

Aphid-eating Gall Midges (Cecidomyiidae), with special reference to those in the Barnes collection

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Those gall midges whose larvae prey on aphids have attracted my attention since 1950. Therefore I gratefully accepted Dr. H. F. BARNES' kind invitation to visit him during February 1956 for the express purpose of studying and discussing with him all such material in his collection.

I am indebted to the Director of Rothamsted Experimental Station, Sir William OGG, and to the Head of the Entomology Department there, Dr. K. MELLANBY, for allowing this visit, as well as to the authorities of the I.P.O., Wageningen, for facilitating my trip to England. I wish to thank Dr. BARNES for his help in preparing this paper and for the hospitality, so kindly offered by him and Mrs. BARNES.

My thanks are also due to Mr. D. HILLE RIS LAMBERS, who was willing to add the modern names of the Aphids; these additions, marked with H.R.L., have been placed between brackets.

Aphid eating gall midges may be divided into A. those whose larvae are internal parasites of aphids and B. those whose larvae are predaceous on aphids.

A. INTERNAL PARASITES

The species known to live as internal parasites of aphids belong either to the genus *Endaphis*, erected by KIEFFER in 1896, or to the genus *Pseudendaphis*, erected by BARNES in 1954. Only two species have been described, viz. *E. perfidus* Kieffer, of which the existing material appears to be three specimens sent by KIEFFER to the Felt collection, and *P. maculans* Barnes. Since the endoparasitic gall midges have recently been reviewed (BARNES, 1954), it only remains to state here that in his collection there are: a male and females of HENNIG's *Endaphis* sp. cf. *perfidus* Kieffer from *Macrosiphum jaceae* (L.), [H.R.L.: *Dactynotus* (Uromelan) *jaceae* subsp. *aeneus* H.R.L.] on *Carduus* in Germany; larvae of *Endaphis* from *Chaitophorus* (*Pseudomicrella*) *salicti* Schrank on *Salix alba* L. and from *Aphis farinosa* Gmel. (syn. *A. saliceti* Kltb.) on *Salix caprea* L., both at Gulpen, Limburg; and the male and female types as well as paratypes of both sexes of *Pseudendaphis meculans* Barnes that parasitizes various aphids in Trinidad, B.W.I.

B. PREDATORS

BARNES, in his review of gall midges as enemies of aphids (1929) and his addenda (1930), listed the following genera: *Adelgimyza* Del Guercio, *Aphidoletes* Kieffer, *Bremia* Rondani sens. lat., *Cecidomyia* Meigen, *Cryptobremia* Kieffer, *Feltiella* Rüb-saamen, *Guerciobremia* Barnes (*Rondaniella* Del Guercio nec Rüb-saamen), *Isobremia* Kieffer, *Lestodiplosis* Kieffer, *Monobremia* Kieffer, *Phaenobremia* Kieffer, *Trilobia* Del Guercio, *Trilobiella* Del Guercio and *Uncinulella* Del Guercio.

Of these *Bremia* is the unspecified appellation of various larvae found eating aphids in Russia during 1912; *Cecidomyia* is in the list by virtue of *Cecidomyia aphidivora* (Felt), whose larvae were found together with those of an *Aphidoletes* sp. on apple leaves infested with aphids, but it was not definitely stated that the larvae were eating the aphids; similarly *Feltiella* is listed because *F. davisii* Felt was described on midges reared from catnip leaves infested with *Aphis gossypii* Glover (the larvae of other species of *Feltiella* feed on mites). *Lestodiplosis*, most of whose larvae are predaceous on other gall midge larvae although some are known to feed on mites, appears in the list of aphid-eating midges because *L. grassator* (Fyles) was reared from larvae feeding on *Phylloxera vastatrix* Pl. and *L. pini* Barnes was reared from larvae said to be feeding on aphids on *Pinus strobus* L. The genera *Trilobia*, *Trilobiella* and *Uncinulella* were erected on larvae and are monospecific.

The undoubted aphid-eating genera are therefore *Adelgimyza*, *Aphidoletes*, *Cryptobremia*, *Guerciobremia*, *Isobremia*, *Monobremia* and *Phaenobremia*.

In the BARNES collection, besides the male and female types and paratypes of both sexes of *Lestodiplosis pini* Barnes, a doubtful aphid-eater, there are specimens belonging to the genera *Aphidoletes*, *Guerciobremia*, *Monobremia* and *Phaenobremia*.

Guerciobremia Barnes (*Rondaniella* Del Guercio nec Rübsaamen)

This was the name proposed by BARNES (1927) to replace *Rondaniella* Del Guercio (1918), sp. typ. *bezzii* Del Guercio. The genus was erected originally for midges bred from larvae feeding on *Aphis symphyti* Schr. The following species, known only as larvae, were also placed by DEL GUERCIO in this genus: *cucullata*, *macrosiphoniellae*, *macrosiphonis*, *ornata*, *phorodontis* and *toxopterae*. The full references to the descriptions of these larvae are given by BARNES (1929).

Males and females, bred from larvae found preying on *Toxoptera aurantii* Fonsc. in Israel by E. RIVNAY during 1936, are labelled in the collection as *Guerciobremia toxopterae* Del Guercio. There is however a note on the slide box suggesting that either *Guerciobremia* may be a synonym of *Phaenobremia* or that the species should have been identified as a *Phaenobremia*. After examining these specimens they proved to be so very similar to *Phaenobremia* that I consider the genus *Guerciobremia* of rather doubtful value if indeed BARNES' specimens are the same species of which DEL GUERCIO described the larva.

Aphidoletes Kieffer, *Monobremia* Kieffer, *Phaenobremia* Kieffer,
Cryptobremia Kieffer and *Isobremia* Kieffer.

KIEFFER (1904) subdivided the genus *Bremia* Rondani, retaining the lignicolous species in the genus *Bremia* with *B. decorata* (H. Loew) as the genotype and erecting the genus *Aphidoletes* for the aphidivorous species up to then included in the genus *Bremia*. These latter species he listed: *abietis* Kieffer, *actiosa* Skuse, *aphidimyza* Rondani, *aphidisuga* Rübsaamen, *aphidivora* Rübsaamen, *cineraria* Skuse, *contigua* Skuse, *cucumeris* Lintner, *fallax* Skuse, *indotata* Skuse, *oreas* Skuse, *saxatilis* Skuse, *sonchi* Kieffer, *subterranea* Kieffer, *urticariae* Kieffer and *violacea* Skuse.

On 1 February 1912 KIEFFER published privately at Bitsch a 2-page (single sheet) leaflet erecting many new genera. Copies of this leaflet are rare, although

the late F. W. EDWARDS of the British Museum (Nat. Hist.) possessed a copy in 1925 as did the late E. P. FELT in 1927. An exact copy now in the BARNES gall midge library was made from FELT's copy by BARNES in 1927. Luckily a reprint of this paper appeared in *Marcellia* (11, 1912, X-XI). In this leaflet KIEFFER erected the following genera: *Monobremia* sp. typ. *Aphidoletes subterranea* Kieffer; *Phaenobremia*, sp. typ. *A. urticariae* Kieffer; and *Cryptobremia*, sp. typ. *aegyptiaca* n. sp.

Later the same year KIEFFER (1912 c) erected the genus *Isobremia*, sp. typ. *A. sonchi* Kieffer.

In KIEFFER's volume Cecidomyiidae in WYTSMAN's *Genera Insectorum* (1913) the genera *Aphidoletes*, *Monobremia*, *Cryptobremia* and *Isobremia* are monospecific, only the genotype in each case being listed. On the other hand, twenty-seven species (including 14 species additional to those listed above in *Aphidoletes* and not made the genotypes of the subsequent genera) are listed as belonging to *Phaenobremia*. Full descriptions are given of all these five genera (*loc. cit.*).

Aphidoletes Kieffer: genotype and only species, *abietis* Kieffer

This species was originally described by KIEFFER (1896) from midges reared from larvae predatory on *Adelges abietis* L. [H.R.L.: *Sacchiphantes abietis* (L.)?] on *Picea* in Lorraine.

In the collection are larvae, males and females of this species. The midges were bred in late May and the first half of June 1944 from larvae collected in early September 1943 by H. S. HANSEN in the Alice Holt woods, Surrey, in galls of *Adelges abietis* L. [H.R.L.: *Gilletteella cooleyi* G.] on Sitka Spruce (*Picea sitchensis* Carrière).

In addition there are two females, a pupa and a cocoon, that were obtained from larvae associated with a *Chermes* [H.R.L.: *Pineus pini* Macquart] on *Pinus sylvestris* L. in Kew Gardens, Surrey, during 1931. These have been provisionally placed in this genus by BARNES.

Monobremia Kieffer: genotype, *subterranea* Kieffer

The larvae of this species were found feeding on an aphid [H.R.L.: *Toxopterina vandergooti* Börner] on the roots of *Tanacetum vulgare* L. in Lorraine (KIEFFER, 1898 and 1913).

Phaenobremia rosea Barnes was described (1927 b) on females bred in 1926 from larvae found at Wye, Kent, preying on *Sappaphis plantaginea* Pass. (*Anuraphis roseus* Baker) on apple leaves. The type and two paratypes as well as a larva are in the collection. In addition there are males, females and larvae reared during 1928 on the same aphid found at East Malling, Kent.

An examination of the male genitalia proved that this generic placing could not stand and that the specimens belong to the genus *Monobremia*, thus confirming the pencilled labelling of *Monobremia* that BARNES had written on some of the slides. *Phaenobremia rosea* Barnes must therefore be known in the future as *Monobremia rosea* (Barnes).

Phaenobremia Kieffer: genotype, *urticariae* Kieffer

KIEFFER (1913) distinguished two types of lower lamella in the male genitalia, viz. the truncate and the cordate. In the genotype it is truncate.

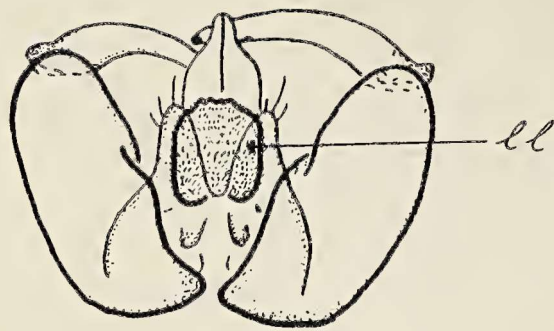


Fig. 1.

The BARNES collection is particularly rich in specimens belonging to this genus. The result of examining all these with regard to the shape of the lower lamella is given below. There are obviously three types: 1. the truncate; 2. the cordate; and 3. the globular.

1. the truncate

This type did not show any variation in shape (Fig. 1, l.l.), so the following material may be considered as *Phaenobremia urticariae* (Kieffer):

from	host plant	country
<i>Aphis pomi</i> de Geer	Apple	England
<i>Aphis urticata</i> Gmelin	<i>Urtica dioica</i> L.	Netherlands
Black aphid	thistle	England
Black aphid	<i>Tropaeolum</i>	England
<i>Myzus persicae</i> Sulz.	<i>Arabis albida</i> Stev.	England

2. the cordate

(a) in identified species

species	aphid	host plant	country
<i>P. aphidimyza</i> Rond.	<i>Aphis frangulae</i> Kltb. [H.R.L.: <i>Aphis gossypii</i> Glover]	Zucce (Cucurbit)	Italy
<i>P. aphidivora</i> Rübs.	<i>Aphis frangulae</i> Kltb. [H.R.L.: <i>A. gossypii</i> Glover]	<i>Cucumis sativus</i> L.	Netherlands
" "	<i>Hyalopterus pruni</i> Geoffr.	<i>Phragmites communis</i> Trin.	Netherlands
<i>P. helichrysis</i> Barnes	<i>Brachycaudus helichrysi</i> Kltb. (<i>Anuraphis heli-</i> <i>chrysi</i> Kltb.)	<i>Achillea millefolium</i> L.	Ireland
<i>P. meridionalis</i> Felt.	<i>Aphis sacchari</i> Zehntn. [H.R.L.: <i>Longiunguis</i> <i>sacchari</i> Zehntner]	<i>Saccharum officinale</i> L.	Hawaii
" "	<i>Phorodon humuli</i> Schrnk.	<i>Humulus lupulus</i> L.	England
" "	?	?	Indiana, U.S.A

(b) in unidentified material

After examining the unidentified specimens I drew the conclusion that two types of cordate lower lamellae could be distinguished.

The first type agrees with that of *Phaenobremia aphidivora* (Rübsaamen) Fig. 2, l.l.). Experiments and field observations have shown that *P. aphidivora* has a wide range of prey and a

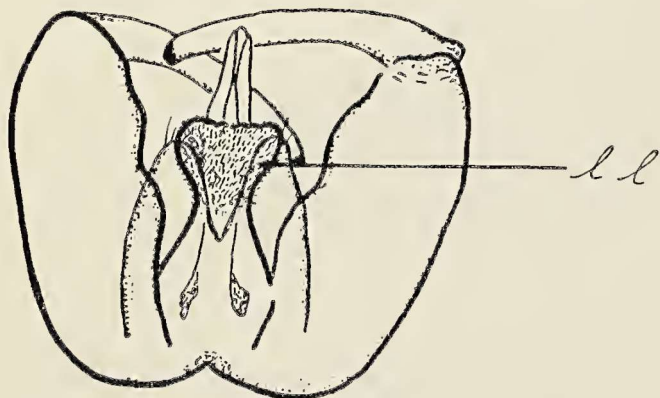


Fig. 2.

wide geographical distribution (NIJVELDT, 1954 and 1955). Therefore, instead of raising new species I proposed to consider the following material for the present as *P. aphidivora* (Rübsaamen).

from the aphid	host plant	country
?	<i>Solanum melongena</i> L.	Israel
?	<i>Chrysanthemum leucanthemum</i> L.	England
?	<i>Chrysanthemum maximum</i> Ramond	England
<i>Aphis nerii</i> Fonsc.	<i>Nerium oleander</i> L.	Israel
<i>Aphis pomi</i> de Geer	Apple	England
<i>Aphis rumicis</i> L.	Apple	England
[H.R.L.: <i>Aphis fabae</i> Scop.]		
<i>Aphis urticata</i> Gmelin	<i>Urtica dioica</i> L.	Netherlands
Black aphid	<i>Tropaeolum</i>	England
<i>Brachycaudus cardui</i> L.	?	England
<i>Brevicoryne brassicae</i> L.	Cabbage	England and Germany
<i>Cryptomyzus ribis</i> L.	Red Currant	England
East Malling aphid culture		England
<i>Aphis pomi</i> de Geer	Apple	Israel
<i>Hyalopterus pruni</i> Geoffr.	<i>Phragmites communis</i> Trin.	England
<i>Myzus ornatus</i> Laing		Israel
<i>Myzus persicae</i> Sulz.	<i>Solanum dulcamara</i> L.	England
<i>M. sanborni</i> Gill.	<i>Chrysanthemum</i>	England
[H.R.L.: <i>Macrosiphoniella sanborni</i> Gill.]		England

The second type agreed with *Phaenobremia meridionalis* (Felt), a species described from *Macrosiphum liriodendri* Mon. [H.R.L.: *Illinoia liriodendri* Monell] at Washington, D.C., U.S.A.

from the aphid	host plant	country
?	<i>Chrysanthemum leucanthemum</i> L.	England
?	<i>Chrysanthemum maximum</i> Ramond	England
?	<i>Viola tricolor</i> L.	England
?	<i>Viola arvensis</i> Murr	England
<i>Aphis frangulae</i> Kltb.	<i>Cucumis sativus</i> L.	Netherlands
[H.R.L.: <i>Aphis gossypii</i> Glover]		
<i>Aphis pomi</i> de Geer	Apple	England
First <i>Aphis pomi</i> de Geer, later on transferred to <i>Aphis rumicis</i> L.		
[H.R.L.: <i>Aphis fabae</i> Scop.] on bean and <i>Brevicoryne brassicae</i> L. on cabbage		England
<i>Brachycaudus cardui</i> L.		England
<i>Brevicoryne brassicae</i> L.	Cabbage	England
<i>Capitophorus ribis</i> L. (<i>Cryptomyzus ribis</i> L.)	Red currant	England

<i>Hyalopterus pruni</i> Geoffr.	<i>Phragmites communis</i> Trin.	Netherlands
<i>Lachnus persicae</i> Cholodk.	?	Israel
[H.R.L.: <i>Pterochloroides persicae</i> Cholodk.]		
<i>Myzus persicae</i> Sulz.	<i>Solanum dulcamara</i> L.	England
” ” ”	<i>Arabis albida</i> Stev.	England
” ” ”	<i>Brassica campestris</i> L.	England
<i>Rhopalosiphum nymphaeae</i> L.	<i>Nymphaea alba</i> L.	England

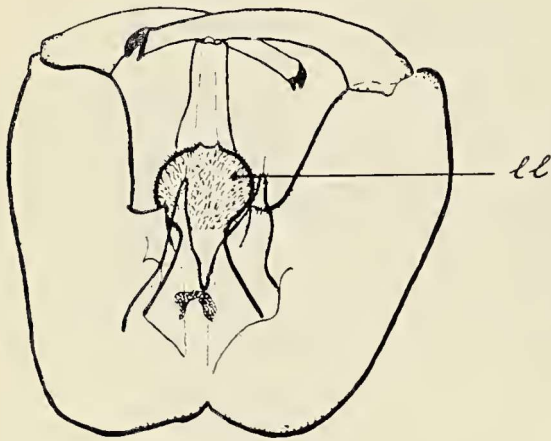


Fig. 3.

3. the globular

This type does not fit into either of KIEFFER's types, because it is neither cordate nor truncate (fig. 3, l.l.). I discovered it for the first time on a specimen caught in a so-called emergence cage in the Netherlands. This cage was used for phenological observations on the Pea-midge (*Contarinia pisi* Winn.). Presumably its larva fed on pea-aphids. It was seen that some specimens in the BARNES collection showed the same type.

from	host plant	country
?	<i>Pisum sativum</i> L.	Netherlands
<i>Brachycaudus amygdalinus</i> Schout.	?	Israel
<i>Hyalopterus pruni</i> Geoffr.	<i>Phragmites communis</i> Trin.	Israel
<i>Rhopalosiphum nymphaeae</i> L.	<i>Nymphaea alba</i> L.	England

Unfortunately it was not possible to categorise the male genitalia of the following two additional species represented in the collection:

P. cucumeris (Lintner), of which there are only three females bred from larvae which had been feeding on an aphid on squash in the U.S.A.

P. macrorosae Barnes which was described on females only. In the collection there is a male specimen, provisionally associated with the type and paratype, but the lower lamella is invisible on the slide. This species feeds on *Macrosiphum rosae* L. var. *glauca* Bucht. on roses in England.

DISCUSSION AND CONCLUSIONS

The examination of the *Phaenobremia* species in the BARNES collection has raised a lot of problems. When we compare the genera *Guerciobremia* and *Phaenobremia* we cannot find any constant difference in morphology, so I consider DEL GUERCIO's description as rather doubtful.

In the male genitalia, in addition to the truncate type, I distinguished two types of cordate-shaped lower lamellae and a globular one, but it would not be wise to accept this as a key for separation; for besides these types I found intermediate forms in material from the same origin. Only the truncate lower lamella of the male *P. urticariae* Kieff. proved to be constant. No distinct difference could be demonstrated between males and females of *P. aphidimyza* Rond., *P.*

aphidivora Rübs. and *P. helichrysis* Barnes. RÜBSAAMEN (1891) stated that *Diplosis cerasi* H. Lw. was identical to *Diplosis aphidimyza* Rond., and so was a midge called *Cecidomyia napi* by KALTENBACH (*Cec. napi* fed on aphids on white cabbage). Later in the same paper he remarked that *Diplosis aphidivora* Rübs., *Dipl. aphidisuga* Rübs. and *Dipl. aphidimyza* Rond. were very closely allied.

Breeding experiments and study of much material of the same origin will have to decide whether the above mentioned *Phaenobremia* species with cordate lamellae in the male genitalia are valid or if they can be reduced to one species, distributed all over the world with a wide range of prey and variable in shape. This variability may be caused by climatic factors, locality, kind, quality and quantity of prey, host plants and, perhaps, artefacts in mounting!

The correct generic placing of *P. rosea* Barnes is in the genus *Monobremia*.

Monobremia rosea (Barnes) and *Phaenobremia macrorosae* Barnes were originally described from females only (1927), but exact measurements carried out on females of *P. aphidivora* Rübsaamen and *P. urticariae* (Kieffer) in the NIJVELDT collection have demonstrated that a description based upon proportions of length and breadth of palp and antennal segments of females only is invalid. This is owing to a wide variation which included the four species mentioned.

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