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Gall midges (Diptera: Cecidomyiidae) of Italy

ABSTRACT

A list of gall midge species including host plant and host animal species was compiled from more than 200 papers of Italian researchers published in period 1840-1994. Present Italian fauna of gall midges includes 324 species. A history of studies is described. Occurrence and distribution of gall midge species in northern and southern Italy, in Sicily and Sardinia is analysed. Members of gall midge fauna are divided into four frequency groups, viz. solitary, scarcely, abundant and most abundant species. Majority of Italian gall midge species (64%) belong to Euro-Siberian, about 18 % to Mediterranean and about 16 % to endemic (native) species.

Key words: Diptera, Cecidomyiidae, faunistics, zoogeography; occurrence, distribution, frequency groups; Euro-Siberian, Mediterranean, endemic species; Italy, Sicily, Sardinia.

INTRODUCTION

The study of the gall midges, larvae of which cause galls on various host plants or feed on various insects or mites, has a very long tradition in Italy. The beginnings may be found even in the ancient times: Plinius the Older, who lived in the lst century P.Ch., described very briefly in his Naturalis historia the galls on the leaves of *Fagus sylvatica*, which were much later, in the 19th century, recognized to be products of larval activity of the gall midge *Mikiola fagi* (Hartig, 1839).

The literature on gall midges and their occurrence in Italy is very extensive and the data are scattered in many papers. We evaluated more than 200 papers dealing with gall midges which were published from 1840 to 1994.

Our paper is divided into four parts. In the first we provide a review of the history and development of studies of gall-making, predacious and free living gall midges with an evaluation of the importance of the journal "Marcellia" for the advance of cecidological studies. In the second part we bring a list of known gall midge species including their host plant and host animal species. The third part deals with the occurrence and distribution of gall midges in the territory of Italy. In the fourth part we compare the results of researches and studies in Italy with those in other Mediterranean countries.

1. History of studies of gall midges

In the 17th century the Italian physician, anatomist and natural historian Marcello Malpighi collected plants with various deformities and was the first to recognize that they are caused by various insects. He described galls of nine species without giving them names; they were named and formally described much later. He is, therefore, considered to be the father of cecidology in Italy ("indiscusso fondatore della cecidologia").

The first descriptions of gall midges were given in Europe in 1758 and 1767 by Linné and in 1781 by Schrank. At the beginning of the 19th century the following seven genera of gall midges were known: *Cecidomyia*, *Lasioptera*, *Oligotrophus*, *Campylomyza*, *Catocha*, *Lasiopteryx* and *Lestremia*.

In Italy the first descriptions and diagnoses of gall midges were given in several papers by Rondani (1840-1860). He described 13 species and established several genera of gall midges. The Latin name "cecidium" for deformities of plant organs, the galls, was introduced in 1873 by Thomas and is still used.

At the beginning of the 20th century about 90 gall midge species were known in Italy. The advance in gall midge studies started with investigations of galls by Bezzi (1892, 1899, 1908), Corti (1901, 1902, 1903) and Mariani (1907, 1908, 1914). The first and second decades of the 20th century can be called "the golden age" of cecidology in Italy. Several excellent scientists, viz. Massalongo, Cecconi, Trotter, Baldrati and later Stefani-Perez, carried out intensive studies on the occurrence of galls caused by various animals in various parts of Italy. Their names remain preserved in the gall midges literature as the names of genera and species of gall midges. For example the genera: *Rondaniola*, *Contarinia*, *Massalongia*, *Baldratia*, *Trotteria*, *Stephaniella*; and the species: *Asphondylia massalongoi*, *Lestodiplosis massalongoi*, *Aphidoletes bezzi*, *Anabremia trotteri*, *Arnoldiola trotteri*, *Stephaniella cecconii* and others.

Corti (1901-1903) published several papers about galls occurring in northern Italy: in Piemonte, Lombardia and in the valey Valtellina. Bezzi (1892-1908) investigated the occurrence of galls in Trentino and in southern Italy.

Massalongo (1891-1916) studied very intensively galls of mites (Acarina) and also galls of other gall makers, among them also galls of gall midges. He investigated the occurrence of galls in the territory of Tergnago near Verona. In his paper in 1892 he mentioned 53 galls of gall midges, in 1895 eleven, in 1897 nine and in 1899 six species of gall midges. He found several gall midge galls at Bologna, Ferrara, in the area north of Verona, at Perugia and also in Sardinia.

Baldrati (1900) in his comprehensive paper reported results of his cecidological studies about the occurrence of galls in various parts of Italy. He found the majority of gall midge galls (47 species) in the surroundings of Lavazzuola near Bologna and galls of several other species at Ravenna (3), at Ferrara (8), at Brescia (9), at Bergamo (9) and at Pisa (4).

Stefani-Perez, who lived and worked in Palermo in Sicily, published in the years 1898-1917 21 contributions about the occurrence of galls caused by various gall makers in Sicily and described there 10 new gall midge species. Stefani-Perez (1909) also published data about the collection of galls found by Prof. Delpino in northern Italy where he noted the occurrence of galls of 14 species of gall midges.

Trotter, the main representative of the group of excellent cecidologists of that time, published his papers in the years 1897-1923. At the beginning of his career he worked at the station of plant pathology at Roma, where he started his cecidological studies and collected galls at Mantova in northern Italy. Later he worked and investigated the occurrence of galls at Avellino in southern Italy. He collected galls practically throughout Italy but his richest collections of gall midge galls are from Higlands Gargano (Puglia) and from Sicily. During the period of 1900-1917 he published in cooperation with Prof. Cecconi the large publication Cecidotheca Italiana. This paper includes the descriptions of 570 galls of various gall makers 170 of which are gall midge species (120 valid species and the rest are undescribed species).

In the period of 1897-1904 Cecconi published seven papers about galls occurring in the surroundings of Vallombrosa. He identified galls of 72 gall midge species in that area and later he found six species in Sardinia. He collected galls in the environs of Roma and Napoli and in Toscana where he gathered galls of 23 gall midge species.

Del Guercio at the beginning of his career studied the economic importance of gall midges developing on *Olea* and the occurrence of galls in Eritrea in Africa. In the years 1918-1919, during a short period of only 18 months, he published descriptions of 19 gall midge species feeding on aphids, coccids and thrips, sometimes based on the larval stages only. He did not designate the type-locality for any of these species. He gave only “southern Italy” and even “Italy”. Because he worked at Firenze, it is possible to assume that these type-localities are situated also in southern Italy. See Fig.1.

The second period of the study of gall midges started after the year 1920 and continues up to the present. This period is characterized mainly by investigations about the economic importance of gall midges and later by the detailed studies of morphology, biology, ecology and ethology of various gall midge species.

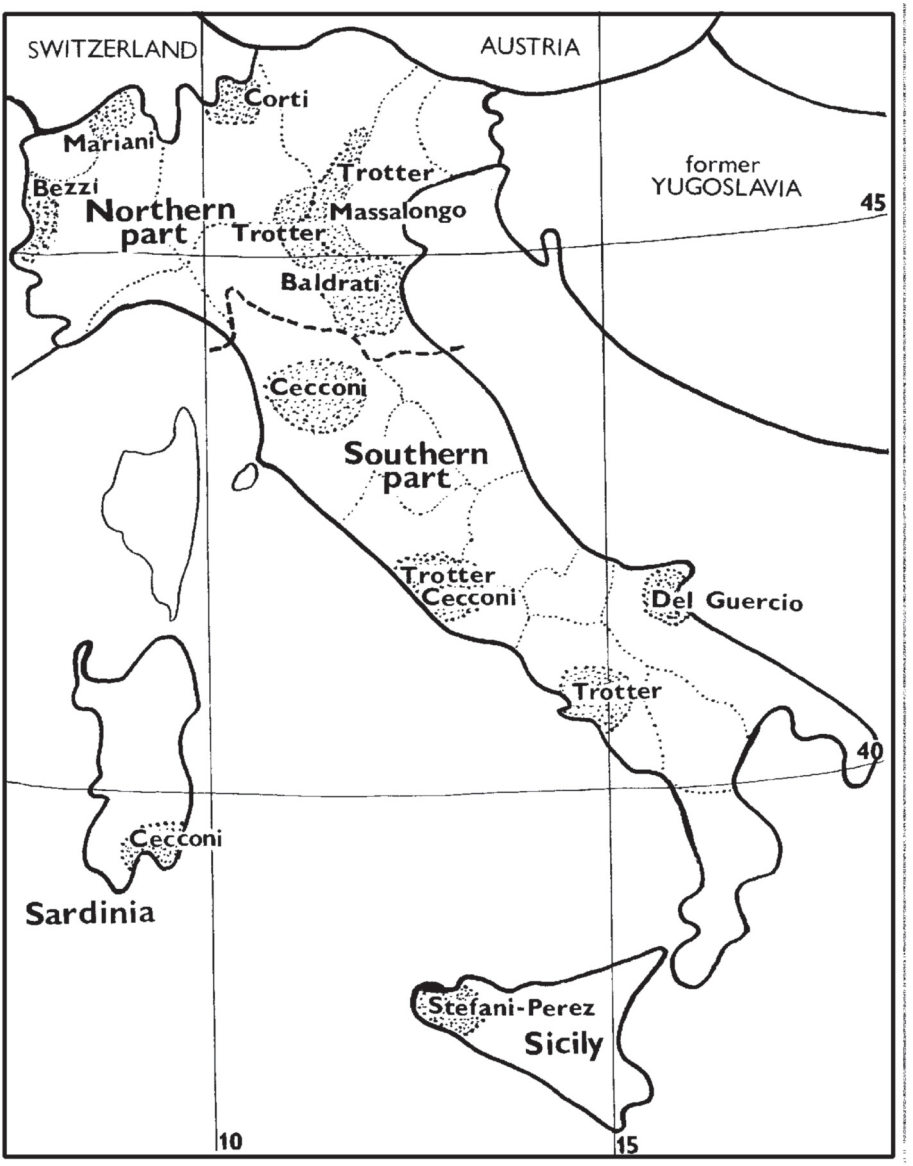

Fig. 1. The territory of Italy with areas where at the beginning of the 20th century intensive cecidological investigations were carried out by several excellent Italian scientists.

Ricchelo (1930) reported about the occurrence and harmfulness of *Mayetiola avenae*, Cecconi (1933-1935) about *Haplodiplosis marginata*, Della Beffa (1938) about *Apiomyia bergenstammi*, Goidanich (1936, 1942) about *Contarinia pyrivora* and *Resseliella oleisuga*, Melis (1938) about *Dasineura pyri*, Venturi (1936, 1938, 1939-40) about *Contarinia tritici* and *Sitodiplosis mosellana*, Rasis (1953) about the occurrence of *Hybolasioptera cerealis* damaging cereals. Roberti (1946, 1955) paid attention to the problems of predacious gall midges, *Aphidoletes aphidimyza* and *Therodiplosis persicae*, and tried to solve the species complex of the genus *Mayetiola* (Roberti, 1953, 1957). Frediani (1952, 1955) contributed to the development of gall midge knowledge by his study of morphology and biology of *Dryomyia lichtensteini*, Principi (1958) by study of morphology and ethology of *Putoniella pruni*, Martino (1956) by study of *Asphondylia gennadii* and Tullio (1968) by study of the ethology of *Planetella* (*Diplolaboncus*) *tumorificus*.

The cecidological studies of M. Solinas and his contribution to the development of knowledge of the gall midge studies in Italy and to the progress of cecidological science are very important. He started his publication activities in 1965 and he is publishing, with the exception of the interval 1971-1981 when he worked at UNESCO, up to the present. He published two monographs, about *Jaapiella medicaginis* and about *Contarinia medicaginis* (Solinas 1965), described five new species and four new genera of gall midges, studied in detail the morphology, anatomy and biology of several gall midges and, based on substantial study of morphological characters and biological observations, synonymized several gall midge species described in the past which cause galls on species of the genus *Euphorbia* and concluded that only three real species exist (Solinas, Pecora, 1984). He used the electron-scanning microscope technique to solve taxonomical problems (Solinas, 1986; Solinas *et al.* 1984, 1987, 1991) and contributed also to the knowledge of the distribution of several gall midge species which were known to occur up to that time only from one locality in Italy (Solinas, Pecora, 1984).

Covassi and Masutti (1973) reported about the occurrence of *Thecodiplosis brachyntera*, and later Covassi (1983) about *Paradiplosis abietis* in Italy.

In recent years, a group of Italian scientists paid attention to the study of the cytological processes of spermatogenesis in males of various cecidomyiids. These studies, made by the electron microscopy, enable the use of sperm morphology for diagnostic characters at the tribal level and for the taxonomy of the higher taxonomical groups (Mazzini, 1977; Dallai *et al.*, 1980, 1983).

Interesting studies deal with antennal sensory stuctures and their meaning in behaviour of several gall midges (Solinas, Nuzzaci, Isidoro, 1987). The first

report about the site of sex pheromone production in gall midges is given by SOLINAS and ISIDORO (1991) and the localisation of the female sex pheromone glands in the abdomen of *Dasineura brassicae* was discovered by ISIDORO, WILLIAMS, SOLINAS, MARTIN (1992).

It is necessary to evaluate and emphasize the role of the journal "Marcellia" for the advance of cecidological studies in Italy and for the development of cecidological studies in Europe. This journal was founded in 1902 by Trotter and named in honour of the Italian scientist Marcello Malpighi. This journal was devoted to cecidological problems whereas the journal "Malpighiana" dealt with botanical problems. Trotter edited the journal "Marcellia" for a long time. One issue (number) appeared regularly four times a year, even during the first world war but the edition stopped at the beginning of the second world war. The publishing of Marcellia was revived in 1958 and continued until 1971 in the Institute of Botany in Strasbourg (France), then it was transferred to the Pergamon Press in Oxford (England) where it continued as an international journal of phytopathological morphogenesis and cecidology until 1977. In 1980 the journal Marcellia was combined with the journal Cecidologia Indica to form the journal Cecidologia Internationale and since that time this journal is published in Allahabad (India) under the editoring of Dr. P. Grover.

1. A LIST OF GALL MIDGE SPECIES INCLUDING THEIR HOST PLANT AND HOST ANIMAL SPECIES

Acodiplosis inulae (Loew, 1847): *Inula britannica* L.

Adelgimyza dactylopii Del Guercio, 1919: predator of *Dactylopius* sp. (=*Pseudococcus* sp.) (Coccoidea)

- *strobilobii* Del Guercio, 1919: predator of *Adelges strobilobius* Vall. (=*Adelges laricis* Vall.) (Aphidoidea)
- *tripidiperda* Del Guercio, 1919: predator of *Phloethrips oleae* Costa (=*Liothrips oleae* (Costa) (Thysanoptera)

Allocontarinia sorghicola (Coquillett, 1899): *Sorghum bicolor* (L.) Moench.

Ampelocusta illata Stefani, 1912: *Vitis vinifera* L.

Anabremia bellevoyei (Kieffer, 1896): *Lathyrus pratensis* L.

- *inquilina* Solinas, 1965: inquilin in galls of *Jaapiella medicaginis* (Rübs.) on *Medicago sativa* L.
- *massalongoi* (Kieffer, 1909): *Vicia villosa* Roth., *V. varia* Host.
- *trotteri* (Kieffer, 1909): *Vicia lutea* L.

Aphidoletes aphidimyza (Rondani, 1847) (Syn. *Rondaniella bezzii* Del Guercio, 1918; *R. toxopterae* Del Guercio, 1918; *R. phorodontis* Del Guercio, 1919; *R. macrosipho-*

nis Del Guercio, 1919; *R. macrosiphoniellae* Del Guercio, 1919; *R. ornata* Del Guercio, 1919; *R. cucullata* Del Guercio, 1919): predator of various species of Aphidae

Apiomyia bergenstammi (Wachtl, 1882): *Pyrus communis* L.

Aplonyx chenopodii Stefani Perez, 1908: *Chenopodium album* L.

Arnoldiola baldratii (Kieffer, 1909): *Quercus ostryaefolia* Borbas

- *trotteri* (Kieffer, 1909): *Quercus cerris* L.
- *tympanifex* (Kieefer, 1909): *Quercus ilex* L.

Arthrocnodax corylligallarum (Targioni-Tozetti, 1886): predator in galls of *Phytoptus avellanae* Nal. (Acarida) on *Corylus avellana* L.

- *diaspidis* Kieffer, 1910: predator of *Aulacaspis pentagona* (Targ.) (Coccoidea) on *Morus alba* L.

Aschistonyx carpinicolus Rübsaamen, 1917: *Carpinus betulus* L.

Asphondylia baudysi Vimmer, 1937: *Coronilla varia* L.

- *borzi* (Stefani, 1898): *Rhamnus alaternus* L.
- *calaminthae* Kieffer, 1909: *Calamintha alpina* Lam.
- *calycatomae* Kieffer, 1912: *Calycotome spinosa* Leik.
- *capparis* Rübsaamen, 1893: *Capparis spinosa* L.
- *celsiae* Kieffer, 1909: *Celsia orientalis* L.
- *conglomerata* Stefani, 1900: *Atriplex halimus* L.
- *coronillae* (Vallot, l829): *Coronilla emerus* L.
- *cytisi* Frauenfeld, 1873: *Cytisus* sp.
- *dorycnii* (Müller, 1870): *Dorycnium herbaceum* Vill.
- *gennadii* (Marchal, 1904) (=*gennadiosi* Del Guercio, 1918): *Ceratonia siliqua* L.
- *lupini* Silvestri, 1908: *Lupinus albus* L.
- *massalongoi* Rübsaamen, 1893: *Ajuga chamaepytis* Schreb.
- *melanopus* Kieffer, 1890: *Lotus corniculatus* L.
- *menthae* Kieffer, 1901: *Menthae* sp.
- *miki* Wachtl, 1890: *Medicago sativa* L., *M. falcata* L.
- *ononidis* F.Löw, 1873: *Ononis spinosa* L.
- *phlomidis* Trotter, 1901: *Phlomis tuberosa* L.
- *pruniperda* Rondani, 1867: *Prunus myrobalana* (L.) Lois.
- *rosmarini* Kieffer, 1896: *Rosmarinus officinalis* L.
- *ruebsaameni* Kertész, 1898: *Ferula* sp.
- *rutae* Kieffer, 1909: *Ruta graveolens* L.
- *sarothamni* Loew, 1850: *Sarothamnus scoparius* (L.) Wimm.
- *scrophulariae* Schiner, 1856: *Scrophularia canina* L.
- *serpylli* Kieffer, 1898: *Thymus serpyllum* L.
- *stachydis* Stelter, 1965: *Stachys recta* L.

- *stefanii* Kieffer, 1898: *Diplotaxis tenuifolia* DC.
- *verbasci* (Vallot, 1827): *Verbascum nigrum* L., *V. pulverulentum* Vill. (=*V. floccosum* W.& K.), *V. thapsus* L., *V. sinuatum* L., *V. phlomoides* L., *V. chaixii* Vill.

Asynapta furcifer Barnes, 1932: saprophytic species developing on olive fruits

Atrichosema aceris Kieffer, 1904: *Acer campestre* L.

Baldratia salicorniae Kieffer, 1897: *Salicornia fruticosa* L.

Bayeriola salicariae (Kieffer, 1888): *Lythrum salicaria* L.

- *thymicola* (Kieffer, 1888): *Thymus serpyllum* L.

Blastodiplosis cocciferae (Tavares, 1902): *Quercus ilex* L.

Blastomyia origani (Tavares, 1902): *Origanum vulgare* L.

Brachineura fuscogrisea Rondani, 1840: biology unknown

Braueriella phillyreae (F. Löw, 1877): *Phillyrea variabilis* Timb.

Bremiola onobrychidis (Bremi, 1847): *Onobrychis viciifolia* Scop. ssp. *sativa* (Lam.) Thell.

Campylomyza fenestralis (Rondani, 1840): biology unknown

- *hedysari* (Kieffer, 1913): mycophagous on *Hedysarum coronarium* L.
- *silvalis* (Rondani, 1840): biology unknown
- *turmalis* (Rondani, 1840): biology unknown

Catocha latipes Haliday, 1833 (=*molobrina* Rondani, 1840): biology unknown

Cecidomyella aulacaspidis Del Guercio, 1919: predator of *Aulacaspis rosae* (Bouché) (Coccoidea) on *Rosa* sp. and *Rubus* sp.

Clinodiplosis botularia (Winnertz, 1853): inquilin in galls on *Fraxinus excelsior* L.

- *cilicrus* (Kieffer, 1889) (=*dahliae* Kieffer, 1904): phytophagous species
- *cirsii* Kieffer, 1909: *Cirsium arvense* L.

Contarinia acerplicans (Kieffer, 1889): *Acer pseudoplatanus* L., *A. opalus* Mill. (=*A. opulifolium* Chaix), *A. monspessulanum* L.

- *aequalis* Kieffer, 1898: *Senecio nemorensis* L.
- *ballotae* Kieffer, 1898: *Ballota nigra* L.
- *carpini* Kieffer, 1897: *Carpinus betulus* L., *Ostrya carpinifolia* Scop.
- *citri* Barnes, 1944: *Citrus* sp.
- *coryli* (Kaltenbach, 1859): *Corylus avellana* L.
- *craccae* Kieffer, 1897: *Vicia villosa* Roth subsp. *varia* (Host) Corb. (=*V. dasycarpa* Ten., *V. villosa* Roth subsp. *pseudocracca* Bertol.) P. W. Ball
- *cucubali* Kieffer, 1898: *Silene vulgaris* (Moench) Garcke (=*S. inflata* Sm.)
- *galeobdolontis* Kieffer, 1909: *Lamium galeobdolon* (L.) Nath.
- *helianthemi* (Hardy, 1850): *Helianthemum grandiflorum* (Scop.) DC.
- *ilicis* Kieffer, 1898: *Quercus ilex* L.
- *jacobaeae* (Loew, 1850): *Senecio vulgaris* L.
- *lonicerae* Kieffer, 1909: *Lonicera caerulea* L.

- *loti* (De Geer, 1778): *Lotus corniculatus* L.; *L. tenuis* W. & K. ex Willd.
- *luteola* Tavares, 1902: *Quercus ilex* L.
- *medicaginis* Kieffer, 1895: *Medicago falcata* L., *M., sativa* L.
- *melanocera* Kieffer, 1904: *Genista tinctoria* L.
- *minima* (Kieffer, 1909): *Quercus ilex* L.
- *molluginis* (Rübsaamen, 1889): *Galium mollugo* L.
- *nasturtii* (Kieffer, 1888): *Nasturtium officinale* R.Br., *Raphanus raphanistrum* L.
- *petioli* (Kieffer, 1898): *Populus tremula* L.
- *picridis* (Kieffer, 1912): *Picris hieracioides* L.
- *pyrivora* (Riley, 1886): *Pyrus communis* L.
- *quercicola* (Rübsaamen, 1899): *Quercus cerris* L.
- *quercina* (Rübsaamen, 1890): *Quercus robur* L. (*Q. pedunculata* Ehrh.)
- *sambuci* (Kaltenbach, 1873): *Sambucus ebulus* L.
- *schlechtendaliana* (Rübsaamen, 1893): *Sonchus* sp.
- *solani* (Rübsaamen, 1891): *Solanum dulcamara* L.
- *sorbi* Kieffer, 1896: *Sorbus aucuparia* L.
- *subulifex* Kieffer, 1897: *Quercus cerris* L.
- *tiliarum* (Kieffer, 1890): *Tilia platyphyllos* Scop., *T. cordata* Mill.
- *tritici* (Kirby, 1798): *Triticum vulgare* L.

Craneiobia corni (Giraud, 1863): *Cornus sanguinea* L.

Cystiphora leontodontis (Bremi, 1847): *Leontodon hispidus* L. subsp. *hastilis* (L.) Soo

- *sanguinea* (Bremi, 1847) (*C. hieracii* F. Löw, 1874; *C. pilosellae* Kieffer, 1892): *Hieracium sylvaticum* (L.) L. (=*H. murorum* auct.)
- *sonchi* (Bremi, 1847): *Sonchus oleraceus* L., *S. arvensis* L.
- *taraxaci* (Kieffer, 1888): *Taraxacum officinale* W.

Dasineura abietiperda (Henschel, 1880): *Picea abies* (L.) Karsten

- *acrophila* (Winnertz, 1853): *Fraxinus excelsior* L.
- *affinis* (Kieffer, 1886): *Viola calcarata* L.
- *albipennis* (Loew, 1850): *Salix alba* L.
- *andreuxi* (Tavares, 1902): *Halimium libanotis* (L.) Lge.
- *asperulae* (F.Löw, 1875): *Asperula cynanchica* L.
- *axillaris* (Kieffer, 1896): *Trifolium scabrum* L.
- *brassicae* (Winnertz, 1853): *Brassica oleracea* L., *B. napus* L.
- *campanularum* (Kieffer, 1909): *Campanula glomerata* L.
- *capsulae* (Kieffer, 1901): *Euphorbia pithyusa* L.
- *cecconiana* (Kieffer, 1909): *Campanula trachelium* L.
- *clavifex* (Kieffer, 1891): *Salix caprea* L.
- *clematidiana* (Kieffer, 1909): *Clematis viticella* L.
- *crataegi* (Winnertz, 1853): *Crataegus oxyacantha* L.

- *daphnes* (Kieffer, 1901): *Daphne striata* Tratt.
- *ericaescopariae* (Dufour, 1837): *Erica scoparia* L., *E. peduncularis* Presl.
- *erigerontis* (Rübsaamen, 1912): *Erigeron acris* L.
- *excavans* (Kieffer, 1909): *Lonicera xylosteum* L.
- *filicina* (Kieffer, 1889): *Pteridium aquilinum* (L.) Kuhn
- *fraxini* (Bremi, 1847): *Fraxinus excelsior* L.
- *galeopsis* (Kieffer, 1897): *Galeopsis tetrahit* L.
- *gallicola* (F. Löw, 1880): *Galium verum* L., *G. sylvaticum* L.
- *glechomae* (Kieffer, 1889): *Glechoma hederacea* L.
- *gleditchiae* (Osten-Sacken, 1866): *Gleditchia triacanthos* L.
- *glyciphylli* (Rübsaamen, 1912): *Astragalus glycyphyllos* L.
- *heterobia* (Loew, 1850): *Salix triandra* L. subsp. *discolor* (Koch) Arc. (=*S. amygdalina* L.)
- *hygrophila* (Mik, 1883): *Galium palustre* L.
- *hyperici* (Bremi, 1847): *Hypericum perforatum* L., *H. perfoliatum* L., *H. veronense* Schrank
- *insignis* (Kieffer, 1906): *Salix purpurea* L.
- *irregularis* (Bremi, 1847) (=*D. acercrispans* Kieffer, 1888): *Acer pseudoplatanus* L., *A. opalus* Mill.(=*A. opulifolium* Chaix)
- *iteophila* (Kieffer, 1890): *Salix alba* L.
- *lathierei* (Del Guercio, 1910): *Olea europaea* L.
- *lathyri* (Kieffer, 1909): *Lathyrus pratensis* L.
- *lithospermi* (Loew, 1850): *Lithospermum officinale* L.
- *lotharingiae* (Kieffer, 1888): *Cerastium arvense* L., *C. alpinum* L.
- *lupulinae* (Kieffer, 1891): *Medicago lupulina* L.
- *luteofusca* Rondani, 1840: biology unknown
- *mali* (Kieffer, 1904): *Malus sylvestris* Mill. (=*Pyrus malus* L.)
- *marginemtorquens* (Bremi, 1847): *Salix cinerea* L., *S. caprea* L., *S. aurita* L., *S. eleagnos* Scop. (=*S. incana* Schrank)
- *medicaginis* (Bremi, 1847) (=*ignorata* Wachtl, 1884): *Medicago sativa* L., *M. falcata* L., *M. truncatula* Gaertn. (=*M. tribuloides* Desr.)
- *minardii* (Stefani, 1913): host unknown
- *obscura* Rondani, 1840: biology unknown
- *odoratae* Stelter, 1982: *Viola odorata* L.
- *oleae* (F.Löw, 1885): *Olea europaea* L.
- *phyteumatis* (F.Löw, 1885): *Phyteuma orbiculare* L., *P. spicatum* L., *P. scheuchzeri* All., *P. michelii* All., *P. hemisphaericum* L.
- *pierrei* (Kieffer, 1896): *Salix fragilis* L.
- *plicatrix* (Loew, 1850): *Rubus caesius* L., *R. fruticosus* L., *R. ulmifolius* Schott

- *populeti* (Rübsaamen, 1889): *Populus tremula* L.
- *pteridicola* (Kieffer, 1901): *Pteridium aquilinum* (L.) Kuhn
- *pustulans* (Rübsaamen, 1889): *Filipendula ulmaria* (L.) Maxim.
- *pyri* (Bouché, 1847): *Pyrus communis* L.
- *ranunculi* (Bremi, 1847): *Ranunculus acris* L., *R. lagunisosus* L., *R. bulbosus* L.
- *rosaria* (Loew, 1850): *Salix purpurea* L.
- *rubella* (Kieffer, 1896): *Acer campestre* L.
- *ruebsaameni* (Kieffer, 1909): *Carpinus betulus* L.
- *rufescens* (Stefani, 1898): *Phillyrea variabilis* Timb. var. *media* L.
- *saliciperda* (Dufour, 1841): *Salix alba* L.
- *salicis* (Schrank, 1803): *Salix purpurea* L., *S. eleagnos* Scop. (=*S. incana* Schrank), *S. arbuscula* L., *S. myrsinites* L.
- *salviae* (Kieffer, 1909): *Salvia pratensis* L.
- *sampaina* (Tavares, 1902): *Linum bienne* Mill. (=*L. angustifolium* Huds.)
- *serotina* (Winnertz, 1853): *Hypericum perforatum* L.
- *similis* (F.Löw, 1888): *Veronica scutellata* L.
- *sisymbrii* (Schrank, 1803) (Syn. *D. fiorii* Cecconi, 1904; *D. zannonnii* Kieffer, 1909): *Rorippa amphibia* (L.) Bess., *N. sylvestris* (L.) Bess., *Sisymbrium zannonii* Ball.
- *strumosa* (Bremi, 1847) (Syn. *D. galeobdolontis* Winnertz, 1853): *Lamium galeobdolon* (L.) Nath.
- *subpatula* (Bremi, 1847): *Euphorbia cyparissias* L., *E. dulcis* L.
- *terminalis* (Loew, 1850): *Salix alba* L., *S. purpurea* L.
- *teucrii* (Tavares, 1903): *Teucrium chamaedrys* L.
- *thomasiana* (Kieffer, 1888): *Tilia platyphyllos* Scop., *T. cordata* Mill.
- *tiliae* (Schrank, 1803) (Syn. *D. tiliamvolvens* Rübsaamen 1889): *Tilia platyphyllos* Scop., *T. cordata* Mill.
- *tortilis* (Bremi, 1848) (Syn. *D. alni* F. Löw, 1877): *Alnus incana* (L.) Moench.
- *tortrix* (F. Löw, 1877): *Prunus spinosa* L., *P. domestica* L.
- *trifolii* (F. Löw, 1874): *Trifolium pratense* L., *T. repens* L.
- *turionum* (Kieffer et Trotter, 1904): *Asparagus acutifolius* L.
- *ulmaria* (Bremi, 1847): *Filipendula ulmaria* (L.) Maxim.
- *urticae* (Perris, 1840): *Urtica dioica* L.
- *vagans* (Kieffer, 1909): *Erica vagans* L.
- *vallisumbrosae* (Kieffer, 1904): *Sarothamnus scoparius* (L.) Wimm.
- *viciae* (Kieffer, 1888): *Vicia sativa* L., *V. grandiflora* Scop., *V. villosa* Roth (= *V. dasycarpa* Ten.), *V. bithynica* L., *V. angustifolia* L., *V. ochroleuca* Ten., *V. gerardi* Vill.
- *vincae* (Kieffer et Trotter, 1904): *Vinca major* L.
- *virgaeaureae* (Liebel, 1889): *Solidago virga-aurea* L.
- *xylostei* (Kieffer, 1909): *Lonicera xylosteum* L.

Dicrodiplosis pseudococci (Felt, 1914): predator of *Planococcus citri* (Risso) (Coccidae)

Dictyomyia setubalensis (Tavares, 1902): *Santolina rosmarinifolia* L.

Diplosis fleothripetiperda (Del Guercio, 1931): predator of *Liothrips oleae* (Costa) (Thysanoptera) on *Olea europaea* L.

Didymomyia tiliacea (Bremi, 1847) (Syn. *D. reaumuriana* F. Löw, 1877): *Tilia platyphyllos* Scop., *T. cordata* Mill.

Diodaulus linariae (Winnertz, 1853): *Linaria vulgaris* Mill.

Diplosiola bursaria Solinas, 1965: *Medicago sativa* L.

Drisina glutinosa Giard, 1893: *Acer pseudoplatanus* L.

Dryomyia circinans (Giraud, 1861): *Quercus cerris* L., *Q. macedonica* A.DC., *Q. pseudosuber* Santi, *Q. suber* L.

- *lichtensteini* (F.Löw, 1878): *Quercus ilex* L.

Geocrypta braueri (Handlirsch, 1884): *Hypericum perforatum* L.

- *galii* (Loew, 1850): *Galium mollugo*, *G. aristatum* L., *G. saccharatum* All., *G. sylvaticum* L., *G. lucidum* All., *G. verum* L.
- *trachelii* (Wachtl, 1885): *Campanula rotundifolia* L.

Gephyraulus diplotaxis (Solinas, 1982): *Diplotaxis muralis* DC.

Haplodiplosis marginata (von Roser, 1840): *Hordeum sativum* L., *Triticum vulgare* L. and rarely also other species of the family Poaceae

Harmandia cavernosa (Rübsaamen, l899): *Populus tremula* L.

- *globuli* (Rübsaamen, 1889): *Populus tremula* L.
- *tremulae* (Winnertz, 1853) (=*loewi* Rübsaamen, 1892): *Populus tremula* L.

Harrisomyia vitrina (Kieffer, 1909): *Populus tremula* L.

Hartigiola annulipes (Hartig, 1839): *Fagus sylvatica* L.

Hybolasioptera cerealis (Lindemann, 1881): *Secale cereale* and other species of the family Poaceae

Inulomyia subterranea (Frauenfeld, 1861): *Inula britannica* L.

Iteomyia caprae (Winnertz, 1853): *Salix caprea* L., S. *nigricans* Sm., *S. cinerea* L., *S. daphnoides* Vill.

Jaapiella alpina (F. Löw, 1885): *Silene acaulis* (L.) Jacq.

- *bryoniae* (Bouché, 1847): *Bryonia dioica* Jacq.
- *buhri* Stelter, 1975: *Peucedanum oreoselinum* (L.) Moench.
- *cucubali* (Kieffer, 1909): *Cucubalus baccifer* L.
- *floriperda* (F.Löw, 1888): *Silene vulgaris* (Moench) Garcke (=*S. inflata* Sm.), *S. italica* (L.) Pers.
- *genistamtorquens* (Kieffer, 1888): *Genista januensis* Viv. (=*G. triangularis* Willd.)
- *genisticola* (F.Löw, 1877): *Genista tinctoria* L., *G. germanica* L., *G. cinerea* (Vill.) DC., *G. diffusa* Willd.
- *loticola* (Rübsaamen, 1889): *Lotus corniculatus* L.

- *medicaginis* (Rübsaamen, 1912): *Medicago sativa* L.
- *parvula* (Liebel, 1889): *Bryonia dioica* Jacq.
- *vacciniorum* (Kieffer, 1913): *Vaccinium myrtillus* L.
- *veronicae* (Vallot, 1827): *Veronica chamaedrys* L.

Janetia cerris (Kollar, 1850): *Quercus cerris* L., *Q. macedonica* A. DC., *Q. pseudosuber* Santi, *Q. suber* L.

- *homocera* (F. Löw, 1877): *Quercus cerris* L.
- *plicans* (Kieffer, 1909): *Quercus cerris* L.
- *szepligetii* Kieffer, 1896: *Quercus cerris* L., *Q. suber* L.

Janetiella euphorbiae Stefani, 1908: *Euphorbia wulfenii* Hoppe ex Koch (= *E. characias* L.)

- *goiranica* Kieffer et Trotter, 1905: *Carpesium cernuum* L.
- *lemeei* (Kieffer, 1904): *Ulmus minor* Mill. (=*U. campestris* L.)
- *oenophila* (Haimhoffen, 1875): *Vitis vinifera* L.
- *thymi* (Kieffer, 1888): *Thymus serpyllum* L.

Kiefferia pericarpiicola (Bremi, 1847) (Syn. *K. pimpinellae* F. Löw, 1874): *Pimpinella saxifraga* L., *P. major* (L.) Huds., *Petroselinum tragium* Vill., *Foeniculum vulgare* Mill., *Daucus carota* L., *Peucedanum oreoselinum* (L.) Moench, *Torilis japonica* (Houtt.) DC. (=*T. anthriscus* Gmel.)

Lasioptera berlesiana Paoli, 1907 (Syn. *L. kiefferiana* Del Guercio, 1910; *L. carpophila* Del Guercio, 1918; *L. brevicornis* Melis, 1927): *Olea europaea* L.

- *carophila* F. Löw, 1874: *Ferula ferulago* L. *Elaeoselinum asclepium* Bert., *Petroselinum ammoides* (L.) Rotb., *P. crispum* (Mill.) A.W.Hill.
- *eryngii* (Vallot, 1829): *Eryngium campestre* L., *E. amethystinum* L.
- *rubi* (Schrank, 1803): *Rubus idaeus* L., *R. caesius* L., *R. discolor* Weihe & Nees, *R. fruticosus* L., *R. corylifolius* Sm., *R. thyrsoideus* Wimm.
- *umbelliferarum* Kieffer, 1909: *Seseli* sp.

Lestodiplosis asphodeli Barnes, 1934: predator of *Silvestrina asphodeli* Barnes on *Asphodelus* sp.

- *conyzae* Kieffer, 1909: predator of *Neokikiella beckiana* on *Inula conyza* DC.
- *massalongoi* Rübsaamen, 1895: predator of *Dasineura salviae* (Kieffer) on *Salvia pratensis* L.
- *woeldickii* (Contarini, 1840): predator probably of *Tyrophagus* sp. (Acarida)

Lestremia leucophaea (Meigen, 1818): biology unknown

Loewiola centaureae (F. Löw, 1875): *Centaurea nigrescens* Willd., *C. scabiosa* L.

- *serratulae* Kieffer, 1905: *Serratula tinctoria* L.

Macrodiplosis dryobia (F. Löw, 1877): *Quercus robur* L., *Q. petraea* (Matt.) Liebl., *Q. pubescens* Willd., *Q. macedonica* A.D.C.

- *volvens* (Kieffer, 1897): *Quercus robur* L., *Q. petraea* (Matt.) Liebl., *Q. pubescens* Willd.

Macrolabis heraclei (Kaltenbach, 1862) (Syn. *M. corrugans* F. Löw, 1877):
Peucedanum oreoselinum (L.) Moench, *P. cervaria* (L.) Lapeyr.
- *hippocrepidis* Kieffer, 1898: *Hippocrepis comosa* L.
- *marteli* Kieffer, 1892: *Hypericum perforatum* L.
- *luceti* Kieffer, 1809: inquilin in galls of *Wachtliella rosarum* (Hardy)
- *podagrariae* Stelter, 1962: *Aegopodium podagraria* L.

Massalongia rubra (Kieffer, 1890): *Betula pendula* Roth
Mayetiola avenae (Marchal, 1895): *Avena sativa* L.
- *bromicola* Roberti, 1953: *Bromus sterilis* L.
- *destructor* (Say, 1817) (Syn. *M. cerealis*, Rondani, 1843; *M. frumentosa*, Rondani, 1864): *Secale cereale* L. and other species of Poaceae
- *poae* Bosc, 1817): *Poa nemoralis* L.

Micromya lucorum Rondani, 1840: biology unknown
Mikomya coryli (Kieffer, 1912): *Corylus avellana* L.
Mikiola fagi (Hartig, 1839): *Fagus sylvatica* L.
Monarthropalpus flavus (Schrank, 1776) (Syn. *M. buxi* Laboulbéne, 1873; *M. schineri* Frauenfeld, 1873): *Buxus sempervirens* L.
Monodiplosis liebeli (Kieffer, 1889): inquilin in galls of *Macrodiplosis dryobia* on *Quercus robur* L.
Moreschiella ilicicola Del Guercio, 1918: *Quercus ilex* L.
- *moricola* Del Guercio, 1918: *Morus alba* L.
- *roburella* Del Guercio, 1918: *Quercus robur* L.

Mycodiplosis erisiphes (Rübsaamen, 1889): mycophagous
Myricomyia mediterranea (F. Löw, 1885): *Erica arborea* L.
Neomikiella beckiana (Mik, 1885): *Inula conyza* DC.
- *lychnidis* (Heyden, 1861): *Silene alba* (Mill.) Kr. (=*Melandrium album* (Mill.) Garcke), *S. dioica* (L.) Clairv. (= *Melandrium rubrum* (Weigel) Garcke)., *Lychnis vespertina* Sib.

Oligotrophus juniperinus (Linnaeus, 1788): *Juniperus communis* L.
- *panteli* Kieffer, 1898): *Juniperus communis* L.

Orseolia cynodontis Kieffer et Massalongo, 1902: *Cynodon dactylon* (L.) Pers.
Ozirhincus anthemidis (Rübsaamen, 1915): *Anthemis arvensis* L.
- *longicollis* Rondani, 1840 (Syn. *Clinorrhyncha chrysanthemi* H. Loew, 1850; *C. leucanthemi* Kieffer, 1898): *Chrysanthemum leucanthemum* L.
- *millefolii* (Wachtl, 1884): *Achillea millefolium* L.
- *tanaceti* (Kieffer, 1889) *(O. parvus* Möhn, 1968): *Tanacetum vulgare* L.

Paradiplosis abietis (Hubault, 1945): *Abies pectinata* DC.
Parallelodiplosis bupleuri Rübsaamen, 1895: *Bupleurum falcatum* L.
- *galliperda* (F.Löw, 1898): inquilin or parasite of *Neuroterus lenticularis* Oliv. on *Quercus robur* L.

Phegomyia fagicola (Kieffer, 1901): *Fagus sylvatica* L.

Physemocecis hartigi (Liebel, 1892): *Tilia platyphyllos* Scop.

- *ulmi* (Kieffer, 1909): *Ulmus minor* Mill. (=*U. campestris* L.)

Placochela nigripes (F. Löw, 1877): *Sambucus ebulus* L.

Planetella gibbosa (Rondani, 1860): biology unknown

- *subterranea* (Kieffer et Trotter, 1904): *Carex divulsa* L.
- *tumorifica* (Rübsaamen, 1899): *Carex riparia* Curt.

Porricondyla nigripennis (Meigen, 1880) (Syn. *P. albitarsis* Rondani, 1856): biology unknown

Probruggmanniella phillyreae (Tavares, 1907): *Phillyrea media* L.

Procontarinia matteiana Kieffer et Cecconi, 1906: *Mangifera indica* L.; imported from India

Psectrosema tamaricis (Stefani, 1902): *Tamarix gallica* L.

Pumilomyia protrahenda Stefani, 1919: *Artemisia arborescens* L.

Putoniella pruni (Kaltenbach, 1872) (Syn. *P. marsupialis* F.Löw, 1889): *Prunus spinosa* L.

Resseliella oleisuga (Targioni- Tozetti, 1886): *Olea europaea* L.

Rhopalomyia artemisiae (Bouché, 1834): *Artemisia campestris* L.

- *baccarum* (Wachtl, 1883): *Artemisia vulgaris* L.,
- *foliorum* (Loew, 1850): *Artemisia vulgaris* L.
- *hypogaea* (F.Löw, 1885): *Chrysanthemum leucanthemum* L.
- *kiefferi* Trotter, 1900: *Artemisia camphorata* L.
- *millefolii* (Loew, 1850): *Achillea millefolium* L.
- *tubifex* (Bouché, 1847): *Artemisia campestris* L.

Rondaniolla bursaria (Bremi, 1847): *Glechoma hederacea* L.

Sackenomyia reaumurii (Bremi, 1847) (Syn. *Phlyctidobia solmsii* Kieffer, 1906): *Viburnum lantana* L.

Schizomyia galiorum Kieffer, 1889: *Galium mollugo* L., *G. lucidum* All.

- *tami* Kieffer, 1901: *Tamus communis* L.

Silvestrina asphodeli Barnes, 1934: *Asphodelus* sp.

- *chinagliana* Del Guercio 1918: predator of *Diaspis* sp. (Coccoidea) on *Rubus* sp. and *Rosa* sp.
- *farinicola* (Barnes, 1929): predator of *Tyroglyphus farinae* (Syn. *Acarus siro*) in flour
- *silvestrii* (Kieffer, 1910): predator of coccids on *Morus alba* L. and *Olea europaea* L.

Spurgia capitigena (Bremi, 1897) (*Bayeria capitigena* Bremi, 1847): *Euphorbia cyparissia* L., *E. helioscopia* L.

- *esulae* Gagné, 1990: *Euphorbia esula* L.

Stefaniella atriplicis Kieffer, 1898: *Atriplex halimus* L.

- *brevipalpis* Kieffer, 1898: *Atriplex portulacoides* L.

- *cecconii* Kieffer, 1909: *Atriplex patula* L.
- *trinacriae* Stefani, 1990: *Atriplex halimus* L.

Stefaniola mediterranea Möhn, 1971: *Salicornia europaea* L. and *Halocnemum strobilaceum* (Pall.) Bieb.

Taxomyia taxi (Inchbald, 1861): *Taxus baccata* L.

Thecodiplosis brachyntera (Schwägrichen, 1835): *Pinus sylvestris* L.

Therodiplosis persicae Kieffer, 1912: predator of *Tetranychus telarius* L.

Trilobia aphidisuga Del Guercio, 1919: predator of *Aphis fabae* (Scop.) (Aphidoidea)

Trilobiella siphae Del Guercio, 1919: predator of *Sipha maydis* (Pass.) (Aphidoidea)

Trotteria obtusa (Loew, 1845) (Syn. *T. sarothamni* Kieffer, 1896; *T. coronillae* Kieffer, 1913): inquilin in galls of *Asphondylia sarothamni* H. Lw. on *Sarothamnus scoparius* (L.) Wimm. and other Fabaceae

Uncinulella eriosomiperda Del Guercio, 1919: predator of *Eriosoma lanigerum* Hsmn. (Aphidoidea)

Wachtliella ericina (F. Löw, 1885): *Erica arborea* L., *E. carnea* L.

- *persicariae* (Linnaeus, 1767): *Polygonum persicaria* L.
- *riparia* (Winnertz, 1853) (Syn. *W. muricatae* Meade, 1886): *Carex vulpina* L.
- *rosarum* (Hardy, 1850): *Rosa canina* L., *R. tomentosa* Sm., *R. sempervirens* L.
- *stachydis* (Bremi, 1847): *Stachys recta* L.

Zeuxidiplosis giardi (Kieffer, 1896): *Hypericum perforatum* L., *H. veronense* Schrank

Zygiobia carpini (F.Löw, 1874): *Carpinus betulus* L.

3. Occurrence and distribution of gall midges in Italy

Italy is divided into four parts: northern, southern, Sicily and Sardinia (personal communication of Prof. Minelli). In the period from 1840 until the present 324 gall midge species were found, forming the present gall midge fauna of Italy. 207 species have been recorded in the northern part, 195 in the southern part, 48 in Sicily and 12 in Sardinia.

The territory of Italy is not been equably investigated from the point of view of gall midge fauna. The provinces Emilia Romagna, Veneto, Lombardia and Piemonte in the north belong to the most explored parts of Italy. Only a few gall midge species are known from Alto Adige, Friuli-Venezia Giulia. In southern Italy intensive studies were carried out in three provinces: in part of the provinces Toscana and Campania; in the area east of Roma and in the surroundings of Napoli. Only a few records of the occurrence of gall midges are known from Marche.

The considerable number of gall midge species which was recorded in northern Italy is connected with the fact that this region belongs to the Euro-

Siberian province with rich vegetation, including many species of trees and shrubs which may be host plants of gall midges. The relatively high number of gall midge species recorded in southern Italy is partially influenced by the fact that the southern part of the Appenino-Tosco-Emiliano mountain, on the slopes of which is situated Vallombrosa where Cecconi collected many galls, is in this region. According to the data about occurrence of gall midges in Italy, it seems to us that the boundary between the northern and southern parts of Italy does not run on the apical part of the mountains (and on the political) boundaries but about 10 or 20 km south of them. Here the composition of vegetation changes into the flora of maquies and garrigues and also the composition of the fauna starts to change.

A relatively low number of gall midge species found in Sicily and in Sardinia does not indicate the absence of gall midges, but with the fact that only a few investigations were carried out there and in Sardinia nobody collected galls: the galls were found incidentally by several scientists during their excursions related to quite different problems.

From the gall midge fauna, including at present 324 species, 72 gall midge species occur in both the northern and southern parts of Italy, 17 species were found in three parts and three gall midge species, viz. *Geocrypta galii*, *Lasioptera carophila* and *Myricomyia mediterranea*, were found in all four parts of Italy. The gall midge species *Geocrypta galii* and *Lasioptera carophila* may be ranked as ubiquitous whereas *Myricomyia mediterranea* is a native species of the Mediterranean region.

The data about research on gall midges in Italy during the period of 1840-1994 are given in the table and in the graph. The continuously increasing number of gall midge species means that the research in Italy is not finished. It may be supposed that in the future a further 150 - 200 gall midge species will be found in the territory of Italy. See Fig. 2.

Biological group of gall midge	1840	1900	1930-1935	1994
free living	10	10	10	12
gall making	3	80	167	275
predacious	-	-	19	22
inquilines	-	-	-	12
mycophagous	-	-	-	3

Table l. Increasing number of gall midge species in Italy in the period 1840-1994

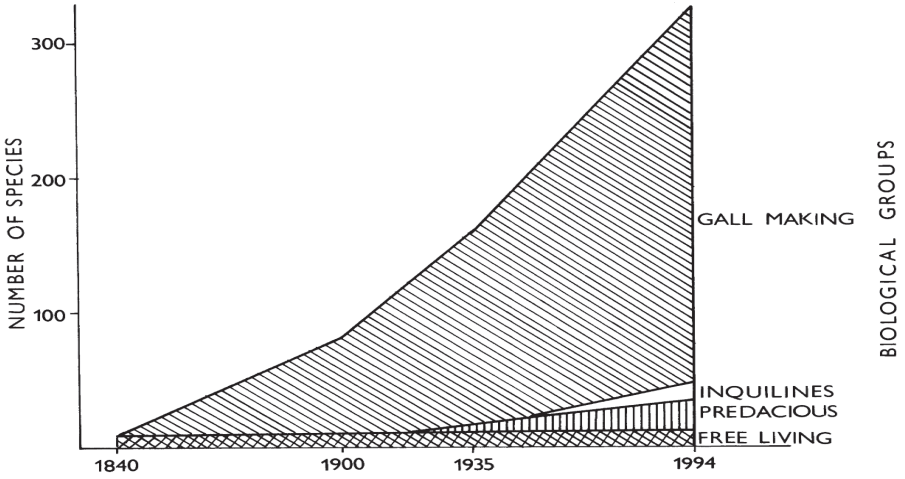

Fig. 2. The increasing number of gall midge species ascertained in Italy during the period 1840-1994.

It is possible to evaluate the occurrence of gall midges in large territory based on the number of localities at which they have been found (evaluation of their frequency). Such evaluation may be done only for the species developing on wild plants, not for pests because such species usually occur in the whole territory at the time of outbreaks.

Nearly one half (48 %) of 324 gall midge species recorded in Italy in the period 1840-1993 were found at only one locality. Such species may be ranked as solitary or rare species. About 40 % species were found at two to six localities; these may be designated as scarcely occurring species. Species found at seven and more localities may be considered to be abundantly occurring species. The most abundant gall midge species (based on the number of findings given in the papers of Italian researchers) seems to be *Lasioptera carophila* the galls of which were found on various host plants of the family Apiaceae at 21 localities in the whole territory of Italy, including Sicily and Sardinia.

The following gall midge species occur in Italy abundantly (the number in parentheses means the number of localities at which galls have been found):

Dasineura salicis on *Salix* spp. (15), *Mikiola fagi* on *Fagus sylvatica* (14), *Asphondylia verbasci* on *Verbascum* spp. (13), *Dryomyia circinans* on *Quercus cerris* (13), *Geocrypta galii* on *Galium* spp. (12), *Janetia cerris* on *Quercus cerris* (12), *Janetiella oenophila* on *Vitis vinifera* (12), *Macrodiplosis dryobia* on *Quercus robur* and *Q. petraea* (12), *Dasineura crataegi* on *Crataegus oxyacantha* (11), *Kiefferia pericarpiicola* on various host plant species and genera of the family Apiaceae (11), *Wachtliella rosarum* on *Rosa* spp. (11), *Spurgia* (*Bayeriola*) *capitigena* on *Euphorbia cyparissias* (10), *Dasineura viciae* on *Vicia* spp. (10), *Cystiphora sonchi* on *Sonchus* spp. (10), *Baldratia salicorniae* on *Salicornia fruticosa* (9), *Dryomyia lichtensteini* on *Quercus ilex* (8), *Lasioptera eryngii* on *Eryngium campestre* (8), *Myricomyia mediterranea* on *Erica arborea* (8), *Aphidoletes aphidimyza* feeding on various species of aphids (7), *Dasineura affinis* on *Viola* spp. (7) and *Schizomyia galiorum* on *Galium* spp. (7).

Predominantly these are gall midge species which belong to the Euro-Siberian province and they occur abundantly in central Europe. They have been recorded mostly by researchers who collected galls in the northern part of Italy. These Euro-Siberian gall midge species are accompanied by several Mediterranean gall midge species, viz. *Myricomyia mediterranea*, *Dryomyia lichtensteini* and *Baldratia salicorniae*.

4. Italy as the part of the Mediterranean

The southern part of Europe is formed by three large peninsulas in the area of the Mediterranean, viz. the Iberian in the west, the Apennines with the islands Sicily, Sardinia and Corsica in the middle, and the Balkans in the east. The southern part of France and Dalmatia must be included also in this area.

Summaries of data about the gall midge fauna of the Iberian and Italic peninsulas have been made and it is possible to compare the results of both these parts. The gall midge fauna of the Iberian Peninsula is at present composed by 240 gall midge species from which 118 occur in Portugal, 199 in Spain and 30 in Andorra; 72 species are common for both these parts (Skuhravá, Skuhravy, Blasco-Zumeta & Pujade, 1995). The present fauna of the Italic Peninsula is more rich than that of the Iberian Peninsula. It includes many gall midge species which occur abundantly in the centrale Europe and the distribution areas of which extend to the southern part of Italy where these species occur only scarcely or even rarely. About 120 gall midge species occur both in the Iberian and Italic Peninsulas and may be considered common species. The faunas of both these peninsulas seem to be closely related.

From the zoogeographical point of view, about 200 species (64 %) of the gall midge species found in the Italic Peninsula present belong to the Euro-Siberian group of species, each of which usually occupies a large distribution area in central Europe and reaches the most southern boundary of its occurrence in the mountain forests of the southern part of Italy. For example, *Mikiola fagi* which develops in galls on the leaves of *Fagus sylvatica*; *Macrodiplosis dryobia* and *M. volvens* on *Quercus robur* and *Q. petraea*, and *Zygiobia carpini* on *Carpinus betulus*, are typical Euro-Siberian species which occur scattered in the territory of Italy.

About 18 % of gall midge species which occur in Italy and along the coast of the Mediterranean Sea may be ranked as Mediterranean species. Typical representatives are, for example: *Dryomyia lichtensteini*, *Contarinia ilicis* and *C. luteola* developing in galls on the leaves of *Quercus ilex*; *Myricomyia mediterranea* and *Dasineura ericaescopariae* on various spp. of *Erica*, *Braueriella phillyreae*, *Dasineura rufescens* and *Probruggmanniella phillyreae* on *Phillyrea* spp., *Psectrosema tamaricis* on *Tamarix tentandra*, *Dasineura oleae* and *Resseliella oleisuga* on *Olea europaea*, *Baldratia salicorniae* on *Salicornia fruticosa*, *Asphondylia gennadii* on *Ceratonia siliqua*, *A. capparis* on *Capparis spinosa* and *A. conglomerata* on *Atriplex halimus*.

About 50 gall midge species (16 %) which were found only in Italy and seem to be restricted to a small area may be endemic (native) species although this term is often a subject of discussions of specialists, because a species first considered to be endemic may later be found in other localities of a wider area. At present there may be ranked as endemic, for example, two species described by Rondani (*Dasineura obscura* and *D. luteofusca*), two species described by Stefani-Perez (*Dasineura minardii* and *Pumilomyia protrahenda*) and several predacious species of the genera *Adelgimyza*, *Cecidomyella*, *Moreschiella*, *Trilobiella* and *Uncinulella* described by Del Guercio. The majority of them are the insufficient known and inadequate described species the types of which have been lost.

Greece remains a “terra incognita” in respect of its gall midge fauna. Only 19 gall midge species are known to occur in this country the majority of which occur also in Italy. Nobody has carried out research there on gall midges. After the investigation of the gall midge fauna of Greece it will be possible to elaborate the maps of distribution areas of gall midges occurring in the area of Mediterranean.

CONCLUSIONS

The present Italian fauna of the family Cecidomyiidae includes 324 species. Data about occurrence of gall midges have been compiled from more than 200 papers. The species richness is a result of scientific activity of many research workers who investigated the gall midge fauna in various parts of Italy.

In the 17th century Marcello Malpighi described galls of nine species without giving them names. First descriptions of gall midge species and diagnoses of several genera were given by RONDANI (1840, 1860).

The history of gall midge studies and investigations in Italy may be divided into two periods. In the first period, at the beginning of the 20th century, about 90 gall midge species were known. The gall midge studies started with investigations carried out by Bezzi, Corti and Mariani in various parts of Italy. In the first and second decades of the 20th century Massalongo, Cecconi, Trotter, Baldrati and Stefani-Perez published results of theirs extend investigations about occurrence of plant galls and gall makers in Italy. The names of these researchers remain preserved in literature as names of genera and species of gall midges. Results of investigations of these researchers are summarized in the paper of TROTTER & CECCONI "Cecidotheca Italiana" (1900-1917). At the end of this period Del Guercio described several predacious gall midge species.

The second period started after 1920 and continues up to the present. It is characterized mainly by investigations about economic important gall midges, by the detailed studies of morphology, biology, ecology and ethology of various gall midge species. The following researchers belong in this group: Ricchello, Della Beffa, Goidanich, Melis, Venturi, Rasis, Roberti, Frediani, Principi, Martino, Tullio and Solinas. Present studies of several entomologists and biologists are concerned in gall midges cytology (Mazzini, Dallai) and in physiology (Solinas, Nuzzaci, Isidoro).

The journal Marcellia which was founded in 1902 by Trotter and named in honour of Marcello Malpighi was very important for the advance of cecidological studies not only in Italy, but also in Europe. In 1980 the journal Marcellia was combined with the journal Cecidologia Indica to form the journal Cecidologia Internationale and since that time it is published in Allahabad (India).

The knowledge about gall midge fauna in Italy is not completed and, therefore, gall midge species seem to be not equable distributed in the territory of Italy. 207 gall midge species have been ascertained in the northern, 195 in

southern part of Italy, 48 in Sicily and 12 in Sardinia. The number of ascertained gall midge species in these areas is influenced not only by the geographical position and by the composition of vegetation but also by the fact if any researcher worked in such area.

Gall midge species found in Italy during the period 1840-1994 may be evaluated, based on the number of findings in the papers of Italian researchers, into four frequency groups.

Frequency group I includes species occurring solitarily or rarely which were found at only one locality. It involves nearly one half (48 %) of all gall midges species recorded in Italy. Frequency group II includes species occurring scarcely which have been found at two to six localities. In this group there belong about 40 % of gall midges. Frequency group III includes abundantly occurring species which were found at seven to 15 localities. It includes 20 gall midge species (%). Frequency group IV includes only one species, occurring most frequently, which was found at 21 localities. It is *Lasioptera carophila* larvae of which cause galls on various host plant species of the family Apiaceae.

From the zoogeographical point of view, the Italian gall midge fauna is formed predominantly of species belonging to the Euro-Siberian province which occur abundantly in central Europe and the distribution areas of which reach up to the northern part of Italy. Some of them extend up to the southern part of Italy but there they occur only scarcely or even rarely. For example: *Mikiola fagi* developing in galls on leaves of *Fagus sylvatica*; *Macrodiplosis dryobia* and *M. volvens* causing galls on leaves of *Quercus* spp.; *Zygiobia carpini* producing galls on leaves of *Carpinus betulus*. All are typical Euro-Siberian species which occur scattered in the territory of Italy.

About 18 % of gall midges which occur in Italy and along the coast of the Mediterranean Sea may be ranked as Mediterranean species. For example: *Dryomyia lichtensteini*, *Contarinia ilicis* and *C. luteola* developing in galls on leaves of *Quercus ilex*; *Myricomyia mediterranea* and *Dasineura ericaescopariae* on various *Erica* spp.; *Braueriella phillyreae*, *Dasineura rufescens* and *Probruggmanniella phillyreae* on *Phillyrea* spp.; *Psectrosema tamaricis* on *Tamarix tetrandra*, *Dasineura oleae* and *Resseliella oleisuga* on *Olea europaea*, *Baldratia salicorniae* on *Salicornia fruticosa*, *Asphondylia gennadii* on *Ceratonia siliqua*, *Asphondylia capparis* on *Capparis spinosa* and *Asphondylia conglomerata* on *Atriplex halimus*.

About 50 gall midge species (16 %) which were found only in Italy and seem to be restricted to a small area may be endemic (native) species. The endemic species are mostly those described by Rondani, Stefani-Perez and Del Guercio.

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DEDICATION

This paper is dedicated to the memory of Marcello Malpighi and Camillo Rondani, the founders of gall midge studies in Italy, and to the memory of the following scientists: A. Trotter, C. Massalongo, I. Baldrati, A. Corti, M. Bezzi, G. Cecconi, T. Stefani-Perez and G. Del Guercio, who started and significantly contributed to the advance of the study of galls and of gall midges during three decades at the beginning of the 20th century.

RIASSUNTO

Viene compilato un elenco di 324 specie di ditteri cecidomiidi e relativi ospiti relativo alla fauna italiana tratto da più di 200 pubblicazioni di Ricercatori italiani dal 1840 al 1994; viene tracciata una storia dello studio del gruppo. Viene analizzata la distribuzione geografica nel nord e sud Italia, Sicilia e Sardegna; le specie vengono riunite in quattro gruppi di frequenza: solitarie, rare, frequenti e molto frequenti. La maggior parte delle specie italiane (64%) sono considerate Euro-Sibirriche, circa il 18% a diffusione Mediterranea e il 16% sono specie endemiche.

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