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# STUDIES ON BOREAL AGROMYZIDAE (DIPTERA). V. ON THE GENUS *CHROMATOMYIA* HARDY, WITH REVISION OF CAPRIFOLIACEAE-MINING SPECIES

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*Quaestiones entomologicae*
*10: 35-69 1974*

*The genus* Chromatomyia *Hardy is redefined on the basis of the structure of the aedeagus. Monophagous and oligophagous members of this genus are known as leaf-miners of Saxifragaceae, Primulaceae, Gentianaceae, Caprifoliaceae, Dipsacaceae, Compositae, Juncaceae and Gramineae. Thirteen species are reported as miners of Caprifoliaceae (*Lonicera, Symphoricarpos *and* Linnaea*). These include five new species from North America, as follows:* Chromatomyia symphoricarpi *n. sp. (type-locality Elk Island National Park, Alberta),* C.fricki *n. sp. (type-locality Union Gap, Washington),* C. linnaeae *n. sp. (type-locality Edmonton, Alberta),* C. nigrilineata *n. sp. (type-locality Elk Island National Park, Alberta) and* C. chamaemetabola *n. sp. (type-locality Elk Island National Park, Alberta).*

*Le genre* Chromatomyia *Hardy est redéfini sur la base de la structure de l'édéage. Les membres monophages et oligophages de ce genre sont connus comme mineurs dans les feuilles des Saxifragacées, Primulacées, Gentianacées, Caprifoliacées, Dipsacacées, Composites, Juncacées et Graminées. Treize espèces sont signalées comme mineuses des Caprifoliacées (*Lonicera, Symphoricarpos *et* Linnaea*). Cinq espèces nouvelles d'Amérique du nord sont inclues, tel que:* Chromatomyia symphoricarpi *n. sp. (localité-type Parc National Elk Island, Alberta),* C. fricki *n. sp. (localité-type Union Gap, Washington),* C. linnaeae *n. sp. (localité-type Edmonton, Alberta),* C. nigrilineata *n. sp. (localité-type Parc National Elk Island, Alberta) et* C. chamaemetabola *n. sp. (localité-type Parc National Elk Island, Alberta).*

*Die Gattung* Chromatomyia *Hardy wird auf Grund der Aedoeagus-Struktur neu definiert. Monophage und oligophage Vertreter dieser Gattung sind als Blattminierer von Saxifragaceae, Primulaceae, Gentianaceae, Caprifoliaceae, Dipsacaceae, Compositae, Juncaceae und Gramineae bekannt. Dreizehn Arten werden als Minierer von Caprifoliaceae (*Lonicera, Symphoricarpos *und* Linnaea*) besprochen. Unter diesen sind die folgenden fünf nordamerikanischen Arten neu:* Chromatomyia symphoricarpi *n. sp. (Fundort vom Typus Elk Island Nationalpark, Alberta),* C. fricki *n. sp. (Fundort vom Typus Union Gap, Washington),* C. linnaeae *n. sp. (Fundort vom Typus Edmonton, Alberta),* C. nigrilineata *n. sp. (Fundort vom Typus Elk Island Nationalpark, Alberta) und* C. chamaemetabola *n. sp. (Fundort vom Typus Elk Island Nationalpark, Alberta).*

This fifth paper of a series follows the form of presentation previously established. See the first paper (Griffiths, 1972a) for explanation of some terms and abbreviations. The holotypes of new species will be deposited in the Canadian National Collection (Ottawa), except those of *fricki* which belong to the California Academy of Sciences (San Francisco).

## DEFINITION OF *CHROMATOMYIA* HARDY

In the first paper of this series (Griffiths, 1972a), I alluded to the possibility of reviving the use of Hardy's (1849) proposed generic name *Chromatomyia*. In the light of subsequent studies I am satisfied that this action is justified. I refer to the genus *Chromatomyia* all those species of *Phytomyza s. l.* in whose males the distal section of the ejaculatory duct is simple (not bifid) and lies below a lobe on the "dorsal" (in anteriorly directed rest position) side of the aedeagus. This aedeagal structure is strongly apomorphous, and I believe that it indicates the limits of a monophyletic group for which Hardy's name *Chromatomyia* is available. The type-species of *Chromatomyia* is *Phytomyza periclymeni* de Meijere ("*Phytomyza obscurella* Fallén" in Hardy's sense, by subsequent designation of Coquillett, 1910: 523). Six of the seven species referred to this genus by Hardy belong here also according to my definition (but not in the original sense of some of the species names!); but I exclude *Phytomyza ilicis* Curtis, doubtfully referred here by Hardy as his seventh species. I rank the taxon *Chromatomyia* as a genus. Those who wish to retain the name *Phytomyza* in a wide sense may prefer to follow Braschnikow (1897) in treating *Chromatomyia* as a subgenus of *Phytomyza*. At present we do not have sufficient historical information on the Agromyzidae to decide such questions of the absolute rank of taxa.

Hardy (1849) separated *Chromatomyia* from *Phytomyza* "on account of differences in the pupa state, accompanied by a corresponding variation in habit. To those with slipper-shaped pupae, whose transformations take place entirely within the leaf, I propose to apply the name *Chromatomyia* (χρῶμα , *color*; μυῖα , *musca*); while the name *Phytomyza* may be retained for the species whose pupae are barrel-shaped, and whose larvae enter the ground to pass the period antecedent to their final change". We now know that internal ("slipper-shaped") puparia are produced by species of several different groups of *Phytomyza s. l.* Clearly any attempt to group all known species according to Hardy's criterion would produce an unacceptable artificial grouping. A satisfactory definition of *Chromatomyia* has only become possible as a result of the genitalia studies of the last decade. Besides in *Chromatomyia*, internal puparia of a similar type (with the anterior spiracles projecting ventrally through the leaf epidermis) are now known also in the *Phytomyza robustella* group, the *P. anemones* group, the *P. ilicis* group, as well as in certain other species whose relationships have not been investigated. Furthermore, there are two sister-species in *Chromatomyia* whose larvae leave the leaf before puparium formation (*alpigenae* and *chamaemetabola*). These are members of the *Chromatomyia periclymeni* group, whose other species have internal puparia (see the detailed treatment below). My interpretation is that the formation of internal puparia (an apotypic character in Agromyzidae) is a groundplan character of *Chromatomyia*, and that the formation of external puparia in this pair of sister-species is secondary.

The forty-seven species which I refer to *Chromatomyia* are now listed according to their host association, as follows.

*On Saxifragaceae*

The five species which I previously treated (Griffiths, 1972a), namely: *Chromatomyia deirdreae* (Griffiths), new combination; *C. saxifragae* (Hering), new combination; *C. aizoon* (Hering), new combination; *C. tiarellae* (Griffiths), new combination; *C. mitellae* (Griffiths), new combination.

*On Primulaceae*

*Chromatomyia primulae* (Robineau-Desvoidy), new combination. I do not know whether *Phytomyza soldanellae* Starý is also a *Chromatomyia*, as its aedeagus has not been studied.

*On Gentianaceae*

Five species can be definitely referred to *Chromatomyia* on the basis of the structure of the aedeagus, namely: *Chromatomyia gentianae* (Hendel), new combination; *C. skuratowiczi* (Beiger), new combination; *C. gentianella* (Hendel), new combination; *C. pseudogentii* (Beiger), new combination; *C. crawfurdiae* (Sasakawa), new combination. I do not know whether *Napomyza gentii* Hendel, *Phytomyza swertiae* Hering and *P. vernalis* Groschke also belong to *Chromatomyia*, as their aedeagi have not been studied.

*On Caprifoliaceae*

Thirteen named species, as treated in detail below. The Japanese *Phytomyza abeliae* Sasakawa seems not to be a *Chromatomyia.*

*On Dipsacaceae*

I know the male genitalia of two species, namely: *Chromatomyia ramosa* (Hendel), new combination; and *C. scabiosae* (Hendel), new combination. Two other similar miners of Dipsacaceae almost certainly also belong here, namely: *Chromatomyia succisae* (Hering), new combination; and *C. scabiosarum* (Hering), new combination.

*On Compositae or polyphagous*

The six species of the *syngenesiae* group in the sense of my recent revision (Griffiths, 1967), namely: *Chromatomyia aragonensis* (Griffiths), new combination; *C. lindbergi* (Spencer), new combination; *C. farfarella* (Hendel), new combination; *C. syngenesiae* Hardy; *C. horticola* (Goureau), new combination; *C. senecionella* (Sehgal), new combination. Also *C. lactuca* (Frost), new combination; *C. erigerontophaga* (Spencer), new combination; *C. asteris* (Hendel), new combination; and the African *C. seneciovora* (Spencer), new combination.

*On Juncaceae*

*Chromatomyia luzulae* (Hering), new combination.

*On Gramineae*

All species described under *Phytomyza*, namely: *Chromatomyia milii* (Kaltenbach), new combination; *C. nigra* (Meigen); *C. fuscula* (Zetterstedt), new combination; *C. puccinelliae* (Spencer), new combination.

*Of unknown life-history*

*Chromatomyia perangusta* (Sasakawa), new combination (Formosa); *C. opacella* (Hendel), new combination (Europe); *C. regalensis* (Steyskal), new combination (U. S. A.); *C. merula* (Spencer), new combination (Canada).

I have previously (Griffiths, 1967) referred to the fact that the name *Chromatomyia* was also proposed by Walker (1849) for a genus of Ortalinae (Tephritidae *s. l.*). Walker's and Hardy's works were both nominally published in December 1849, and it is no longer possible to establish which was in fact distributed first. I drew this matter to the attention of the Secretariat of the International Commission on Zoological Nomenclature, but they declined to take any action. I therefore propose to regard Hardy's name as having priority for purposes of nomenclature on my own authority.

## TERMS APPLIED TO AEDEAGUS

The apomorphous structure of the distal section of the aedeagus in *Chromatomyia* poses certain terminological difficulties. Sclerites of the medial lobe ("hypophallus") are well developed in some species, although the lobe itself is poorly differentiated; in others they are reduced or lost. As in other Agromyzidae the sclerites of the medial lobe are well separated at their base. In some previous descriptions certain more centrally situated sclerotization below

part of the ejaculatory duct (such as the trough-like sclerite in *lonicerae*, Fig. 11) has been mistaken for sclerotization of the medial lobe. It is not clear whether such sclerotization can be homologized with any of the sclerotization found in other genera of Agromyzidae (possibly the paramesophalli are involved, but this is rather speculative). The terminal section of the ejaculatory duct is either membranous or forms a sclerotized tubule. I doubt whether such a tubule is homologous with any sclerotization found in other genera of Agromyzidae, and therefore avoid the terms distiphallus and mesophallus in describing the aedeagi of *Chromatomyia.* Sclerites of the "dorsal" lobe are called supporting sclerites when discrete (following von Tschirnhaus, 1969), or the supporting sclerite complex when paired sclerites are not differentiated. The lettering on Fig. 11 and 14 exemplifies my use of the above terms.

## PRELIMINARY REMARKS ON CAPRIFOLIACEAE-MINERS

Whether all the Caprifoliaceae-mining species of *Chromatomyia* form a monophyletic group cannot be determined until further information is available on other species. Two European species, *lonicerae* and *aprilina*, stand apart from the rest by virtue of retained plesiomorphous characters, namely: (i) the presence of the second cross-vein (m-m) (Fig. 3), (ii) the high costal ratio $mg_2/mg_4$ (over 3.0), and (iii) the presence of the "trough-like sclerite" supporting part of the terminal section of the ejaculatory duct (Fig. 11). The only other *Chromatomyia* species in which the second cross-vein is retained are some of the miners of Gentianaceae.

Ten of the species of Caprifoliaceae-miners probably form a monophyletic group, which I propose to call the *periclymeni* group. These species are: *periclymeni, gregaria, involucratae, symphoricarpi, caprifoliae, fricki, linnaeae, nigrilineata, alpigenae* and *chamaemetabola.* Synapomorphous characters of these species are: (i) the loss of the second cross-vein (m-m) (Fig. 2), (ii) the lower costal ratio $mg_2/mg_4$ (up to 3.0 only in the largest species, *involucratae*), and (iii) the loss of all sclerotization supporting the terminal section of the ejaculatory duct. The adults of this group are very uniform in appearance, and can in most cases be separated only by careful study of the male aedeagus. Caught females can usually not be identified to species. The European species *nervi* probably does not belong to the *periclymeni* group, as it has a high costal ratio and puparia with posterior spiracles like those of *lonicerae* (with long dorsal horn). Clarification of its relationships must await discovery of the male.

No holarctic species have been found among the *Chromatomyia* miners of *Lonicera* and *Symphoricarpos.* Presently both these plant genera find the northern limits of their range in the northern part of the Alaska Panhandle near Haines, where *Symphoricarpos rivularis* Suksd. and *Lonicera involucrata* (Richards.) have both been collected (Hulteń, 1968). It seems unlikely that the Asiatic and North American ranges of these plant genera have met at any time during the Pleistocene. However, a holarctic distribution may be expected for the newly discovered *Linnaea*-miner (*linnaeae*), since the host plant is widespread at more northerly latitudes, including both sides of the Bering Sea.

In Europe the three lowland species of *Chromatomyia* (*lonicerae, aprilina* and *periclymeni*) apparently attack whatever *Lonicera* species are available, and two of them also attack the introduced *Symphoricarpos rivularis* Suksd. The two alpine species (*alpigenae* and *nervi*) may be more restricted in their host choice, but this requires confirmation as they have been collected only on few occasions. In Alberta the situation is different. The *Chromatomyia* miners of *Symphoricarpos* are different from those of *Lonicera*; and within *Lonicera* the two species occuring in the Edmonton area, *L. dioica* L. and *L. involucrata* (Richards.), are attacked by different *Chromatomyia* miners.

There is some nomenclatural confusion in the records of *Symphoricarpos* species as hosts of Agromyzidae. In this paper I apply the name *Symphoricarpos albus* (L.) only to the low-growing small-leaved plant common in Alberta, known as subspecies *albus* by those who apply the species name in a wider sense. I call the taller plant widespread on the West Coast *Symphoricarpos rivularis* Suksd., irrespective of the name used in any previous citing of the record. This is the plant widely introduced in Europe. It is also known to botanists as *Symphoricarpos albus* subsp. *laevigatus* (Fern.) or *S. racemosus* var. *laevigatus* (Fern.). In the literature on Agromyzidae this plant has often been listed as *Symphoricarpos albus* (L.) or *S. racemosus* Michx. without qualification.

Hering (1962) has described *Phytomyza isicae* on the basis of a male fly which he caught on *Lonicera caerulea* L. in the Austrian Alps (Brunnstein-See im Warscheneck-Gebirge). I have examined this holotype (including genitalia preparation) through courtesy of K. A. Spencer. In my opinion it is not a *Lonicera*-feeder, but belongs to *Chromatomyia milii* (Kaltenbach), a widespread grass-feeding species. The empty mines and larvae on *Lonicera* which Hering associated with "*isicae*" are in my opinion those of a *Paraphytomyza* species.

I received no material from the eastern half of North America. Frost (1924) recorded "*Phytomyza obscurella* var. *nigritella* (Zett.) Melander" from leaves of "peach, black cherry and bush honeysuckle" in Pennsylvania and New York. Obviously he had more than one species before him. The flies from honeysuckle (*Lonicera*) presumably belonged to a species of the *Chromatomyia periclymeni* group, but I cannot determine which species was involved from the limited information provided.

## DIAGNOSIS

In the available keys to species of *Phytomyza s. l.*, the *Chromatomyia* species are found scattered in different parts of the key due to early divisions based on colour, costal ratio and other characters subject to variation among closely related species. I have therefore included my new species in an entirely new key to adults of the *Chromatomyia* species of North America (below). This key can be used for males alone or for males and females in association; but not for females alone. A similar key to European species cannot yet be offered, as there are still many species of *Phytomyza s. l.* whose genitalia have not yet been studied.

Keys to *Chromatomyia* miners on *Lonicera* and *Symphoricarpos* are also given below. Larvae of various *Paraphytomyza* species also mine the leaves of these host genera. Mines of most *Chromatomyia* species can be readily separated from those of *Paraphytomyza* by the formation of puparia inside the leaf. The two exceptions, *alpigenae* and *chamaemetabola*, have a form of mine (linear channels radiating from midrib) not found in *Paraphytomyza*. The new miner on *Linnaea* is the only miner of any kind known on that plant.

**Key to North American species of *Chromatomyia***

1. Third antennal article with long white pubescence, enlarged in female (Spencer, 1969b, Fig. 449-450) ..... *C. lactuca* (Frost)
– Third antennal article with short pubescence, not sexually dimorphic ..... 2
2. (1) Acrostichals very few (0-4). Terminal section of ejaculatory duct forming sclerotized distal tubule ..... 3
– Acrostichals normally more numerous. If very few (in some specimens of *puccinelliae*), terminal section of ejaculatory duct scarcely sclerotized ..... 4

3. (2) Distal tubule of aedeagus as figured by Griffiths (1967, Fig. 12), bent at single point ..... *C. syngenesiae* Hardy
– Distal tubule of aedeagus more sinuate (Sehgal, 1971, Fig. 123; Griffiths, 1972b, Fig. 13) ..... *C. senecionella* (Sehgal)
4. (2) Third antennal article much enlarged. Aedeagus as figured by Spencer (1969b, Fig. 427-428) ..... *C. erigerontophaga* (Spencer)
– Third antennal article not enlarged ..... 5
5. (4) Acrostichals in 2 rows ..... 6
– Acrostichals in at least 4 rows anteriorly ..... 8
6. (5) Eyes densely pubescent. Aedeagus characterized by hypertrophy of sclerites of distal section (Griffiths, 1964, Fig. 7; Spencer, 1969b, Fig. 469) ..... *C. nigra* (Meigen)
– Eyes sparsely pubescent. Aedeagus not as above ..... 7
7. (6) Frons black. Supporting sclerite complex as figured by Spencer (1969b, Fig. 497) ..... *C. puccinelliae* (Spencer)
– Frons deep yellow, or more rarely brown. Supporting sclerite complex as figured by Spencer (1969b, Fig. 432) ..... *C. fuscula* (Zetterstedt)
8. (5) Genae broad, almost half eye height. Each supporting sclerite forked (Spencer, 1969b, Fig. 459) ..... *C. merula* (Spencer)
– Genae narrower. Supporting sclerites not forked ..... 9
9. (8) No sclerites in distal section of aedeagus except pair of supporting sclerites; terminal section of ejaculatory duct in slender membranous process (Steyskal, 1972, Fig. 8) ..... *C. regalensis* (Steyskal)
– Not as above; additional sclerites present in distal section of aedeagus, except in *nigrilineata* ..... 10
10. (9) 11-16 postsutural ia. Aedeagus as figured by Griffiths (1972a, Fig. 8-9), with Y-shaped supporting sclerite complex and with terminal section of ejaculatory duct supported by ventral sclerotization ..... *C. deirdreae* (Griffiths)
– Fewer postsutural ia. Aedeagus not as above ..... 11
11. (10) Supporting sclerite complex consisting of pair of slender parallel rods; terminal section of ejaculatory duct supported by ventral sclerotization ..... 12
– Supporting sclerite complex not divided into paired sclerites; terminal section of ejaculatory duct entirely membranous, not supported by ventral sclerotization (in ventral view wide gap between laterally situated sclerites of medial lobe). 14
12. (11) Supporting sclerites slightly clubbed apically, not turned downwards (Spencer, 1969b, Fig. 460; Sehgal, 1971, Fig. 113) ..... *C. milii* (Kaltenbach)
– Supporting sclerites turned downwards apically ..... 13
13. (12) Aedeagus as figured by Griffiths (1972a, Fig. 13). Mesonotum strongly shining ..... *C. mitellae* (Griffiths)
– Aedeagus as figured by Griffiths (1972a, Fig. 17). Mesonotum finely grey-dusted, only weakly shining ..... *C. tiarellae* (Griffiths)
14. (11) Basal sclerites of aedeagus extending anterior to base of supporting sclerite complex (Fig. 26, 29, 31) ..... 15
– Basal sclerites of aedeagus ending at or posterior to base of supporting sclerite complex ..... 17
15. (14) Supporting sclerite complex straight and parallel-sided in lateral view, narrow in ventral view (Fig. 26-27) ..... *C. caprifoliae* (Spencer)
– Supporting sclerite complex tapered apically in lateral view, broader in ventral view (Fig. 29-32) ..... 16

16. (15) Wing length: ♂, 1.3-1.7 mm; ♀, 1.7-1.85 mm ..... *C. fricki* n. sp.
– Wing length: ♂, 1.7-2.2 mm; ♀, 2.3-2.5 mm ..... *C. linnaeae* n. sp.
17. (14) Wing length 2.7-3.3 mm. Ejaculatory apodeme rather large (Fig. 25). Aedeagus as Fig. 23-24 ..... *C. involucratae* (Spencer)
– Wing length shorter. Ejaculatory apodeme very small ..... 18
18. (17) Sclerites of medial lobe minute or absent (Fig. 33)..... *C. nigrilineata* n. sp.
– Sclerites of medial lobe well developed ..... 19
19. (18) Sclerites of medial lobe band-shaped (Fig. 39)..... *C. chamaemetabola* n. sp.
– Sclerites of medial lobe subtriangular or diamond-shaped ..... 20
20. (19) Supporting sclerite complex with mid-dorsal hump in lateral view (Fig. 20).... ..... *C. gregaria* (Frick)
– Supporting sclerite complex gradually tapered in lateral view, without such hump (Fig. 17) ..... *C. symphoricarpi* n. sp.

**Key to *Chromatomyia* mines on *Lonicera****

1. Larvae leaving leaf before puparium formation, forming communal mine along midrib from which radiate linear channels (Fig. 45, 52) ..... 2
– Puparia formed inside leaf, with anterior spiracles projecting ventrally through epidermis ..... 3
2. (1) North America. On *L. involucrata* (Richards.)..... *C. chamaemetabola* n. sp.
– Central Europe. On. *L. alpigena* L., *L. nigra* L. and *L. xylosteum* L. ..... ..... *C. alpigenae* (Hendel)
3. (1) Posterior spiracles of puparium and third instar larva with conspicuous dorsal horn much longer than ventral (Fig. 6) ..... 4
– Posterior spiracles of puparium and third instar larva knob-shaped or with short more or less equal horns (Fig. 4-5) ..... 5
4. (3) Mine consisting largely of broad channel over midrib on basal part of leaf (Fig. 53). Central Europe. On *L. alpigena* L. ..... *C. nervi* (Groschke)
– Mine in leaf parenchyma, linear, with initial stellate channels (Fig. 43). Europe. ..... *C. lonicerae* (Robineau-Desvoidy)
5. (3) Puparia white with contrasting black stripe along centre-line of venter. North America. On *L. dioica* L. ..... *C. nigrilineata* n. sp.
– Puparia more or less unicolorous, without contrasting ventral stripe ..... 6
6. (5) Larvae forming communal mine along midrib, from which radiate linear channels (Fig. 46). North America. On. *L. involucrata* (Richards) ..... ..... *C. gregaria* (Frick)
– Mine normally produced by single larva. Europe and North Africa ..... 7
7. (6) Puparia pale green (white when empty), with small posterior spiracles scarcely raised above level of last segment. Mine with long linear channels (Fig. 42). .. ..... *C. aprilina* (Goureau)
– Puparia ochreous yellow or brown, with posterior spiracles on large conical projections. Mine irregular blotch, at most with short linear offshoots (Fig. 44A, 44B) ..... *C. periclymeni* (de Meijere)

**Key to *Chromatomyia* mines on *Symphoricarpos***

1. Posterior spiracles of puparium and third instar larva with conspicuous dorsal horn much longer than ventral (Fig. 6). Europe ..... *C. lonicerae* (R. - D.)

* excluding the unnamed *Chromatomyia* from Japan.

– Posterior spiracles of puparium and third instar larva knob-shaped or with short more or less equal horns (Fig. 4-5) ..... 2

2. Posterior spiracles of puparium on large conical projections (compare Fig. 4), with 15-21 bulbs. Europe. ..... *C. periclymeni* (de Meijere)

– Posterior spiracles of puparium on short projections or scarcely raised above level of last segment (Fig. 5), with not more than 15 bulbs. North America..... 3

3. Mine irregular blotch over midrib on basal part of leaf (Fig. 49). Puparia 2.0-2.3 mm long. ..... *C. symphoricarpi* n. sp.

– Mine in leaf parenchyma. Puparia 1.6-1.85 mm long. ..... 4

4. Mine linear-blotch, not stellate initially (Fig. 48)..... *C. caprifoliae* (Spencer)

– Mine stellate initially, then becoming irregular blotch (Fig. 47).. *C. fricki* n. sp.

## TREATMENT OF SPECIES

### *Chromatomyia aprilina* (Goureau 1851), new combination

"*Chromatomyia flaviceps* (Macquart)". Hardy, 1849: 390. (nomen dubium).

*Phytomyza aprilina* Goureau. Goureau, 1851: 145. Spencer, 1969a: 19. Lectotype ♂ by present designation, Cherbourg (France), in University Museum, Oxford.

*Phytomyza xylostei* Robineau-Desvoidy. Goureau, 1851: 145. Robineau-Desvoidy, 1851: 398. Lectotype ♂ by present designation same specimen as lectotype of *aprilina*. Synonymy after Goureau, 1851: 145.

*Agromyza lonicerae* Kaltenbach. Kaltenbach, 1862: 93.–1874: 306. Syntypes ♂♀, Homburg (Germany), in Zoologisches Museum, Humboldt Universität, Berlin. Synonymy after Spencer, 1969a: 19.

*Napomyza lonicerae* (Kaltenbach). Hering, 1925: 378.

*Phytomyza (Napomyza) lonicerae* (Kaltenbach). Hering, 1932: 578. De Meijere, 1934: 284. Secondary homonym of *Phytomyza lonicerae* Robineau-Desvoidy (1851).

*Phytomyza (Napomyza) lonicerella* Hendel. Hendel, 1932: 317. De Meijere, 1938: 88. New name for *Agromyza lonicerae* Kaltenbach (1862).

*Adult.* – Head with orbits only slightly projecting above eye in lateral view; genae in middle 1/4 to 1/3 of eye height; eyes with fine inconspicuous pubescence. Frons at level of front ocellus about twice width of eye. Two ors, of equal length, posteriorly directed; two pairs of strong inwardly directed ori and in some specimens also very short third pair; orbital setulae one-rowed. Peristomal margin with vibrissa and 3 upcurved peristomal setulae. Third antennal article rounded distally, with short pubescence.

3 + 1 dc; acr numerous anteriorly (in 4-6 rows), becoming sparse posteriorly; presutural ia numerous; 4-5 postsutural ia; inner pa over half as long as outer pa.

Second cross-vein (m-m) normally present (Fig. 3), situated close to wing base shortly beyond first cross-vein (r-m) (but absent on one wing in one specimen). Costal ratio $mg_2/mg_4$ 4.2-4.5. Wing length 2.7-3.2 mm.

Frons whitish yellow centrally, with ocellar plate and vertex contrastingly dark (both vt on dark ground, or vti on boundary between dark and pale ground); orbits yellow anteriorly, becoming brownish posteriorly. Face and genae whitish yellow. Occiput dark dorsally, becoming yellowish ventrally. Antennae with first and second articles yellow, contrasting with dark third article. Palpi brown; labella whitish yellow. Thorax finely grey-dusted over largely black ground-colour, only weakly shining, with yellow coloration only along seams of sutures

(especially notopleural and mesopleural sutures) and at margins of humeral calli (especially around anterior spiracles); wing base and squamae yellowish white, latter with dark fringe. Legs with coxae, trochanters and femora largely dark, with tips of femora contrastingly yellow; tibiae largely brown or yellow-brown; tarsi deep yellow or yellow-brown. Abdomen largely brown, becoming yellow-brown on sides at base. Basal cone of ovipositor (♀) almost entirely grey-dusted.

Male postabdomen with 8th sternum fused with 6th tergum. Telomeres not delimited from periandrium, indicated by dense group of short setulae. Pregonites with short, weakly pigmented ventral extensions. Aedeagus as Fig. 7-8, with basal sclerites relatively small, ending posterior to base of supporting sclerite complex; sclerites of medial lobe joined at their base with the trough-like sclerite (this narrower basally than in *lonicerae*) which supports part of the terminal section of the ejaculatory duct; supporting sclerite complex large, with V-shaped ridge visible in dorsal and ventral views. Ejaculatory apodeme small, unpigmented (Fig. 9).

The aedeagus has previously been figured by Spencer (1969a).

*Puparium and third instar larva.* – See the descriptions of de Meijere (1934, 1938). Mandibles with two alternating teeth; right mandible longer than left (notwithstanding de Meijere's figure to the contrary). Anterior spiracles knob-shaped, with about 14 irregularly distributed bulbs; posterior spiracles small, scarcely raised above level of last segment, knob-shaped (more or less circular in posterior view), with 11-16 bulbs; anus flanked by pair of prominent tubercles ("anal lobes"). Puparia pale green (white when empty), 2.8 mm long.

*Mine.* – Larvae solitary leaf-miners on *Lonicera*. Mine (Fig. 42) initially in midrib with short linear channels radiating into parenchyma, later with long linear channels (up to 1½ mm wide) extending to all parts of leaf, appearing white in reflected light when fresh; faeces deposited as fine particles, mostly forming long beaded strips; mine formed largely on upper surface of leaf, but with parts of initial channels on lower surface and with puparium formation following in chamber on lower surface. Puparium with its ventral surface adjacent to lower surface of leaf, with its anterior spiracles projecting ventrally through epidermis.

The mine has previously been figured by Hering (1932, 1957).

*Material examined.* – Lectotype ♂, 1 ♀ paratype bred by Goureau from *Lonicera xylosteum* L., Cherbourg, France (emerged in April from larvae collected in March). 1 ♂ 1 ♀ from mines on *Lonicera periclymenum* L., Lyon, France, emerged 13-18.ix.36, leg. Riel. 1 ♀ from puparium 18.vi.52 on *Lonicera periclymenum* L., The Lizard, Cornwall, England, emerged 27.vi.52, leg. K. A. Spencer. 1 ♂ from larva 15.ix.54 on *Lonicera periclymenum* L., Wonwell, Devon, England, emerged 10.x.54, leg. K. A. Spencer. Preparation of larva 30.viii.66 on *Lonicera periclymenum* L., Poulavallan, Co. Clare, Ireland, leg. G. C. D. Griffiths.

*Other records.* – This species seems restricted to Western and Southern Europe and North Africa. Firm records are as follows.

Britain – Widespread and common on *Lonicera periclymenum* L. in Ireland, Wales and the West of England (from Cornwall to Cumberland); apparently local in the East (recently reported only from localities in Northumberland, Hants. and Surrey). Locality records given by Griffiths (1966, 1968) and Spencer (1972); also sheets for Luccombe (Isle of Wight) and the New Forest (Hants.) in Hering's mine herbarium. Hardy's "*flaviceps*" collected in Berwickshire is presumably also this species, since the name (meaning yellow-headed) is appropriate to no other *Lonicera*-miner.

France – In addition to the above localities, recorded also on *Lonicera periclymenum* L. at Barbizon, near Fontainebleau (de Meijere, 1934); also sheets of *L. periclymenum* L. in Hering's mine herbarium for Hermanville and Verson (Normandy), and of *L. xylosteum* L. for Mesnil (near Paris).

Germany – Collected by Kaltenbach on *Lonicera periclymenum* L. at Homburg (near Saarbrücken); also in Bavaria according to Hering (1957), unfortunately without details of the record.

Norway – Kristiansand, 14.vii.72, mines on *Lonicera periclymenum* L. (K. A. Spencer).

Spain – Mines on *Lonicera* sp. at Montserrat, 19.iv.58 (Spencer, 1960).

Portugal – Mines on *Lonicera implexa* Ait. at Sintra, flies emerged 20.iii and 2.v.53 (Spencer, 1954).

Corsica – Corté and Sagone, on *Lonicera periclymenum* L. (Buhr, 1941b).

Italy – Mines on *Lonicera implexa* Ait., Portici (Naples), 20-25.viii.59 (sheet in Hering's mine herbarium).

Morocco – 4 ♀♀ from puparia 23.i.66 on *Lonicera biflora* Desf., Tangiers (La Montagne), emerged 28.i - 6.ii.66 (Spencer, 1967).

*Remarks.* – The application of the name *Phytomyza aprilina* Goureau (= *xylostei* Robineau-Desvoidy) was universally misunderstood until Spencer (1969a) inferred that it applied to the present species. The rediscovery of type material has now confirmed that Spencer's interpretation is correct. The numerous records of "*xylostei* R.-D." prior to Spencer's paper refer to *Paraphytomyza luteoscutellata* (de Meijere). The types of *Agromyza lonicerae* Kaltenbach were redescribed by Hering (1925). There is no doubt that they belong to the present species, since this can be readily separated from all other *Chromatomyia* miners of Caprifoliaceae by its largely yellow head, including yellow first and second antennal articles.

Since the earliest published description of this species is in Goureau's (1851) paper, antedating Robineau-Desvoidy's (1851) paper by one month, it is preferable to use Goureau's name. The listing of Robineau-Desvoidy's names in Goureau's paper (presumably to serve as a cross-reference) should not be construed as description under those names.

The collection dates suggest that this species is bivoltine in the northern parts of its range. The form of the mine and pale green puparia are diagnostic.

### *Chromatomyia lonicerae* (Robineau-Desvoidy 1851), new combination

*Phytomyza lonicerae* Robineau-Desvoidy. Robineau-Desvoidy, 1851: 596. Lectotype ♂ by present designation, Cherbourg (France), in University Museum, Oxford.

*Agromyza xylostei* Kaltenbach. Kaltenbach, 1862: 93. Types lost; type-locality, Germany. New synonymy.

*Phytomyza (Napomyza) harlemensis* Weyenbergh. Weyenbergh, 1870: 196. Lectotype ♂ by designation of Spencer (1969a: 21), Haarlem (Holland), in Zoölogisch Museum, Amsterdam. New synonymy.

*Phytomyza xylostei* (Kaltenbach). Kaltenbach, 1874: 306. Trägårdh, 1909: 301. Secondary homonym of *Phytomyza xylostei* Robineau-Desvoidy (1851).

*Napomyza xylostei* (Kaltenbach). Hendel, 1920: 151. De Meijere, 1924: 143.–1926: 233. Hering, 1926: 454.–1927: 85. Nowakowski, 1962: 104.

*Phytomyza (Napomyza) xylostei* (Kaltenbach). Hendel, 1934: 322. De Meijere, 1937: 236.

*Phytomyza harlemensis* Weyenbergh. Spencer, 1969a: 19.

*Adult.* – Head with orbits not or only slightly projecting above eye in lateral view; genae in middle 1/5 to 1/4 of eye height; eyes with very fine, sparse inconspicuous pubescence. Frons at level of front ocellus about twice width of eye. Ors directed posteriorly, ori directed inwardly; posterior ors variable in length, half to fully as long as anterior ors; only one strong ori (anterior ori short or absent); orbital setulae one-rowed. Peristomal margin with vibrissa and 3-4 upcurved peristomal setulae. Third antennal article rounded distally, with fairly short pubescence.

3 + 1 dc; acr numerous anteriorly (in 4-5 rows), becoming sparse posteriorly; presutural ia numerous; 2-7 postsutural ia; inner pa 1/4 to 1/2 as long as outer pa.

Second cross-vein (m-m) present, situated close to wing base just beyond (or in one specimen opposite) first cross-vein (r-m). Costal ratio $mg_2/mg_4$ 3.1-3.5 (means: ♂, 3.2; ♀, 3.3). Wing length: ♂, 1.95-2.1 mm (mean 2.0 mm); ♀, 2.1-2.7 mm.(mean 2.35 mm).

Colour largely dark. Frons largely pale brown, with black ocellar plate; genae pale brown. Antennae with first and second articles brown, third article black. Palpi black; labella dull yellow. Thorax finely grey-dusted over black ground colour, only weakly shining, with pale coloration only along seams of sutures (especially notopleural and mesopleural sutures); wing base and squamae yellowish white, latter with dark fringe. Legs with coxae, trochanters and femora largely dark, with tips of front femora contrastingly yellow; tips of other femora yellow-brown (scarcely contrasting); tibiae largely brown or yellow-brown, becoming yellow basally; tarsi deep yellow or yellow-brown. Abdomen largely brown. Basal cone of ovipositor (♀) grey-dusted on basal two-thirds.

Male postabdomen with 8th sternum fused with 6th tergum. Telomeres not delimited from periandrium, indicated by dense group of short setulae. Pregonites with short, weakly pigmented ventral extensions. Aedeagus as Fig. 10-12, with very broad basal sclerites ending posterior to base of supporting sclerite complex; sclerites of medial lobe small but well defined, close to apex of basal sclerites; large trough-like sclerite (broad basally, tapered to point distally) supporting part of terminal section of ejaculatory duct (situated between sclerites of medial lobe); supporting sclerite complex consisting of pair of large conspicuous lateral sclerites and small narrow forked sclerite (visible in dorsal or ventral view) on centre-line. Ejaculatory apodeme small, weakly pigmented in most specimens (Fig. 13).

The male genitalia have been previously figured by Nowakowski (1962) (as *xylostei*) and by Spencer (1969a) (as *harlemensis*).

*Puparium and third instar larva.* – See the descriptions of Trägårdh (1909) and de Meijere (1926, 1937). Mandibles with two alternating teeth; right mandible longer than left. Anterior spiracles with two equal horns, with 14-18 bulbs; posterior spiracles (Fig. 6) on short conical projections, with 20-25 bulbs, with short ventral and very long dorsal horn (the latter dorsally or posteriorly directed on puparium); anus flanked by pair of prominent tubercles ("anal lobes"). Puparia largely golden yellow or yellow-brown, but mostly somewhat infuscated on venter, 2.0-2.5 mm long.

*Mine.* – Larvae solitary leaf-miners on *Lonicera* and *Symphoricarpos*. Mine (Fig. 43) initially stellate, with short channels radiating from oviposition site, then irregularly linear (in most cases branching), 1-1½ mm wide terminally, appearing white in reflected light when fresh; faeces deposited as fine particles, partly forming long beaded strips (especially in mines on *Lonicera periclymenum* L.); mine formed largely on upper surface of leaf, but in many cases with initial stellate channels partly on lower surface and with puparium formation sometimes following in chamber on lower surface. Puparium with its ventral surface adjacent to (upper or lower) surface of leaf, with its anterior spiracles projecting ventrally through epidermis.

*Material examined.* – Lectotype ♂, 1 ♀ paratype bred by Goureau from "chevrefeuille à fruits blancs"(presumably *Symphoricarpos rivularis* Suksd.), Cherbourg, France. 1 ♂ from puparium 3.ix.65 on *Symphoricarpos rivularis* Suksd., Balquhidder, Perth, Scotland, emerged 4.ix.65, leg. K. A. Spencer. 1 ♂ from puparium 20.viii.56 on *Symphoricarpos rivularis* Suksd., Grasmere, Westmorland, England, emerged 28.viii.56, leg. K. A. Spencer. 1 ♀ from puparium 8.xi.53 on *Lonicera periclymenum* L., Northaw Great Wood, Herts., England, emerged 8.v.54, leg. G. C. D. Griffiths; 2 ♀♀ from puparia 6.viii.54, same plant and locality, emerged 14 and 24.viii.54, leg. G. C. D. Griffiths. 2 ♀♀ from puparia 31.vii.54 on *Lonicera periclymenum* L.,

Chilworth, Surrey, England, emerged 13-14.viii.54, leg. G. C. D. Griffiths. 1 ♀ from mine 30.vii.19 on *Lonicera periclymenum* L., 's Hage, Holland, emerged 20.viii.19, leg. J. C. H. de Meijere. 1 ♀ from puparium 19.vi.21 on *Lonicera periclymenum* L., Winterswijk, Holland, emerged 21.vi.21, leg. J. C. H. de Meijere. 1 ♂ from mine 1.vi.21 on *Lonicera periclymenum* L., Bussum, Holland, emerged 26.vi.21, leg. J. C. H. de Meijere. 2 ♂♂ 1 ♀ from mines vii.23 on *Lonicera periclymenum* L., Bergen-binnen, Holland, emerged 17.vii-7.viii.23, leg. J. C. H. de Meijere. 1 ♂ from mine on *Lonicera periclymenum* L., Berlin (-Jungfernheide), Germany, emerged 22.vii.19, leg. M. Hering (no. 1158). 1 ♂ from mine on *Lonicera alpigena* L., Beuron, Baden-Württemberg, Germany, 1943, leg. E. M. Hering. 1 ♂ 2 ♀♀ from mines 11.x.50 on *Lonicera nigra* L., Betzigau, Bavaria, Germany, emerged 9.iii.51, leg. F. Groschke. 2 ♀♀ from puparia 14.vii.65 on *Symphoricarpos rivularis* Suksd., Mühlhausen (Rieseninger), Thuringia, Germany, emerged 17.vii.64, leg. H. Buhr (no. 2486). Preparations of two larvae 2.ix.66 on *Symphoricarpos rivularis* Suksd., Ballynalacken, Co. Clare, Ireland, leg. G. C. D. Griffiths.

*Other records.* – This species is common in much of Northern and Central Europe. Records for Japan (Sasakawa, 1954 and 1961; Kuroda, 1960) (as *xylostei*) refer to a different species, as is clear from the obvious discrepancies in the descriptions of these authors. The record for Roumania (Popescu-Gorj and Drăghia, 1966) is also probably incorrect, as the authors state that the puparia were formed outside the mine. Firm records are as follows.

Britain – Widespread from South-East England to Sutherland (Scotland) and the West coast of Ireland, common on both the native *Lonicera periclymenum* L. and the introduced *Symphoricarpos rivularis* Suksd.; locality records given by Inchbald (1882, 1885), Spencer (1955) and Griffiths (1961, 1966, 1968).

Holland – Widespread on *Lonicera periclymenum* L. and *Symphoricarpos rivularis* Suksd. (de Meijere, 1924 and 1926). Hering also collected mines on *Lonicera ruprechtiana* Regel in Amsterdam Botanical Gardens (sheet in his mine herbarium).

Germany – "Common everywhere" (Hering, 1927); locality records given by Voigt (1929) (on *Lonicera periclymenum* L., *L. xylosteum* L., *L. tatarica* L. and *Symphoricarpos rivularis* Suksd.), Buhr (1932, 1941a, 1964) (on *Lonicera caprifolium* L., *L. nigra* L., *L. periclymenum* L., *L. tatarica* L., *L. xylosteum* L., *Symphoricarpos rivularis* Suksd., and also in botanical gardens on *S. rotundifolius* Gray. and *Lonicera brownii* var. *fuchsioides* Rehd.), Griffiths (1966) (collections by Buhr on *Lonicera orientalis* Lam. and *Symphoricarpos rivularis* Suksd.) and Zoerner (1969, 1970) (on *Lonicera periclymenum* L.). In addition there is a sheet of mines on cultivated plants of *L. caerulea* L. in Hering's mine herbarium.

Austria – Reaching 1000 metres elevation in the Tirolean mountain forest (Hendel, 1934); also sheet of *Lonicera alpigena* L. for Mauthen (Carinthia) in Hering's mine herbarium.

Czechoslovakia – Brno and Vranov, on *Symphoricarpos rivularis* Suksd. and *Lonicera xylosteum* L. (Starý, 1930).

Poland – Reported from localities near the Baltic Coast, in Silesia and in the Pienin mountains, on *Lonicera periclymenum* L., *L. xylosteum* L. and *Symphoricarpos rivularis* Suksd. (see Nowakowski, 1954).

Denmark – Syd-Fyen, on *Symphoricarpos rivularis* Suksd. (Trägårdh, 1909); Bornholm, on *Lonicera periclymenum* L., *L. tatarica* L. and *L. xylosteum* L. (Buhr, 1932); other localities listed by Sønderup (1949) (mines on *Lonicera* and *Symphoricarpos*).

Norway – Lillesand, 13.vii.72, mines on *Symphoricarpos rivularis* Suksd. (K.A.Spencer).

Sweden – Reported by Rydén (1934, 1940, 1952) from Skåne, Öland and Gotland (on *Symphoricarpos rivularis* Suksd. and *Lonicera xylosteum* L.).

Finland – Korso (Nylandia), on *Lonicera xylosteum* L. (Linnaniemi, 1913). Frey's (1946) records require checking, as they are based on caught flies which were not dissected.

*Remarks.* – This well-known species has a confused synonymy. Most authors have called it *Phytomyza* or *Napomyza xylostei* (Kaltenbach), a correct name but one whose availability has been in doubt because of secondary homonymy. Because of this difficulty Spencer (1969a) proposed to revive the use of the later name *harlemensis*. However, following the rediscovery of Robineau-Desvoidy's types, I have established that his name *lonicerae* applies to this species. On grounds of priority this name should now be used.

In extracting information from the literature, care should be taken not to confuse records of the present species as *xylostei* (Kaltenbach) with records of "*xylostei* Robineau-Desvoidy". The latter specific name, irrespective of what generic name it was combined with, has generally been applied to *Paraphytomyza luteoscutellata* (de Meijere) (see Spencer, 1969a). In fact this usage was quite incorrect, since the original *Phytomyza xylostei* R.-D. was the species treated above under the name *Chromatomyia aprilina* (Goureau). The nomenclature here proposed has the happy effect of eliminating all the confusing uses of the name *xylostei.*

Hering (1951) proposed to interpret *Phytomyza lonicerae* Robineau-Desvoidy as a certain *Paraphytomyza* species, and designated a neotype to this effect on the assumption that the original types had been lost. Now that the original types have been found, Hering's neotype designation must be set aside. His interpretation was in any case scarcely compatible with the original description of *lonicerae.*

This species is multivoltine in all known parts of its range. The larvae and puparia may be readily separated from those of all other Caprifoliaceae-feeding species except *nervi* by the presence of long horns on the posterior spiracles. The retention of the second cross-vein will distinguish the adult from all other Caprifoliaceae-feeding species in Europe except *aprilina.* I doubt the correctness of Hendel's (1934) statement that this cross-vein is occasionally absent; this was probably based on a female he misidentified in Hering's collection (its costal ratio is too low for *lonicerae*).

### *Chromatomyia nervi* (Groschke 1957), new combination (♀)

*Phytomyza nervi* Groschke. Hering, 1956: 273. Groschke and Hering, 1957: 132. Holotype ♀, Bavaria (Germany), in Staatliches Museum für Naturkunde, Ludwigsburg.

*Adult.* – Head with orbits narrowly projecting above eye in lateral view; genae in middle 1/4 to 1/3 of eye height; eyes with very fine, sparse inconspicuous pubescence. Frons at level of front ocellus about twice width of eye. Two ors, of equal length, posteriorly directed; two ori, inwardly directed, anterior about half as long as posterior; orbital setulae one-rowed. Peristomal margin with vibrissa and 4-5 upcurved peristomal setulae. Third antennal article rounded distally, with short pubescence.

3 + 1 dc; acr numerous anteriorly (in 5-6 rows), becoming sparse posteriorly; presutural ia numerous; 1-3 postsutural ia; inner pa about half as long as outer pa.

Second cross-vein (m-m) absent. Costal ratio $mg_2/mg_4$ 3.3-4.0. Wing length 2.8 mm in holotype (erroneously stated to be 1.4-1.6 mm in original description).

Colour largely dark. Frons largely yellow-brown, with black ocellar plate and vertex (vte on black ground, vti on boundary between black and yellow-brown ground); genae yellow-brown. Antennae with first article yellow-brown, second and third articles black. Palpi black; labella dull yellow. Thorax finely grey-dusted over black ground-colour, only weakly shining,

with pale coloration only along seams of sutures (especially notopleural and mesopleural sutures); wing base and squamae yellowish white, latter with dark fringe. Legs with coxae, trochanters and femora largely dark, with tips of front femora contrastingly yellow; tips of other femora yellow-brown (scarcely contrasting); front tibiae yellow-brown at base and apex, dark brown only in middle; other tibiae largely dark brown; tarsi yellow-brown. Abdomen largely brown. Basal cone of ovipositor grey-dusted on about basal half.

*Puparium and third instar larva.* – See the detailed larval description given by Hering (1956). Mandibles with alternating teeth; right mandible longer than left, with two teeth; left mandible with only single tooth. Anterior spiracles with two equal horns, with about 15 bulbs; posterior spiracles on large conical projections, with 32-35 bulbs, with short ventral and very long dorsal horn (the latter erect on puparium); anus flanked by pair of prominent tubercles ("anal lobes"). Puparium golden yellow, 2.4 mm. long.

*Mine.* – Larvae solitary leaf-miners on *Lonicera alpigena* L. Mine (Fig. 53) formed entirely on upper surface of leaf, appearing white or brownish in reflected light, consisting largely of broad channel over midrib on basal part of leaf, with short broad offshoots into leaf parenchyma; feeding lines visible in transmitted light; faeces deposited as particles, partly forming beaded strips, mostly along midrib (where scarcely visible without opening the leaf) and along sides of offshoots. Puparium formed within mine, with its ventral surface adjacent to upper surface of leaf,with its anterior spiracles projecting ventrally through epidermis.

*Material examined.* – Holotype ♀ from larva 13.x.51 on *Lonicera alpigena* L., Partnachklamm, Bavaria, Germany, emerged 28.iv.52, leg. F. Groschke.

*Remarks.* – The only known material remains that stated in the original description, five females bred by Groschke from immature stages collected on *Lonicera alpigena* L. in early October, 1951, at two localities in Bavaria (Partnachklamm and Wolfratshausen).

The puparia of *nervi* can be readily separated from those of all other *Lonicera*-feeders except *lonicerae* by the presence of long erect horns on the posterior spiracles. Confusion with the latter species is hardly likely, however, since its larvae do not feed in the midrib.

### *Chromatomyia* sp. (Japan)

"*Napomyza xylostei* (Kaltenbach)". Sasakawa, 1954: 60.–1961: 425. Kuroda, 1960: 172.

This species described from Japan by Sasakawa and Kuroda is obviously an unnamed species, not the same as the European *lonicerae* (= *xylostei* Kaltenbach), as evidenced by the described differences in the form of the aedeagus and the posterior larval (and puparial) spiracles. Sasakawa bred his flies from linear mines on *Lonicera gracilipes* Miq. and *L. japonica* Thunb. He also lists *Akebia quinata* (Thunb.) (Lardizabalaceae) as a host; a record which seems to me most improbable, particularly when adults from that plant were not obtained for study.

### *Chromatomyia periclymeni* (de Meijere 1924), new combination

"*Chromatomyia obscurella* (Fallén)". Hardy, 1849: 390.

*Phytomyza periclymeni* de Meijere. Hendel, 1922: 71.–1935: 452. De Meijere, 1924: 145.–1926: 281.–1937: 224. Hering, 1926: 455.–1927: 148. Nowakowski, 1962: 104. Lectotype ♂ by present designation, Bussum (Holland), in Zoölogisch Museum, Amsterdam.

*Adult.* – Head (Fig. 1) with orbits not or only slightly projecting above eye in lateral view; genae in middle 1/5 to 1/3 of eye height; eyes with very fine, sparse inconspicuous pubescence. Frons at level of front ocellus about twice width of eye. Two ors, of equal length, posteriorly directed; two ori, inwardly directed, anterior short (at most half as long as posterior, absent on one side in one specimen); orbital setulae one-rowed. Peristomal margin with vibrissa and 3-4

upcurved peristomal setulae. Third antennal article rounded distally, with fairly short pubescence.

3 + 1 dc; acr numerous anteriorly (in 4-6 rows), becoming sparse posteriorly; presutural ia numerous (at least 7); 2-4 postsutural ia; inner pa 1/4 to 1/2 as long as outer pa.

Second cross vein (m-m) absent (Fig. 2). Costal ratio $mg_2/mg_4$ 2.0-2.5 (means: ♂, 2.3; ♀, 2.4). Wing length: ♂, 1.7-2.2 mm (mean 1.9 mm); ♀, 1.9-2.4 mm (mean 2.1 mm).

Colour largely dark. Frons largely dark brown, with black ocellar plate and vertex; genae brown. Antennae black. Palpi black; labella dull yellow. Thorax finely grey-dusted over black ground-colour, only weakly shining, with pale coloration only along seams of sutures (especially notopleural and mesopleural sutures); wing base and squamae yellowish white, latter with dark margin and fringe. Legs dark, with tips of femora yellow-brown or reddish (scarcely contrasting). Abdomen largely brown, becoming yellow-brown on sides at base. Basal cone of ovipositor (♀) grey-dusted on basal third to half.

Male postabdomen with 8th sternum fused with 6th tergum. Telomeres not delimited from periandrium, indicated by dense group of short spiniform setulae. Pregonites with short, weakly pigmented ventral extensions. Aedeagus as Fig. 14-15, with basal sclerites ending posterior to supporting sclerite complex; sclerites of medial lobe small; supporting sclerite complex broad basally in lateral view; terminal section of ejaculatory duct in completely membranous area, extending well anterior to supporting sclerite complex. Ejaculatory apodeme as Fig. 16, rather large but normally inconspicuous (weakly pigmented).

The male genitalia were previously figured by Nowakowski (1962: 104).

*Puparium and third instar larva.* – Mandibles with two alternating teeth; right mandible longer than left. Anterior spiracles with two short horns, with 11-14 irregularly distributed bulbs; posterior spiracles on large conical projections, knob-shaped (more or less circular in posterior view), with 15-21 bulbs; anus on small circular prominence. Puparia ochreous yellow or brown, 1.9-2.3 mm long. See further the descriptions and figures of de Meijere (1926, 1937).

*Mine.* – Larvae solitary leaf-miners on *Lonicera* and *Symphoricarpos.* Mine (Fig. 44A, 44B) formed entirely on upper surface of leaf, appearing dull white in reflected light when fresh, initially stellate (with short channels radiating from oviposition site), then becoming irregular blotch (but in some cases with linear offshoots); oviposition site in leaf parenchyma in mines from England, but according to de Meijere (1924) often in midrib in Holland, as shown in Hering's (1927, 1957) figure; faeces deposited as fine particles, mostly separated by less than 1 mm. Puparium formed within mine, with its ventral surface adjacent to upper surface of leaf, with its anterior spiracles projecting ventrally through epidermis.

*Material examined.* – Lectotype ♂, 1 ♂ 1 ♀ paratypes from mines 1.vi.21 on *Lonicera periclymenum* L., Bussum, Holland, emerged 25.vi-1.vii.21, leg. J. C. H. de Meijere; 1 ♂ paratype from mine vi.95, same plant and locality, emerged vii.95, leg. J. C. H. de Meijere. 2 ♂♂ 1 ♀ paratypes from mines 7.vii.23 on *Lonicera periclymenum* L., Bergen-binnen, Holland, emerged mid vii-5.viii.23, leg. J. C. H. de Meijere. 1 ♂ paratype from mine 30.vii.19 on *Symphoricarpos rivularis* Suksd. (as *racemosus*), Leimuiden, Holland, emerged 18.vii.19, leg. J. C. H. de Meijere. 2 ♀♀ from puparia 6.viii.54 on *Lonicera periclymenum* L., Northaw Great Wood, Herts., England, emerged 30.xi.54 and 16.iii.55, leg. G. C. D. Griffiths. 5 ♀♀ from puparia 5.vii.64 on *Lonicera periclymenum* L., Bookham Common, Surrey, England, emerged 14-20.vii.64, leg. G. C. D. Griffiths. 1 ♂ from puparium 26.x.55 on *Lonicera xylosteum* L., Borgholm (Borga), Öland, Sweden, leg. S. Johansson. 1 ♂ 1 ♀ from mines vii.26 on *Lonicera periclymenum* L., Prerow (Darss), Mecklenburg, Germany, emerged 4-8.viii.26, leg. O. Hering (no. 2973). 1 ♂ 1 ♀ from mines 18.x.22 on *Lonicera xylosteum* L., Berlin (-Babelsberg), Germany, emerged iv.23, leg. Oldenberg. 1 ♂ 1 ♀ from larvae 4.x.65 on *Lonicera xylosteum* L., Mühlhausen (Stadtwald), Thuringia, Germany, emerged 3-11.iii.66, leg. H. Buhr (no. 2698). 1 ♂ from mine on *Lonicera* sp., Kiental, Switzerland, emerged 12.iii.51, leg. F. Groschke.

*Other records.* – The true *periclymeni* is known only from Europe. Records for North America refer either to *gregaria* or to the new species described below as *fricki*. Apparently reliable records are listed below. I have omitted certain Fennoscandian records based on undissected caught specimens, as such determinations are not reliable.

Ireland – Glengariff, Co. Cork (Spencer, 1972).

Great Britain – Boxhill, Surrey (Spencer, 1972); Berwickshire (Hardy, 1849).

Spain – Tibidabo (near Barcelona), 20.iv.58, mines on *Lonicera* sp. (Spencer, 1960).

Belgium – Forêt de Soignes (Collart, 1942)

Holland – Additional locality given by de Meijere (1937), mines on *Lonicera periclymenum* L. and the introduced *Symphoricarpos rivularis* Suksd. (as *racemosus*).

Germany – Widespread on *Lonicera periclymenum* L., *L. nigra* L., *L. caprifolium* L. and *L. xylosteum* L., localities given by Hering (1927), Buhr (1932, 1964), Griffiths (1966: 845) and Zoerner (1969, 1970); also on the introduced *Lonicera tatarica* L., *Symphoricarpos orbiculatus* Moench and *S. rivularis* Suksd. (as *racemosus*) (Buhr, 1932), and on *Lonicera brownii* var. *fuchsioides* Rehd. and *L. caerulea* L. in Rostock Botanical Gardens (Buhr, 1941a).

Austria – Recorded by Hendel (1935) without further details.

Italy – Alto Adige, on *Lonicera alpigena* L., *L. nigra* L. and *L. xylosteum* L. (Hartig, 1939).

Czechoslovakia – Lednice, on *Lonicera xylosteum* L. (Starý, 1930).

Poland – Habendorf, Silesia (Hering, 1927); bred from *Lonicera* sp. at Słupsk (Stolp), Pomerania (Karl, 1936); Isle of Wolin and Dziwnów Peninsula, on *Lonicera periclymenum* L. and *L. xylosteum* L. (Nowakowski, 1954); Warsaw, on *Lonicera xylosteum* L., leg J. T. Nowakowski (Griffiths, 1966: 845).

Denmark – Widespread on *Lonicera* and *Symphoricarpos*, localities listed by Sønderup (1949).

Norway – Lillesand, 13.vii.72, mines on *Lonicera periclymenum* L. (K. A. Spencer).

Sweden – On *Lonicera xylosteum* L., localities in Skåne, Öland and Södermanland given by Rydén (1940) and Griffiths (1966: 844).

Russia – On *Lonicera caerulea* L. in Königsberg Botanical Gardens (Buhr, 1941a); collected in Estonia by Petersen (Hering, 1926).

*Remarks.* – The male genitalia of this species clearly differ from those of the North American species with which it was confused by Frick (1954, 1959) and Spencer (1969b), in that the terminal section of the ejaculatory duct extends well anterior to the supporting sclerite complex and the ejaculatory apodeme is rather large.

Hardy (1849) stated that the larva of his "*obscurella*" lived in "shapeless blotches in the leaves of the honeysuckle". On the basis of this statement it must be concluded that he had before him the present species (the only blotch-mining *Chromatomyia* on *Lonicera* in Britain).

The following nine species are referred, with *periclymeni*, to the *periclymeni* group. See my previous discussion in the section entitled "Preliminary remarks on Caprifoliaceae-miners".

### *Chromatomyia gregaria* (Frick 1954), new combination

*Phytomyza gregaria* Frick. Frick, 1954: 371. Holotype ♂, Berkeley (California), in California Academy of Sciences, San Francisco.

"*Phytomyza periclymeni* de Meijere". Spencer, 1969b: 265.

*Adult.* – As described for *periclymeni*, except as follows.

Costal ratio $mg_2/mg_4$ 2.1-3.0 (means: ♂, 2.45; ♀, 2.6). Wing length: ♂, 1.5-2.4 mm (mean 2.0 mm); ♀, 2.0-2.5 mm (mean 2.2 mm).

Aedeagus as Fig. 20-21, with basal sclerites ending posterior to or at base of supporting sclerite complex; sclerites of medial lobe diamond-shaped; supporting sclerite complex with characteristic mid-dorsal hump in lateral view. Ejaculatory apodeme minute, weakly or not pigmented (Fig. 22).

The aedeagus was previously figured by Spencer (1969b) (as *periclymeni*).

*Puparium and third instar larva.* – Mandibles with two alternating teeth; right mandible longer than left. Anterior spiracles with two short horns, with 10-13 irregularly distributed bulbs; posterior spiracles (Fig. 4) on large conical projections, knob-shaped (more or less circular in posterior view), with 16-23 bulbs; anus on small circular prominence. Puparia ranging from dull yellow to almost black (mostly dark brown), 1.7-2.3 mm long.

*Mine.* – Larvae leaf-miners on *Lonicera involucrata* (Richards.), forming communal mine along midrib of leaf from which radiate linear channels formed by individual larvae (Fig. 46); mine entirely on upper surface, appearing dull white or grey-brown in reflected light when fresh; faeces deposited as fine particles, partly forming beaded strips at first but well separated in channels produced by third-instar larvae. Puparia formed within mine, with their ventral surfaces adjacent to (upper or lower) surface of leaf, with their anterior spiracles projecting ventrally through epidermis.

*Material examined.* – 3 ♂♂ 6 ♀♀ paratypes from larvae and puparia 31.v-10.vii.48 on *Lonicera involucrata* (Richards.), Berkeley (Strawberry Canyon), Alameda Co., California, emerged 18.vi-14.ix.48, leg. K. E. Frick. 8 ♂♂ 11 ♀♀ from larvae 20-29.vii.71 on *Lonicera involucrata* (Richards.), Elk Island National Park, Alberta, emerged 9-19.viii.71 and 10-13.v.72, leg. G. C. D. Griffiths. 1 ♀ from larva 26.vii.66 on *Lonicera involucrata* (Richards.), Edmonton (river valley), Alberta, emerged 15.viii.66, leg. V. K. Sehgal (recorded as *periclymeni* by Sehgal, 1971). 1 ♂ (caught), 14.vi.66, St. Albert (near Edmonton), Alberta, leg. V. K. Sehgal (recorded as *periclymeni* by Sehgal, 1971). Larvae and puparia in alcohol from type locality.

*Other records.* – Spencer (1969b) reports 11 ♂♂ 1 ♀ caught 17.vi.66 on *Lonicera involucrata* (Richards.) at Prince George, British Columbia. Frick's (1959) identifications of caught specimens from Washington and Idaho need to be checked, as this species cannot be distinguished on external characters from some of the others described below.

*Remarks.* – Only six of the nineteen specimens from Elk Island Park emerged in the same year, indicating that this species is partially univoltine in the northern part of its range.

Similar mines on *Lonicera involucrata* (Richards.) are produced by the new species described below as *chamaemetabola*, but the larvae of that species leave the leaf before puparium formation.

Spencer (1969b) incorrectly applied the name *gregaria* to the species described below as *nigrilineata*.

### *Chromatomyia involucratae* (Spencer 1969), new combination

*Phytomyza involucratae* Spencer. Spencer, 1969b: 249. Holotype ♂, St. Albert (Alberta), in K. A. Spencer's collection.

*Adult.* – As described for *periclymeni*, except as follows.

Eye pubescence denser (but still fine and inconspicuous). Costal ratio $mg_2/mg_4$ 3.0. Wing length 2.7-3.3 mm (consistently longer than in all other species of the *periclymeni* group).

Colour of head somewhat paler, with posterior half of frons yellowish brown and genae pale brown. Thorax more densely grey-dusted, scarcely shining.

Aedeagus as Fig. 23-24, with basal sclerites tapering to point at base of supporting sclerite complex; sclerites of medial lobe small and weakly pigmented; supporting sclerite complex tapered and distinctly downcurved apically in lateral view. Ejaculatory apodeme as Fig. 25,

fan-shaped and rather large, but inconspicuous (largely unpigmented).

The aedeagus was previously figured by Spencer (1969b).

*Material examined.* – Paratype ♂ caught on *Lonicera involucrata* (Richards.), 17.vi.66, Prince George, British Columbia, leg. K. A. Spencer.

*Other records.* – The known material of this species remains that listed in the original description: 5 ♂♂ 2 ♀♀ (including holotype ♂), 14.vi.66, St. Albert (near Edmonton), Alberta; 6 ♂♂ 1 ♀, 17.vi.66, Prince George, British Columbia; 1 ♀, 26.vi.66, Frank, British Columbia (all collected by K. A. Spencer).

*Remarks.* – The larvae and mines of this species have not yet been discovered. Spencer (1969b) reported that nearly all his specimens were caught individually on leaves of *Lonicera involucrata* (Richards.). I agree with Spencer that this plant is almost certainly the host. But I do not think he was right in supposing that certain greenish linear mines on it were caused by *involucratae*, since I have bred a *Paraphytomyza* species from mines of this kind.

### *Chromatomyia symphoricarpi* new species

*Adult.* – As described for *periclymeni*, except as follows.

2-6 postsutural ia. Costal ratio $mg_2/mg_4$ 1.9-2.8 (means: ♂, 2.2; ♀, 2.3). Wing length: ♂, 1.8-2.0 mm (mean 1.9 mm); ♀, 2.1-2.4 mm (mean 2.25 mm).

Thorax more densely grey-dusted, scarcely shining. Basal cone of ovipositor (♀) grey-dusted on basal half to two-thirds.

Aedeagus as Fig. 17-18, with basal sclerites ending posterior to base of supporting sclerite complex; sclerites of medial lobe large, subtriangular; supporting sclerite complex with slightly sinuate margins and tapered apically in lateral view. Ejaculatory apodeme very small, unpigmented (Fig. 19).

*Puparium and third instar larva.* – Mandibles with two alternating teeth; right mandible longer than left. Anterior spiracles small, two-horned, with 8-10 bulbs in widely open narrow ellipse; posterior spiracles (Fig. 5) small, close together, only slightly raised above level of last segment, with two equal short horns, with 10-15 bulbs in partly open ellipse; anus on small circular prominence. Puparia dull yellow or yellow-brown, 2.0-2.3 mm long.

*Mine.* – Larvae solitary leaf-miners on *Symphoricarpos occidentalis* Hook. Mine (Fig. 49) formed entirely on upper surface of leaf, appearing brown or greenish brown in reflected light when fresh, consisting largely of irregular blotch or linear-blotch over midrib on basal part of leaf; narrow linear initial channel visible in mines where the oviposition site was remote from the midrib (as in Fig. 49); faeces deposited as fine particles, mostly along midrib (where scarcely visible without opening leaf). Puparium formed within mine, with its ventral surface adjacent to upper surface of leaf, with its anterior spiracles projecting ventrally through epidermis.

*Types.* – Holotype ♂, 16 ♂♂ 28 ♀♀ paratypes from larvae and puparia 18.ix.71 on *Symphoricarpos occidentalis* Hook., Elk Island National Park (near South shore of Astotin Lake), Alberta, emerged 12-15.v.72, leg. G. C. D. Griffiths.

*Remarks.* – This species is probably univoltine, since the characteristic mines were not found earlier in the season. Larvae of the other two known miners of *Symphoricarpos* in North America (*caprifoliae* and *fricki*) do not feed on the midrib.

### *Chromatomyia caprifoliae* (Spencer 1969), new combination

*Phytomyza caprifoliae* Spencer. Spencer, 1969b: 233. Holotype ♂, Red Deer (Alberta), in K. A. Spencer's collection.

*Adult.* – As described for *periclymeni*, except as follows.

Costal ratio $mg_2/mg_4$ 1.9-2.4 (means: ♂, 2.0; ♀, 2.2). Wing length: ♂, 1.6-1.8 mm (mean 1.7 mm); ♀, 1.7-1.95 mm (mean 1.9 mm).

Thorax more densely grey-dusted, scarcely shining. Basal cone of ovipositor (♀) grey-dusted on basal half to two-thirds.

Aedeagus as Fig. 26-27, with basal sclerites extending as narrow processes anterior to base of supporting sclerite complex; sclerites of medial lobe close to base of supporting sclerite complex, strongly pigmented, with more or less rounded margins; supporting sclerite complex straight and more or less parallel-sided in lateral view, narrow in ventral view. Ejaculatory apodeme minute, unpigmented (Fig. 28).

The aedeagus was previously figured by Spencer (1969b).

*Puparium and third instar larva.* – Mandibles with two alternating teeth; right mandible longer than left. Anterior spiracles small, two-horned, with 7-8 bulbs in narrow ellipse; posterior spiracles small, close together, only slightly raised above level of last segment, knob-shaped (more or less circular in posterior view), with7-11 bulbs; anus on small circular prominence. Puparia translucent yellow or yellow-brown with infuscated area on venter, 1.6-1.8 mm long.

*Mine.* – Larvae solitary leaf-miners on *Symphoricarpos*. Mine (Fig. 48) gradually widening linear-blotch, formed entirely on upper surface of leaf, appearing brown in reflected light when fresh; faeces deposited as fine particles, mostly separated by less than 1 mm. Puparium formed within mine, with its ventral surface adjacent to upper surface of leaf, with its anterior spiracles projecting ventrally through epidermis.

*Material examined.* – 4 ♂♂ 4 ♀♀ from larvae 25.vi.71 on *Symphoricarpos occidentalis* Hook., Elk Island National Park, Alberta, emerged 15-16.vii.71, leg. G. C. D. Griffiths; 7 ♂♂ 9 ♀♀ from larvae and puparia 9-16.vii.71, same plant and locality, emerged 27-31.vii.71 and 15.v.72 (1 ♂), leg. G.C.D. Griffiths. 1 ♂ (caught), 8.vi.67, Edmonton (Whitemud Creek), Alberta, leg. V.K. Sehgal.

*Other records.* – Spencer (1969b) described this species from two series bred from *Symphoricarpos albus* (L.) in Alberta (3 ♂♂, including holotype, from mines 12.vi.66, Red Deer, emerged 23.vi.66; 4 ♂♂ 2 ♀♀ from mines 11.vi.66, Okotoks, emerged 22-23.vi.66). Sehgal (1971) reported flies bred from mines collected on 10.ix.66 at Edmonton, but the puparia mounted with specimens from this series left in the University of Alberta collections are clearly those of *nigrilineata*.

*Remarks.* – The above records indicate that this species is multivoltine, with at least three generations in midsummer in Alberta. Mines of the other *Chromatomyia* on *Symphoricarpos* in Alberta (*symphoricarpi*) were not found until fall.

Spencer (1969b) illustrated a mine of this species on the small-leaved *Symphoricarpos albus* (L.) as an apparent blotch. In the larger leaves of *S. occidentalis* Hook. it is clear that the mine is basically a linear-blotch (linear initially).

### *Chromatomyia fricki* new species

"*Phytomyza periclymeni* de Meijere". Frick, 1954: 374.

*Adult.* – As described for *periclymeni*, except as follows.

1-3 postsutural ia. Costal ratio $mg_2/mg_4$ 1.8-2.3 (means: ♂, 2.0; ♀, 2.1). Wing length: ♂, 1.3-1.7 mm (mean 1.6 mm); ♀, 1.7-1.85 mm (mean 1.8 mm).

Aedeagus as Fig. 29-30, with basal sclerites extending anterior to base of supporting sclerite complex; sclerites of medial lobe large; supporting sclerite complex tapered apically in lateral view, strongly cleft in ventral view. Ejaculatory apodeme minute and unpigmented, as in *caprifoliae* (Fig. 28).

*Puparium and third instar larva.* – Mandibles with two alternating teeth; right mandible longer than left. Anterior spiracles two-horned, with 10-12 irregularly distributed bulbs; posterior spiracles on short conical projections, with two short horns, with 12-14 bulbs in partly open

ellipse; anus on small circular prominence. Puparia deep yellow to red-brown, 1.6-1.85 mm long.

*Mine.* – Larvae solitary leaf-miners on *Symphoricarpos*. Mine (Fig. 47) formed entirely on upper surface of leaf, appearing dull white or brown in reflected light, initially stellate (with short channels radiating from oviposition site in leaf parenchyma), then becoming irregular blotch (in some cases with short linear offshoots); faeces deposited as fine particles, mostly separated by less than ½ mm. Puparium formed within mine, with its ventral surface adjacent to upper surface of leaf, with its anterior spiracles projecting ventrally through epidermis.

*Types.* – Holotype ♂, 5 ♂♂ 9 ♀♀ paratypes from larvae and puparia 7.vi.51 on *Symphoricarpos rivularis* Suksd. (labelled *albus*), Union Gap, Yakima County, Washington, emerged 8-17.vi.51, leg. K. E. Frick; 1 ♂ paratype, same plant and locality, emerged 15.x.49, leg K. E. Frick. 11 ♂♂ 7 ♀♀ paratypes from larvae and puparia 28.v.-1.xi.48 on *Symphoricarpos rivularis* Suksd. (labelled *albus*), Berkeley (University Campus), Alameda County, California, emerged 13.vi-17.xi.48, leg. K. E. Frick. Additional paratype larvae, puparia and adults from above samples in alcohol.

*Remarks.* – I am pleased to name this species in honour of Dr. Kenneth E. Frick, in recognition of his major contribution to our knowledge of North American Agromyzidae. It is the smallest species of all those treated in this paper.

### *Chromatomyia linnaeae* new species

*Adult.* – As described for *periclymeni*, except as follows.

Costal ratio $mg_2/mg_4$ 2.1-2.75 (means: ♂, 2.3; ♀, 2.55). Wing length: ♂, 1.7-2.2 mm (mean 2.0 mm); ♀, 2.3-2.5 mm (mean 2.4 mm).

Aedeagus as Fig. 31-32, with basal sclerites extending anterior to base of supporting sclerite complex; sclerites of medial lobe large, strongly pigmented; supporting sclerite complex tapered apically in lateral view. Ejaculatory apodeme minute and unpigmented, as in *caprifoliae* (Fig. 28).

*Puparium and third instar larva.* – Mandibles with two alternating teeth; right mandible longer than left. Anterior spiracles with two short horns, with 8-12 irregularly distributed bulbs; posterior spiracles on short conical projections, with two short horns, with 12-17 bulbs in partly open ellipse; anus on small circular prominence. Puparia deep yellow, 1.9-2.2 mm long.

*Mine.* – Larvae solitary leaf-miners on *Linnaea borealis* L. Mine (Fig. 50) occupying whole or greater part of leaf, basically linear-blotch but with initial linear channel in most cases enclosed by later feeding, formed entirely on upper surface of leaf, appearing brown or greenish brown in reflected light when fresh; faeces deposited as fine particles, mostly separated by less than 1 mm. Puparium formed within mine, with its ventral surface adjacent to upper surface of leaf, with its anterior spiracles projecting ventrally through epidermis.

*Types.* – Holotype ♂, 3 ♂♂, 7 ♀♀ paratypes from larvae 22.ix.69 on *Linnaea borealis* L., Edmonton (Whitemud Creek), Alberta, emerged 17-24.v.70, leg. G. C. D. Griffiths. 1 ♂ 1 ♀ paratypes from larvae 31.viii-1.ix.69 on *Linnaea borealis* L., East shore of Lake Teslin, Yukon Territory, emerged 14-16.v.70, leg. G. C. D. Griffiths. 1 ♂ 1 ♀ paratypes from larvae 2.ix.69 on *Linnaea borealis* L., Big Creek (Alaska Highway mile 674), Yukon Territory, emerged 16-17.v.70, leg. G. C. D. Griffiths. 1 ♂ paratype (caught), 4.vi.67, Elk Island National Park, Alberta, leg. V. K. Sehgal (recorded as *periclymeni* by Sehgal, 1971).

*Remarks.* – The aedeagus of *linnaeae* is very similar to that of *fricki*, and there is a risk that caught specimens of these species may be confused if sole reliance is placed on study of this organ. Fortunately there seems to be scarcely any overlap in wing length between these

species; only the smallest of the males of *linnaeae* before me (with wing length 1.7 mm.) is within the range of *fricki*.

This species seems to be univoltine, since no larvae have been found until very late in the season. In Yukon the mines appeared earlier than in the Edmonton district, a circumstance which suggests that frost is needed to induce hatching of the eggs. The host plant is common in the ground layer of the boreal forest in Canada, and is one of a few plants with evergreen leaves which grow vigorously in the fall. Another such plant is *Mitella nuda* L. (Saxifragaceae), which also supports a late-feeding *Chromatomyia* species (see Griffiths, 1972a).

Mines similar to those of *linnaeae* are known on *Linnaea* in Europe, and it will not be surprising if this species is found to have a holarctic distribution. Hering (1957: 620) attributed such mines (conjecturally) to *periclymeni*, unfortunately without stating the locality where they had been found. K. A. Spencer reports (in correspondence) that the mines occur in Swedish Lappland. It is interesting that no other insect miners of any kind are known from *Linnaea*, nor are any gall-formers reported.

In addition to localities listed above, I also noted larvae of this species feeding on *Linnaea borealis* L. near Banff townsite, Alberta, on 3.x.73 at 4600 feet elevation.

### *Chromatomyia nigrilineata* new species

"*Phytomyza gregaria* Frick". Spencer, 1969b: 243. Sehgal, 1971: 364.

*Adult.* – As described for *periclymeni*, except as follows.

Acr in 5-8 rows anteriorly; 2-9 postsutural ia. Costal ratio $mg_2/mg_4$ 2.15-2.7 (mean 2.5 in female). Wing length 1.9-2.5 mm (mean 2.2 mm in female).

Thorax more densely grey-dusted, scarcely shining. Basal cone of ovipositor (♀) grey-dusted on basal half to two-thirds.

Aedeagus as Fig. 33-34, with basal sclerites ending posterior to base of supporting sclerite complex; sclerites of medial lobe minute or absent; supporting sclerite complex small, narrow in ventral view. Ejaculatory apodeme minute, unpigmented (Fig. 35).

The aedeagus has been previously figured by Spencer (1969b) and Sehgal (1971) (as that of *gregaria*).

*Puparium and third instar larva.* – Mandibles with two alternating teeth; right mandible longer than left. Anterior spiracles with two short horns, with 8-15 irregularly distributed bulbs; posterior spiracles on short conical projections, knob-shaped (more or less circular in posterior view), with 9-14 bulbs; anus on small circular prominence. Puparia white, with contrasting black stripe along centre-line of venter, 1.8-2.4 mm long.

*Mine.* – Larvae leaf-miners on *Lonicera dioica* L. Mine (Fig. 51) irregularly linear (in some cases branching), in some cases stellate initially (with short channels radiating from oviposition site in leaf parenchyma), white or greenish white in reflected light when fresh; normally 2-4 larvae in same leaf, with their mines crossing or partly coalescing (as in Fig. 51); mines entirely on upper surface of leaf, but with puparium formation following in most cases in chamber on lower surface; faeces deposited as very fine particles, partly forming beaded strips. Puparium with its ventral surface adjacent to surface of leaf, with its anterior spiracles projecting ventrally through epidermis.

*Types.* – Holotype ♂, 7 ♀♀ paratypes from larvae and puparia 21.ix.71 on *Lonicera dioica* L., Elk Island National Park (near NE shore of Astotin Lake), Alberta, emerged 9-10.v.72, leg. G. C. D. Griffiths; 1 ♂ 4 ♀♀ paratypes from puparia 24-29.vi.71 on *Lonicera dioica* L., Elk Island National Park (1 mile E Spruce Island Lake), Alberta, emerged 4-6.vii.71, leg. G. C. D. Griffiths. 4 ♀♀ paratypes from mines 10.ix.66, Edmonton (Whitemud Creek), Alberta, emerged 9.i-7.iii.67 (forced), leg. V. K. Sehgal (recorded as *caprifoliae* by Sehgal, 1971).

*Other records.* – Spencer (1969b) has recorded (as *gregaria*) two further bred males from Elk Island Park and Edmonton, Alberta. Sehgal (1971) has recorded (also as *gregaria*) a male caught at St. Albert (near Edmonton).

*Remarks.* – The name *nigrilineata* ("black-striped") refers to the black ventral stripe on the puparia.

This species was unfortunately confused with *gregaria* by Spencer (1969b). I have found the mines only on *Lonicera dioica* L., never on *L. involucrata* (Richards.) (the host of the true *gregaria*). Spencer's (1969b, Fig. 436) figure of the leaf mines of "*gregaria*" refers to this species, but he has probably misidentified the leaf; it has a shape typical of *dioica*, not of *involucrata*. Sehgal (1971) recorded *Symphoricarpos* as the host-plant of his four specimens here designated paratypes, again a probable misidentification.

This species seems to be bivoltine in Central Alberta, with larvae feeding in June and September. No larvae have been found during July and August. The characteristic black stripe on the puparia makes them easily identifiable in the field.

### *Chromatomyia alpigenae* (Hendel 1925), new combination

*Phytomyza alpigenae* Hendel. Hendel, 1925: 307.– 1934: 342. De Meijere, 1928: 165.– 1938: 87. Hering, 1957: 629. Syntypes 2 ♀♀, Salzkammergut (Austria), in Naturhistorisches Museum, Vienna.

*Adult.* – As described for *periclymeni*, except as follows.

Posterior ors variable in length, half to fully as long as anterior ors; anterior ori 1/3 to 2/3 as long as posterior ori. 1-5 postsutural ia. Costal ratio $mg_2/mg_4$ 2.5-3.0. Wing length 1.8-2.5mm. Basal cone of ovipositor (♀) grey-dusted on basal half to two-thirds. See further the detailed description of the external form by Hendel (1934).

Aedeagus as Fig. 36-37, with basal sclerites ending at base of supporting sclerite complex; sclerites of medial lobe minute; supporting sclerite complex broadened distally in ventral view; terminal section of ejaculatory duct extending as membranous tubule well anterior to supporting sclerite complex. Ejaculatory apodeme minute, unpigmented (Fig. 38).

*Puparium and third instar larva.* – See de Meijere's (1928, 1938) descriptions. Mandibles with two alternating teeth; right mandible longer than left. Anterior spiracles with two short horns, with 8-12 irregularly distributed bulbs; posterior spiracles on short conical projections, with two short horns, with 13-18 bulbs in irregular ellipse; anus on small circular prominence. Puparia yellow-brown to dark brown, 1.9-2.2 mm. long.

*Mine.* – Larvae leaf-miners on *Lonicera*, forming communal mine (up to 20 larvae in leaves of *L. alpigena* L. according to Hendel) along midrib of leaf from which radiate short linear channels up to 2 mm wide formed by individual larvae (Fig. 52); mine entirely on upper surface of leaf, appearing greenish white or light brown in reflected light; faeces deposited as fine particles, in some mines partly forming beaded strips; larvae leaving leaf through semicircular slits on upper or lower surface (at ends of their individual channels) before puparium formation.

*Material examined.* – 2 ♀♀ syntypes from larvae 28.viii.23 on *Lonicera alpigena* L., Toplitzsee, Salzkammergut, Austria, emerged 5.iii.24, leg. F. Hendel. 3 ♂♂ 1 ♀ from larvae on *Lonicera nigra* L., Lenggries, Bavaria, Germany, emerged 10.ii-8.iv.54, leg. F. Groschke.

*Other records.* – Additional known localities for this species are as follows: Schönau (near Berchtesgaden), Bavaria, Germany (sheet of mines 7.viii.50 on *Lonicera nigra* L. in Hering's mine herbarium, leg F. Groschke); Giessbach am Brienzer See, Switzerland, on *Lonicera nigra* L. (de Meijere, 1928); Reiwies, Silesia, Czechoslovakia (sheet of mines 18.vii.47 on *Lonicera nigra* L. in Hering's mine herbarium, leg Zavřel); and Madonna di Campiglio, Alto Adige, Italy,

on *Lonicera alpigena* L., *L. nigra* L. and rarely *L. xylosteum* L. (Hartig, 1939). It has also been reported for Thuringia, Germany (by Hering, 1957), but without details of the record.

*Remarks.* – Hartig's collection dates, ranging from 9th June to 6th September, indicate that this species is multivoltine in his area.

This and the following are the only *Chromatomyia* species whose larvae normally leave their mines before puparium formation.

*Chromatomyia chamaemetabola* new species

*Adult.* – As described for *periclymeni*, except as follows.

Only one pair of ors in holotype, but two (of about equal length) in both paratypes. Costal ratio $mg_2/mg_4$ 2.5. Wing length 1.9-2.1 mm. Basal cone of ovipositor (♀) grey-dusted on basal two-thirds.

Aedeagus as Fig. 39-40, with basal sclerites ending at base of supporting sclerite complex; sclerites of medial lobe band-shaped; supporting sclerite complex broadened distally in ventral view; terminal section of ejaculatory duct extending anterior to supporting sclerite complex. Ejaculatory apodeme minute, unpigmented (Fig. 41).

*Puparium and third instar larva.* – Mandibles with two alternating teeth; right mandible longer than left. Anterior spiracles with two short horns, with 11-13 irregularly distributed bulbs; posterior spiracles on short conical projections, with two short horns, with 20-21 bulbs in partly open irregular ellipse; anus only slightly raised above level of last segment. Puparia dark brown, 1.7-1.8 mm. long.

*Mine.* – Larvae leaf-miners on *Lonicera involucrata* (Richards.), forming communal mine along midrib of leaf from which radiate linear channels formed by individual larvae (Fig. 45); mine entirely on upper surface of leaf, appearing greenish white or brown in reflected light when fresh; faeces deposited as fine particles, mostly separated by less than 1 mm; larvae leaving leaf through semicircular slits on upper surface (at ends of their individual channels) before puparium formation.

*Types.* – Holotype ♂, 1 ♂ 1 ♀ paratypes from larvae 20.vii.71 on *Lonicera involucrata* (Richards.), Elk Island National Park (Elk Island in Astotin Lake), Alberta, emerged 14.v.72, leg. G. C. D. Griffiths.

*Remarks.* – The name *chamaemetabola* ("transforming on the ground") refers to puparium formation. This species and *alpigenae* are the only known *Chromatomyia* species whose larvae normally leave their mines before puparium formation.

The mines of *chamaemetabola* are very similar to those of *gregaria* on the same host-plant, but larvae of the latter species form puparia within their mine channels.

## ACKNOWLEDGEMENTS

I am grateful to the following for the loan of insects for study: R. Lichtenberg (Naturhistorisches Museum, Vienna), T. van Leeuwen (Zoölogisch Museum, Amsterdam), E. Lindner (Staatliches Museum für Naturkunde, Ludwigsburg), H. Schumann (Zoologisches Museum, Humboldt University, Berlin), K. A. Spencer (London, England), G. Steyskal (U. S. Department of Agriculture, Washington) and E. Taylor (University Museum, Oxford). A. C. Pont and J. P. Dear of the British Museum (Natural History) provided information on the Hering mine herbarium and arranged the loan of some mines from this. My wife Deirdre assisted my field work and prepared the illustrations of leaf mines (Fig. 42-53). Collections in the Yukon

Territory in 1969 were supported by a grant from the Boreal Institute of the University of Alberta.

## REFERENCES

Braschnikow, W. C. 1897. Zur Biologie und Systematik einiger Arten minierender Dipteren. Izv. mosk. sel'. -khoz. Inst. 3: 19-43.

Buhr, H. 1932. Mecklenburgische Minen. I. Agromyziden-Minen. Stettin. ent. Ztg. 93: 57-115.

Buhr, H. 1941a. Mecklenburgische Minen. IV. Nachtrag zu den Dipteren-Minen mit Einschluss der in den Rostocker Botanischen Gärten festgestellten. Arch. Ver. Freunde Naturg. Mecklenb. 15: 21-101.

Buhr, H. 1941b. Dipteren-, insbesondere Agromyziden-Minen aus Südeuropa. Stettin. ent. Ztg. 102: 73-119.

Buhr, H. 1964. Sächsische Minen. Abh. Ber. NaturkMus. Görlitz 39, no. 3. 72 pp.

Collart, A. 1942. Diptères mineurs de Belgique, I. Bull. Mus. r. Hist. nat. Belg. 18, no. 4. 10 pp.

Coquillett, D. W. 1910. They type-species of North American genera of Diptera. Proc. U. S. natn. Mus. 37: 499-647.

Frey, R. 1946. Anteckningar om Finlands agromyzider. Notul. ent. 26: 13-55.

Frick, K. E. 1954. Three North American *Phytomyza* species closely related to *P. nigritella* Zetterstedt (Agromyzidae: Diptera). Ann. ent. Soc. Am. 47: 367-374.

Frick, K. E. 1959. Synopsis of the species of agromyzid leaf miners described from North America (Diptera). Proc. U. S. natn. Mus. 108: 347-465.

Frost, S. W. 1924. A study of the leaf-mining Diptera of North America. Mem. Cornell Univ. agric. Exp. Stn no. 78. 228 pp.

Goureau, C. 1851. Mémoire pour servir à l'histoire des Diptères dont les larves minent les feuilles des plantes, et à celle de leurs parasites. Annls Soc. ent. Fr. 9: 131-176.

Griffiths, G. C. D. 1961. The Cambridge collection of Agromyzidae (Diptera). Entomologist's Gaz. 12: 123-126.

Griffiths, G. C. D. 1964. The agromyzid fauna of Iceland and the Faroes, with appendices on the *Phytomyza milii* and *robustella* groups (Diptera, Agromyzidae). Ent. Meddr. 32: 393-450.

Griffiths, G. C. D. 1966. The Alysiinae (Hym. Braconidae) parasites of the Agromyzidae (Diptera). III. The parasites of *Paraphytomyza* Enderlein, *Phytagromyza* Hendel and *Phytomyza* Fallén. Beitr. Ent. 16: 775-951.

Griffiths, G. C. D. 1967. Revision of the *Phytomyza syngenesiae* group (Diptera, Agromyzidae), including species hitherto known as "*Phytomyza atricornis* Meigen". Stuttg. Beitr. Naturk. no. 177. 28 pp.

Griffiths, G. C. D. 1968. Agromyzidae (Diptera) from Ireland. Proc. R. Ir. Acad. 67B: 37-61.

Griffiths, G. C. D. 1972a. Studies on boreal Agromyzidae (Diptera). I. *Phytomyza* miners on Saxifragaceae. Quaest. ent. 8: 67-80.

Griffiths, G. C. D. 1972b. Studies on boreal Agromyzidae (Diptera). II. *Phytomyza* miners on *Senecio, Petasites* and *Tussilago* (Compositae, Senecioneae). Quaest. ent. 8: 377-405.

Groschke, F. and E. M. Hering. 1957. Miszellen über Blattminen und -minierer III. Dt. ent. Z. 4: 113-134.

Hardy, J. 1849. On the primrose-leaf miner, with notice of a proposed new genus, and characters of three species of Diptera. Ann. Mag. nat. Hist. 4: 385-392.

Hartig, F. 1939. Sulla minefauna della Venezia Tridentina. Archo Alto Adige 34: 407-472.

Hendel, F. 1920. Die paläarktischen Agromyziden (Dipt.) (Prodromus einer Monographie).

Arch. Naturgesch. A. 84 (7): 109-174.
Hendel, F. 1922. Blattminierende Fliegen (Musciden). Wien. ent. Ztg. 39: 65-72.
Hendel, F. 1925. Neue europäische Minierfliegen. (8. Beitrag zur Blattminenkunde Europas.). Konowia 4: 301-309.
Hendel, F. 1931-1936. Agromyzidae. Fliegen palaearkt. Reg. 6 (2), Teil 59. 570 pp.
Hering, M. 1925. Bemerkungen zu einigen Agromyziden der Loewschen Sammlung. Dt. ent. Z. 1925: 376-380.
Hering, M. 1926. Minenstudien VII. Z.Morph. Ökol. Tiere 5: 447-488.
Hering, M. 1927. Agromyzidae. Tierwelt Dtl. 6. 172 pp.
Hering, M. 1932. Minenstudien 13. Z. PflKrankh. PflSchutz 42: 567-579.
Hering, E. M. 1951. Neue paläarktische und nearktische Agromyziden (Dipt.). Notul ent. 31: 31-45.
Hering, E. M. 1956. Die Larven der Agromyziden (Diptera). II. Tijdschr. Ent. 98: 257-281.
Hering, E. M. 1957. Bestimmungstabellen der Blattminen von Europa einschliesslich des Mittelmeerbeckens und der Kanarischen Inseln. Uitgeverij Dr. W. Junk, The Hague. 1185 + 86 pp. (3 vols.).
Hering, E. M. 1962. Neue Blattminen-Studien II. (Col., Dipt., Lep.). Dt. ent. Z. 9: 30-65.
Hultén, E. 1968. Flora of Alaska and neighbouring territories. Stanford University Press, Stanford, California. xxii + 1008 pp.
Inchbald, P. 1882. Observations upon our plant-mining and gall-making Diptera and Hymenoptera in 1882. Entomologist 15: 217-222.
Inchbald, P. 1885. Leaf-mining Diptera in 1884. Entomologist 18: 124.
Kaltenbach, J. H. 1862. Die deutschen Phytophagen aus der Klasse der Insekten. Verh. naturh. Ver. preuss. Rheinl. 19: 1-106.
Kaltenbach, J. H. 1874. Die Pflanzenfeinde aus der Klasse der Insekten. Julius Hoffmann, Stuttgart. 848 pp.
Karl, O. 1936. Die Fliegenfauna Pommerns. Diptera Brachycera. Stettin. ent. Ztg. 97: 318-330.
Kuroda, M. 1960. Studies on the spiracles and cephalopharyngeal sclerites of the larvae of the agromyzid flies (Report IV). Kontyû 28: 172-176.
Linnaniemi, W. M. 1913. Zur Kenntnis der Blattminierer speziell derjenigen Finnlands. I. Acta Soc. Fauna Fl. fenn. 37, no. 4. 137 pp.
Meijere, J. C. H. de. 1924. Verzeichnis der holländischen Agromyzinen. Tijdschr. Ent. 67: 119-155.
Meijere, J. C. H. de. 1926. Die Larven der Agromyzinen (Fortsetzung und Schluss). Tijdschr. Ent. 69: 227-317.
Meijere, J. C. H. de. 1928. Die Larven der Agromyzinen. Erster Nachtrag. Tijdschr. Ent. 71: 145-178.
Meijere, J. C. H. de. 1934. Die Larven der Agromyzinen. Zweiter Nachtrag. Tijdschr. Ent. 77: 244-290.
Meijere, J. C. H. de. 1937. Die Larven der Agromyzinen. Dritter Nachtrag. Tijdschr. Ent. 80: 167-243.
Meijere, J. C. H. de. 1938. Die Larven der Agromyzinen. Vierter Nachtrag. Tijdschr. Ent. 81: 61-116.
Nowakowski, J. T. 1954. Owady minujące wyspy Wolina i Połwyspu Dziwnowskiego. Pr. Kom. biol., Poznań 15, zeszyt 1. 118 pp.
Nowakowski, J. T. 1962. Introduction to a systematic revision of the family Agromyzidae (Diptera) with some remarks on host plant selection by these flies. Annls zool., Warsz. 20: 67-183.
Popescu-Gorj, A. and I. Drăghia. 1966. Contributions à la connaissance de l'entomofaune

mineuse de Roumanie. Trav. Mus. Hist. nat. Gr. Antipa 6: 99-117.
Robineau-Desvoidy, J.-B. 1851. Description d'Agromyzes et de Phytomyzes écloses chez M. le colonel Goureau. Rev. Mag. Zool. 3: 391-405.
Rydén, N. S. 1934. Bidrag till kännedomen om svenska bladminerare. III. Ent. Tidskr. 55: 149-159.
Rydén, N. 1940. Till kännedomen om svenska bladminerare. VI. Opusc. ent. 5: 15-21.
Rydén, N. 1952. Zur Kenntnis der schwedischen Minierer XV. Agromyziden von Gotland. Opusc. ent. 17: 25-32.
Sasakawa, M. 1954. New and unrecorded Agromyzidae (Diptera) from Japan IV. Kontyû 20: 55-61.
Sasakawa, M. 1961. A study of the Japanese Agromyzidae (Diptera). Part 2. Pacif. Insects 3: 307-472.
Sehgal, V. K. 1971. A taxonomic survey of the Agromyzidae (Diptera) of Alberta, Canada, with observations on host-plant relationships. Quaest. ent. 7: 291-405.
Sønderup, H. P. S. 1949. Fortegnelse over de danske Miner (Hyponomer). Spolia zool. Mus. haun. no. 10. 256 pp.
Spencer, K. A. 1954. Agromyzidae (Dipt.) in Portugal, including a description of a new species. Entomologist's mon. Mag. 90: 219-221.
Spencer, K. A. 1955. Notes on the British Agromyzidae (Dipt.). – IV. A revision of the Hamm collection. Entomologist's mon. Mag. 91: 68-70.
Spencer, K. A. 1960. Seven new species of Agromyzidae from Spain, together with other new and interesting records (Diptera). Eos, Madr. 36: 375-386.
Spencer, K. A. 1967. Some Agromyzidae (Diptera) from Morocco. Entomologist's mon. Mag. 103: 126-130.
Spencer, K. A. 1969a. Notes on European Agromyzidae (Diptera) – 2. Beitr. Ent. 19: 5-26.
Spencer, K. A. 1969b. The Agromyzidae of Canada and Alaska. Mem. ent. Soc. Can. no. 64. 311 pp.
Spencer, K. A. 1972. Diptera: Agromyzidae. Handbk Ident. Br. Insects 10, part 5(g). 136 pp.
Starý, B. 1930. O minujicim hymzu v zemi Moravskoslezské. Acta Soc. Sci. nat. morav. 6: 125-242.
Steyskal, G. C. 1972. New and little-known Agromyzidae from Michigan (Diptera: Acalyptratae). Gt Lakes Entomologist 5: 1-10.
Trägårdh, I. 1909. Zur Kenntnis von *Phytomyza Xylostei* Kltb. eine in *Lonicera Symphoricarpus* minierende Fliege. Z. wiss. InsektBiol. 5: 301-304.
Tschirnhaus, M. von. 1969. Zur Kenntnis der Variabilität, Eidonomie und Verwandtschaft bemerkenswerter Agromyzidae (Diptera). Senckenberg. biol. 50: 143-157.
Voigt, G. 1929. Beiträge zur Kenntnis der Minen und ihrer Erreger, sowie Beobachtungen über das Vorkommen von Minen im Rheingau und benachbarten rheinischen Gebieten. Jb. nassau. Ver. Naturk. 80, II. Teil: 24-73.
Walker, F. 1849. List of the specimens of Dipterous Insects in the collection of the British Museum. – Part IV: 689-1172. British Museum, London.
Weyenbergh, H. 1870. Nederlandsche Diptera in metamorphose en levenswijs. Tijdschr. Ent. 13: 190-206.
Zoerner, H. 1969. Zur Kenntnis der Blattminen der Naturschutzgebiete des Mittelelbegebietes. Ent. Ber. 1969: 17-24, 69-73.
Zoerner, H. 1970. Blattminenstudien in der Umgebung von Prerow/Darss. Ent. Ber. 1970: 19-29.

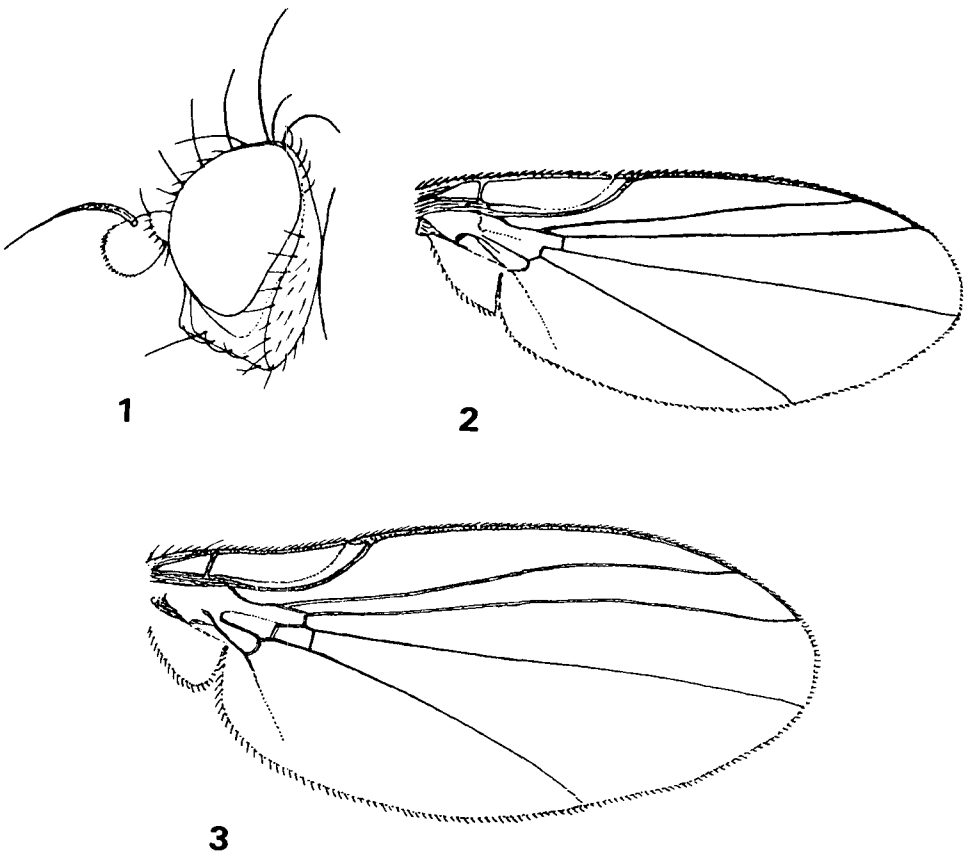


Fig. 1. Head in left lateral view of *Chromatomyia periclymeni* (de Meijere) (after Hendel, 1935). Fig. 2. Wing of *Chromatomyia periclymeni* (de Meijere) (after Hendel, 1936). Fig. 3. Wing of *Chromatomyia aprilina* (Goureau) (after Hendel, 1936).

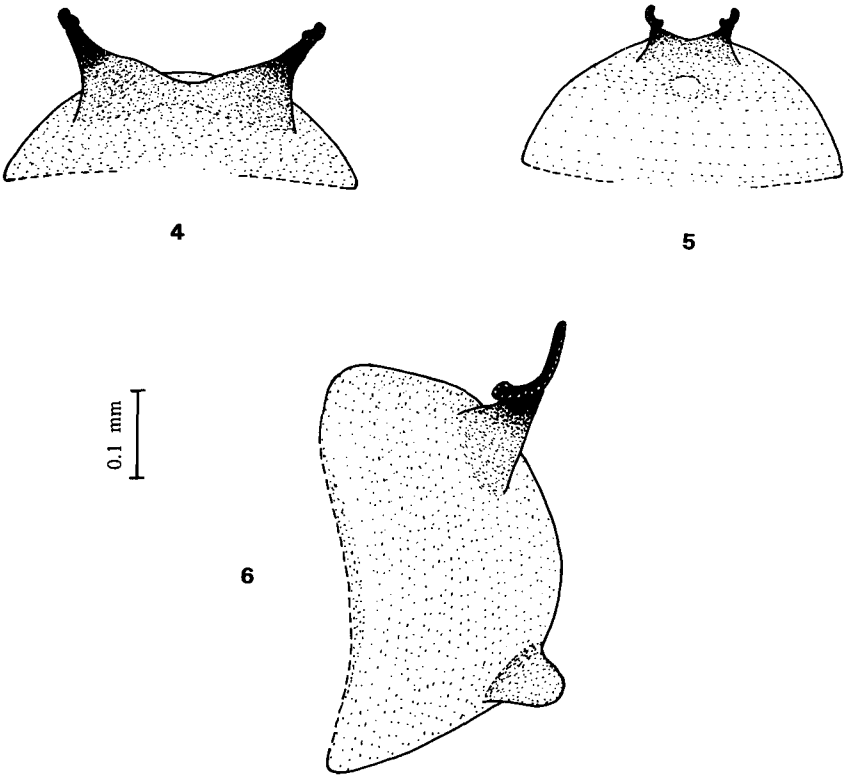


Fig. 4-6. Last segment of puparium, to illustrate description of posterior spiracles: 4, *Chromatomyia gregaria* (Frick) in dorsal view ("posterior spiracles on large conical projections"); 5, *Chromatomyia symphoricarpi* n.sp. in dorsal view ("posterior spiracles close together, only slightly raised above level of last segment"); 6, *Chromatomyia lonicerae* (Robineau-Desvoidy) in left lateral view ("posterior spiracles with short ventral and very long dorsal horn").

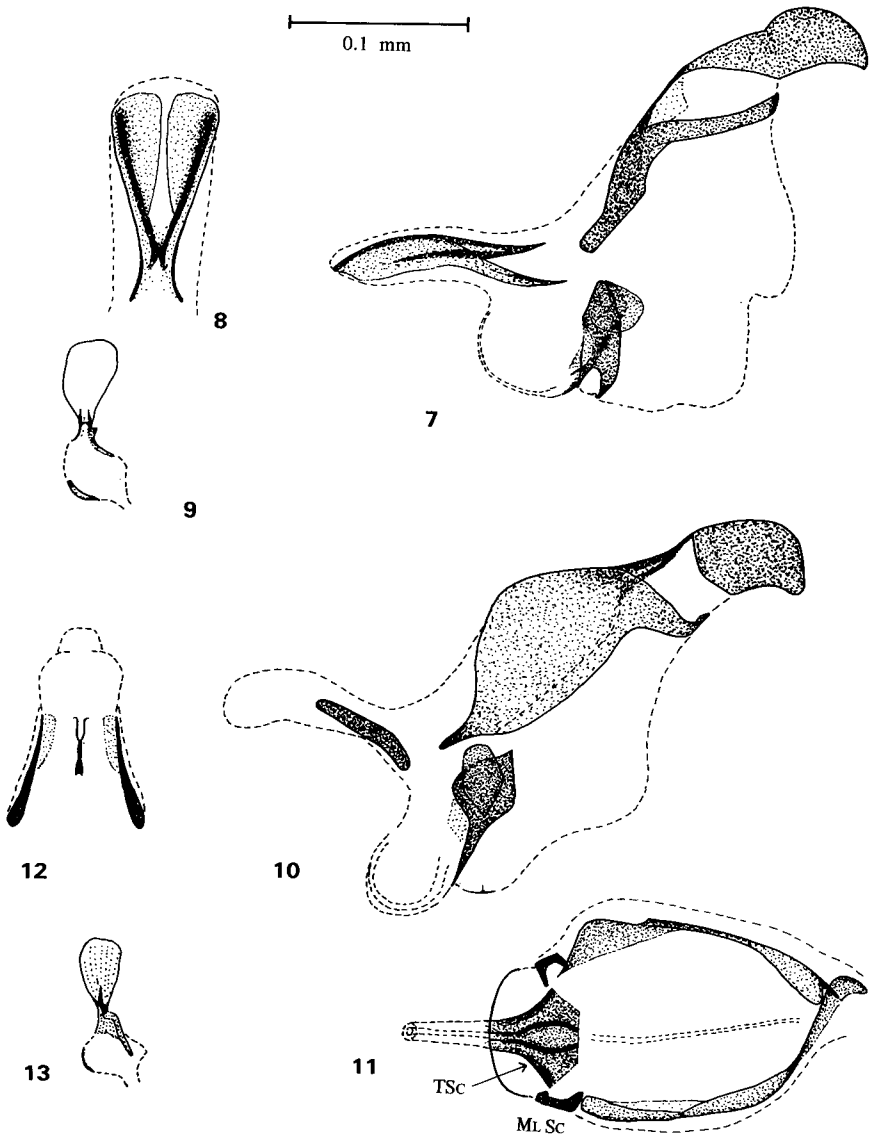


Fig. 7-9. *Chromatomyia aprilina* (Goureau), lectotype ♂: 7, aedeagus in lateral view; 8, supporting sclerite complex in ventral view; 9, ejaculatory apodeme. Fig. 10-13. *Chromatomyia lonicerae* (Robineau-Desvoidy), lectotype ♂: 10, aedeagus in lateral view; 11, aedeagus in posteroventral view (MLSC sclerite of medial lobe, TSC trough-like sclerite); 12, supporting sclerite complex in ventral view; 13, ejaculatory apodeme.

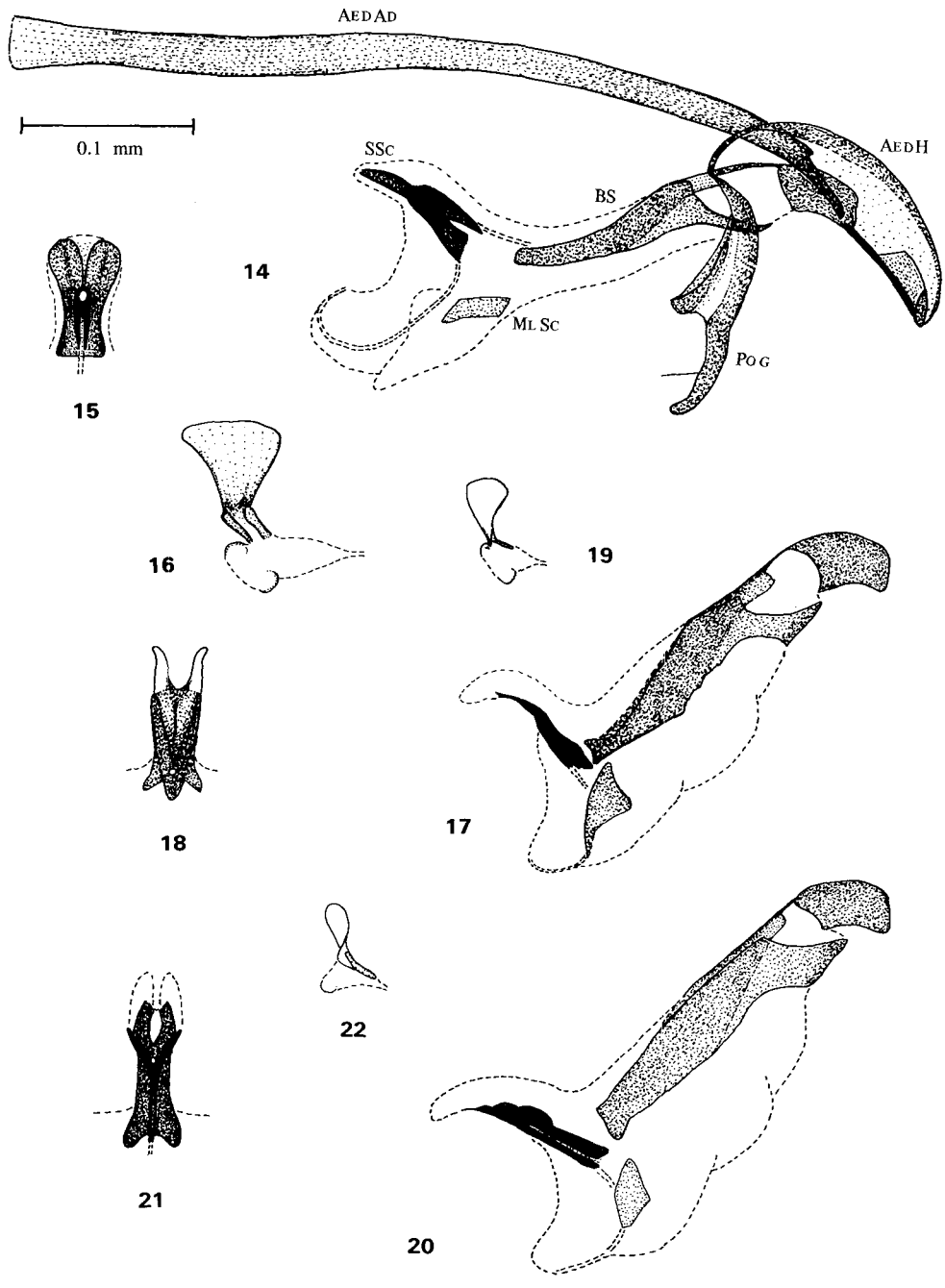


Fig. 14-16. *Chromatomyia periclymeni* (de Meijere) (♂), Sweden: 14, aedeagus and associated structures in lateral view (AEDAD aedeagal apodeme, AEDH aedeagal hood, BS basal section of aedeagus, MLSC sclerite of medial lobe, POG postgonite, SSC supporting sclerite complex); 15, supporting sclerite complex in dorsal view; 16, ejaculatory apodeme. Fig. 17-19. *Chromatomyia symphoricarpi* n.sp., holotype ♂: 17, aedeagus in lateral view; 18, supporting sclerite complex in ventral view; 19, ejaculatory apodeme. Fig. 20-22. *Chromatomyia gregaria* (Frick) (♂), Alberta: 20, aedeagus in lateral view; 21, supporting sclerite complex in ventral view; 22, ejaculatory apodeme.

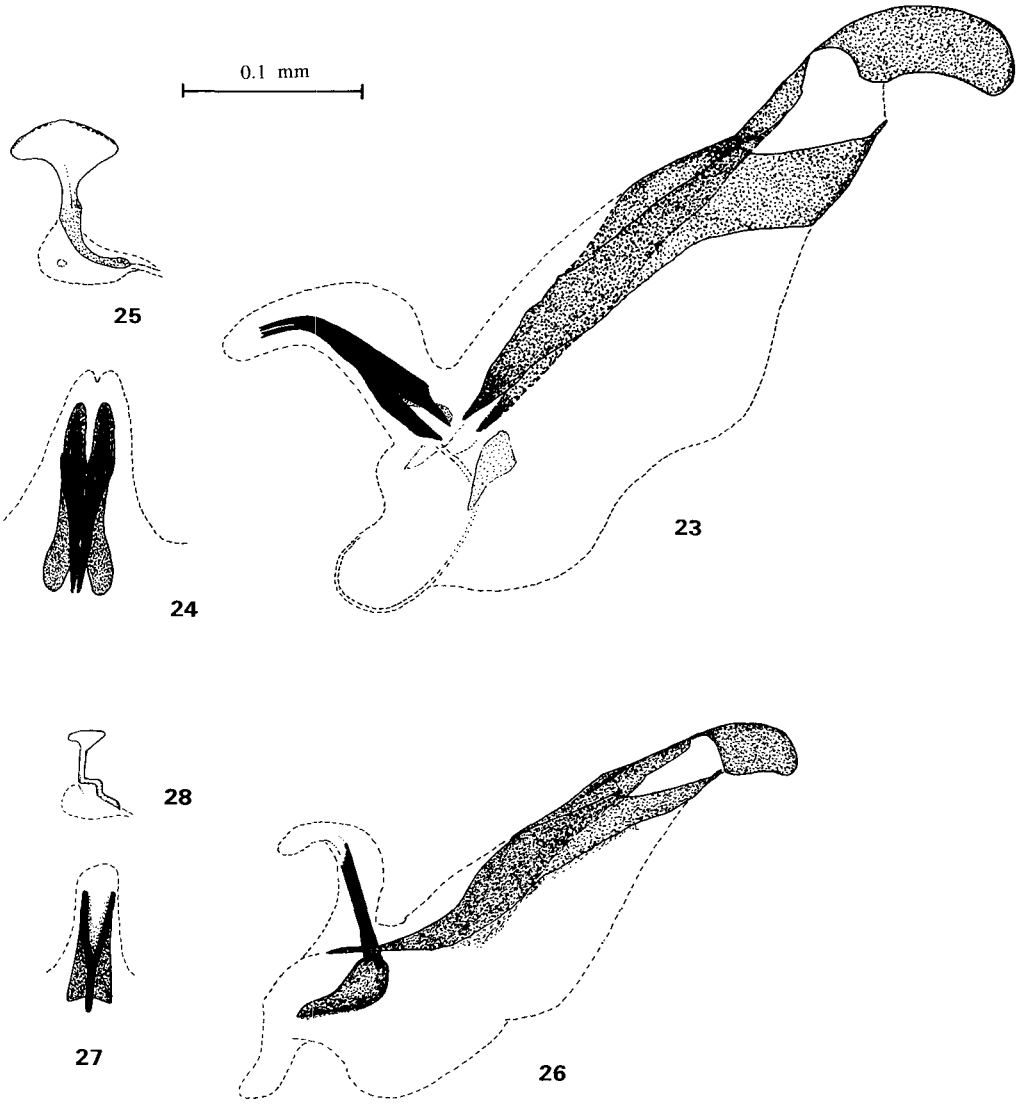


Fig. 23-25. *Chromatomyia involucratae* (Spencer), paratype ♂, British Columbia: 23, aedeagus in lateral view; 24, supporting sclerite complex in ventral view; 25, ejaculatory apodeme. Fig. 26-28. *Chromatomyia caprifoliae* (Spencer) (♂), Alberta: 26, aedeagus in lateral view; 27, supporting sclerite complex in ventral view; 28, ejaculatory apodeme.

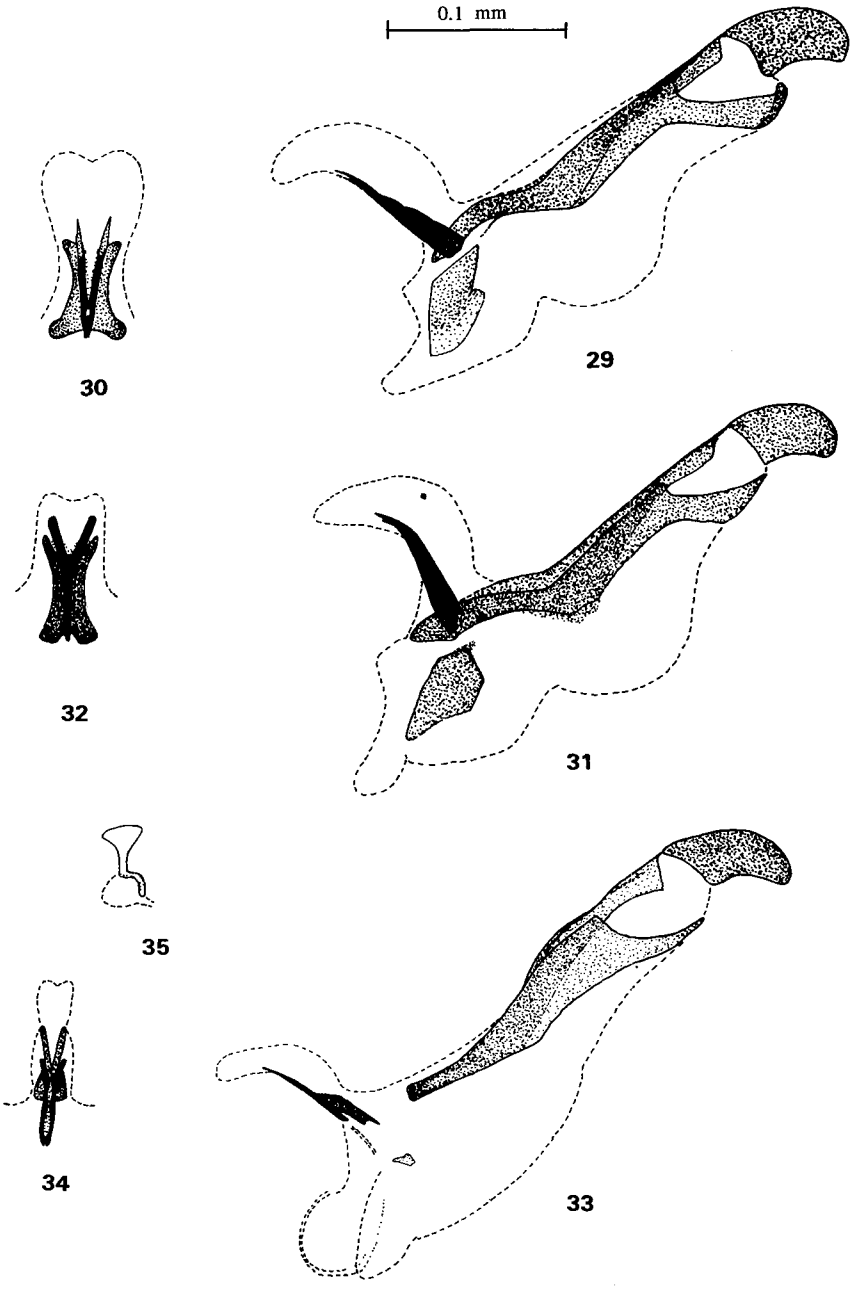


Fig. 29-30. *Chromatomyia fricki* n.sp., holotype ♂: 29, aedeagus in lateral view; 30, supporting sclerite complex in ventral view. Fig. 31-32. *Chromatomyia linnaeae* n.sp., holotype ♂: 31, aedeagus in lateral view; 32, supporting sclerite complex in ventral view. Fig. 33-35. *Chromatomyia nigrilineata* n.sp., paratype ♂: 33, aedeagus in lateral view; 34, supporting sclerite complex in ventral view; 35, ejaculatory apodeme.

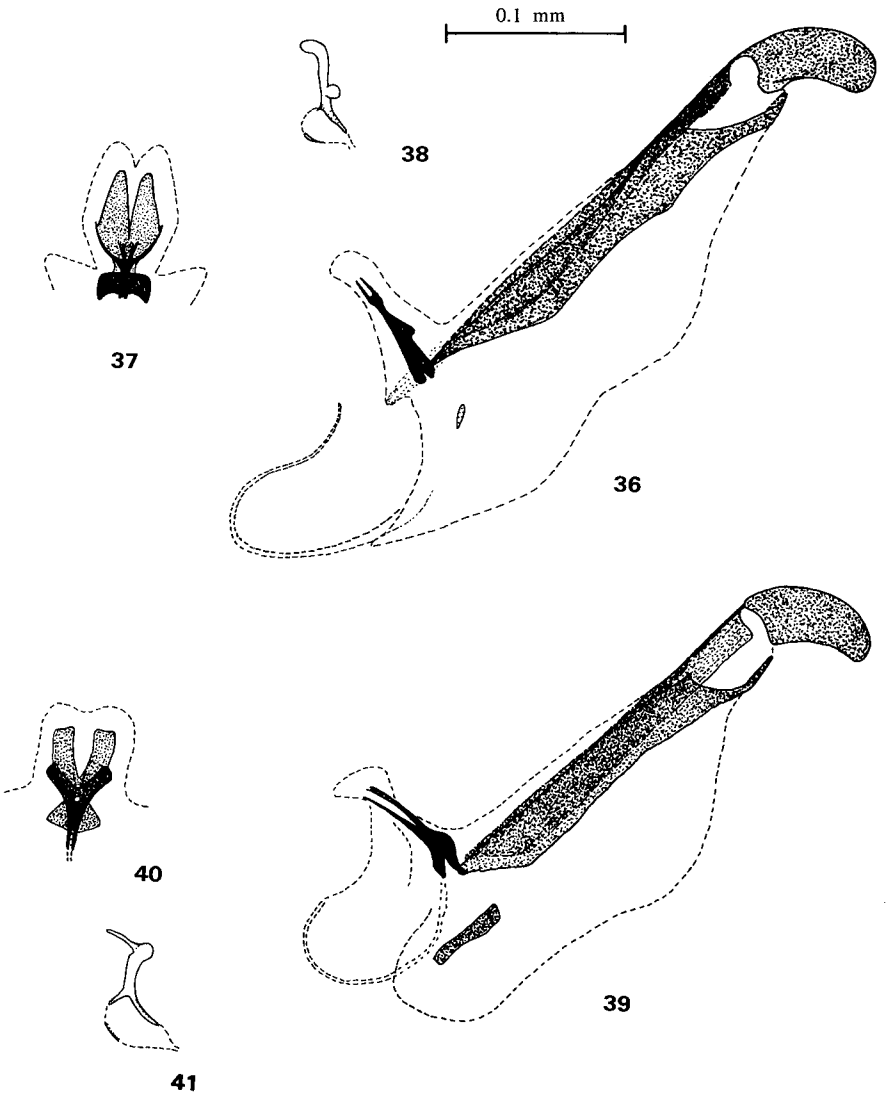


Fig. 36-38. *Chromatomyia alpigenae* (Hendel) (♂), Bavaria: 36, aedeagus in lateral view; 37, supporting sclerite complex in ventral view; 38, ejaculatory apodeme. Fig. 39-41. *Chromatomyia chamaemetabola* n.sp., holotype ♂: 39, aedeagus in lateral view; 40, supporting sclerite complex in dorsal view; 41, ejaculatory apodeme.

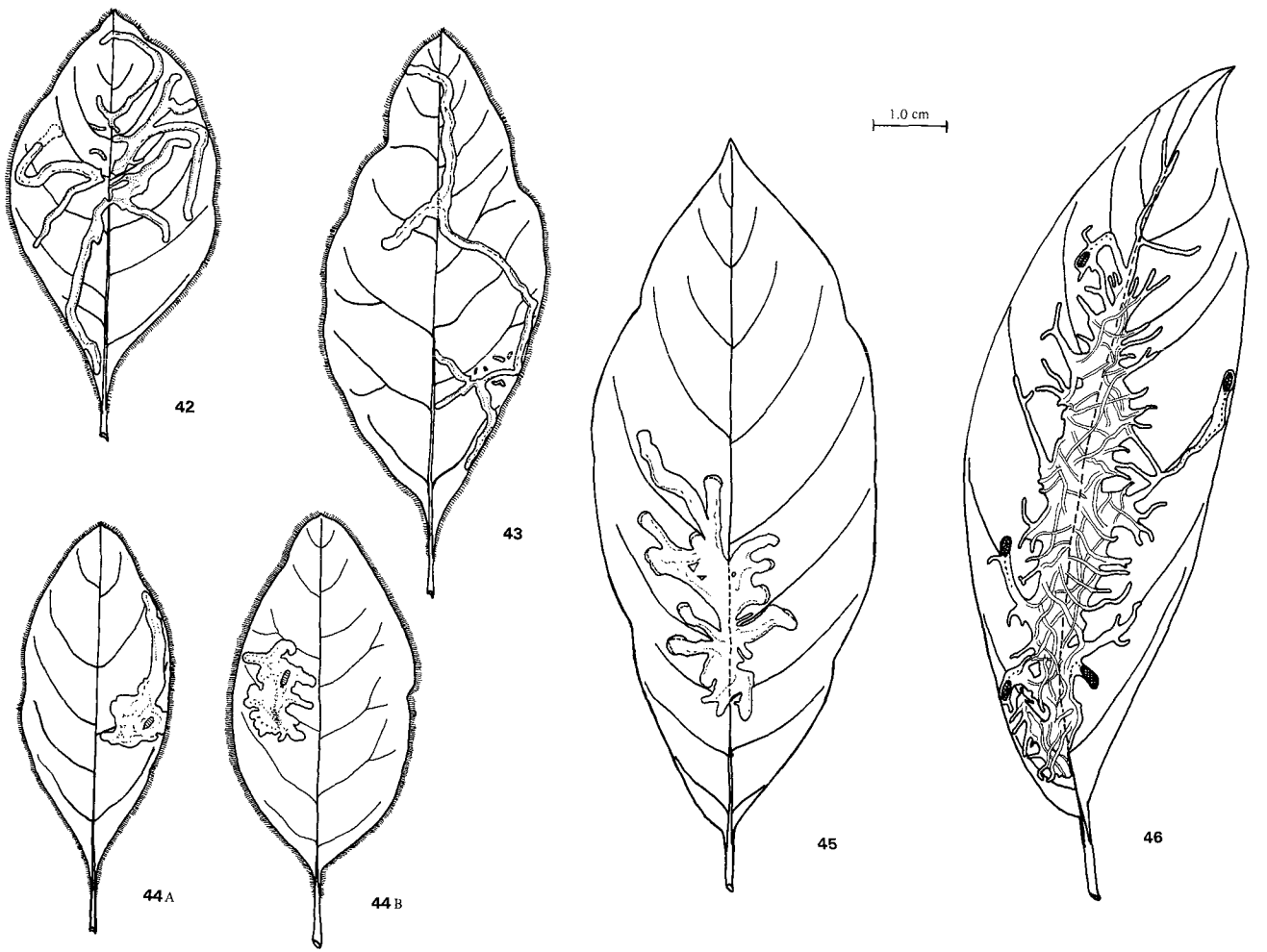


Fig. 42-44. Leaves of *Lonicera periclymenum* L. with mines of: 42, *Chromatomyia aprilina* (Goureau); 43, *Chromatomyia lonicerae* (Robineau-Desvoidy); 44A and 44B, *Chromatomyia periclymeni* (de Meijere) (both from Bookham, Surrey, England). Fig. 45-46. Leaves of *Lonicera involucrata* (Richards.) with communal mines of: 45, *Chromatomyia chamaemetabola* n.sp.; 46, *Chromatomyia gregaria* (Frick) (after Frick, 1954).

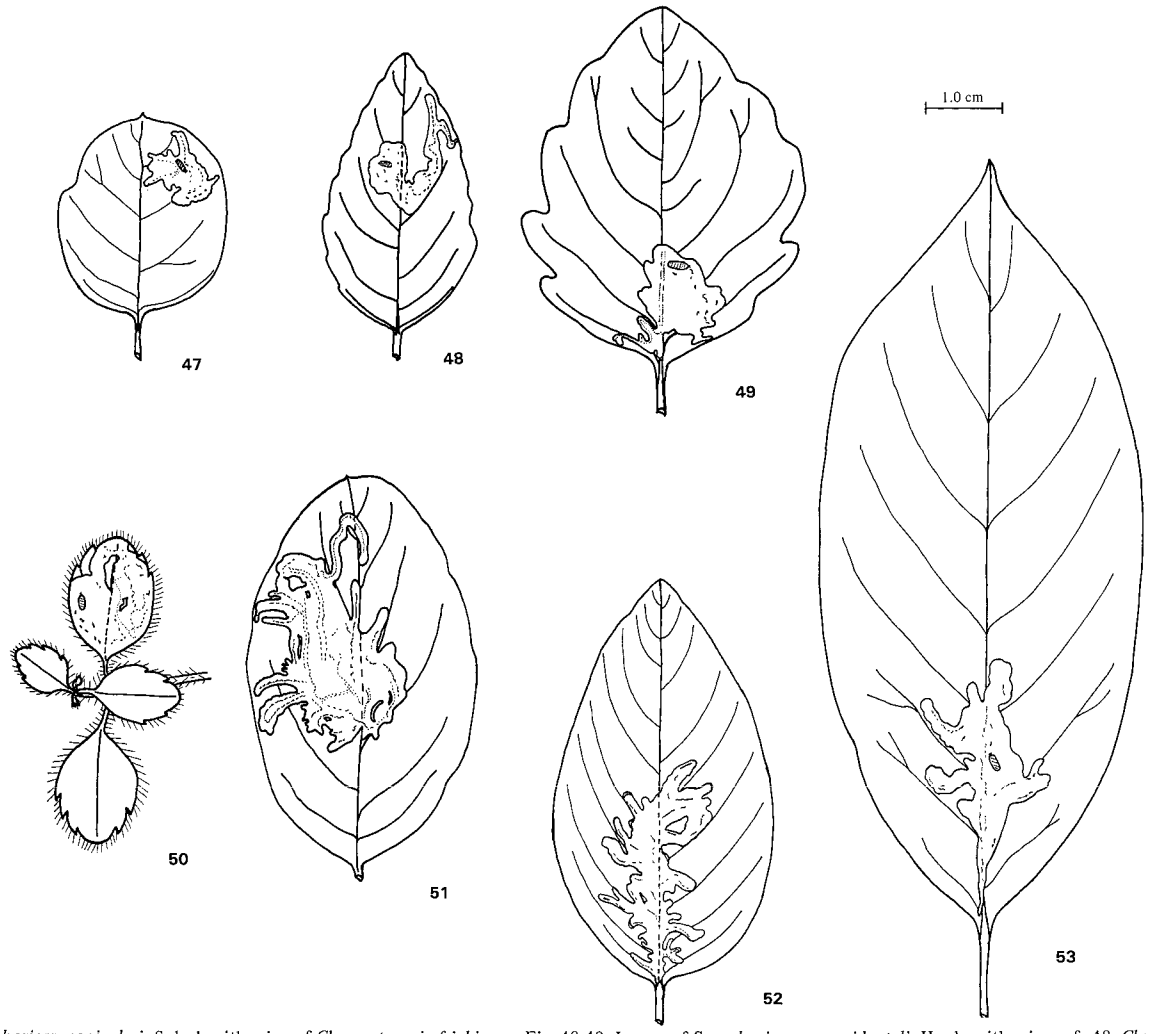


Fig. 47. Leaf of *Symphoricarpos rivularis* Suksd. with mine of *Chromatomyia fricki* n.sp. Fig. 48-49. Leaves of *Symphoricarpos occidentalis* Hook. with mines of: 48, *Chromatomyia caprifoliae* (Spencer); 49, *Chromatomyia symphoricarpi* n.sp. Fig. 50. Leaf of *Linnaea borealis* L. with mine of *Chromatomyia linnaeae* n.sp. Fig. 51. Leaf of *Lonicera dioica* L. with partly coalescing mines of *Chromatomyia nigrilineata* n.sp. Fig. 52. Leaf of *Lonicera nigra* L. with communal mines of *Chromatomyia alpigenae* (Hendel). Fig. 53. Leaf of *Lonicera alpigena* L. with mine of *Chromatomyia nervi* (Groschke).