Skuhravá and V. Skuhravý in South Tyrol in the years 1999-2009

Year	Part of South Tyrol	Number of localities	Number of records	Reference
1999	whole area	13	200	Skuhravá et al. (2001)
2001	Stilfser Joch, Dolomite Alps	9	115	Skuhravá et al. (2002)
2002	Sexten Dolomits	14	250	Skuhravá & Skuhravý (2003)
2003	Zillertal Alps	18	303	Skuhravá & Skuhravý (2005a)
2004	Unterland	18	307	Skuhravá & Skuhravý (2005b)
2005	Western part	19	270	Skuhravá & Skuhravý (2006)
2006	Western Dolomite Alps	12	190	Skuhravá & Skuhravý (2007)
2007	Eastern Dolomite Alps	13	195	Skuhravá & Skuhravý (2009b)
2009	Sarntaler Alps	8	120	Skuhravá & Skuhravý (2010)
Total	124 localities		1950 records	

Fig. 4: Map of South Tyrol showing investigations of the family Cecidomyiidae at 124 localities during the period from 1999 to 2009.



During our investigations we used the same collectig method at each sample locality. We noted in the protocol its altitude and short characteristics of biotopes. At each locality we collected each gall midge species only once in the course of the two to four hours of the search. All findings were recorded, including notes about the local abundance of species. During excursions several specimens of each host plant with galls were put in a separate small plastic bag. 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. The advantage of this method is the fact that the causers of all galls were identified to the species level, including gall midge species larvae of which develop inside galls as inquilines, predators and mycophages.

All data obtained during our investigations of gall midge fauna in South Tyrol, enriched with data of earlier authors, are here evaluated and analysed from two points of view, viz. from the geographic and from the zoological points of view using the methods of Skuhravá (1980, 1987, 1994a, 1994b, 1997b). From the geographic point of view, the horizontal occurrence is presented by various average numbers of species in parts of South Tyrol and the vertical occurrence is shown by the average numbers of gall midge species which occur in the rising altitudinal zones.

Identification of gall midge galls is based on keys of Buhr (1964-1965), Houard (1908-1909), Redfern & Askew (1992) and Redfern et al. (2002), identification of gall midge larvae on Möhn (1955, 1966-1971), of gall midge adults on Skuhravá (1997a). The nomenclature

of gall midge species is based on Skuhravá (1986, 1989, 1997a), Jaschhof (1998) and Gagné (2004), the nomenclature of host plant species on Tutin et al. (1964-1980) and Lauber & Wagner (2001). Economic importance of gall midge species has been analysed using knowledge of Barnes (1946-1956), Nijveldt (1969), Skuhravý & Skuhravá (1993, 1996), Darvas et al. (2000) and Skuhravá & Roques (2000).

5. Results

All fundamental data dealing with the species of the family Cecidomyiidae found in the territory of South Tyrol since 1887 until the present time are given in two lists. In the first list all species are arranged according to the alphabetic order of the Latin names of the genera (Appendix 1). For each species the following information is recorded: host plant species, type of biology, frequency given as number of localities where species was found, altitude or altitudinal span (in m a.s.l.) of the lowest and highest situated localities, type of geographical distribution and reference to the map showing the occurrence of species in South Tyrol (Fig. 5 - Fig. 13). In the second list are given host plant species and their families together with gall midge species associated with them (Appendix 2). All these data are subjects of zoogeographical analysis and are evaluated in the following part.

6. Evaluation of results

6.1 Number of gall midge species recorded in the present fauna

The present gall midge fauna of South Tyrol includes 311 species in 68 genera. Of them, 272 are valid (i.e.described) species and 40 species are identified to the genus level having been discovered on new host plants and representing new species for science. They belong to the ten following genera: *Arthrocnodax* (1 species), *Contarinia* (5 species), *Dasineura* (15 species), *Jaapiella* (6 species), *Lestodiplosis* (2 species), *Macrolabis* (2 species), *Mycodiplosis* (1 species), *Rabdophaga* (5 species), *Rhopalomyia* (1 species).
Most of the gall midges recorded here belong to the subfamily Cecidomyiinae, with only *Aprionus confusus* belonging to the subfamily Lestremiinae and *Asynapta viscicola* to the subfamily Porricondylinae. Most (96%) are phytophagous. Their larvae cause galls on various host plants or live on or in plant organs without inducing galls and a small part of them, 16 gall midge species, are inquilines that live in galls caused by other gall midges without affecting them; five species are zoophagous and seven are mycophagous species. Phytophagous gall midges are associated with 221 host plant species that belong to 48 plant families. 150 species (68%) are herbs, 45 species (20%) are trees and 26 species (12%) are shrubs. Only six of the recorded gall midge species are zoophagous, viz. *Aphidoletes aphidimyza*, *Arthrocnodax* sp. and four species of the genus *Lestodiplosis*, larvae of which were found in cones of *Picea abies*, and in inflorescences of *Achillea millefolium* and

Homogyne alpina, respectively. Seven gall midge species are mycophagous, viz. *Aprionus confusus, Asynapta viscicola, Clinodiplosis cilicrus, Mycodiplosis coniophaga, M. melampsorae* and two undescribed species of the genus *Mycodiplosis*. The biology of *Planetella producta* is unknown as the adults were caught.

Of 68 genera representing the gall midge fauna of South Tyrol, *Dasineura* Rondani, 1840, is most species rich including 92 species. It is followed by the following genera with decreasing species numbers: *Contarinia* Rondani, 1860, with 46 species; *Jaapiella* Rübsaamen, 1915, with 23 species, *Macrolabis* Kieffer, 1892, with 19 species, *Rabdophaga* Westwood, 1847, with 18 species, *Rhopalomyia* Rübsaamen, 1892, with 9 species, and *Asphondylia* Loew, 1850, with 8 species. The remaining genera contain five to two species and 42 genera are represented by single species.

The gall midge fauna of South Tyrol currently totalling 311 species may be evaluated as rich and South Tyrol may be counted among the best explored parts of Europe, so far as gall midges are concerned. The level of knowledge about the gall midge faunas in Europe is uneven. In comparison with adjacent countries, the gall midge fauna of Switzerland with 227 species (Skuhravá & Skuhravý 1997) is poorer and the gall midge fauna of Austria including 396 species (Skuhravá & Skuhravý 2009a) is richer than the gall midge fauna of South Tyrol.

It is necessary to emphasize that the gall midge fauna of South Tyrol may be evaluated as well known for gall-inducing species but it is very poorly known for non-galling species of the subfamilies Porricondylinae and Lestremiinae. Each of these subfamilies is represented in South Tyrol by only one species, *Aprionus confusus* of the subfamily Lestremiinae and *Asynapta viscicola* of the subfamily Porricondylinae. The progress of knowledge of these two groups is conditioned above all by using other collecting methods which have not been used by the present authors. Both of these groups include non-galling species, larvae of which are mycophagous and saprophagous, and their adults are usually obtained by various types of traps exposed in natural habitats, or by sweeping and individual collecting. In some parts of Europe these two groups of non-galling gall midges are more abundant (probably because they are there intensively studied), as for example in Germany where the gall midge fauna is formed of 836 species (Meyer & Jaschhof 1999), the Lestremiinae include 125 species (15%) and the Porricondylinae 58 species (7%), both groups together forming about one fifth of all gall midge species known in Germany. In the Czech Republic, where the gall midge fauna includes 549 species, and in the Slovak Republic with 355 species (Skuhravá 2006b), the Lestremiinae include 14 species and the Porricondylinae 17 species.

The number of gall midge species found at individual localities is an important result of investigations. In South Tyrol we found from 3 to 36 gall midge species at individual localities. On the basis of data gathered during long-term investigations it is possible to count the average species numbers for separated parts (i.e. for faunal regions, see further sub-chapter) and the average species number per locality for the whole territory. The **average species number** for the whole territory of South Tyrol is 15. Uttenheim in Ahrntal, situated between 850-950 m a.s.l., is the locality with the richest gall midge species number. We found there 36 gall midge species in the course of one excursion lasting several hours.

Table 2: Comparison of results obtained during faunal investigations of the family Cecidomyiidae in countries of Central Europe and calculated species densities. The countries are arranged according to increasing size of areas, NL is the number of localities where gall midges were investigated, NS number of species resulted from investigations (including species found by earlier researchers), ASN average species number per locality and HSN is the highest species number per locality obtained in the course of investigations in each area. SD is species density in an area of 1000 km^2 calculated recently (it is not included in the articles given in references).

Country	Total area (in km^2)	NL	NS	ASN	HSN	SD	Reference
South Tyrol	7,400	124	310	15	36	189	present article
Switzerland	41,290	56	237	16,7	29	90	Skuhravá, Skuhravý 1997
Slovak Republic	48,845	336	362	19,5	43	134	Skuhravá 2006b
Czech Republic	78,866	670	549	26	77	189	Skuhravá 2006b
Austria	83,870	274	396	17	38	116	Skuhravá & Skuhravý 2009a
Hungary	93,030	22	332	29	52	107	Skuhravá & Skuhravý 1999
Poland	312,658		397			94	Skuhravá et al. 2008
Germany	357,021	26	653	16	28	150	Skuhravá & Skuhravý, in preparation
France	547,030	17	581	26	43	120	Skuhravá et al. 2005

If we compare the fundamental characteristics for countries of Central Europe with results of faunal investigations (Table 2), it is apparent that South Tyrol, Switzerland and Austria, belonging to Alpine countries, have lower average species numbers than Hungary and the Czech Republic. The Slovak Republic occupies an intermediate position. It seems that the average species number is connected mainly with geographical position of countries, altitudinal position of localities and number of localities under study. The relatively lower average species number that has been obtained in South Tyrol, Switzerland and Austria (15, 16, 7 and 17) is connected with the mountainous character of these countries and with the fact that many investigations have been done in Alpine and sub-Alpine zones with relatively low gall midge species numbers.

It is also possible to calculate the **density** of gall midge species occurring in an area of 1000 km^2 (that is a square with four equal sides each 31,62 km long) in South Tyrol using the formula of MacArthur & Wilson (1967): $\mathbf{S = x/a^{0,25}}$ where **S** is the number of species per area of 1000 km^2, **x** is the number of gall midge species found in the country and **a** is the whole area of the country expressed in 1000 km^2. The value calculated from this formula for South Tyrol is 189 gall midge species for 1000 km^2. It is a relatively high number of species and this value is the same as that which was calculated for the density of gall midge species occurring in the Czech Republic. It seems that the species density does not depend on the size of the area but it is probably influenced by the number of localities that were examined in the area under study. From this point of view the Czech Republic and South Tyrol seem to be the best explored areas in the world for gall midges. Germany, Slovakia, France and Austria are countries with high gall midge species densities and Poland and Switzerland have lower species densities.

6.2 Similarity of gall midge faunas of South Tyrol, Austria and Switzerland

We compared the list of gall midge species occurring in South Tyrol with the lists of species occurring in Austria and in Switzerland. We found that the gall midge fauna of South Tyrol is very similar in species composition to the gall midge faunas of Austria and Switzerland. Altogether two hundred species occur in both South Tyrol and Austria, and 157 species in both South Tyrol and Switzerland (Table 3). Shared species in South Tyrol, where the fauna includes 311 species, form 64%, in Austria, where the fauna includes 396 species, 50% and in Switzerland, where the fauna involves 237 species, 65%.
We confirmed the similarity of gall midge faunas using the formula of Sørensen's quotient of similarity (Sørensen 1948):

$$QS = \frac{2C}{A+B}$$

where *A* and *B* are the species numbers in the samples **A** and **B,** respectively, and **C** is the number of species shared by the two samples. If we insert our data for similarity of gall midge faunas of South Tyrol and Austria in the fraction, where **2C** are 2 x 200 common species, **A** is 396 species of Austria, **B** is 311 species of South Tyrol, and calculate according to the formula, then we obtain the value of **QS= 0,56** which indicates that both faunas are very similar although there are substantial differences in the sizes of those countries. We obtained similar values of QS for the gall midge faunas of South Tyrol and Switzerland (QS = 0,57).
This similarity of gall midge faunas of the three countries is based above all on the fact that large parts of the territory of these coutries are contiguous and are formed by the Alps and the vegetation, including host plants for gall midges, is very similar. The similarity is apparent also in the number of common species of the main genera with exception of the genus *Lasioptera*. Only one species, *Lasioptera rubi*, occurs in all three countries, and seven other species occur in Austria.

Table 3: Comparison of species numbers and numbers of common species of the main genera in the gall midge faunas of South Tyrol, Austria and Switzerland.

	Switzerland	Common species	**South Tyrol**	Common species	Austria
Total species	237	157	**311**	200	396
Dasineura	60	45	**92**	55	91
Contarinia	39	22	**46**	27	56
Jaapiella	13	11	**23**	13	19
Macrolabis	7	7	**19**	8	13
Rabdophaga	10	8	**18**	10	13
Rhopalomyia	7	5	**9**	4	8
Asphondylia	6	4	**8**	8	16
Harmandiola	5	5	**5**	4	4
Cystiphora	3	3	**3**	3	3
Lasioptera	3	1	**1**	1	8

6.3 Contribution to the knowledge of the fauna of South Tyrol and Italy

In 1999, at the beginning of our investigations, the fauna of gall midges of South Tyrol included 24 species and of Italy 324 species (Skuhravá & Skuhravý 1994, Skuhravá 1995). We discovered each year during our investigations several gall midge species that were new records for the fauna of South Tyrol and Italy as is shown in Table 4.

Table 4: Increasing numbers of gall midge species new to South Tyrol and Italy during investigations in the years 1999-2009

Investigated area	Year of investigation	Species number of gall midges found	New records for South Tyrol	Total species number of South Tyrol	New records for Italy
South Tyrol	1999	118	75	145	43
Stilfser Joch, Dolomite Alps	2001	65	13	151	17
Sexten Dolomits	2002	95	21	189	12
Zillertal Alps	2003	93	16	208	10
Unterland	2004	134	22	230	10
Westen part	2005	117	14	245	8
Western Dolomite Alps	2006	94	11	254	8
Eastern Dolomite Alps	2007	94	7	263	4
Sarntaler Alps	2009	63	3	266	2

The number of gall midge species found in explored parts of South Tyrol successively increased in each year of our investigations as new records accumulated. In 1996 Hellrigl (1996) gave 24 gall midge species known at that time to occur in South Tyrol. It was the starting number when we began our investigations there in 1999. In that year we increased the recorded gall midge fauna by 121 species and our investigations resulted in the assembly of 145 gall midge species forming the gall midge fauna of South Tyrol at that time. It is necessary to emphasize that each first investigation in a particular country or area where systematic faunal investigations have not been done usually brings the highest growth of new records. Each of the subsequent investigations brought new records but their number was each year smaller. In the course of our investigations in the years 1999-2009 we enriched the fauna of South Tyrol to 287 gall midge species (Fig. 14).
Each year a part of gall midge species that we found in South Tyrol was new for the fauna of Italy. The first investigation brought the largest number of new records and investigations in the following years have brought decreasing numbers of new records. In the course of our investigations in South Tyrol during 1999-2009 we enriched the gall midge fauna of Italy by 114 species. The present list of the family Cecidomyiidae of Italy includes 510 species (Skuhravá, in preparation).

6.4 Frequency of occurrence

The horizontal occurrence of the gall midge species is analysed according to their overall occurrence throughout South Tyrol where the investigations were carried out at 124 localities. The basis for such analysis is the number of localities at which a particular species was found, without taking into account the local abundance of the species. All gall midge species found in South Tyrol (311 species) may be divided into six frequency groups using the first six members of the geometrical progression with quotient "2" and coefficient "a", as follows:

$$a.2^0 + a.2^1 + a.2^2 + a.2^3 + a.2^4 + a.2^5.$$

The value of each next member of the geometrical progression is given by the sum of values of the preceding members (Table 5, Fig. 15).

Table 5: Frequency groups of gall midges found in South Tyrol

Frequency group	I.	II.	III.	IV.	V.	VI.
Numbers of progression	$a.2^0$	$a.2^1$	$a.2^2$	$a.2^3$	$a.2^4$	$a.2^5$
Simplified	a	2a	4a	8a	16a	32a
Number of localities	1-2	3-6	7-14	15-30	31-62	63-126
Verbal denomination	very rare	rare	moderately frequent	frequent	very frequent	most frequent

In South Tyrol, 151 gall midge species (49% of all species found) belong in the first frequency group. They occur **very rarely**. 105 species were found at only one locality and 46 species at only two localities. Many of them were recorded in South Tyrol for the first time, some of them are undescribed species identified to the genus level found on new host plants and representing new species that will be described in the future. Galls of some species were found in the past and have not been rediscovered in the present, as for example *Rhopalomyia luetkemuelleri* causing galls on *Artemisia spicata* and *R. ruebsaameni* causing galls on *Erigeron uniflorus*, both found and described by Thomas (1893). Some of these species became possibly extinct. Galls of several gall midge species that were discovered in the Alps in the past by Thomas (1892a, 1892b) and denominated as "Dipterocecidium" by Dalla Torre (1892, 1894, 1896) were later described by Kieffer (1909) who gave them names referring only to Thomas´s descriptions of galls without having any other material for the description of adults and immature stages. Several gall midge species of the genus *Rabdophaga* associated with high-mountainous *Salix*-species host plants were found at single localities and belong in this group of very rarely occurring species.

Another 66 gall midge species (21%) occurring **rarely** in South Tyrol belong in the second frequency group. Each of them was recorded at 3 to 6 localities. The most interesting representatives of this group are *Jaapiella alpina*, causing galls on *Silene acaulis*, and *Craneiobia corni*, inducing galls on leaves of *Cornus sanguinea.*

Fifty three gall midge species (17%) occur **moderately frequently**. Each of them was found at 7 to 14 localities and belongs in the third frequency group. One of the typical representative is *Asphondylia verbasci*, causing flower galls on *Verbascum lychnitis*. It occurs here and there over South Tyrol. Similarly distributed is *Contarinia aequalis*, causing leaf bud galls on *Senecio nemorensis* subsp. *Fuchsii.* Another interesting species is *Dasineura daphnes*, causing galls on several *Daphne* species. This species occurs very rarely in the Czech Republic and, therefore, it has been included as a critically endangered species in the red list (Farkač et al. 2005, Skuhravá 2005).

Twenty eight gall midge species (9%) occur **frequently** and belong in the fourth frequency group. Each of them was recorded from 15 to 30 localities. Many gall midge species associated with trees and shrubs belong in this group, viz. *Dasineura berberidis*, causing leaf bud galls on *Berberis vulgaris, Contarinia sorbi*, inducing leaflet galls of *Sorbus aucuparia*, *Semudobia betulae* fruit galls on *Betula* spp., *Harmandiola cavernosa* leaf galls of *Populus tremula* and *Dasineura fraxini* galling leaflets of *Fraxinus excelsior*. Of the gall midges associated with herbaceous host plants, the following species may be mentioned: *Hygrodiplosis vaccinii* causing rolled leaf margins of *Vaccinium uliginosum*, *Dasineura virgaureae* galling *Solidago virgaurea*, *Dasineura phyteumatis* inducing flower buds on various *Phyteuma* species, *Dasineura urticae* causing galls on *Urtica dioica* and *Schizomyia galiorum* inducing stem galls on *Galium mollugo* and other *Galium*-species.
Twelve species (4%) occur **very frequently**. Each of them was recorded at 31 to 62 localities. They belong in the fifth frequency group. Four gall midge species are associated with trees, three species with shrubs and five species with herbs. Larvae of *Rabdophaga rosaria* cause rosette bud galls on various *Salix* species, *Dasineura kellneri* bud galls on *Larix decidua*, *Dasineura fraxinea* leaflet galls on *Fraxinus excelsior* and *Dasineura tortilis* galls on leaves of *Alnus glutinosa* and *A. incana*. Larvae of *Oligotrophus juniperinus* cause galls on buds of *Juniperus communis*, *Wachtliella ericina* bud galls on *Erica carnea* and larvae of *Dasineura rosae* induce galls on leaflets of various species of *Rosa*. Of species developing on herbs, larvae of *Dasineura epilobii* cause flower bud galls on *Epilobium angustifolium*, *Geocrypta galii* on *Galium mollugo* and its relatives, *Dasineura trifolii* leaflet galls on *Trifolium repens*, *Macrolabis heraclei* galls on leaves of *Heracleum sphondylium* and *Cystiphora taraxaci* galls on leaves of *Taraxacum officinale*. *Iteomyia capreae*, causing galls on leaves of *Salix caprea* and related species, is **the most frequent species** in South Tyrol. Its galls were found at 66 localities, probably reflecting the widespread occurrence of its host plant.

6.5 Horizontal occurrence

The horizontal occurrence of each gall midge species found in the territory of South Tyrol is shown in the map (Fig. 5 - Fig. 13). For the purpose of zoogeographical analysis, the species that occur only at one or two localities and are rare in the wild in the area under study usually do not provide much information about their horizontal occurrence. Surprisingly not even the species occurring very frequently, as for example *Iteomyia capreae* and *Macrolabis heraclei,* give useful information for evaluation. It is therefore necessary to select suitable species for such evaluation.
Large parts of South Tyrol is formed by the Alps that are covered mainly with coniferous forests. Of the gall midges associated with coniferous trees, *Dasineura kellneri* causing bud galls on *Larix decidua* (Fig. 8) is spread quite regularly over the territory of South Tyrol with exception of the most southern part. *Kaltenbachiola strobi* developing in cones of *Picea abies* (Fig. 10) occurs mainly in the south-eastern part and *Thecodiplosis brachyntera* causing galls on needles of *Pinus sylvestris* and *P. mugo* (Fig. 13) mainly in the eastern part. *Oligotrophus juniperinus* and *O. panteli* inducing bud galls on *Juniperus communis* (Fig. 12) are spread quite regularly over the territory of South Tyrol with the exception of its central part.
Of gall midges associated with broad-leaved trees, *Mikiola fagi* and *Hartigiola annulipes* developing in leaf galls on *Fagus sylvatica* (Figs. 9, 11) occur in the southern part of South Tyrol. *Macrodiplosis pustularis* and *M. roboris* inducing leaf galls mainly on *Quercus pubescens*

(Fig. 11) occur scattered in the southern and central part, *Dasineura fraxinea* and *D. fraxini* causing galls on leaflets of *Fraxinus excelsior* (Fig. 7) mainly in the eastern part. Seven gall midge species causing galls of various shape on the leaves of *Populus tremula* (Figs. 6, 9) occur mainly in the central and eastern part of South Tyrol. Surprising is the low number of gall midges associated with *Acer pseudoplatanus* in South Tyrol, in contrast to our finding that two species, *Drisina glutinosa* and *Acericecis vitrina*, occurred in the Czech Republic very abundantly in the past (Skuhravá & Skuhravý 1986). Eighteen species of the genus *Rabdophaga* associated with various species of the genus *Salix* (Fig. 12) were found scattered in South Tyrol from altitudes of 240 m up to 2330 m a.s.l. Galls of *Rabdophaga* species were observed mainly in localities situated in higher altitudinal zones.
Several gall midge species penetrate together with their host plants from southern Europe into southern part of South Tyrol along the river Adige (Etsch). There are the following south-European and Mediterranean species: *Asphondylia coronillae* on *Coronilla emerus, A. echii* on *Echium vulgare, A. ononidis* on *Ononis spinosa, A. verbasci* on *Verbascum* spp., *Myricomyia mediterranea* on *Erica carnea, Rhopalomyia artemisiae* and *R. tubifex* on *Artemisia campestris,* of gall midges associated with trees *Sackenomyia reaumurii* on *Viburnum lantana* and *Craneiobia corni* on *Cornus sanguinea*. Also two Nearctic species, *Obolodiplosis robiniae* galling leaves of *Robinia pseudoacacia* and *Dasineura gleditchiae* causing galls on leaflets of *Gleditchia triacanthos* penetrated from southern part into South Tyrol along this river several years ago but both species are known to occur much further north, in the UK as well as in other northern European countries (Skuhravá et al. 2007).

6.6 Vertical occurrence

The composition of vegetation, including the host plant species for phytophagous species, changes with rising altitude. Therefore, we analyzed the distribution of the gall midge species according to the altitudinal zones proposed by Ellenberg (1978) that we adapted for the territory of South Tyrol (Skuhravá et al. 2001). Elevations of localities at which particular species were found are an essential basis for such evaluation. In South Tyrol the colline zone includes the span from 200 to 600 m a.s.l., the submontane zone 600-900 m a.s.l., the montane zone 900-1700 m a.s.l., the sub-alpine zone 1700-2200 m a.s.l., the alpine zone 2200-2600 m a.s.l., the subnivale zone 2600-2800 m a.s.l. (the snow-line at 2800 m) and the nivale zone over 2800 m a.s.l. (Fig. 6). We investigated the occurrence of gall midges at 124 localities separated into six altitudinal zones from the lowest situated locality at Salurn, 250 m a.s.l. in the valley of the river Adige (Etsch) in the most southern part of South Tyrol up to 2581 m a.s.l. at Schaubachhütte in the Ortler Range. Twelve localities were in the colline zone, 15 in the submontane zone, 65 in the montane zone, 23 in the sub-alpine and 9 localities in the alpine zone. We included in analyses of vertical occurrence also data obtained by earlier researchers. Two aspects are very important for evaluation of vertical occurrence of gall midges: the lowest situated locality where the particular species has been found and the highest point of its occurrence.
We recognize sixteen types of vertical distribution in the gall midge fauna of South Tyrol on the basis of altitudinal span which is given by elevations of the lowest and the highest situated locality where a particular species was found (Fig. 16). Two fundamental patterns of vertical distribution were found in each of the lower situated zones, viz. the occurrence of a species only inside a particular zone and the occurrence of a species exceeding this zone and reaching higher zones or running across them to higher altitudinal zones.

In the colline zone we found 97 gall midge species, in the submontane zone 60 species, in the montane zone 216 species, in the sub-alpine zone 104 species and in the alpine zone 33 species. Few gall midge species associated with their host plants occur in the narrow altitudinal span of one zone. They may be named monozonal species. Most species occupy larger areas of distribution in the vertical direction and usually are able to occur with their host plants in relatively large altitudinal ranges. They may be named bi-, tri**-,** or polyzonal species.

Of 97 species occurring in the **colline zone**, about one third (29 species) occur only in this zone, six species rise from colline to submontane zone, forty-five species rise from colline zone across submontane to montane zone, another 15 species reach up to the sub-alpine zone and only two species, *Jaapiella veronicae* and *Rabdophaga salicis*, reach the peak of their occurrence in the alpine zone. *J. veronicae* inhabits localities from 500 to 2300 m a.s.l. and its altitudinal span is 1800 m, *R. salicis* localities from 560 to 2330 m and its span is 1770 m. Of 60 species occurring in the **submontane zone**, thirteen occur only in this zone, 22 rise to the montane zone, 19 to the sub-alpine zone and six species reach up to the alpine zone. In addition, many species starting their occurrence in the colline zone, may occur also in this zone. Of 216 species occurring in the **montane zone** (that is the zone occupying the largest altitudinal span of 800 meters), the large amount of about eighty species occur only in this zone, 14 species rise into the sub-alpine zone and 12 species into the alpine zone. In the **sub-alpine zone** 104 species occur. Of them 23 species occur only here, 12 species reach into the alpine zone and two species, *Rhopalomyia luetkemuelleri* and *Jaapiella alpina*, reach up to even the subnivale zone. These two species were found at the end of the nineteenth century and have not been found since then (they may be extinct species). Thirty three species are known to occur in the **alpine zone**. Their distribution is shown in Fig. 17.

Galls of two gall midge species were found in the **subnivale zone.** Both species reach here the peak of their vertical occurrence. Galls of *Rhopalomyia luetkemuelleri* larvae of which cause galls on *Artemisia spicata* were found in subalpine and alpine zones from 2000 to 2700 m a.s.l. Galls of *Jaapiella alpina* larvae of which induce galls on leaf buds of *Silene acaulis* were found in montane to subalpine zones from 1320 to 2700 m a.s.l.

Five gall midge species occur only in the alpine zone, viz. *Rhopalomyia ruebsaameni* inducing galls on *Erigeron uniflorus*, *Rabdophaga alpicola* causing galls on *Salix myrsinifolia* ssp. *alpicola*) and three species of the genus *Dasineura*, larvae of which were found in the flower heads of *Doronicum grandiflorum*, *Bellidiastrum michelii* and *Pedicularis verticillata.*

The occurrence of the eight following species that were found in the alpine zone start in the sub-alpine zone: *Dasineura aucupariae, D. bistortae, D. daphnes, Bayeriola thymicola, Rabdophaga amenticola* and three species identified to the genus level, viz. *Contarinia* sp. (*Bartsia alpina*), *Dasineura* sp. (*Pedicularis kerneri*) and *Dasineura* sp. (*Astragalus alpinus*).

The following eleven species occurring in the alpine zone occupy a large altitudinal span. Their occurrence starts in the montane zone, runs across the sub-alpine zone up to the alpine zone: *Dasineura alpestris, D. phyteumatis, D. thomasi, Dasineura* sp. (*Galium anisophyllum*), *Dasineura* sp. (*Homogyne alpina*), *Geocrypta campanulae, Jaapiella antennariae, Mycodiplosis melampsorae, Neomikiella lychnidis, Resseliella skuhravyorum* and *Rhopalomyia astericola.*

The occurrence of the five following species, viz. *Contarinia loti, Hygrodiplosis vaccinii, Oligotrophus juniperinus, O. panteli* and *Macrolabis achilleae*, that inhabit host plants in the alpine zone, starts in the submontane zone. *Rabdophaga salicis* causing galls on branches of various *Salix*-species and *Jaapiella veronicae* inducing galls on leaf buds of *Veronica chamaedrys* are two species with the largest ecological potency. They are able to live in

various altitudinal zones starting from the colline zone up to the alpine zone. Galls of *R. salicis* were found from 560 to 2330 m a.s.l., that is an altitudinal span of 1770 meters and galls of *J. veronicae* from 500 to 2300 meters, that is an altitudinal span of 1800 meters.
The vertical distribution of gall midges in South Tyrol may be shown by the **average numbers** of species recorded at localities in separate successive altitudinal belts by 100 meters (Fig. 18). The average species number in the colline zone including four altitudinal belts is 18 and the lowest average number (14) was found in the lowest altitudinal belt between 200-300 meters. The average species number in the submontane zone is little higher, similarly as in the lower part of the montane zone. In the montane zone the highest average species number was found between 1100 and 1400 meters. Above the altitude of 1400 m the average species number abruptly falls and ten to fourteen species occur on average at localities in the sub-alpine zone. Only 3,5 to 6 species occur on average in the alpine zone. The average species number decreases with rising altitude. However, these results might be influenced by uneven numbers of collections made at respective altitudes.

6.7 Geographical distribution

The gall midge species occurring in South Tyrol may be divided, according to their overall distribution in the Palaearctic region or in the world, into the following zoogeographical units: European, Eurosiberian, Euroasian, Mediterranean including Submediterranean, Holarctic, Nearctic. See the maps of distribution areas of typical representatives in Skuhravá et al. (2001, 2002), Skuhravá (1987, 1997b) and Skuhravá & Skuhravý 1993.
About 210 species (68%) occurring in South Tyrol are **European** having their centres of distribution in Europe. Their areas may range from very small to large. Some species are known to occur only in South Tyrol, several species have small area of distribution occurring in South Tyrol and in one or two adjacent countries. Only a few species occur abundantly in South Tyrol and other countries of Central Europe and extend southwards to the Mediterranean and even to North Africa, others extend to south-east or to western Turkey or the Caucasus. Typical representatives are *Mikiola fagi, Taxomyia taxi* and *Macrodiplosis pustularis.*
About 80 species (25%) may be regarded as **Eurosiberian**. They occur abundantly in Europe, extend at least to Western Siberia, and a few species reach to the most eastern part of the Palaearctic Region. Typical representatives of Eurosiberian species are *Harmandiola cavernosa, H. globuli, H. populi, Lasioptera rubi, Iteomyia capreae, Geocrypta galii* and *Dasineura urticae.*
Twelve species (4%) are of **Mediterranean** or **sub-Mediterranean origin**. The true Mediterranean species are associated with Mediterranean host plants. *Janetiella oenephila*, causing galls on leaves of *Vitis vinifera,* and *Asphondylia coronillae*, causing galls on *Coronilla emerus*, are two true Mediterranean species. Other species reaching from southern parts of Europe to South Tyrol occupy broader distribution areas.
Eleven species (3%) may be considered to be **Holarctic**. They occur in Europe and in North America. *Aphidoletes aphidimyza, Mycodiplosis coniophaga* and *Semudobia betulae* are considered to be true Holarctic species. Other species, viz. *Contarinia medicaginis, C. pyrivora, Dasineura leguminicola, D. mali, D. pyri, D. trifolii, Monarthropalpus flavus* and *Ozirhincus millefolii*, occurring in Europe and North America, are primarily European species that were imported into North America with their host plants.

Dasineura bistortae causing galls on leaves of *Polygonum bistorta* is the only gall midge species with a marginally **Euro-Asian** type of distribution. The galls of this species were found in mountain areas of Kazakhstan (Fedotova 2000).
Two species, viz. *Dasineura gleditchiae* and *Obolodiplosis robiniae,* are primarily **Nearctic** species that have been accidentally imported to Europe probably with their host plants, *Gleditsia triacanthos* and *Robinia pseudoacacia*. In Europe they are **alien** species.

6.8 Alien species

Larvae of *Dasineura gleditchiae* develop in leaflets of *Gleditsia triacanthos* and change them into galls. It is a Nearctic species and an immigrant to Europe from the coastal zones of the eastern part of the USA. The galls were first found in the Netherlands in 1975 (Nijveldt 1980), then in northern Italy in 1980 (Bolchi-Serini & Volonté 1985) and then they were recorded from many countries in Europe (Simova-Tosic, Skuhravá 1995, Skuhravá & Skuhravý 2009a, Skuhravá et al. 2006). Recently the galls were found in southern Sweden (Molnar et al. 2009). This species has spread in the course of about 30 years from the place of its probable introduction in the Netherlands to as far as Ankara in Turkey (Bayram et al. 2005) a distance of about 2700 km.
Larvae of *Obolodiplosis robiniae* cause galls on leaflets of *Robinia pseudoacacia.* Galls were recorded for the first time by Duso & Skuhravá (2003) at Paese, Treviso Province, in northern Italy. In 2004 the galls were found at several localities around Bolzano and in the same year also in the Czech Republic. Since that time *O. robiniae* spread quickly in Europe and in 2009 the galls were recorded even in southern Sweden (Molnar et al. 2009) and in Denmark (J. Jörgensen, pers. communication). This species has spread rapidly throughout Europe in the course of seven years and at present it occupies a large distribution area from southern England in the west up to Doneck in Ukraine in the east and from southern Italy up to the southern part of Sweden (Skuhravá et al. 2007). *Obolodiplosis robiniae* may cause severe damage to young trees and shrubs. This species multiplies very quickly and may have several generations during one vegetative season. In addition, females are noted for their high fecundity. These factors are reasons why it spread so quickly throughout Europe. After appearing in Central Europe a high degree of occurrence was observed. Shortly afterwards new parasitoid, coming probably from North America, appeared - *Platygaster robiniae*. Its larvae develop in larval bodies of *O. robiniae* and cause their death. This parasitoid species successfully decreases the population density of *O. robiniae* at localities in Europe (Buhl & Duso 2008).

6.9 Threatened species

According to the definition of the "*IUCN Red List Categories and Criteria*" (2001) the threatened species are any species which are vulnerable to extinction in the near future. We analysed the gall midge fauna of South Tyrol from the point of view of the species occurrence at the present time on the basis of our own results of search in various habitats and compare our data with the occurrence in the past using data of occurrence obtained from earlier researchers in the course of more than hundred years.

The gall midges and their galls produced by larvae on host plants can be found in the wild from spring to autumn and the galls of species developing in branches of trees and shrubs even in the course of the whole winter period. The galls have always a certain characteristic shape and many species can be identified based on them. Most galls remain on the host plant for the whole vegetation period. The occurrence of the galls also indicates the presence of the species at the locality even for a long time after adult emergence. The galls are mostly very conspicuous formations and thus, there are many data on their abundance from the beginning of the 20th century and, in certain European countries even from the second half of the 19th century. The gall midges and their galls can therefore be used as bioindicators of long-term changes in nature.

According to the definition of the IUCN the **extinct species (EX)** is such species when there is no reasonable doubt that the last individual has died and presumed extinct when exhaustive surveys in known and expected habitat, at appropriate times, throughout its historic range have failed to record an individual. **Critically endangered (CR)** species have an extremely high risk of becoming extinct in the wild or completely extinct in the immediate future. They are species in danger of extinction whose survival is unlikely if causal factors continue operation. **Endangered (EN)** species is such when the best available evidence indicates that it is to be facing a very high risk of extinction in the wild.

Of the 311 species belonging to the gall midge fauna of South Tyrol, 24 species may be designated as threatened in the terms of the International Union for Conservation of Nature and Natural Resources and may be placed in the red list of threatened gall midge species of South Tyrol. We classify five species as regionally extinct, twelve species as critically endangered species and seven as endangered species. Five species of the family Cecidomyiidae classified as threatened in South Tyrol were classified as threatened in the Czech Republic and were included in the "*Red list of threatened species in the Czech Republic. Invertebrates*" (Farkač et al. 2005, Skuhravá 2005).

We evaluate the following five species as **extinct**. Their galls were found in South Tyrol at the end of the nineteenth century and since that time they have not been discovered although we intensively searched for them at localities where they were formerly found: *Cecidomyia pini, Dasineura polygalae, Jaapiella alpina, Rhopalomyia luetkemuelleri* and *Rhopalomyia ruebsaameni*.

Twelve gall midge species are classified as **critically endangered species.** Their galls were found in the past and at present at only one or two localities. These species are in extremely high risk of becoming extinct in the wild: *Bayeriola thymicola, Bremiola onobrychidis, Contarinia crispans, Contarinia valerianae, Dasineura berti, Dasineura cardaminis, Dasineura clematidina, Dasineura comosae, Dasineura daphnephila, Dasineura similis, Dasineura spicatae* and *Geomyia alpina.* Three of them, *Bayeriola thymicola, Dasineura cardaminis* and *Dasineura similis,* are listed in the Czech Republic as critically endangered species (Skuhravá 2005).

Seven gall midge species are classified as **endangered.** Their galls were found in the wild very rarely and these species are at risk of extinction in the future: *Dasineura alpestris, Dasineura armoraciae, Dasineura bistortae, Dasineura daphnes, Dasineura thomasi, Geocrypta campanulae* and *Rhopalomyia astericola*. Three of them, *Dasineura armoraciae, Dasineura daphnes* and *Geocrypta campanulae* are listed in the Czech Republic as endangered species (Skuhravá 2005).

6.10 Host plant – gall midge relationships

Larvae of phytophagous gall midges live in close relationships with plants. Larvae live in, or on, various plant organs where they feed by sucking sap from the tissues. They may feed without causing galls but most induce development of some type of abnormal plant growth or galls. The majority of gall midges found in the Palaearctic region are phytophagous. This includes about 1,200 species or some 76% of all described species. Most of these, about 60%, produce galls, but some 10% live on, or in plants without doing so. A few, about 6%, live as inquilines in galls of other gall midges or other insects (Skuhravá et al. 1984).

Relationships of gall midges to their host plants are influenced mainly by the feeding mode of gall midge larvae, their feeding ability to accept various or particular nutriments and by the biochemistry of host plants. Many gall midges are specifically bound to their host plant species and their larvae feed on only one host plant species (monophagous species), some gall midge species are oligophagous and larvae may feed and develop on several species of one plant genus, such as *Dasineura rosae*. Larvae of polyphagous species feed on host plant species belonging to several genera of one plant family, as do for example *Mayetiola destructor* on Poaceae, *Resseliella oculiperda* on Rosaceae and *Kiefferia pericarpiicola* on Apiaceae. Uechi et al. (2003) confirmed by DNA analyses that *Contarinia maculipennis* is a highly polyphagous species whose larvae may develop on several host plants belonging to unrelated plant families.

The flora of South Tyrol includes 2361 species (Wilhalm & Hilpold 2006). Nearly one tenth of them, a relatively high number, are host plants for gall midges. In South Tyrol 311 gall midge species are associated with 221 host plant species that belong to 48 plant families. About 40 gall midge species are associated with host plant species of the family Asteraceae, 35 species with Fabaceae, 31 species with Salicaceae, 20 species with Rosaceae. Each of 14 plant families host only one gall midge species. Of the host plant species, about 150 (68%) are herbs, 45 species (20%) are trees and 26 species (12%) are shrubs. *Populus tremula, Quercus robur, Salix caprea* and *S. purpurea* are the host plants with the highest number of associated gall midge species. Each of them is hosting seven gall midge species, followed by *Betula pendula* and *Fraxinus excelsior* hosting six gall midge species, *Picea abies, Tilia cordata* and *Tilia platyphyllos* hosting five gall midge species. On the other hand, more than one half of all host plants – 122 species (55%) – are associated with only one gall midge species, 45 plant species host two gall midge species, 19 plant species three gall midge species and 6 plant species host four gall midge species. The galls of gall midges are not equally distributed on organs of their host plants. Most gall midges (33%) cause galls on leaves of trees and shrubs, about 25% of species induce galls on leaf buds, 25% develop in flower buds, 8% in fruits and 7% develop in stems where they cause galls or develop inside stems without inducing galls.

6.11 Economic importance

Among the gall midges occurring in South Tyrol there are several species which can cause injury to their host plants. The designation of species as agricultural pests is based on references to their harmfulness in the applied entomological literature (Darvas et al. 2000, Skuhravá & Roques 2000). The damage of some species depends mainly on the number of occurring gall midge species and on the plant organs that are attacked, on the atmospheric

conditions and on the incidence of parasitoids that may reduce the population density of the pest. We classified the pests into four groups (Skuhravý & Skuhravá 1993, 1996). In the first group belong the gall midge species causing dying off of the host plants, in the second group the species causing important restriction of the assimilation surface of the host plant organs leading to the stoppage of the growth, in the third group the species causing less important reduction of the assimilation surface and in the fourth group the species occurring abundantly but not causing important damage to their host plant.
In South Tyrol in the course of our investigations we did not find gall midge species causing damage or injury that could justify classifying them as serious pests in agriculture and forestry. We found thirteen gall midge species that could cause damage in agriculture and forestry if their number and occurrence increases in the future and, therefore, they must be evaluated as **potential pests**. At present they damage the host plants but their populations are low and their damage is not observed because the causers develop usually hidden in galls or in organs of host plants and the injury is not apparent. They are the following species:
Contarinia pyrivora and *Dasineura pyri* damaging fruits and leaves of *Pyrus communis* in orchards, *Dasineura mali* curling young leaves of cultivated apple trees in orchards; *Contarinia medicaginis* and *Dasineura leguminicola* reducing seed production of lucerne and clovers, respectively, *Janetiella oenephila* damaging grape leaves and *Monarthropalpus flavus* and two alien species, *Obolodipoisis robiniae* and *Dasineura gleditchiae*, which may reduce the aesthetic value of ornamental trees and shrubs in parks and gardens.
Thecodiplosis brachyntera is serious pest in Central Europe that may cause damage to *Pinus*-stands mainly in higher situated country parts (Skuhravý 1991), *Dasineura kellneri* may injure larch buds, *Plemeliella abietina* may contribute to reducing seed yield of spruce and *Resseliella skuhravyorum* may reduce the seed yield of larch.

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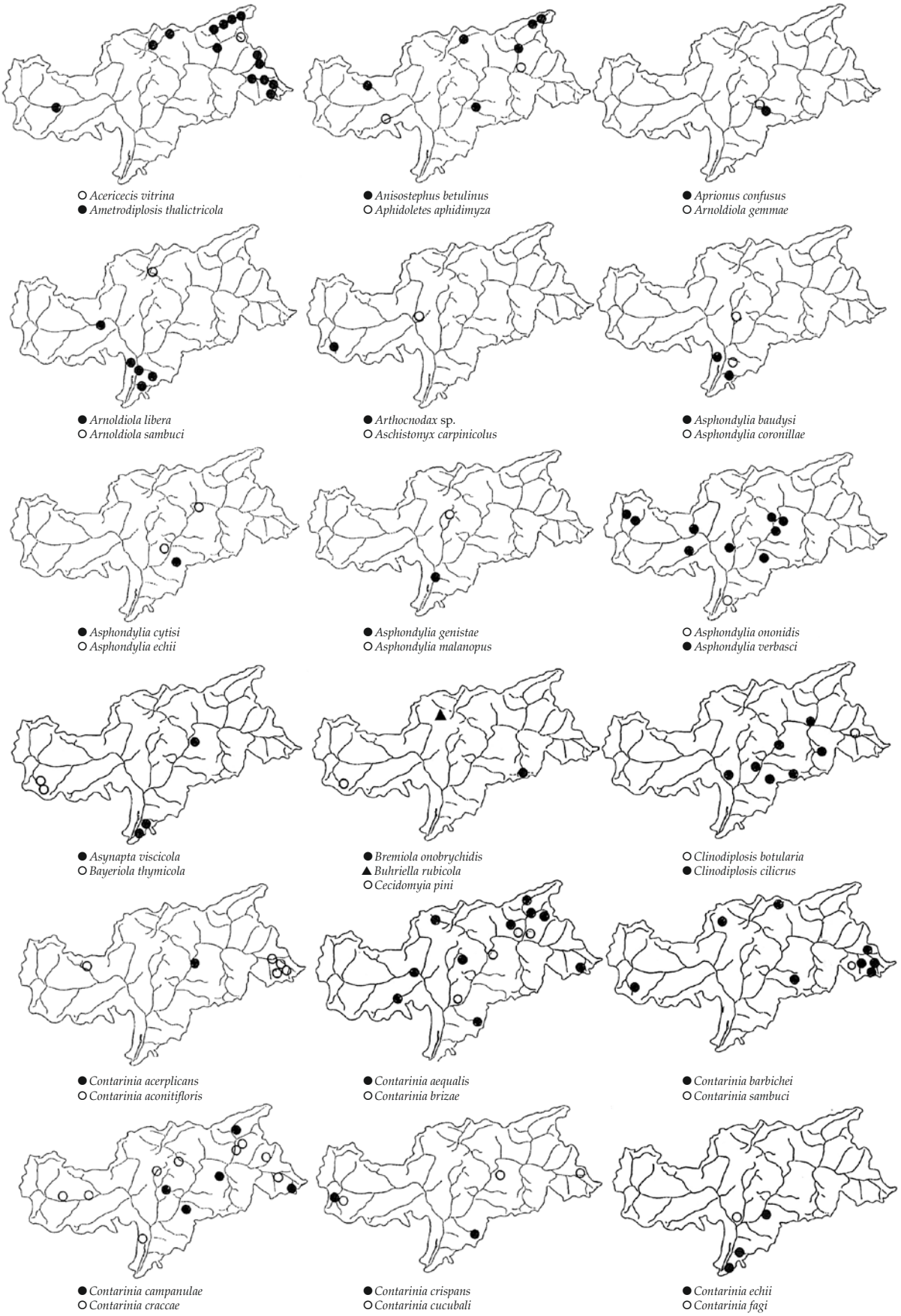

Fig. 5: Occurrence of gall midges (Cecidomyiidae) in South Tyrol (*Acericecis vitrina – Contarinia fagi*)

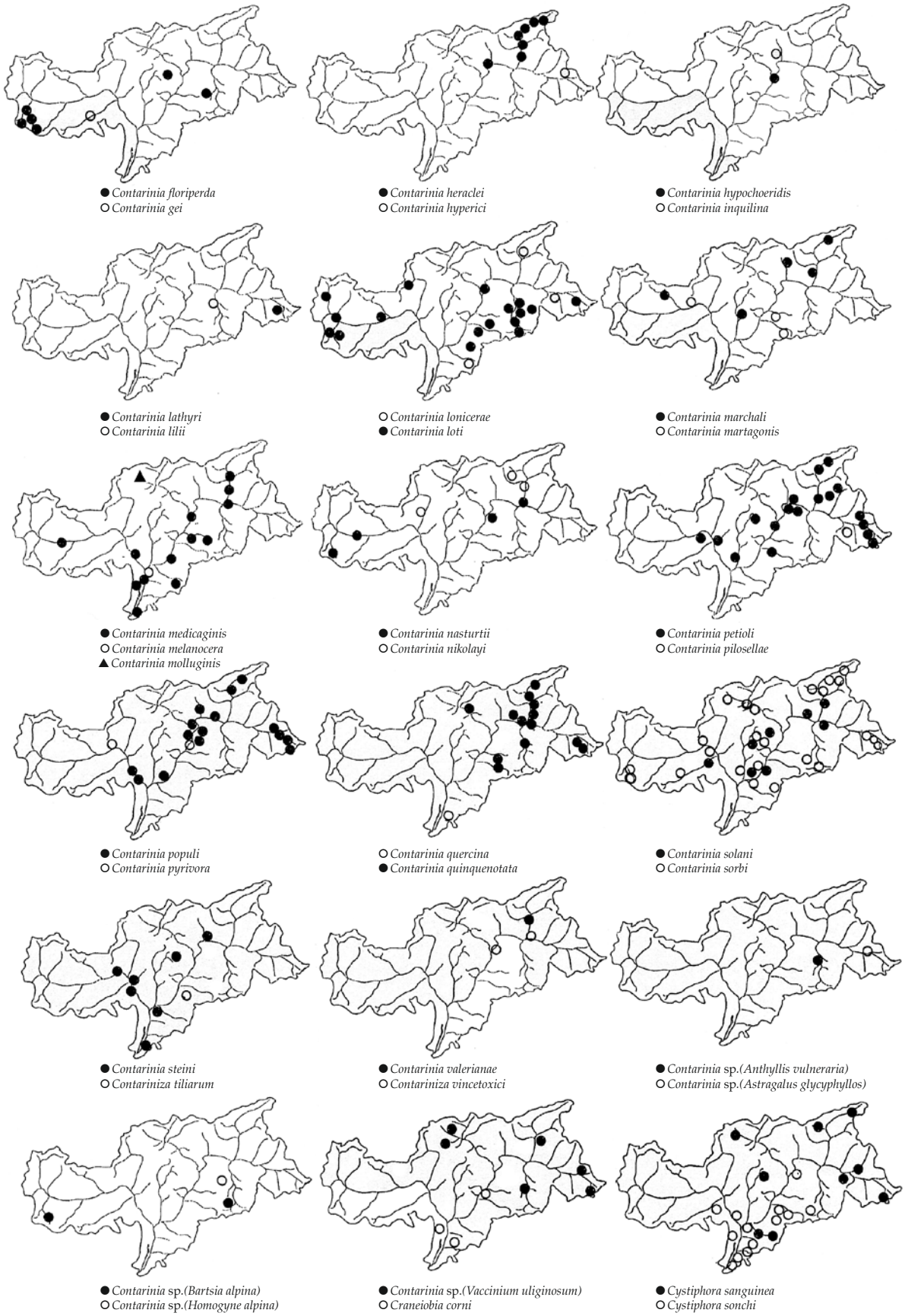

Fig. 6: Occurrence of gall midges (Cecidomyiidae) in South Tyrol (*Contarinia floriperda – Cystiphora sonchi*)

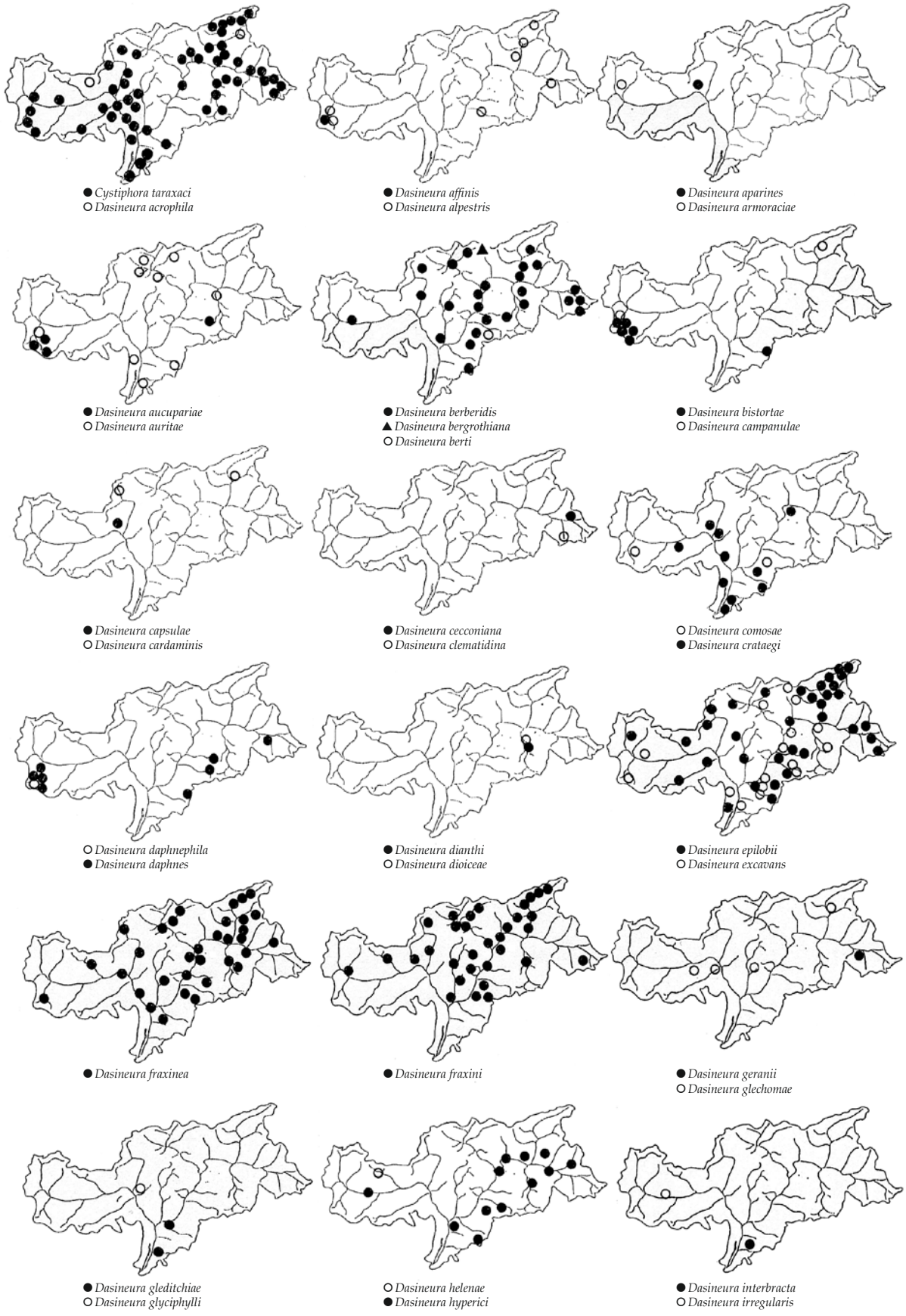

Fig. 7: Occurrence of gall midges (Cecidomyiidae) in South Tyrol (*Cystiphora taraxaci – Dasineura irregularis*)

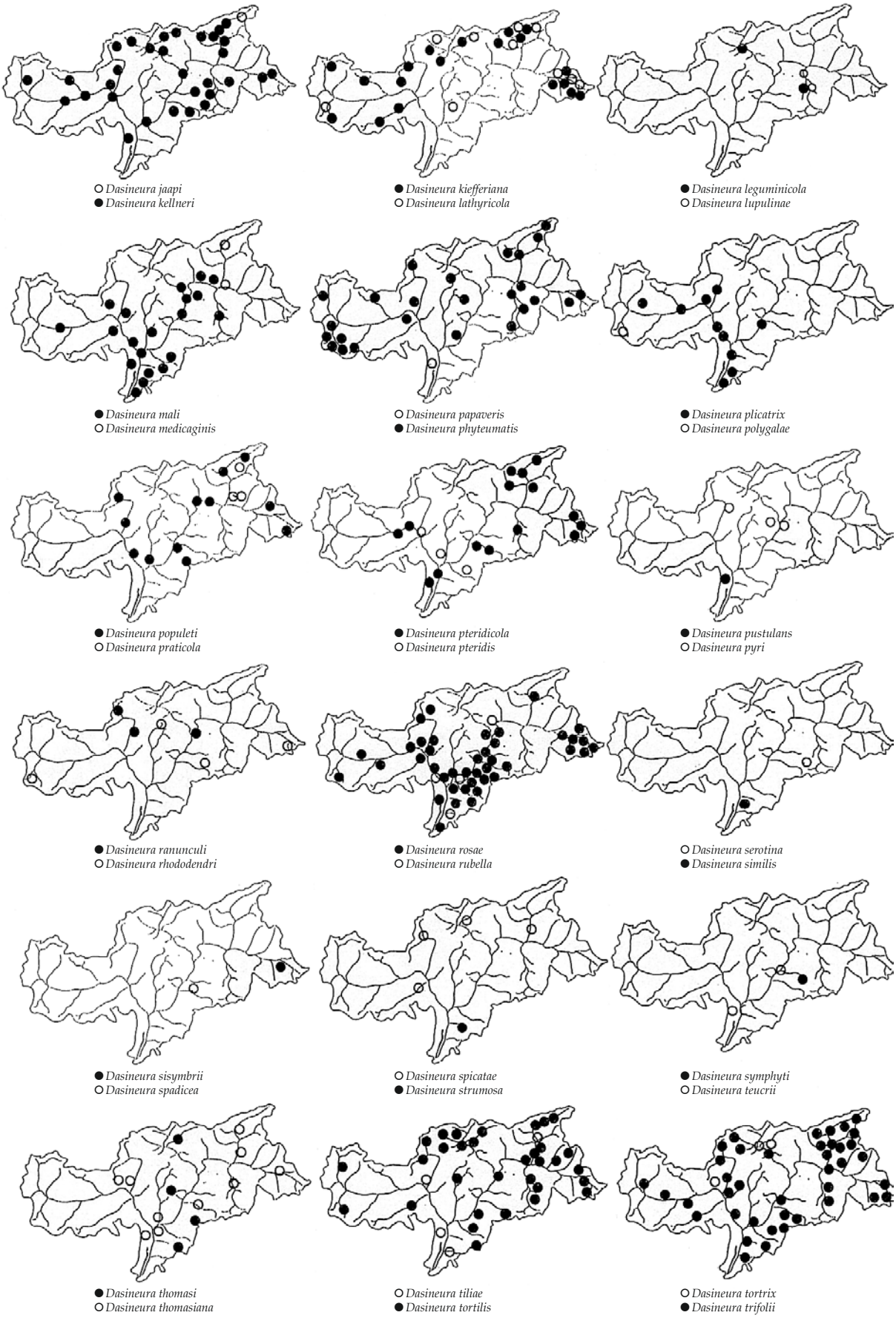

Fig. 8: Occurrence of gall midges (Cecidomyiidae) in South Tyrol (*Dasineura jaapi – Dasineura trifolii*)

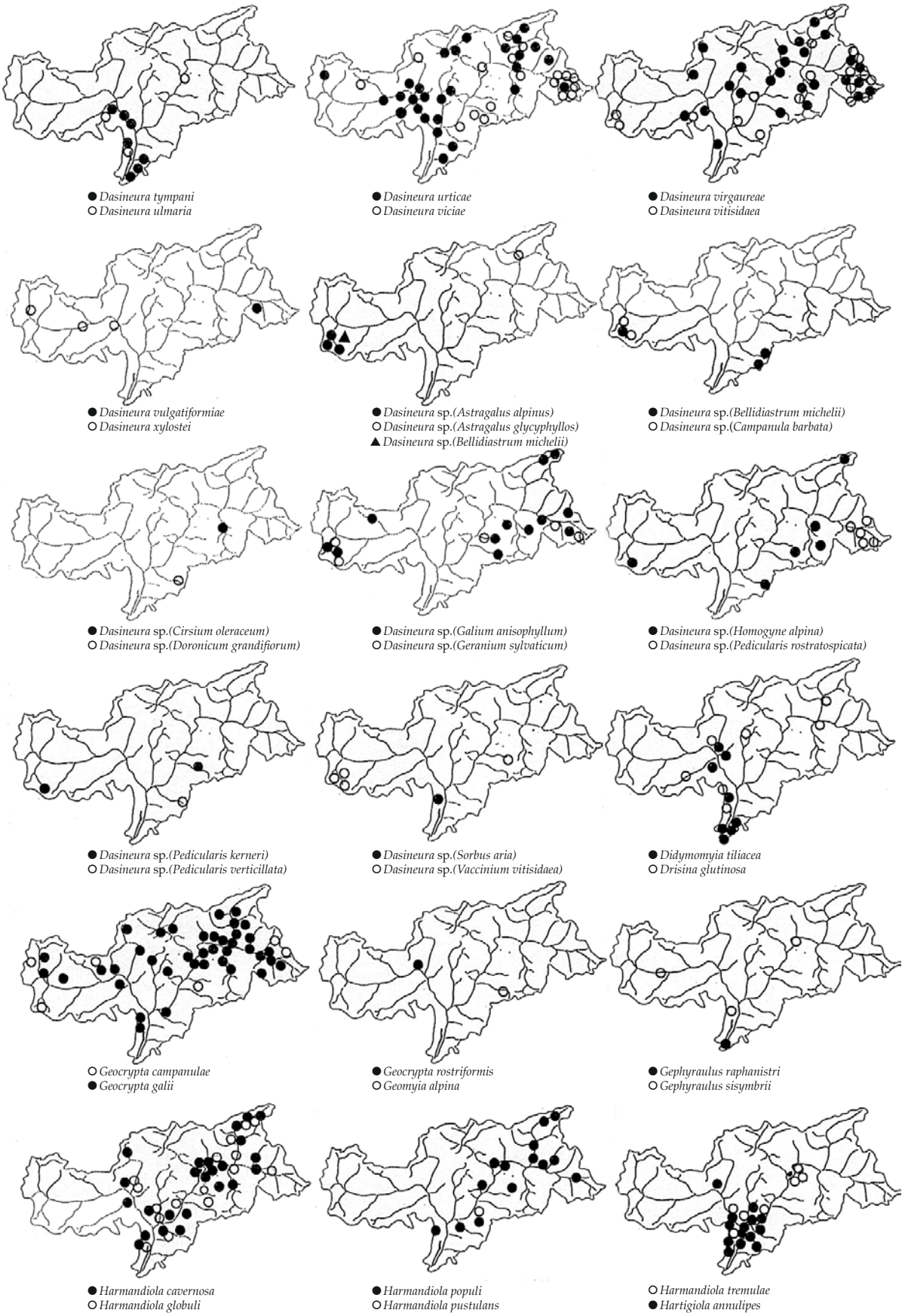

Fig. 9: Occurrence of gall midges (Cecidomyiidae) in South Tyrol (*Dasineura tympani – Hartigiola annulipes*)

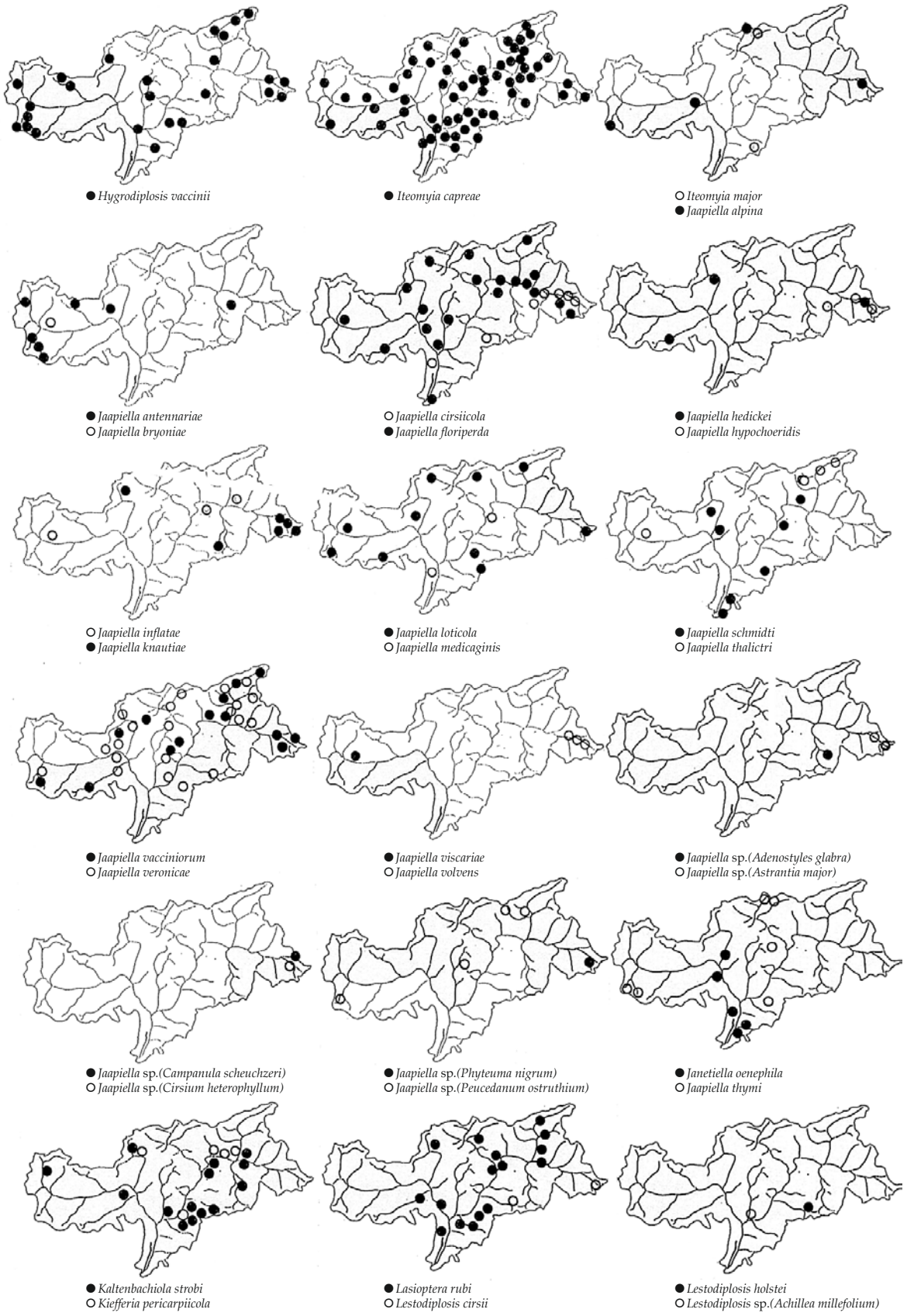

Fig. 10: Occurrence of gall midges (Cecidomyiidae) in South Tyrol (*Hygrodiplosis vaccinii – Lestodiplosis* sp.)

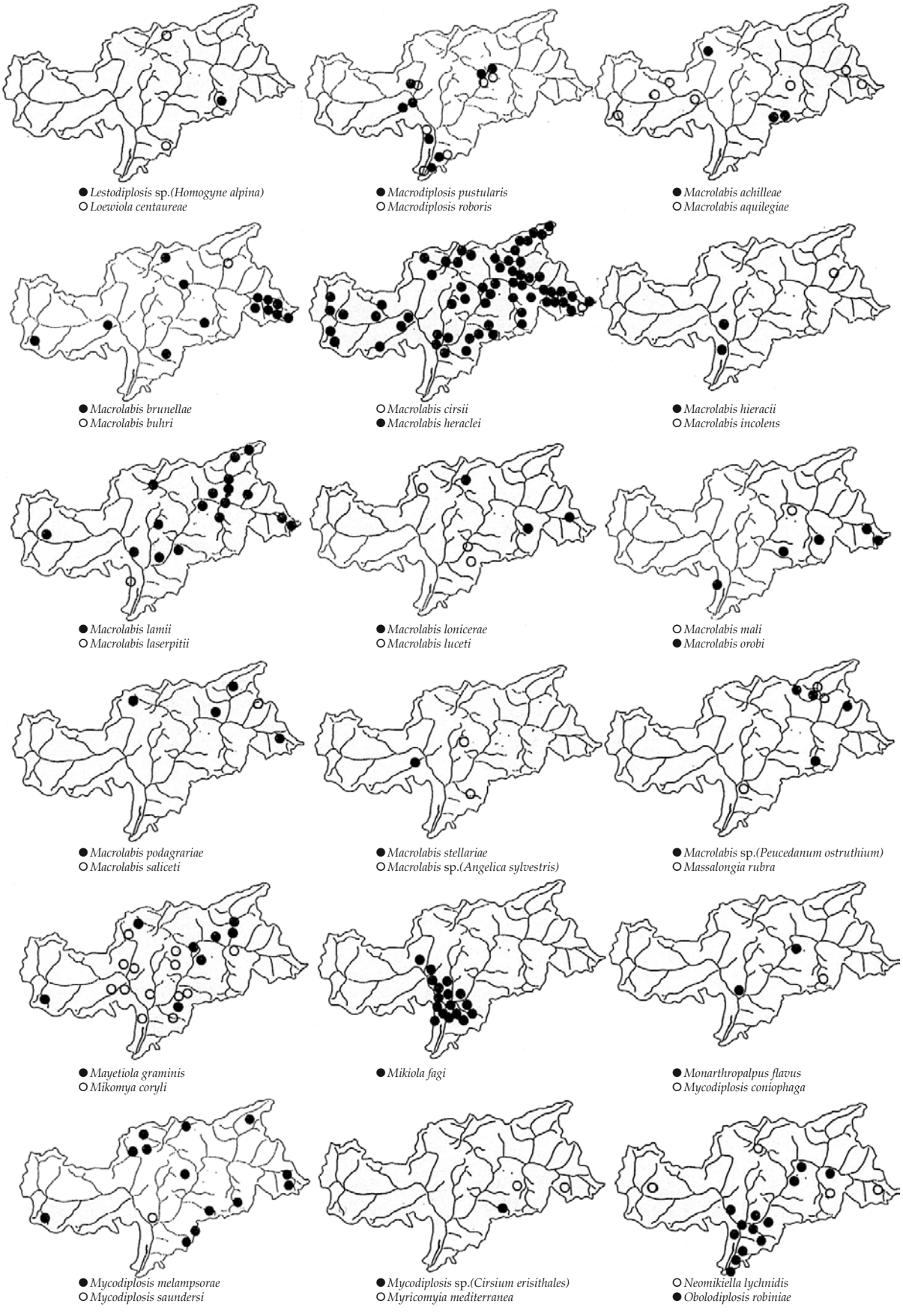

Fig. 11: Occurrence of gall midges (Cecidomyiidae) in South Tyrol (*Lestodiplosis* sp. – *Obolodiplosis robiniae*)

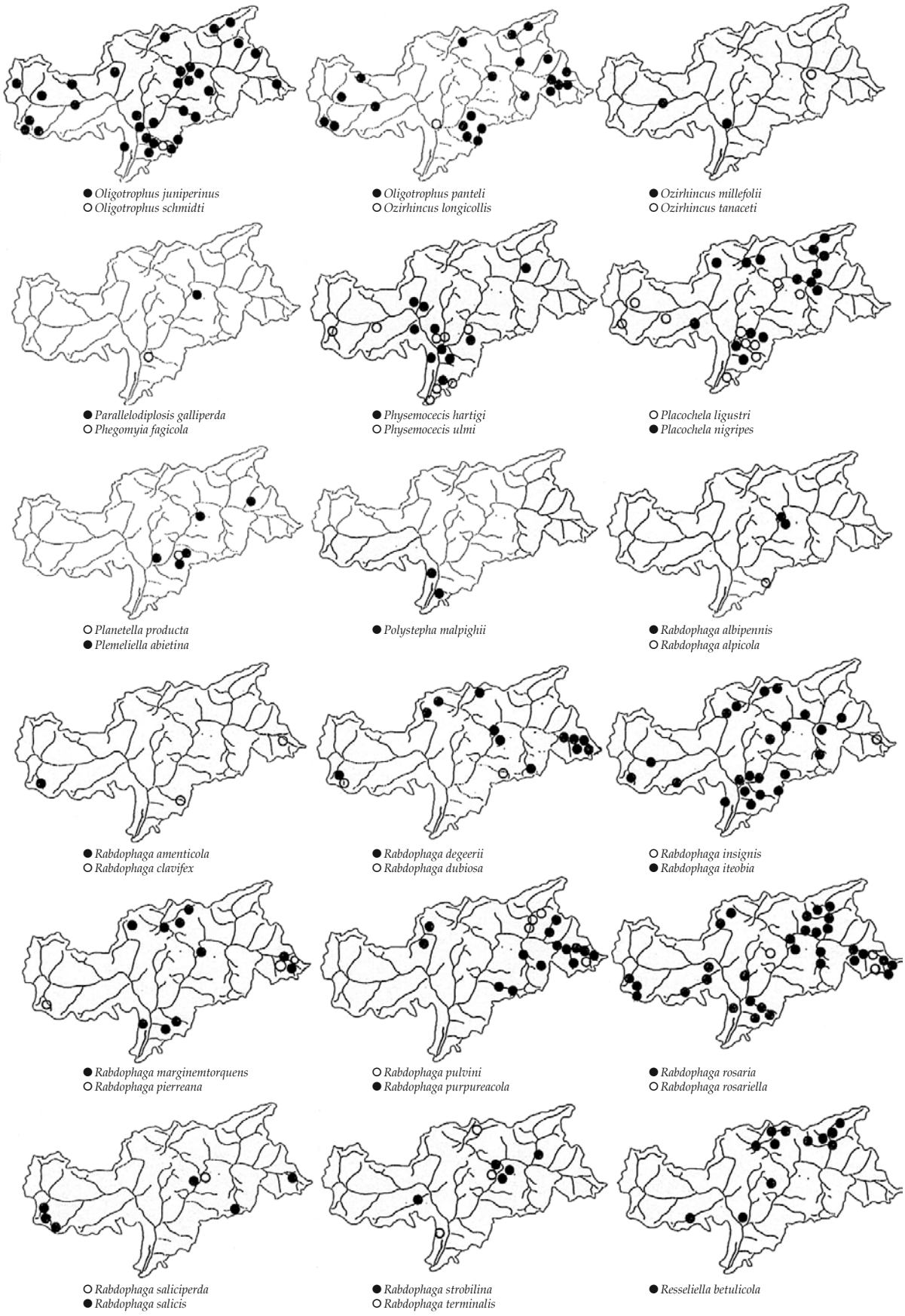

Fig. 12: Occurrence of gall midges (Cecidomyiidae) in South Tyrol (*Oligotrophus juniperinus – Resseliella betulicola*)

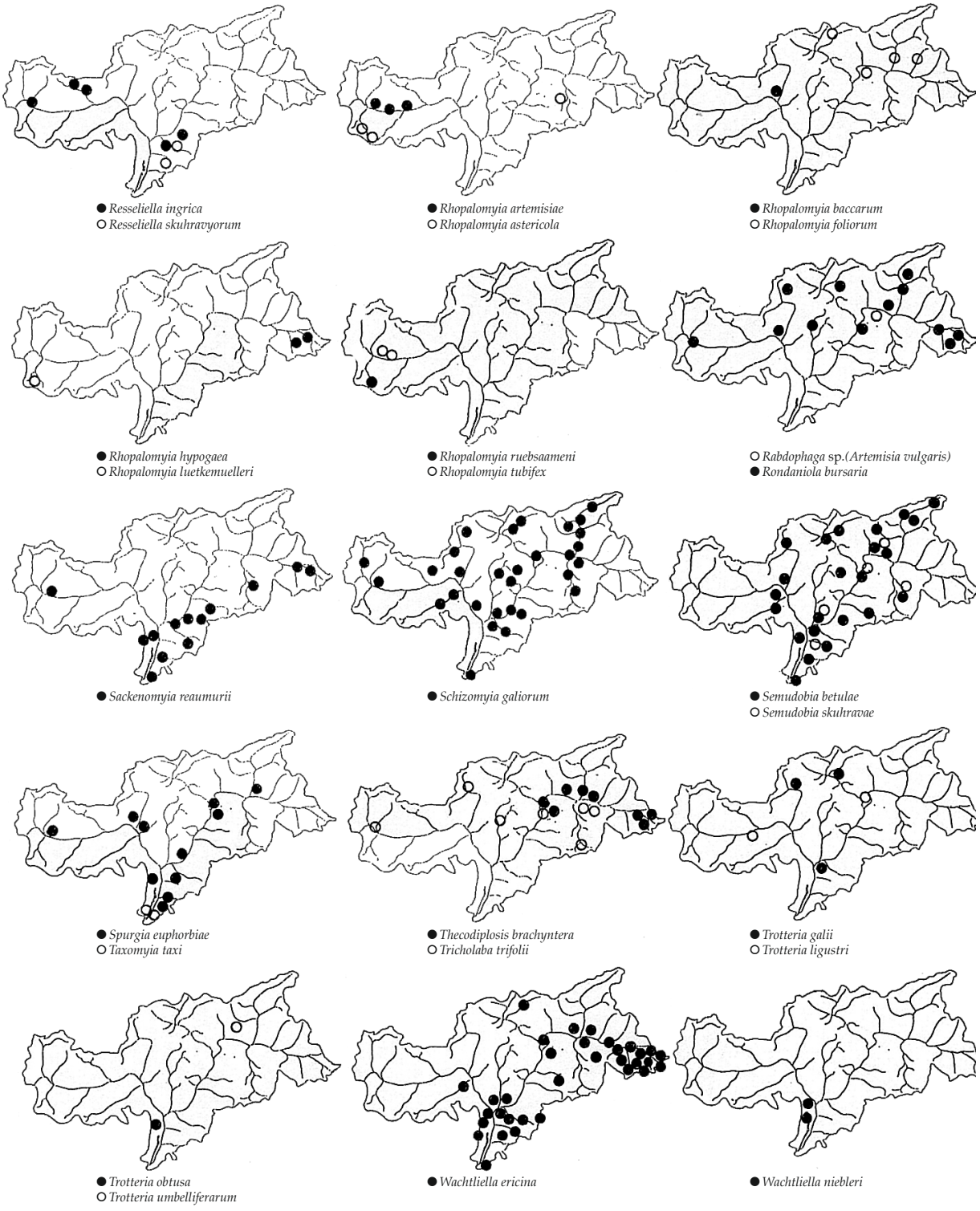

Fig. 13: Occurrence of gall midges (Cecidomyiidae) in South Tyrol (*Resseliella ingrica – Wachtliella niebleri*)

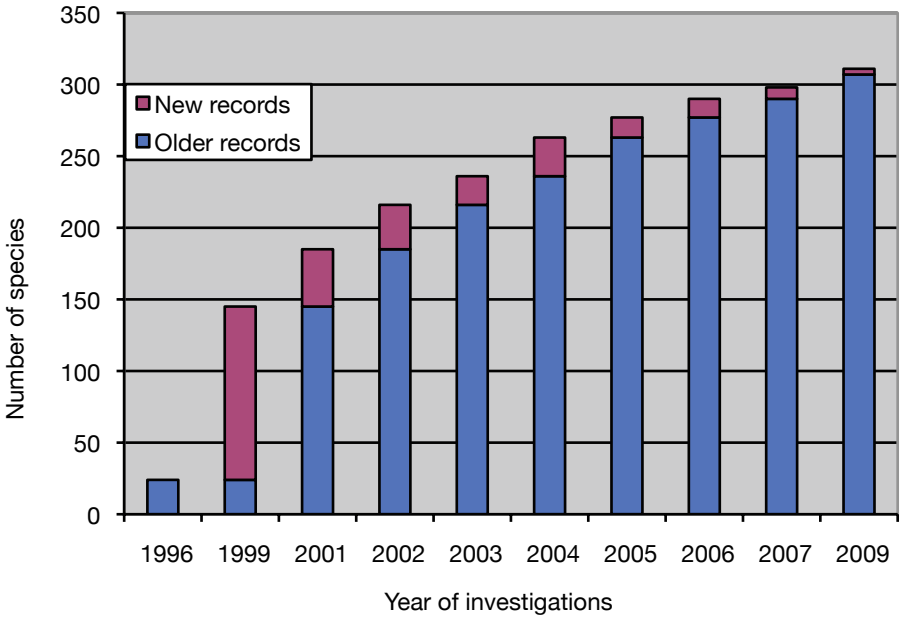

Fig. 14: Increasing number of recorded species of the family Cecidomyiidae in the course of investigations in South Tyrol in the period from 1999 to 2009

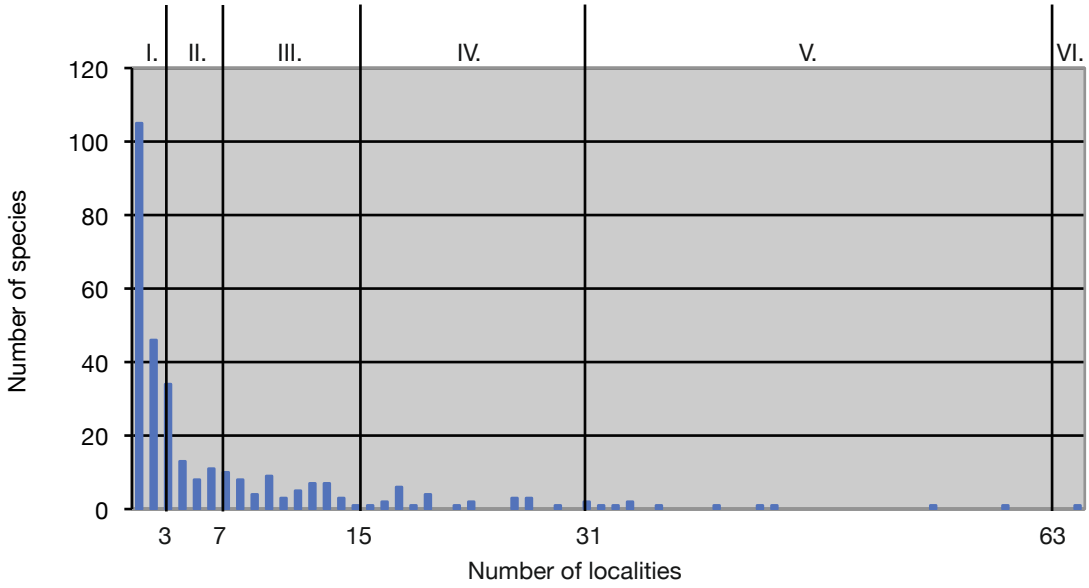

Fig. 15: Frequency of gall midge species (Cecidomyiidae) in South Tyrol. All species found in South Tyrol in the period 1999-2009 are arranged in six frequency groups according to the numbers of localities at which each species was found. The first column on the left includes 105 species of which each was found at only one locality, the last point at the right shows only one species, *Iteomyia capreae,* the most frequent species in South Tyrol, which was found at 66 localities

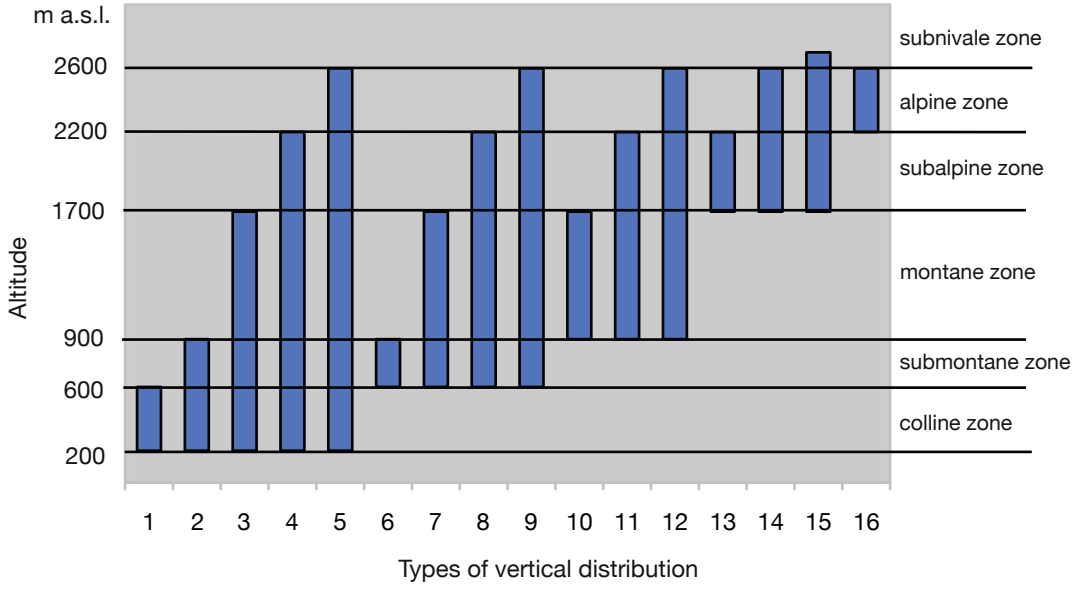

Fig. 16: Diagram of sixteen types of vertical distribution of gall midge species in six altitudinal zones of South Tyrol recognized in the gall midge fauna in the course of investigations carried out at 124 localities in the years 1999-2009

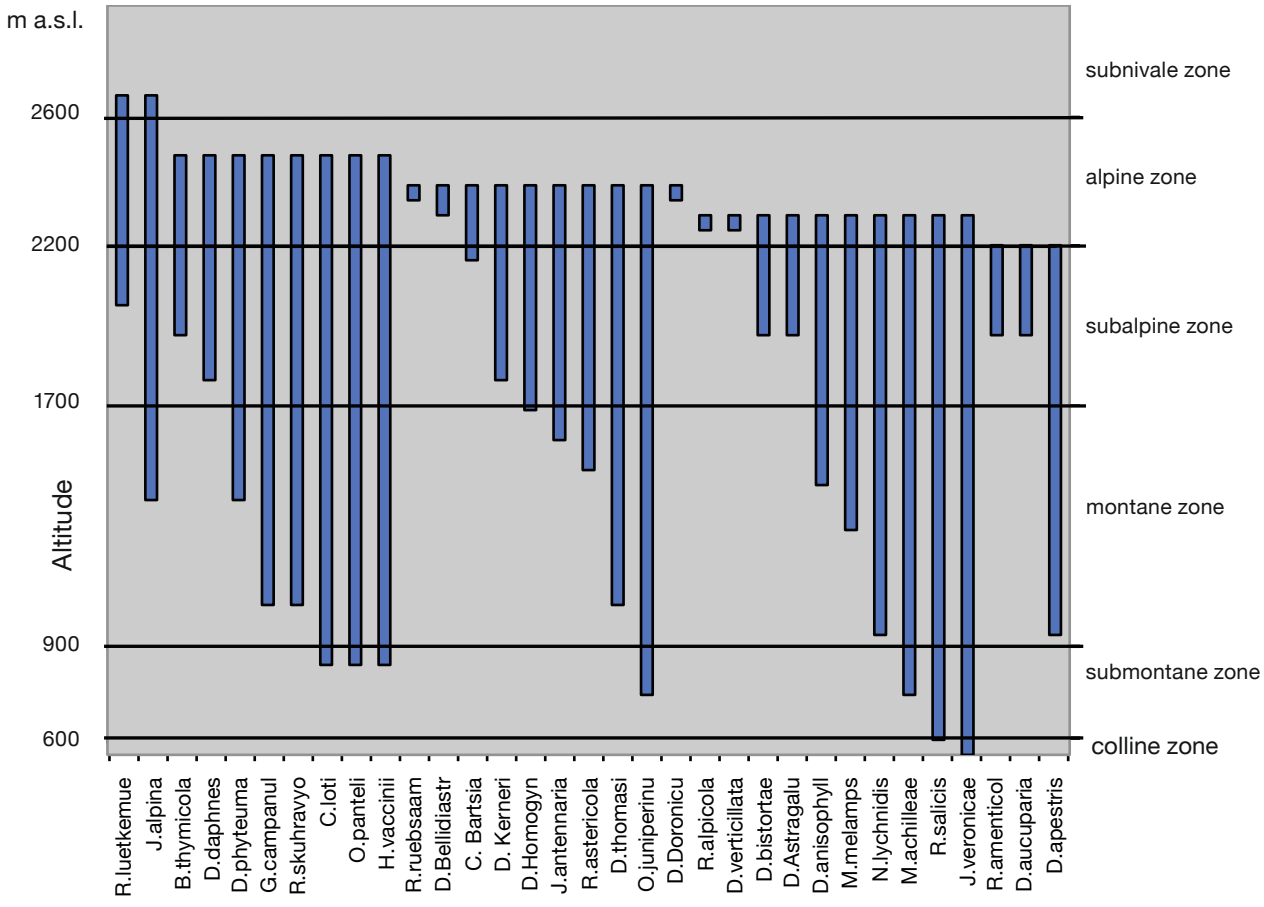

Fig. 17: Gall midge species occurring in the Alpine zone in South Tyrol and their range from the lowest to highest altitude where they were found

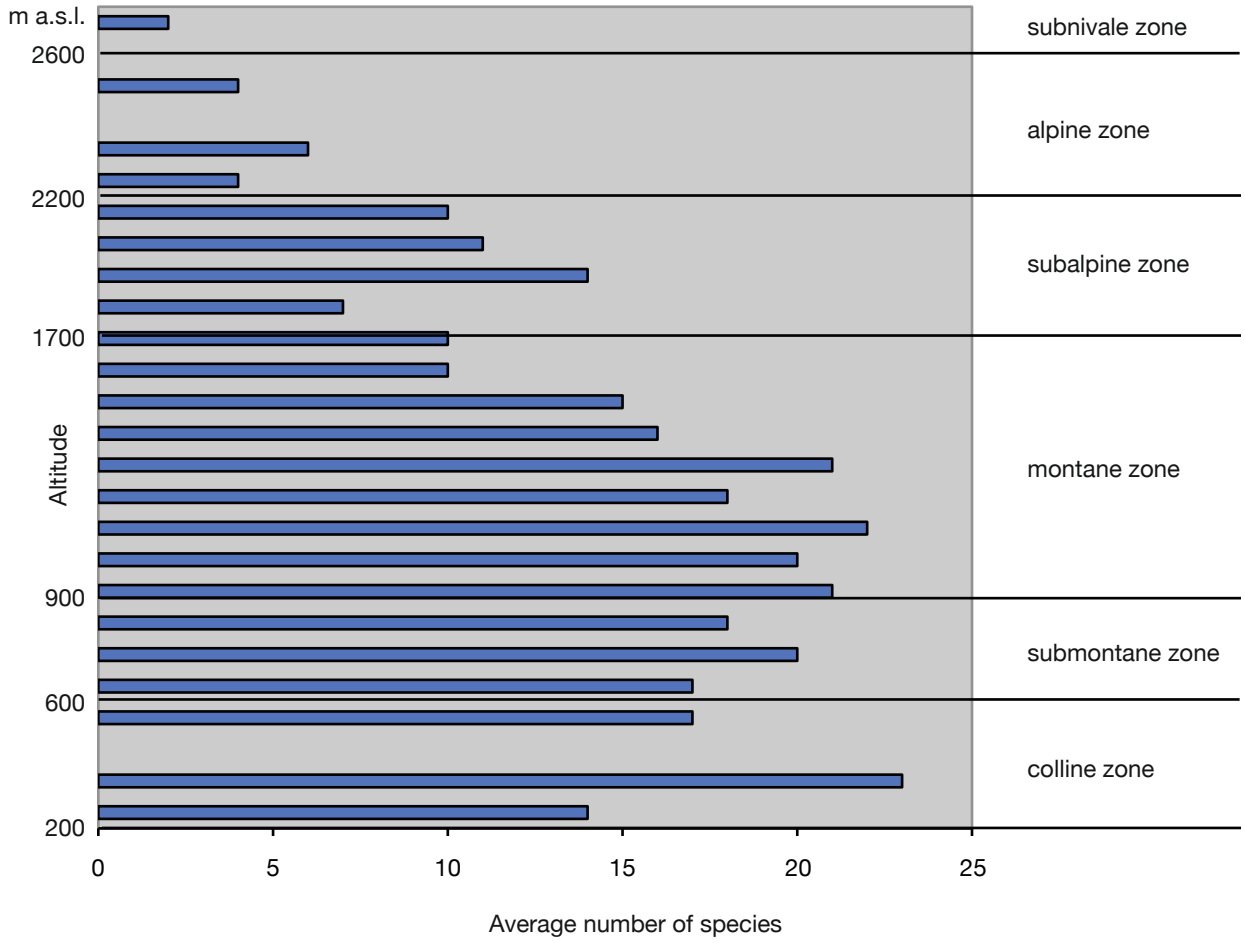

Fig. 18: Vertical distribution of gall midges (Cecidomyiidae) shown as average numbers of species in belts by 100 meters in altitudinal zones of South Tyrol

References

Barnes H.F., 1946-1956: Gall midges of economic importance. Vols 1-7. London: Crosby Lockwood & Son.

Bayram S., Skuhravá M & Cobanoglu S., 2005: Cystiphora sonchi (Vallot, 1827) and Dasineura gleditchiae (Osten Sacken, 1866) (Diptera: Cecidomyiidae), two new records from Turkey. Türk. Entomol. Derg., 29: 247-254.

Bolchi Serini G. & Volonté L., 1985: Dasineura gleditchiae (Osten Sacken), Cecidomide nuovo per l´Italia (Diptera, Cecidomyiidae). Bolletino di Zoologia agraria e di Bachicoltora, Ser. II, 18: 185-189.

Buhl P.N. & Duso C., 2008: Platygaster robiniae n. sp. (Hymenoptera: Platygastridae) parasitoid of Obolodiplosis robiniae (Diptera: Cecidomyiidae) in Europe. Ann. Entomol. Soc. Am., 101 (2): 297-300.

Buhr H., 1964-1965: Bestimmungstabellen der Gallen (Zoo- und Phytocecidien) an Pflanzen Mittel- und Nordeuropas. Gustav Fischer, Jena, 1572 pp.

Dalla Torre K.W., 1892: Die Zoocecidien und Cecidozoen Tirols und Vorarlbergs. Ber. naturwiss.-med. Ver. Innsbruck, 20 (1891/92): 90-172.

Dalla Torre K.W., 1894: Die Zoocecidien und Cecidozoen Tirols und Vorarlbergs. II. Beitrag. Ber. naturwiss.-med. Ver. Innsbruck, 21 (1892/93): 1-24.

Dalla Torre K.W., 1896: Die Zoocecidien und Cecidozoen Tirols und Vorarlbergs. III. Beitrag. Ber. naturwiss.-med. Ver. Innsbruck, 22 (1894/95): 135-165

Darvas B., Skuhravá M. & Andersen A. (eds), 2000: Agricultural dipteran pests of the Palaearctic region. In: Papp L. & Darvas B. (eds.): Contributions to a Manual of Palaearctic Diptera 1: 565-650; Budapest: Science Herald.

Duso C. & Skuhravá M., 2003: First record of Obolodiplosis robiniae (Haldeman) (Diptera Cecidomyiidae) galling leaves of Robinia pseudoacacia L. (Fabaceae) in Italy and Europe. Frustula entomol. (2002), N. S. 25 (38): 117-122.

Ellenberg H., 1987: Vegetation Mitteleuropas mit den Alpen in ökologischer Sicht. Stuttgart: Ulmer.

Farkač J., Král D. & Škorpík M. (eds), 2005: Červený seznam ohrožených druhů České republiky. Bezobratlí. Red list of threatened species in the Czech Republic. Invertebrates. Agentura ochrany přírody a krajiny ČR, Praha, 760 pp.

Fedotova Z. A., 2000: Plant-feeding gall midges (Diptera, Cecidomyiidae) of the deserts and mountains of Kazakhstan: Morphology, biology, distribution, phylogeny and systematics. Samara, 803 pp. (in Russian).

Gagné R.J., 2004: A Catalog of the Cecidomyiidae (Diptera) of the World. Mem. Entomol. Soc. Wash., 25: 1-408.

Harris K.M., 2009a: The willow rosette gall, Rabdophaga rosaria: name correction. Cecidology, 21: 34-35.

Harris K.M., 2009b: Rosette galls on willows: Rabdophaga rosariella (Kieffer) restored from synonymy. Cecidology, 24: 27-30.

Hellrigl K., 1996: Die Tierwelt Südtirols. Kommentiertes sytematisch- faunistisches Verzeichnis der auf dem Gebiet der Provinz Bozen – Südtirol (Italien) bekannten Tierarten. Naturmuseum Südtirols, Bozen, 831 pp.

Hellrigl K., 2004: Über Gallmilben, Gallmücken und gallenbildende Blattwespen. Nachträge zur Faunistik Südtirols. Forest Observer, 1: 197-206.

Hellrigl K., 2007: Gallmücken und Gallmilben: Nachträge zur Faunistik Südtirols (2). Forest Observer, 2/3 (2006): 251-280.

Houard C., 1908-1909: Les Zoocécidies des Plantes d´Europe et du Bassin de la Méditerranée. Vols 1+2. A. Hermann et Fils, Paris, 1247 pp.

IUCN Red List Categories and Criteria, Version 3.1., 2001: IUCN Species Survival Commision. IUCN, Gland, Switzerland and Cambridge, UK, ii+30 pp.

Jaschhof M., 1998: Revision der «Lestremiinae» (Diptera, Cecidomyiidae) der Holarktis. Studia dipterologica, Suppl. 4: 1-552.

Kieffer J.J., 1909: Contribution à la connaissance des insectes gallicoles. Bull. Soc. Hist. Nat. Metz (3), 2(26): 1-35.

Lauber K. & Wagner G., 2001: Flora Helvetica. Verlag Paul Haupt, Bern, Stuttgart, Wien, 1615 pp., 3773 Farbphotos.

Mac Arthur R.H. & Wilson E.O.,1967: Island Biogeography. Princeton: Princeton University Press, 203 pp.

Meyer H. & Jaschhof M., 1999: Cecidomyiidae. In: Schumann H., Bährmann R. & Stark A. (eds): Entomofauna Germanica 2. Checkliste der Dipteren Deutschlands. Studia dipterologica, Suppl. 2: 18-22.

Möhn E., 1955: Beiträge zur Systematik der Larven der Itonididae (=Cecidomyiidae, Diptera). 1. Teil: Porricondylinae und Itonidinae Mitteleuropas. Zoologica, 38 (105): 1-247.

Möhn E.,1966-1971: Cecidomyiidae (= Itonididae). In: Lindner E.: Die Fliegen der palaearktischen Region, 2(2): Lief. 269: 1-48, 273: 49-96, 274: 97-160, 277: 161-200, 288: 201-248.

Molnar B., Boddum T., Szöcz G. & Hillbur Y., 2009: Occurrence of two pest gall midges, Obolodiplosis robiniae (Haldeman) and Dasineura gleditchiae (Osten Sacken) (Diptera: Cecidomyiidae) on ornamental trees in Sweden. Entomol. Tidskr., 130: 113-120.

Nijveldt W., 1969: Gall midges of economic importance. Vol. 8. London: Crosby Lockwood & son, 221 pp.

Nijveldt W., 1980: Niewe galmuggen voor de Nederlandse fauna (VII). Entomol. Ber., 40: 53-56.

Noirfalise A.,1987: Map of the natural vegetation of the member countries of the European Community and the Council of Europe (with explanatory notes). 80 pp.; Luxembourg.

Pokorny E.,1887: Beitrag zur Dipterenfauna Tirols. Verh. Zool. Bot. Ges. Wien, 37: 381-420.

Redfern M.& Askew R. R., 1992: Plant galls. Naturalists´ Handbooks 17, Richmond Publishing Co. Ltd., Slough, England, 99 pp.

Redfern M., Shirley P. & Bloxham M., 2002: British Plant Galls. Identification of Galls on Plants and Fungi. Field Studies, 10: 207-531.

Simova-Tošič D. & Skuhravá M., 1995: The occurrence and biology of Dasineura gleditchiae (Diptera: Cecidomyiidae) in Serbia. Acta Societatis Zoologicae Bohemicae, 59: 121-126.

Skuhravá M., 1980: Verbreitungsareal einiger europäischer Gallmückenarten (Diptera, Cecidomyiidae). Acta Univ. Carol., Biol., 1977: 403-416.

Skuhravá M., 1986: Family: Cecidomyiidae, pp. 72-297. In: Soós Á. & Papp L. (eds): Catalogue of Palaearctic Diptera, Vol. 4. Hungarian Academy of Sciences, Budapest, Akadémiai Kiadó and Elsevier, Amsterdam, 441 pp.

Skuhravá M., 1987: Analysis of areas of distribution of some Palaearctic gall midge species (Cecidomyiidae, Diptera). Cecidologia Internationale, 8: 1-48.

Skuhravá M., 1989: Taxonomic changes and records in Palaearctic Cecidomyiidae (Diptera). Acta Entomologica Bohemoslovaca, 86: 202-233.

Skuhravá M.,1994a: The zoogeography of gall midges (Cecidomyiidae, Diptera) of the Czech Republic. I. Evaluation of the faunistic researches in the 1855-1990 period. Acta Soc. Zool. Bohem., 57 (1993): 211-293.

Skuhravá M., 1994b: The zoogeography of gall midges (Cecidomyiidae, Diptera) of the Czech Republic. II. Review of gall midge species including zoogeographical diagnoses. Acta Soc. Zool. Bohem., 58: 41-88.

Skuhravá M., 1995: Cecidomyiidae, pp. 23-32. In: Minelli A., Ruffo S. & La Posta S. (eds): Checklist delle species della fauna Italiana. Fasc. 64. Calderini, Bologna, 1-39.

Skuhravá M., 1997a: Family Cecidomyiidae, pp. 71-204, with 739 figs. In: Papp L. & Darvas B. (eds): Contributions to a Manual of Palaearctic Diptera (with special reference to flies of economic importance). Vol. 2. Nematocera and Lower Brachycera. Budapest: Science Herald, 592 pp.

Skuhravá M., 1997b: Gall midges (Diptera, Cecidomyiidae) of the Czech and Slovak Republics as members of zoogeographical units in the Palaearctic Region. In: Vaňhara J., Rozkošný R. (eds): Dipterologica bohemoslovaca, Vol. 8. Folia Fac. Sci. Nat. Univ. Masarykianae Brunensis, Biol., 95: 149-171.

Skuhravá M., 2005: Cecidomyiidae (Bejlomorkovití), pp. 255-258. In: Farkač J., Král D. & Škorpík M. (eds): Červený seznam ohrožených druhů České republiky. Bezobratlí. Red list of threatened species in the Czech Republic. Invertebrates. Agentura ochrany přírody a krajiny ČR, Praha, 760 pp.

Skuhravá M., 2006a: Species richness of gall midges (Diptera: Cecidomyiidae) in the main biogeographical regions of the world. Acta Soc. Zool. Bohemicae, 69: 327-372.

Skuhravá M., 2006b: Cecidomyiidae Macquart, 1838. In: Jedlička L., Stloukalová V. & Kúdela M. (eds). 2006: Checklist of Diptera of the Czech Republic and Slovakia. Electronic version 1. http://zoology.fns.uniba.sk/diptera

Skuhravá M.: Check List of the family Cecidomyiidae of Italy (in preparation).

Skuhravá M. & Roques A., 2000: Forest dipteran pests of Palaearctic region, pp.651-692. In: Papp L. & Darvas B.(eds): Contributions to a Manual of Palaearctic Diptera. Vol. 1. General and Applied Dipterology. Science Herald, Budapest, 978 pp.

Skuhravá M. & Skuhravý V. 1986: Outbreak of two gall midges, *Harrisomyia* n. gen. *vitrina* (Kieffer) and *Drisina glutinosa* Giard (Cecidomyiidae, Diptera) on maple, *Acer pseudoplatanus* L. in Czechoslovakia. Z. Angew. Entomol., 101: 256-274.

Skuhravá M. & Skuhravý V., 1993: The distribution areas of several Euro-Siberian gall midge species (Cecidomyiidae, Diptera), pp. 101-108. In: Jedlička L., Rozkošný R. & Vaňhara J. (eds): Dipterologica Bohemoslovaca, Vol. 5.

Skuhravá M. & Skuhravý V., 1994: Gall midges (Cecidomyiidae, Diptera) of Italy. Entomologica, Bari, 28: 45-76.

Skuhravá, M. & Skuhravý V., 1997: Gall midges (Diptera: Cecidomyiidae) of Switzerland. Mitt. Schweiz. Entomol. Ges., 70: 133-176.

Skuhravá M. & Skuhravý V.,1999: Gall midges (Diptera: Cecidomyiidae) of Hungary. Annls Hist.-Nat. Mus. Nat. Hung., 91: 105-139.

Skuhravá M. & Skuhravý V., 2003: Die Gallmückenfauna (Cecidomyiidae, Diptera) Südtirols: 3. Die Gallmücken der Sextener Dolomiten. Gredleriana, 3: 49-76.

Skuhravá M. & Skuhravý V., 2005a: Die Gallmückenfauna (Diptera: Cecidomyiidae) Südtirols: 4. Gallmücken des Tauferer-Ahrntales (Zillertaler Alpen). Gredleriana, 5: 263-284.

Skuhravá M. & Skuhravý V., 2005b: Die Gallmückenfauna (Diptera: Cecidomyiidae) Südtirols: 5. Gallmücken des Unterlandes. Gredleriana, 5: 285-310.

Skuhravá M. & Skuhravý V., 2006: Die Gallmückenfauna (Diptera, Cecidomyiidae) Südtirols 6. Gallmücken im Westen: Burggrafenamt – Vinschgau. Gredleriana, 5: 317-342.

Skuhravá M. & Skuhravý V., 2007: Die Gallmückenfauna (Diptera, Cecidomyiidae) Südtirols: 7. Gallmücken des Schlerngebietes in den westlichen Dolomiten. Gredleriana, 7: 307-324.

Skuhravá M. & Skuhravý V., 2009a: Gall midges (Diptera: Cecidomyiidae) of Austria. - Annotated list of species and zoogeographical analysis. - Gallmücken (Diptera: Cecidomyiidae) von Österreich - Kommentierte Artenliste und zoogeographische Analyse. Studia dipterologica, 15 (1/2): 49-150.

Skuhravá M. & Skuhravý V., 2009b: Die Gallmückenfauna (Diptera, Cecidomyiidae) Südtirols: 8. Gallmücken der Östlichen Dolomiten. Gredleriana, 9: 259-278.

Skuhravá M. & Skuhravý V., 2010: Die Gallmückenfauna (Diptera, Cecidomyiidae) Südtirols: 9. Gallmücken der Sarntaler Alpen. Gredleriana, 10: 267-274.

Skuhravá M., Skuhravý V. & Brewer J. W., 1984: Biology of gall midges, pp. 169-222. In: Anantakrishnan T. N. (editor): Biology of Gall Insects. Oxford + IBH Publishing Company, New Delhi, Bombay, Calcutta, 362 pp.

Skuhravá M., Skuhravý V. & Csóka G., 2007: The invasive spread of the gall midge Obolodiplosis robiniae in Europe. Cecidology, 22: 84-90, figs on pages 70-71.

Skuhravá M., Skuhravý V., Dauphin P. & Coutin R., 2005: Gall midges (Diptera: Cecidomyiidae) of France. Mém. Soc. Linn. Bordeaux, 5: 1-212.

Skuhravá M., Skuhravý V. & Hellrigl K., 2001: Gallmückenfauna (Cecidomyiidae, Diptera) des Südtirols – ein Beitrag zur Gallmückenfauna Italiens. Gredleriana, 1: 83-132.

Skuhravá M., Skuhravý V. & Hellrigl K., 2002: Die Gallmückenfauna (Cecidomyiidae, Diptera) Südtirols (2): Gallmücken des Nationalparks Stilfser Joch und der Gadertaler Dolomiten. Gredleriana, 2: 103-136.

Skuhravá M, SkuhravýV. & Jörgensen J., 2006: Gall midges (Diptera: Cecidomyiidae) of Denmark. Entomologiske Meddelelser, 74 (special issue): 1-94.
Skuhravá M., Skuhravý V., Skrzypczyńska M. & Szadziewski R., 2008: Gall midges (Cecidomyiidae, Diptera) of Poland. Pryszczarki (Cecidomyiidae, Diptera) Polski. Annals of the Upper Silesian Museum (Entomology), 16: 5-160.
Skuhravý V., 1991: The needle-shortening gall midge Thecodiplosis brachyntera (Schwägr.) on the genus Pinus. Rozpravy Československé akademie věd, Řada matematických a přírodních věd 10, 104 pp.
Skuhravý V. & Skuhravá M., 1993: Zur Verbreitung und Schädlichkeit der Gallmücken (Cecidomyiidae, Diptera) an Waldbäumen in Mitteleuropa. Anzeiger für Schädlingskunde, Pflanzenschutz, Umweltschutz, 66: 134-140.
Skuhravý V. & Skuhravá M., 1996: Betrachtung der Gallmücken (Diptera, Cecidomyiidae) an dominanten Forstgehölzen Eurasiens nach ihrem Schädlichkeitsgrad mit Anführung einiger taxonomischer Probleme. Anzeiger für Schädlingskunde, Pflanzenschutz, Umweltschutz 69: 56-58.
Sørensen T., 1948: A method of establishing groups of equal amplitude in plant sociology based on similarity of species and its application to analyses of the vegetation on Danish commons. Biologiske Skrifter, 5 (4): 1–34.
Thomas F., 1878: Über 42 neue, durch Dipteren, Psylloden und Acariden erzeugte Cecidien (Pflanzengallen). Zeitschrift für Naturwissenschaften, 51: 703-708.
Thomas F., 1892a: Beobachtungen über Mückengallen. Programm des gräflich gleichenschen Gymnasiums zu Ohrdruf, 702: 1-16.
Thomas F., 1892b: Alpine Mückengallen. Verh. Zool.-Bot. Ges. Wien, 42: 356-376.
Thomas F., 1893: Zwei hochalpine Rhopalomyia-Arten. Verh. Zool.-Bot. Ges. Wien, 43: 301-309.
Tutin T.G., Heywood V.H., Burges N.A., Valentine D.H., Walters S.M. & Webb A.A. (eds), 1964-1980: Flora Europaea. Cambridge Univ. Press, 1 (1964): 428 pp, 2 (1968): 420 pp., 3 (1972): 370 pp., 4 (1976): 505 pp., 5 (1980): 510 pp.
Uechi N., Tokuda M., Yukawa J., Kawamura F., Teramoto K.K. & Harris K.M., 2003: Confirmation by DNA analysis that Contarinia maculipennis (Diptera: Cecidomyiidae) is a polyphagous pest of orchids and other unrelated cultivated plants. Bull. Entomol. Res., 93: 545-551.
Udvardy M.D.F., 1975: A classification of the biogeographical provinces of the world. IUCN Occasional paper 18: 1-48.
Wilhalm T. & Hilpold A., 2006: Rote Liste der gefährdeten Gefässpflanzen Südtirols. Gredleriana, 6: 115-198.

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Appendix 1: List of gall midge species (Cecidomyiidae, Diptera) known from South Tyrol

The following data are included: Gall midge species; Host plant species; Biol.: biology of larvae (I – inquiline, M – mycophagous, P – phytophagous, Z – zoophagous, U – biology unknown); Freq.: frequency given by number of records (localities) where species was found; Alt. - altitude or altitudinal span (in m a.s.l.) of the lowest and highest situated locality; Distr. - type of geographical distribution (E – European, EA – Euro-Asian, ES – Euro-Siberian, H – Holarctic, M – Mediterranean and sub-Mediterranean, N - Nearctic); Ref. - reference to the number of figure with the distribution map of species in South Tyrol.

Gall midge species	Host plant species	Biol.	Freq.	Alt.	Distr.	Ref.
Acericecis vitrina (Kieffer, 1909)	*Acer pseudoplatanus*	P	1	1700	E	5
Ametrodiplosis thalictricola (Rübsaamen, 1895)	*Thalictrum aquilegiifolium*	P	14	730-1600	ES	5
Anisostephus betulinus (Kieffer, 1889)	*Betula pendula*	P	6	1000-1600	ES	5
Aphidoletes aphidimyza (Rondani, 1847)		Z	2	830-1520	H	5
Aprionus confusus Mamaev, 1969		M	1	1500	ES	5
Arnoldiola gemmae (Giraud, 1868)	*Quercus robur*	I	1	1060	E	5
Arnoldiola libera (Kieffer, 1909)	*Quercus robur*	P	5	250-850	E	*5*
Arnoldiola sambuci (Kieffer, 1901)	*Sambucus nigra*	I	1	945	E	5
Arthrocnodax sp.		Z	1	2170	E	5
Aschistonyx carpinicolus Rübsaamen, 1917	*Carpinus betulus*	P	1	1320	E	5
Asphondylia baudysi Vimmer, 1937	*Coronilla varia, C. coronata*	P	2	250-350	E	5
Asphondylia coronillae (Vallot, 1829)	*Coronilla emerus*	P	2	350-500	M	5
Asphondylia cytisi Frauenfeld, 1873	*Cytisus nigricans*	P	1	1160	ES	5
Asphondylia echii H.Loew, 1850	*Echium vulgare*	P	2	500-770	M	5
Asphondylia genistae (H.Loew, 1850)	*Genista germanica*	P	1	250	ES	5
Asphondylia melanopus Kieffer, 1890	*Lotus corniculatus*	P	1	800	E	5
Asphondylia ononidis (F.Löw, 1873)	*Ononis spinosa*	P	1	350	M	*5*
Asphondylia verbasci (Vallot,1827)	*Verbascum nigrum*	P	9	270-1552	M	5
Asynapta viscicola Skuhravá, 2008	*Viscum album*	P	3	450-750	E	5
Bayeriola thymicola (Kieffer, 1888)	*Thymus serpyllum*	P	2	1900-2510	E	5
Bremiola onobrychidis (Bremi, 1847)	*Onobrychis montana*	P	1	2138	ES	5
Buhriella rubicola Stelter, 1960	*Rubus idaeus*	P	1	1570	ES	5
Cecidomyia pini (De Geer, 1776)	*Pinus sylvestris*	P	1	1850	ES	5
Clinodiplosis botularia (Winnertz,1853)	*Fraxinus excelsior*	I	1	1300	E	5
Clinodiplosis cilicrus (Kieffer, 1889)		I, M	7	500-1570	ES	5
Contarinia acerplicans (Kieffer, 1889)	*Acer pseudoplatanus*	P	1	560	E	5
Contarinia aconitifloris Stelter, 1962	*Aconitum vulparia*	P	5	1327-2000	ES	*5*
Contarinia aequalis Kieffer, 1898	*Senecio nemorensis* ssp. *Fuchsii*	P	10	900-1650	E	5
Contarinia baeri (Prell, 1931)	*Pinus sylvestris*	P	4	840-1320	ES	5
Contarinia barbichei (Kieffer, 1890)	*Lotus corniculatus*	P	8	1400-2348	E	5
Contarinia brizae Kieffer, 1896	*Briza media*	P	1	1500	E	5
Contarinia campanulae (Kieffer, 1895)	*Campanula barbata*	P	5	1500-2100	E	5
Contarinia craccae Kieffer, 1897	*Vicia cracca*	P	9	630-1740	ES	5
Contarinia crispans Kieffer, 1909	*Valeriana officinalis*	P	2	1900	E	5
Contarinia cucubali Kieffer, 1909	*Silene vulgaris*	P	3	560-2150	ES	5
Contarinia echii (Kieffer, 1895)	*Echium vulgare*	P	3	250-500	E	5

Gall midge species	Host plant species	Biol.	Freq.	Alt.	Distr.	Ref.
Contarinia fagi Rübsaamen, 1921	*Fagus sylvatica*	P	1	1320	E	*5*
Contarinia floriperda Rübsaamen, 1917	*Sorbus aucuparia*	P	6	1900-2200	E	6
Contarinia gei Kieffer, 1909	*Geum urbanum*	P	1	1520	ES	6
*Contarinia heraclei (*Rübsaamen, 1889)	*Heracleum sphondylium*	P	7	840-1600	E	6
Contarinia hyperici Barnes, 1952	*Hypericum maculatum*	P	1	1600	EE	6
Contarinia hypochoeridis (Rübsaamen, 1891)	*Hypochoeris radicata*	P	1	560	E	6
Contarinia inquilina Rübsaamen, 1917	*Pimpinella major*	I	1	1400	E	6
Contarinia lathyri Kieffer, 1909	*Lathyrus pratensis*	P	1	1550	ES	6
Contarinia lilii Kieffer, 1909	*Lilium martagon*	P	1	1540	E	6
Contarinia lonicerae Kieffer, 1909	*Lonicera caerulea*	P	3	1350-2000	ES	6
Contarinia loti (De Geer, 1776)	*Lotus corniculatus*	P	17	800-2518	E	6
Contarinia marchali Kieffer, 1896	*Fraxinus excelsior*	P	5	950-1327	E	6
Contarinia martagonis Kieffer, 1909	*Lilium martagon*	P	3	1730-2138	E	6
Contarinia medicaginis Kieffer, 1895	*Medicago sativa*	P	13	240-1050	ES, H	6
Contarinia melanocera Kieffer, 1904	*Genista tinctoria*	P	1	300	E	6
Contarinia molluginis (Rübsaamen, 1889)	*Galium mollugo*	P	1	1570	E	6
Contarinia nasturtii (Kieffer, 1888)	*Barbarea vulgaris*	P	4	560-1900	E	6
Contarinia nikolayi (Rübsaamen, 1895)	*Heracleum sphondylium*	P	3	950-1740	E	6
Contarinia petioli (Kieffer, 1898)	*Populus tremula*	P	19	770-1700	ES	6
Contarinia pilosellae Kieffer, 1896	*Hieracium* sp.	P	1	1500	E	6
Contarinia populi (Rübsaamen, 1917)	*Populus tremula*	P	15	770-1640	ES	6
Contarinia pyrivora (Riley, 1886)	*Pyrus communis*	P	2	560-1000	H	6
Contarinia quercina (Rübsaamen, 1890)	*Quercus pubescens*	P	1	370	E	6
Contarinia quinquenotata (F.Löw, 1888)	*Hemerocallis fulva*	P	13	800-1360	E	6
Contarinia solani (Rübsaamen, 1891)	*Solanum dulcamara*	P	8	500-1000	E	6
Contarinia sorbi Kieffer, 1896	*Sorbus aucuparia*	P	24	945-2200	E	6
Contarinia steini (Karsch, 1881)	*Silene pratensis*	P	7	250-1552	ES	6
Contarinia tiliarum (Kieffer, 1890)	*Tilia platyphyllos, T. cordata*	P	1	1060	ES	6
Contarinia valerianae (Rübsaamen, 1890)	*Valeriana versifolia*	P	1	870	E	6
Contarinia vincetoxici Kieffer, 1909	*Vincetoxucum officinale*	P	2	800-900	E	6
Contarinia sp.	*Anthyllis vulneraria*	P	1	2003	E	6
Contarinia sp.	*Astragalus glycyphyllos*	P	2	300-1500	E	6
Contarinia sp.	*Bartsia alpina*	P	2	2138-2348	E	6
Contarinia sp.	*Homogyne alpina*	P	1	1540	E	6
Contarinia sp.	*Vaccinium uliginosum*	P	6	1700-2200	H	6
Craneiobia corni (Giraud,1863)	*Cornus sanguinea*	P	3	370-580	M	6
Cystiphora sanguinea (Bremi, 1847)	*Hieracium lachenalii*	P	9	950-1700	E	6
Cystiphora sonchi (Vallot, 1827)	*Sonchus oleraceus, S. arvensis*	P	14	250-1850	ES	6
Cystiphora taraxaci (Kieffer, 1888)	*Taraxacum officinale*	P	61	250-2150	ES	7
Dasineura acrophila (Winnertz, 1853)	*Fraxinus excelsior*	P	2	1327-1350	E	7
Dasineura affinis (Kieffer, 1886)	*Viola palustris*	P	1	1900	E	7
Dasineura alpestris (Kieffer, 1909)	*Arabis alpina*	P	7	900-2230	E	7
Dasineura aparines (Kieffer, 1889)	*Galium aparines*	P	1	1552	E	7
Dasineura armoraciae Vimmer, 1936	*Armoracia rusticana*	P	1	1070	E	7
Dasineura aucupariae (Kieffer, 1909)	*Sorbus aucuparia*	P	3	1900-2230	E	7

Gall midge species	Host plant species	Biol.	Freq.	Alt.	Distr.	Ref.
Dasineura auritae (Rübsaamen, 1915)	*Salix aurita, S. caprea, S. glaucosericea*	P	9	240-2172	E	7
Dasineura berberidis (Kieffer, 1909)	*Berberis vulgaris*	P	25	800-1740	E	7
Dasineura bergrothiana (Mik, 1889)	*Silene nutans*	P	1	1550	E	7
Dasineura berti Sylvén, 1993	*Astragalus alpinus*	P	1	2330	E	7
Dasineura bistortae (Kieffer, 1909)	*Polygonum bistorta*	P	7	1900-2340	EA	7
Dasineura campanulae (Rübsaamen, 1914)	*Campanula rotundifolia*	P	2	1600-1900	E	7
Dasineura capsulae (Kieffer, 1901)	*Euphorbia cyparissias*	P	1	600	E	7
Dasineura cardaminis (Winnertz, 1853)	*Cardamine amara*	P	2	1750-2100	E	7
Dasineura cecconiana (Kieffer, 1909)	*Campanula barbata*	P	1	2100	E	7
Dasineura clematidina (Kieffer, 1913)	*Clematis vitalba*	P	1	1550	E	7
Dasineura comosae (Rübsaamen, 1915)	*Hippocrepis comosa*	P	2	1730-1900	E	7
Dasineura crataegi (Winnertz, 1853)	*Crataegus laevigata*	P	10	350-1160	E	7
Dasineura daphnephila (Kieffer, 1909)	*Daphne striata*	P	1	2330	E	7
Dasineura daphnes (Daphnes, 1901	*Daphne cneorum, D. mezereum, D. striata*	P	11	1730-2518	E	7
Dasineura dianthi (Kieffer, 1909)	*Diathus carthusianorum*	P	1	2003	E	7
Dasineura dioiceae (Rübsaamen, 1895)	*Urtica dioica*	P	1	980	E	7
Dasineura epilobii (F. Löw, 1889)	*Epilobium angustifolium*	P	35	860-1860	ES	7
Dasineura excavans (Kieffer, 1909)	*Lonicera xylosteum*	P	19	350-2200	E	7
Dasineura fraxinea (Kieffer, 1907)	*Fraxinus excelsior*	P	37	560-1450	E	7
Dasineura fraxini (Bremi, 1847)	*Fraxinus excelsior*	P	28	600-1450	E	7
Dasineura geranii (Kieffer, 1907)	*Geranium sylvaticum*	P	1	1600	ES	7
Dasineura glechomae (Kieffer, 1989)	*Glechoma hederacea*	P	4	630-970	E	7
Dasineura gleditchiae (Osten Sacken, 1866)	*Gleditsia triacanthos*	P	2	260-360	N	7
Dasineura glyciphylli (Rübsaamen, 1912)	*Astragalus glycyphyllos*	P	1	300	E	7
Dasineura helenae Sylven, 1993	*Fraxinus excelsior*	P	1	1327	E	7
Dasineura hyperici (Bremi, 1847)	*Hypericum perforatum*	P	12	240-1850	E	7
Dasineura interbracta Roskam, 1979	*Betula pendula, B. pubescens*	P	1	350	E	7
Dasineura irregularis (Bremi, 1847)	*Acer pseudoplatanus*	P	1	730	E	7
Dasineura jaapi (Rübsaamen, 1914)	*Veronica fruticans*	P	1	1620	E	8
Dasineura kellneri (Henschel, 1875)	*Larix decidua*	P	33	700-2000	E	8
Dasineura kiefferiana (Rübsaamen, 1891)	*Epilobium angustifolium*	P	19	900-2000	ES	8
Dasineura lathyricola (Rübsaamen, 1890)	*Lathyrus pratensis*	P	10	1000-1900	ES	8
Dasineura leguminicola (Lintner, 1879)	*Trifolium medium, T. pratense*	P	2	945-1100	H	8
Dasineura lupulinae (Kieffer, 1891)	*Medicago lupulina*	P	2	980-1100	E	8
Dasineura mali (Kieffer, 1904)	*Malus sylvestris*	P	20	250-1500	H	8
Dasineura medicaginis (Bremi, 1847)	*Medicago sativa, M. falcata*	P	2	830-1300	ES	8
Dasineura papaveris (Winnertz, 1853)	*Papaver rhoeas*	P	1	580	E	8
Dasineura phyteumatis (F. Löw, 1885)	*Phyteuma orbiculare, P. spicatum* and other	P	26	1320-2518	E	8
Dasineura plicatrix (Loew, 1850)	*Rubus caesius*	P	10	250-1050	E	8
Dasineura polygalae (Kieffer, 1909)	*Polygala alpestris*	P	1	1893	E	8
Dasineura populeti (Rübsaamen, 1889)	*Populus tremula*	P	12	700-1640	ES	8

Gall midge species	Host plant species	Biol.	Freq.	Alt.	Distr.	Ref.
Dasineura praticola Kieffer, 1892)	*Silene flos-cuculi*	P	3	900-1400	E	8
Dasineura pteridicola (Kieffer, 1901)	*Pteridium aquilinum*	P	15	250-1600	E	8
Dasineura pteridis (Müller, 1871)	*Pteridium aquilinum*	P	3	1320-1500	ES	8
Dasineura pustulans Rübsaamen, 1889)	*Filipendula ulmaria*	P	1	240	E	8
Dasineura pyri (Bouché, 1847)	*Pyrus communis*	P	3	560-1000	H	8
Dasineura ranunculi (Bremi, 1847)	*Ranunculus acris*	P	3	700-1750	ES	8
Dasineura rhododendri (Kieffer, 1909)	*Rhododendron ferrugineum*	P	4	1700-2170	E	8
Dasineura rosae (Bremi, 1847)	*Rosa canina* and other spp.	P	44	260-2200	ES	8
Dasineura rubella (Kieffer, 1896)	*Acer campestre*	P	4	260-700	ES	8
*Dasineura sero*tina (Winnertz, 1853)	*Hypericum maculatum*	P	1	2000	E	8
Dasineura similis (F.Löw, 1888)	*Veronica officinalis*	P	1	1600	E	8
Dasineura sisymbri (Schrank, 1803)	*Barbarea vulgaris*	P	1	350	E	8
Dasineura spadicea Rübsaamen, 1917	*Vicia cracca*	P	1	1060	ES	8
Dasineura spicatae (Kieffer, 1909)	*Veronica spicata*	P	1	370	E	8
Dasineura strumosa (Bremi, 1847)	*Lamium galeobdolon*	P	4	900-1300	E	8
Dasineura symphyti (Rübsaamen, 1891)	*Symphytum officinale*	P	1	1000	E	8
Dasineura teucrii (Tavares, 1901)	*Teucrium chamaedrys*	P	2	250-1000	M	8
Dasineura thomasi (Kieffer, 1909)	*Campanula cochleariifolia*	P	4	1000-2340	E	8
Dasineura thomasiana (Kieffer, 1888)	*Tilia platyphyllos, T. cordata*	P	10	250-1320	E	8
Dasineura tiliae (Schrank, 1803)	*Tilia platyphyllos, T. cordata*	P	4	250-900	ES	8
Dasineura tortilis (Bremi, 1847)	*Alus incana*	P	35	700-1900	E	8
Dasineura tortrix (F. Löw, 1873)	*Prunus spinosa*	P	3	945-1029	E	8
Dasineura trifolii (F. Löw, 1874)	*Trifolium repens*	P	45	240-2150	ES, H	8
Dasineura tympani (Kieffer, 1909)	*Acer campestre*	P	7	250-370	E	9
Dasineura ulmaria (Bremi, 1847)	*Filipendula ulmaria*	P	3	240-900	ES	9
Dasineura urticae (Perris, 1840)	*Urtica dioica*	P	28	260-1552	ES	9
Dasineura viciae (Kieffer, 1888)	*Vicia sepium*	P	19	770-2138	ES	9
Dasineura virgaureae (Liebel, 1889)	*Solidago virgaurea*	P	27	700-2150	E	9
Dasineura vitisidaea (Kieffer, 1909)	*Vaccinium vitis-idaea*	P	19	800-2200	E	9
Dasineura vulgatiformiae Sylvén, 1998	*Hieracium lachanalii*	P	1	2000	E	9
Dasineura xylostei (Kieffer, 1909)	*Lonicera xylosteum*	P	3	300-1070	E	9
Dasineura sp.	*Astragalus alpinus*	P	3	1900-2330	E	9
Dasineura sp.	*Astragalus glycyphyllos*	P	1	1300	E	9
Dasineura sp.	*Bellidiastrum michelii*	P	3	1900-2230	E	9
Dasineura sp.	*Bellidiastrum michelii*	P	3	2300-2348	E	9
Dasineura sp.	*Campanula barbata*	P	2	1900-1950	E	9
Dasineura sp.	*Cirsium oleraceum*	P	1	1540	E	9
Dasineura sp.	*Doronicum grandiflorum*	P	1	2340	E	9
Dasineura sp.	*Galium anisophyllum*	P	12	1400-2300	E	9
Dasineura sp.	*Geranium sylvaticum*	P	3	1640-2138	E	9
Dasineura sp.	*Homogyne alpina*	P	6	1620-2348	E	9

Gall midge species	Host plant species	Biol.	Freq.	Alt.	Distr.	Ref.
Dasineura sp.	*Pedicularis rostratospicata*	P	5	1550-2150	E	9
Dasineura sp.	*Pedicularis kerneri*	P	2	1730-2348	E	9
Dasineura sp.	*Pedicularis verticillata*	P	1	2300	E	9
Dasineura sp.	*Sorbus aria*	P	1	1370	E	9
Dasineura sp.	*Vaccinium vitis-idaea*	P	4	1900-2000	E	9
Didymomyia tiliacea (Bremi, 1847)	*Tilia platyphyllos, T. cordata*	P	8	220-1000	ES	9
Drisina glutinosa Giard, 1893	*Acer pseudoplatanus*	P	7	250-1552	E	9
Geocrypta campanulae (Müller, 1871)	*Campanula scheuchzeri*	P	6	1000-2518	E	9
Geocrypta galii (Loew, 1850)	*Galium mollugo* and other species	P	41	300-1740	ES	9
Geocrypta rostriformis Fedotova, 1997	*Galium verum*	P	1	1000	ES	9
Geomyia alpina Skuhravá, 2005	*Geum reptans*	P	2	1570-2000	E	9
Gephyraulus raphanistri (Kieffer,1886)	*Raphanus raphanistrum*	P	1	250	E	9
Gephyraulus sisymbrii Fedotova, 1992	*Sisymbrium austriacum*	P	3	580-1070	ES	9
Harmandiola cavernosa (Rübsaamen, 1899)	*Populus tremula*	P	27	300-1550	ES	9
Harmandiola globuli (Rübsaamen 1889)	*Populus tremula*	P	18	800-1550	ES	9
Harmandiola populi (Rübsaamen, 1917)	*Populus tremula*	P	14	800-1370	ES	9
Harmandiola pustulans (Kieffer, 1909)	*Populus tremula*	P	1	1000	E	9
Harmandiola tremulae (Winnertz, 1853)	*Populus tremula*	P	7	250-1160	ES	9
Hartigiola annulipes (Hartig, 1839)	*Fagus sylvatica*	P	15	250-1552	E	9
Hygrodiplosis vaccinii (Kieffer, 1897)	*Vaccinium uliginosum*	P	27	800-2500	E	10
Iteomyia capreae (Winnertz, 1853)	*Salix caprea, S. appendiculata*	P	66	480-2138	ES	10
Iteomyia major Kieffer, 1898	*Salix cinerea*	P	2	1000-1400	E	10
Jaapiella alpina (F. Löw, 1885)	*Silene acaulis*	P	4	1320-2700	E	10
Jaapiella antennariae Fedotova, 1993	*Antennaria dioica*	P	7	1552-2350	ES	10
Jaapiella bryoniae (Bouché, 1847)	*Bryonia alba*	P	1	900	E	10
Jaapiella cirsiicola Rübsaamen, 1915	*Cirsium arvense*	P	7	250-1570	ES	10
Jaapiella floriperda (F.Löw, 1888)	*Silene vulgaris*	P	20	250-1750	E	10
Jaapiella hedickei Rübsaamen, 1921	*Pimpinella saxifraga*	P	3	700-1520	ES	10
Jaapiella hypochoeridis Sylvén, 1898	*Hypochoeris radicata*	P	3	1300-1500	E	10
Jaapiella inflatae (Rübsaamen, 1914)	*Silene vulgaris*	I	3	800-1400	E	10
Jaapiella knautiae Rübsaamen, 1917	*Knautia dipsacifolia, K. transalpina*	P	6	1300-2138	E	10
Jaapiella loticola (Rübsaamen, 1889)	*Lotus corniculatus*	P	10	800-1900	ES	10
Jaapiella medicaginis (Rübsaamen, 1912)	*Medicago sativa*	P	2	560-580	ES	10
Jaapiella schmidti (Rübsaamen, 1912)	*Plantago lanceolata*	P	7	250-1750	E	10
Jaapiella thalictri (Rübsaamen, 1895)	*Thalictrum aquilegiifolium, T. minus*	P	4	900-1450	ES	10
Jaapiella vacciniorum (Kieffer, 1913)	*Vaccinium myrtillus*	P	14	800-2200	E	10
Jaapiella veronicae (Vallot, 1827)	*Veronica chamaedrys*	P	21	500-2300	E	10
Jaapiella viscariae (Kieffer, 1886)	*Lychnis viscaria*	P	1	800	E	10
Jaapiella volvens Rübsaamen, 1917	*Lathyrus pratensis*	P	3	1300	ES	10
Jaapiella sp.	*Adenostyles glabra*	P	1	1500	E	10
Jaapiella sp.	*Astrantia major*	P	2	1400-1680	E	10
Jaapiella sp.	*Campanula scheuchzeri*	P	1	2150	E	10

Gall midge species	Host plant species	Biol.	Freq.	Alt.	Distr.	Ref.
Jaapiella sp.	*Cirsium heterophyllum*	P	1	1400	E	10
Jaapiella sp.	*Phyteuma nigrum*	P	1	1450	E	10
Jaapiella sp.	*Peucedanum ostruthium*	P	4	1860-2100	E	10
Janetiella oenephila (Haimhoffen, 1875)	*Vitis vinifera*	P	5	300-600	M	10
Janetiella thymi (Kieffer, 1888)	*Thymus serpyllum*, *T. chamaedrys*	P	6	1098-2180	ES	10
Kaltenbachiola strobi (Winnertz, 1853)	*Picea abies*	P	14	1000-1850	E	10
Kiefferia pericarpiicola (Bremi, 1847)	*Pimpinella major*	P	5	700-1400	ES	10
Lasioptera rubi (Schrank, 1803)	*Rubus idaeus*	P	16	250-1500	ES	10
Lestodiplosis cirsii Barnes, 1928		Z	2	1570	E	10
Lestodiplosis holstei Kieffer, 1920		Z	1	1570	E	10
Lestodiplosis sp.	*Achillea millefolium*	Z	1	1320	E	10
Lestodiplosis sp.	*Homogyne alpina*	Z	1	1540	E	11
Loewiola centaureae (F.Löw, 1875)	*Centaurea scabiosa*	P	2	1000-1550	E	11
Macrodiplosis pustularis (Bremi, 1847)	*Quercus robur*, *Q. petraea*	P	8	250-1000	E	11
Macrodiplosis roboris (Hardy, 1854)	*Quercus robur*, *Q. petraea*	P	8	250-1000	E	11
Macrolabis achilleae Rübsaamen, 1893	*Achillea millefolium*	P	3	700-2300	E	11
Macrolabis aquilegiae (Kieffer, 1909)	*Aquilegia alpina*	P	7	1327-1900	E	11
Macrolabis brunellae Tavares, 1907	*Prunella grandiflora*, *P. vulgaris*	P	13	800-2000	E	11
Macrolabis buhri Stelter, 1956	*Stellaria nemorum*	P	1	900	E	11
Macrolabis cirsii (Rübsaamen, 1890)	*Cirsium erisithales*	P	1	1650	E	11
Macrolabis heraclei (Kaltenbach, 1862)	*Heracleum sphondylium*	P	56	700-1950	ES	11
Macrolabis hieracii Rübsaamen, 1917	*Hieracium sylvaticum*	P	2	250-1050	E	11
Macrolabis incolens (Rübsaamen, 1895)	*Veronica chamaedrys*	I	1	1100	E	11
Macrolabis lamii Rübsaamen, 1915	*Lamium album*	P	18	260-1680	E	11
Macrolabis laserpitii Rübsaamen, 1917	*Laserpitium latifolium*	P	1	1370	E	11
Macrolabis lonicerae Rübsaamen, 1912	*Lonicera xylosteum*	P	3	1029-1500	E	11
Macrolabis luceti Kieffer, 1899	*Rosa canina*, *Rosa* sp.	I	3	500-1060	E	11
Macrolabis mali Anfora, 2005	*Malus domestica*	I	1	770	E	11
Macrolabis orobi (F. Löw, 1877)	*Lathyrus vernus*, *L. occidentalis*	P	5	1100-1650	E	11
Macrolabis podagrariae (Loew, 1850)	*Aegopodium podagraria*	P	4	860-1300	E	11
Macrolabis saliceti (Loew, 1850	*Salix purpurea*	I	1	1640	E	11
Macrolabis stellariae (Liebel, 1889)	*Stellaria media*	P	1	900	E	11
Macrolabis sp.	*Angelica sylvestris*	P	2	950-970	E	11
Macrolabis sp.	*Peucedanum ostruthium*	P	4	1570-2100	E	11
Massalongia rubra (Kieffer, 1890)	*Betula pubescens*, *B. pendula*	P	3	900-1450	E	11
Mayetiola graminis (Fourcroy, 1785)	*Poa nemoralis*	P	8	900-1900	E	11
Mikiola fagi (Hartig, 1839)	*Fagus sylvatica*	P	19	250-1552	E	11
Mikomya coryli (Kieffer, 1901)	*Corylus avellana*	P	13	300-1320	E	11
Monarthropalpus flavus (Schrank, 1776)	*Buxus sempervirens*	P	2	560-1320	H	11
Mycodiplosis coniophaga (Winnertz, 1853)	*Rosa* sp.	M	1	1540	H	11
Mycodiplosis melampsorae (Rübsaamen, 1889)	*Salix caprea*	M	14	1245-2300	ES	11
Mycodiplosis saundersi (Rübsaamen, 1889)	*Cirsium arvense*	M	2	1320	ES	11

Gall midge species	Host plant species	Biol.	Freq.	Alt.	Distr.	Ref.
Mycodiplosis sp.	*Cirsium erisithales*	M	1	1570	E	11
Myricomyia mediterranea (F. Löw, 1885)	*Erica carnea*	P	3	1500-1900	M	11
Neomikiella lychnidis (Heyden, 1861)	*Silene pratensis*	P	4	900-2300	M	11
Obolodiplosis robiniae (Haldeman, 1847)	*Robinia pseudoacacia*	P	13	770-1160	N	11
Oligotrophus juniperinus (Linnaeus, 1758)	*Juniperus communis*	P	32	700-2348	E	12
Oligotrophus panteli Kieffer, 1898	*Juniperus communis*	P	21	800-2500	E	12
Oligotrophus schmidti Rübsaamen, 1914	*Juniperus communis*	P	1	1360	E	12
Ozirhincus longicollis Rondani, 1840	*Anthemis arvensis*	P	1	260	E	12
Ozirhincus millefolii (Wachtl, 1884)	*Achillea millefolium*	P	2	700-1320	H	12
Ozirhincus tanaceti (Kieffer, 1889)	*Tanacetum vulgare*	P	1	830	ES	12
Paralleldiplosis galliperda (F. Löw, 1882)	*Quercus pubescens*	I	1	680	E	12
Phegomyia fagicola (Kieffer, 1901)	*Fagus sylvatica*	P	1	1250	E	12
Physemocecis hartigi (Liebel, 1892)	*Tilia platyphyllos, T. cordata*	P	10	250-1250	E	12
Physemocecis ulmi (Kieffer, 1909)	*Ulmus minor*	P	8	250-1160	E	12
Placochela ligustri (Rübsaamen, 1899)	*Ligustrum vulgare*	P	10	350-1000	E	12
Placochela nigripes (F. Löw, 1877)	*Sambucus nigra*	P	15	500-1360	E	12
Planetella producta (Meigen, 1830)		U	1	1007	E	12
Plemeliella abietina Seitner, 1908	*Picea abies*	P	6	1060-1850	E	12
Polystepha malpighii (Kieffer, 1909)	*Quercus robur, Q. petraea*	P	2	250-350	E	12
Rabdophaga albipennis (Loew, 1850)	*Salix alba*	P	2	550-600	E	12
Rabdophaga alpicola (Note 1)	*Salix myrsinifolia* ssp. *alpicola*	P	1	2300	E	12
Rabdophaga amenticola (Kieffer, 1909) (Note 2)	*Salix reticulata*	P	1	1920-2230	E	12
Rabdophaga clavifex (Kieffer, 1891)	*Salix caprea*	P	2	1450-1630	ES	12
Rabdophaga degeerii (Bremi, 1847)	*Salix purpurea*	P	11	700-1600	E	12
Rabdophaga dubiosa (Kieffer, 1913)	*Salix foetida*	P	2	1900-2100	E	12
Rabdophaga insignis (Kieffer, 1906)	*Salix purpurea*	P	1	1400	E	12
Rabdophaga iteobia (Kieffer, 1890)	*Salix caprea*	P	22	500-2172	ES	12
Rabdophaga marginemtorquens (Bremi, 1847)	*Salix viminalis*	P	10	945-1550	ES	12
Rabdophaga pierreana Kieffer, 1909)	*Salix nigricans*	P	3	1450-1900	E	12
Rabdophaga pulvini (Kieffer, 1891)	*Salix caprea*	P	4	950-1400	E	12
Rabdophaga purpureacola (Note 3)	*Salix purpurea*	P	14	700-1640	E	12
Rabdophaga rosaria Loew,1850) (Note 4)	*Salix alba, S. caprea* and other	P	32	240-1950	ES	12
Rabdophaga rosariella (Kieffer, 1897) (Note 5)	*Salix cinerea*	P	3	1500-1700	E	12
Rabdophaga saliciperda (Dufour, 1841)	*Salix alba*	P	1	560	ES	12
Rabdophaga salicis (Schrank, 1803) (Note 6)	*Salix caprea, S. cinerea* and other	P	6	560-2330	ES	12
Rabdophaga strobilina (Bremi, 1847)	*Salix purpurea*	P	5	600-900	E	12
Rabdophaga terminalis (Bremi, 1847)	*Salix fragilis*	P	3	240- 600	E	12
Resseliella betulicola (Kieffer,1889)	*Betula pendula, B. pubescens*	P	12	900-1520	ES	12
Resseliella ingrica (Mamaev, 1971)	*Picea abies*	P	2	1000-1730	E	13
Resseliella skuhravyorum Skrzypczynska, 1975	*Larix decidua*	P	5	1070-2500	E	13
Rhopalomyia artemisiae (Bouché, 1834)	*Artemisia campestris*	P	4	900-1740	M	13
Rhopalomyia astericola (Kieffer, 1909)	*Aster alpinus*	P	3	1450-2348	ES	13

Gall midge species	Host plant species	Biol.	Freq.	Alt.	Distr.	Ref.
Rhopalomyia baccarum (Wachtl, 1883)	*Artemisia vulgaris*	P	1	600	ES	13
Rhopalomyia foliorum Loew, 1850)	*Artemisia vulgaris*	P	3	770-1100	ES	13
Rhopalomyia hypogaea F. Löw, 1885)	*Leucanthemum halleri*	P	2	1360-1450	E	13
Rhopalomyia luetkemuelleri Thomas, 1893	*Artemisia spicata*	P	1	2000-2700	E	13
Rhopalomyia ruebsaameni (Thomas, 1893)	*Erigeron uniflorus*	P	1	2390	E	13
Rhopalomyia tubifex Bouché, 1847)	*Artemisia campestris*	P	2	900	M	13
Rhopalomyia sp.	*Artemisia vulgaris*	P	1	770	E	13
Rondaniola bursaria (Bremi, 1847)	*Glechoma hederacea*	P	12	560-1600	E	13
Sackenomyia reaumurii (Bremi, 1847)	*Viburnum lantana*	P	13	250-1370	E	13
Schizomyia galiorum Kieffer, 1889	*Galium mollugo*	P	30	250-1450	ES	13
Semudobia betulae (Winnertz, 1853)	*Betula pendula, B. pubescens*	P	23	250-1620	ES, H	13
Semudobia skuhravae Roskam, 1977	*Betula pendula*	P	6	560-1360	ES	13
Spurgia euphorbiae (Loew, 1850)	*Euphorbia cyparissias*	P	13	250-1000	E	13
Taxomyia taxi (Inchbald, 1861)	*Taxus baccata*	P	2	800-1200	E	13
Thecodiplosis brachyntera (Schwägrichen, 1835)	*Pinus sylvestris, P. mugo*	P	8	800-2150	ES	13
Tricholaba trifolii Rübsaamen, 1917	*Trifolium pratense, T. medium*	P	7	560-2003	ES	13
Trotteria galii Rübsaamen, 1912	*Galium mollugo*	I	3	700-1250	E	13
Trotteria ligustri Barnes, 1954	*Ligustrum vulgare*	I	2	630-800	E	13
Trotteria obtusa (H. Loew, 1845)	*Coronilla varia*	I	1	250	E	13
Trotteria umbelliferarum (Kieffer, 1901)	*Pimpinella major*	I	1	1400	ES	13
Wachtliella ericina (F. Löw, 1885)	*Erica carnea*	P	33	250-2000	M	13
Wachtliella niebleri Rübsaamen 1915	*Cytisus nigricans*	P	2	250-580	ES	13

Appendix 2: List of host plants attacked by gall midges (Cecidomyiidae, Diptera) in South Tyrol

Host plant species	Plant family	Gall midge species
Acer campestre	Aceraceae	*Dasineura rubella, Dasineura tympani*
Acer pseudoplatanus	Aceraceae	*Contarinia acerplicans, Dasineura irregularis, Drisina glutinosa, Acericecis vitrina*
Achillea millefolium	Asteraceae	*Macrolabis achilleae, Ozirhincus millefolii, Aphidoletes aphidimyza, Lestodiplosis* sp.
Aconitum vulparia, A. variegatum	Ranunculaceae	*Contarinia aconitifloris*
Adenostyles glabra	Asteraceae	*Jaapiella* sp.
Aegopodium podagraria	Apiaceae	*Macrolabis podagrariae*
Alnus glutinosa, A. incana	Betulaceae	*Dasineura tortilis*
Angelica silvestris	Apiaceae	*Macrolabis* sp.
Antennaria dioica	Asteraceae	*Jaapiella antennariae*
Anthemis arvensis	Asteraceae	*Ozirhincus longicollis*
Anthyllis vulneraria	Fabaceae	*Contarinia* sp.
Aquilegia alpina	Ranunculaceae	*Macrolabis aquilegiae*
Arabis alpina	Brassicaceae	*Dasineura alpestris*
Armoracia rusticana	Brassicaceae	*Dasineura armoraciae*
Artemisia campestris	Asteraceae	*Rhopalomyia artemisiae, R. baccarum, R. tubifex*
Artemisia spicata	Asteraceae	*Rhopalomyia luetkemuelleri*
Artemisia vulgaris	Asteraceae	*Rhopalomyia foliorum, Rhopalomyia* sp.
Aster alpinus	Asteraceae	*Rhopalomyia astericola*
Astragalus alpinus	Fabaceae	*Dasineura berti, Dasineura* sp.
Astragalus glycyphyllos	Fabaceae	*Dasineura glyciphylli, Dasineura* sp., *Contarinia* sp.
Astrantia major	Apiaceae	*Jaapiella* sp.
Barbarea vulgaris	Brassicaceae	*Contarinia nasturtii, Dasineura sisymbrii*
Bartsia alpina	Scrophulariaceae	*Contarinia* sp.
Bellidiastrum michelii	Asteraceae	*Dasineura* sp.
Berberis vulgaris	Berberidaceae	*Dasineura berberidis*
Betula pendula	Betulaceae	*Anisostephus betulinus, Massalongia rubra, Dasineura interbracta, Resseliella betulicola, Semudobia betulae, S. skuhravae*
Brassica sp.	Brassicaceae	*Contarinia nasturtii*
Briza media	Poaceae	*Contarinia brizae*
Bryonia alba	Cucurbitaceae	*Jaapiella bryoniae*
Buxus sempervirens	Buxaceae	*Monarthropalpus flavus*
Campanula barbata	Campanulaceae	*Contarinia campanulae, Dasineura cecconiana, Dasineura* sp.
Campanula cochleariifolia	Campanulaceae	*Dasineura thomasi*
Campanula rotundifolia	Campanulaceae	*Dasineura campanulae*
Campanula scheuchzeri	Campanulaceae	*Geocrypta campanulae, Jaapiella* sp.
Cardamine amara	Brassicaceae	*Dasineura cardaminis*
Carpinus betulus	Corylaceae	*Aschistonyx carpinicolus*
Centaurera scabiosa	Asteraceae	*Loewuiola centaureae*
Cirsium arvense	Asteraceae	*Jaapiella cirsiicola, Mycodiplosis saundersi*
Cirsium erisithales	Asteraceae	*Jaapiella cirsiicola, Macrolabis cirsii, Lestodiplosis cirsii, Mycodiplosis* sp.
Cirsium heterophyllum	Asteraceae	*Jaapiella* sp.

Host plant species	Plant family	Gall midge species
Cirsium oleraceum	Asteraceae	*Jaapiella cirsiicola, Clinodiplosis cilicrus, Dasineura* sp.
Clematis vitalba	Ranunculaceae	*clematidina*
Cornus sanguinea	Cornaceae	*Craneiobia corni*
Coronilla emerus	Fabaceae	*Asphondylia coronillae*
Coronilla coronata	Fabaceae	*Asphondylia baudysi*
Coronilla varia	Fabaceae	*Asphondylia baudysi, Trotteria obtusa*
Corylus avellana	Corylaceae	*Micomya coryli*
Crataegus laevigata	Rosaceae	*Dasineura crataegi*
Cytisus nigricans	Fabaceae	*Asphondylia cytisi, Wachtliella niebleri*
Daphne cneorum	Thymelaeaceae	*Dasineura daphnes*
Daphne striata	Thymelaeaceae	*Dasineura daphnephila, D. daphnes*
Dianthus cartusianorum	Caryophyllaceae	*Dasineura dianthi*
Doronicum grandiflorum	Asteraceae	*Dasineura* sp.
Echium vulgare	Boraginaceae	*Asphondylia echii, Contarinia echii*
Epilobium angustifolium	Onagraceae	*Dasineura epilobii, D. kiefferiana*
Erica carnea	Ericaceae	*Myricomyia mediterranea, Wachtliella ericina*
Erigeron uniflorus	Asteraceae	*Rhopalomyia ruebsaameni*
Euphorbia cyparissias	Euphorbiaceae	*Dasineura capsulae, Spurgia euphorbiae*
Fagus sylvatica	Fagaceae	*Contarinia fagi, Hartigiola annulipes, Mikiola fagi, Phegomyia fagicola*
Filipendula ulmaria	Rosaceae	*Dasineura pustulans, D. ulmaria*
Fraxinus excelsior	Oleaceae	*Dasineura acrophila, D. fraxinea, D. fraxini, D. helenae, Contarinia marchali, Clinodiplosis botularia*
Galeobdolon luteum	Lamiaceae	*Dasineura strumosa*
Galium anisophyllum	Rubiaceae	*Dasineura* sp.
Galium aparine	Rubiaceae	*Dasineura aparines*
Galium mollugo	Rubiaceae	*Contarinia molluginis, Geocrypta galii, Schizomyia galiorum, Trotteria galii*
Galium verum	Rubiaceae	*Geocrypta galii, G. rostriformis*
Genista germanica	Fabaceae	*Asphondylia genistae*
Genista tinctoria	Fabaceae	*Contarinia melanocera*
Geranium sylvaticum	Geraniaceae	*Dasineura geranii, Dasineura* sp.
Geum reptans	Rosaceae	*Geomyia alpina*
Geum urbanum	Rosaceae	*Contarinia gei*
Glechoma hederacea	Lamiaceae	*Dasineura glechomae, Rondaniola bursaria*
Gleditsia triacanthos	Caesalpiniaceae	*Dasineura gleditchiae*
Hemerocallis fulva	Liliaceae	*Contarinia quinquenotata*
Heracleum sphondylium	Apiaceae	*Contarinia heraclei, C. nikolayi, Macrolabis heraclei*
Hieracium lachenalii	Asteraceae	*Cystiphora sanguinea, Dasineura vulgatiformiae*
Hieracium sylvaticum	Asteraceae	*Macrolabis hieracii*
Hieracium sp.	Asteraceae	*Contarinia pilosellae*
Homogyne alpina	Asteraceae	*Contarinia* sp., *Dasineura* sp., *Lestodiplosis* sp.
Hypericum maculatum	Hypericaceae	*Dasineura serotina, Contarinia hyperici*
Hypericum perforatum	Hypericaceae	*Dasineura hyperici*
Hypochoeris radicata	Asteraceae	*Contarinia hypochoeridis, Jaapiella hypochoeridis*
Hippocrepis comosa	Fabaceae	*Dasineura comosae*
Juniperus communis	Cupressaceae	*Oligotrophus juniperinus, O. panteli, O. schmidti*
Knautia dipsacifolia	Dipsacaceae	*Jaapiella knautiae*

Host plant species	Plant family	Gall midge species
Lamium album	Lamiaceae	*Macrolabis lamii*
Lamium galeobdolon	Lamiaceae	*Dasineura strumosa*
Larix decidua	Pinaceae	*Dasineura kellneri, Resseliella skuhravyorum*
Laserpitium latifolium	Apiaceae	*Macrolabis laserpitii*
Lathyrus occidentalis	Apiaceae	*Macrolabis orobi*
Lathyrus vernus	Apiaceae	*Macrolabis orobi*
Lathyrus pratensis	Apiaceae	*Contarinia lathyri, Dasineura lathyricola, Jaapiella vplvens*
Leucanthemum halleri	Asteraceae	*Rhopalomyia hypogaea*
Ligustrum vulgare	Oleaceae	*Placochela ligustri, Trotteria ligustri*
Lilium martagon	Liliaceae	*Contarinia martagonis, C. lilii*
Lonicera caeruela	Caprifoliaceae	*Contarinia lonicerae, Dasineura excavans*
Lonicera xylosteum	Caprifoliaceae	*Dasineura excavans, D. xylostei, Macrolabis lonicerae*
Lotus corniculatus	Fabaceae	*Asphondylia melanopus, Contarinia barbichei, C. loti, Jaapiella loticola*
Malus sylvestris	Rosaceae	*Dasineura mali, Macrolabis mali*
Medicago lupulina	Fabaceae	*Dasineura lupulinae*
Medicago sativa	Fabaceae	*Contarinia medicaginis, Dasineura medicaginis, Jaapiella medicaginis*
Onobrychis montana	Fabaceae	*Bremiola onobrychidis*
Ononis spinosa	Fabaceae	*Asphondylia ononidis*
Papaver rhoeas	Papaveraceae	*Dasineura papaveris*
Pedicularis kerneri, P. rostratospicata,P. verticillata	Scrophulariaceae	*Dasineura* sp.
Peucedanum ostruthium	Apiaceae	*Macrolabis* sp., *Jaapiella* sp.
Phyteuma betonicifolium, P. hemisphaericum, P. orbicularis, P. spicatum	Campanulaceae	*Dasineura phateumatis*
Phyteuma nigrum	Campanulaceae	*Jaapiella* sp.
Picea abies	Pinaceae	*Kaltenbachiola strobi, Plemeliella abietina, Clinodiplosis cilicrus, Lestodiplosis holstei, Resseliella ingrica*
Pimpinella major	Apiaceae	*Kiefferia pericarpiicola, Contarinia inquilina, Trotteria umbelliferarum*
Pimpinella saxifraga	Apiaceae	*Jaapiella hedickei*
Pinus sylvestris, P. mugo		*Cecidomyia pini, Contarinia baeri, Thecodiplosis brachyntera*
Plantago lanceolata	Pinaceae	*Jaapiella schmidti*
Poa nemoralis	Poaceae	*Mayetiola graminis*
Polygala alpestris	Polygalaceae	*Dasineura polygalae*
Polygonum viviparum	Polygonaceae	*Dasineura bistortae*
Polyporus sp.	Fungi	*Aprionus confusus*
Populus tremula	Salicaceae	*Contarinia petioli, C. populi, Dasineura populeti, Harmandiola cavernosa, H. globuli, H. populi, H. tremulae*
Prunella grandiflora, P. vulgaris	Lamiaceae	*Macrolabis brunellae*
Prunus spinosa, P. domestica	Rosaceae	*Dasineura tortrix*
Pteridium aquilinum	Dennstaedtiaceae	*Dasineura pteridicola, D. pteridis*
Pyrus communis	Rosaceae	*Contarinia pyrivora, Dasineura pyri*
Quercus petraea, Q. robur, Q. pubescens	Fagaceae	*Arnoldiola gemmae, A. libera, Contarinia quercina, Macrodiplosis pustularis, M. roboris, Polystepha malpighii, Clinodiplosis cilicrus*

Host plant species	Plant family	Gall midge species
Ranunculus acris	Ranunculaceae	*Dasineura ranunculi*
Raphanus raphanistrum	Brassicaceae	*Gephyraulus raphanistri*
Rhododendron ferrugineum	Ericaceae	*Dasineura rhododendri, Arthrocnodax* sp.
Robinia pseudoacacia	Fabaceae	*Obolodiplosis robiniae*
Rosa canina, Rosa pendulina	Rosaceae	*Dasineura rosae, Clinodiplosis cilicrus, Marcolabis luceti, Mycodiplosis coniophaga*
Rubus caesius	Rosaceae	*Dasineura plicatrix, Lasioptera rubi*
Rubus idaeus	Rosaceae	*Lasioptera rubi, Buhriella rubicola*
Salix alba	Salicaceae	*Rabdophaga rosaria, R. saliciperda*
Salix appendiculata	Salicaceae	*Iteomyia capreae*
Salix aurita, S. caprea	Salicaceae	*Dasineura auritae, Rabdophaga pierreana, R. pulvini, R. rosaria, R. salicis*
Salix caesia	Salicaceae	*Rabdophaga* (near *terminalis*)
Salix caprea	Salicaceae	*Rabdophaga clavifex, R. iteobia, R. rosaria, R. salicis, Iteomyia capreae, Mycodiplosis melampsorae*
Salix cinerea	Salicaceae	*Iteomyoa major, Rabdophaga pulvini*
Salix elaeagnos	Salicaceae	*Rabdophaga marginemtorquens, R. degeerii*
Salix foetida	Salicaceae	*Rabdophaga dubiosa*
Salix fragilis	Salicaceae	*Rabdophaga terminalis*
Salix glaucosericea	Salicaceae	*Dasineura auritae*
Salix hastata	Salicaceae	*Rabdophaga salicis*
Salix helvetica	Salicaceae	*Rabdophaga salicis*
Salix myrsinifolia	Salicaceae	*Rabdophaga* sp.
Salix nigricans	Salicaceae	*Rabdophaga pierreana, R. rosaria*
Salix purpurea	Salicaceae	*Rabdophaga marginemtorquens, R. degeerii, R. insignis, R. rosaria, R. strobilina, R. terminalis, Macrolabis saliceti*
Salix reticulata	Salicaceae	*Rabdophaga amenticola*
Salix viminalis	Salicaceae	*Rabdophaga marginemtorquens*
Sambucus nigra	Caprifoliaceae	*Arnoldiola sambuci, Placochela nigripes*
Senecio nemorensis spp. Fuchsii	Asteraceae	*Contarinia aequalis*
Silene acaulis	Caryophyllaceae	*Jaapiella alpina*
Silene dioica (*M. rubrum*)	Caryophyllaceae	*Contarinia steini*
Silene (*Lychnis*) *flos-cuculi*	Caryophyllaceae	*Dasineura praticola, Neomikiella lychnidis*
Silene (*Lychnis*) *flos-jovis*	Caryophyllaceae	*Neomikiella lychnidis*
Silene nutans	Caryophyllaceae	*Dasineura bergrothiana, Neomikiella lychnidis*
Silene pratensis (=*M. album*)	Caryophyllaceae	*Contarinia steini*
Silene vulgaris	Caryophyllaceae	*Contarinia cucubali, Jaapiella floriperda, J. inflatae*
Silene (*Lychnis*) *viscaria*	Caryophyllaceae	*Jaapiella viscariae*
Sisymbrium altissimum	Brassicaceae	*Gephyraulus sisymbrii*
Sisymbrium austriacum	Brassicaceae	*Gephyraulus sisymbrii*
Solanum dulcamara	Solanaceae	*Contarinia solani*
Solidago virgaurea	Asteraceae	*Dasineura virgaureae*
Sonchus oleraceus	Asteraceae	*Cystiphora sonchi*
Sorbus aria	Rosaceae	*Dasineura* sp.
Sorbus aucuparia	Rosaceae	*Contarinia floriperda, C. sorbi, Dasineura aucupariae*
Stellaria media	Caryophyllaceae	*Macrolabis stellariae*
Stellaria nemorum	Caryophyllaceae	*Macrolabis buhri*
Symphytum officinale	Boraginaceae	*Dasineura symphyti*

Host plant species	Plant family	Gall midge species
Tanacetum vulgare	Asteraceae	*Ozirhincus tanaceti*
Taraxacum officinale	Asteraceae	*Cystiphora taraxaci*
Taxus baccata	Taxaceae	*Taxomyia taxi*
Teucrium chamaedrys	Lamiaceae	*Dasineura teucrii*
Thalictrum aquilegiifolium, *T. minus*	Ranunculaceae	*Ametrodiplosis thalictricola*, *Jaapiella thalictri*
Thymus praecox spp. *polytrichus*	Lamiaceae	*Bayeriola thymicola*, *Janetiella thymi*
Thymus serpyllum, *T. chamaedrys*	Lamiaceae	*Bayeriola thymicola*, *Janetiella thymi*
Tilia cordata, *T. platyphyllos*	Tiliaceae	*Contarinia tiliarum*, *Dasineura thomasiana*, *D. tiliae*, *Didymomyia tiliacea*, *Physemococis hartigi*
Trifolium medium, *T. pratense*	Fabaceae	*Dasineura leguminicola*, *Tricholaba trifolii*, *Clinodiplosis cilicrus*
Trifolium repens	Fabaceae	*Dasineura trifolii*
Ulmus minor	Ulmaceae	*Physemococis ulmi*
Urtica dioica	Urticaceae	*Dasineura dioicae*, *D. urticae*
Vaccinium myrtillus	Ericaceae	*Jaapiella vacciniorum*
Vaccinium uliginosum	Ericaceae	*Hygrodiplosis vaccinii*, *Contarinia* sp.
Vaccinium vitis-idaea	Ericaceae	*Dasineura vitisidaea*, *Hygrodiplosis vaccinii*, *Dasineura* sp.
Valeriana officinalis	Valerianaceae	*Contarinia crispans*, *C. valerianae*
Valeriana tripteris, *V. montana*	Valerianaceae	*Contarinia crispans*
Verbascum nigrum, *Verbascum* sp.	Scrophulariaceae	*Asphondylia verbasci*
Veronica fruticans	Scrophulariaceae	*Dasineura jaapi*
Veronica chamaedrys	Scrophulariaceae	*Jaapiella veronicae*, *Macrolabis incolens*
Veronica officinalis	Scrophulariaceae	*Dasineura similis*
Veronica spicata	Scrophulariaceae	*Dasineura spicatae*
Viburnum lantana	Caprifoliaceae	*Sackenomyia reaumurii*
Vicia cracca	Fabaceae	*Contarinia craccae*, *Dasineura spadicea*, *D. viciae*
Vicia sepium	Fabaceae	*Dasineura viciae*
Vincetoxicum officinale	Apocyanaceae	*Contarinia vincetoxici*
Viola palustris	Violaceae	*Dasineura affinis*
Vitis vinifera	Vitaceae	*Janetiella oenephila*