

A STUDY OF THE JAPANESE AGROMYZIDAE (Diptera)

Part 2

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This paper is the second of a study of the Agromyzidae of Japan. The first was published in No. 12 of the Scientific Reports of the Kyoto Prefectural University, Agriculture (1960). This part is the systematic study. A general introduction to the studies, historical review of the Japanese species, life history and characteristics and classification of mines are given in the preceding part. This work consists of an examination, description and illustration of all the species, including the immature stages, but only the male and female terminalia are described for well-known species.

Systematic collection of the leaf-mines and careful breeding to the adult stage are not only valuable for the identification of many closely related species but useful for the purpose of their biological surveys. The adult flies are preserved as dry specimens pinned on micropins between the coxae and the majority of the larvae and puparia are preserved in 70% alcohol. The male and female terminalia and the head and spiracles of larvae are mounted in several aspects on slides with Gater's solution. The herbarium specimens with mines of various stages of development are preserved in the same way as normal botanical collections. All the types of the new species are deposited in the Entomological Laboratory, Kyoto Prefectural University (formerly Saikyo Univ.).

The body length is measured from the frontal margin of head to the epandrium in male and to the ovipositor sheath in female. The front width is measured at level of an anterior ocellus between the margins of eyes when viewed in the dorsal aspect of head, and the front length is measured from the ocellar triangle to the tip of frontal lunule in the frontal aspect of head. The eye measurements are taken at the widest and highest distances, in the head viewed in profile. The genal height between the ventral margin of eye and the peristome is measured midway between the vibrissal angle and the anteroventral margin of postgena. The number of rows of the acrostichal bristles is counted at level of the first pair of postsutural dorsocentrals. The egg guides, spermathecae and ejaculatory apodeme are measured respectively at the points of greatest length and breadth. The spermathecal ratio is the relative length of spermatheca to that of spermathecal duct. The length of the spiracle is measured at distal end. The number of rows of the larval cuticular processes is counted on each median line of the dorsal, lateral and ventral sides.

The drawings, except for those of heads and leaf-mines, were made from slide preparations using the Zeichenapparat. The figures are not in the same scale or any constant scale of enlargement.

Abbreviations used in this paper are as follows: for bristles and wing veins: see figs. 7-8; for larva: A, abdominal segment; D, dorsal side; L, lateral side; T, thoracic segment; V, ventral side; 1-3 T, pro-, meso- and meta-thorax; 1-8 A, 1st to 8th abdominal segments; spinal pattern, for example, 3 A=8·0, 8 rows along anterior margin of 3rd abdominal segment but absent posteriorly; 3 T-4 A=3-4·2-3, metathorax to 4th abdominal segments bear 3 to 4 rows along anterior and 2 to 3 rows along posterior margins of each segment; angle A, amount of divergence between dorsal and median spiracular bulbs; B, amount of divergence between median and ventral bulbs; for pupation: E, in ground; M, in mine; for figures: *adult*-a, lateral view of head; b, wing; c, surstylus; d, lateral view of phallus; e, half of hypandrium, ventral view; f, ejaculatory apodeme; g, egg guide; h, halves of 9th tergite and sternite; i, spermatheca; j, ventral receptacle; q, cercus of male; r, processus longus; s, phallic hood; t, postgonite; *larva*-k, lateral view of head; l, cephalopharyngeal skeleton; m, anterior spiracle; n, posterior spiracle (rarely with last abdominal segment); p, cuticular processes on lateral side of 3rd abdominal segment; *puparium*-u, dorsal and v, caudal aspect; *mine*-o, mine on leaf.

I express my sincere thanks to Prof. Keizo Yasumatsu for his cordial help and to Dr. J. L. Gressitt, Mrs. M. K. Gressitt and Miss Laura Lofgren for their kindness in the editing of this paper.

KEY TO JAPANESE SUBFAMILIES AND GENERA

1. Subcosta developed throughout its length, coalescing with R_1 before reaching costa (Agromyzinae) 2
- Subcosta becoming a fold distally and ending in costa separately and basad of R_1 (Phytomyzinae)..... 7
- 2 (1). Halteres white or yellowish; mesonotum mostly with well-developed presutural dorso-central bristles **Agromyza**
- Halteres dark brown or black; presutural *dc* lacking 3
- 3 (2). Prescutellar bristles present; halteres with stalks brownish black, knobs partially yellow..... **Japanagromyza**
- Prescutellar bristles usually absent; halteres entirely black 4
- 4 (3). Carina between bases of antennae narrow..... 5
- Carina fusiformally or hemispherically prominent 6
- 5 (4). Frontalia without median carina **Melanagromyza**
- Frontalia with median carina **Carinagromyza**
- 6 (4). Orbital hairs reclinate..... **Ophiomyia**
- Orbital hairs proclinate **Tylomyza**
- 7 (1). Scutellar bristles four 8
- Scutellar bristles two **Cerodontha**
- 8 (7). Orbital hairs erect or reclinate, sometimes weakly developed or absent 9
- Orbital hairs proclinate, well-developed 12
- 9 (8). Costa reaching M_{1+2} 10
- Costa reaching R_{4+5} **Phytagromyza**
- 10 (9). Scutellum concolorous with mesonotum..... **Phytobia**
- Scutellum yellow, at least centrally..... 11
- 11 (10). Head and humeri black **Metopomyza**

	Head and humeri partly yellow.....	Liriomyza
12 (8).	Costa reaching apex of M_{1+2}	Phytoliriomyza
	Costa reaching apex of R_{4+5}	13
13 (12).	Cross-vein m-m present	Napomyza
	Cross-vein m-m absent	Phytomyza

Subfamily AGROMYZINAE Fallén

1. Genus *Agromyza* Fallén, 1810

This moderately large genus contains 14 Japanese species, 3 of which are Holarctic in distribution and 4 are Palaearctic. The rice leaf-miner, *A. oryzae*, and the barley and wheat miners, *A. albipennis* and *yanonis*, are among the most important insect pests in Japan.

The genus *Agromyza* was divided by Hendel (1931) into 6 groups, i. e., *anthracina*, *cinerascens*, *orobi*, *reptans*, *rubi* and *spiraeae*-group, depending mainly on the chaetotaxy, wing venation and coloration of fringe on the calypter. I am here adopting his method of dividing the species groups, but I have found it necessary to modify some of the definitions for the Japanese species because the best characters for group definition lie in the male and female genital structures. The Japanese species of this genus are divided into 2 distinct sections. The first section which is represented by the *reptans* group is subdivided into 2 subgroups: viz., *reptans* (including *A. reptans*, *rufipes* and *wistariae*) and *albipennis* (*A. albipennis*, *lunulata*, *mobilis*, *oryzae*, *phragmitidis* and *yanonis*) and the second *rubi* group also into 2: *rubi* (*A. rubi* and *cinerascens*) and *spiraeae* (*A. spiraeae*, *betulae* and *nigrescens japonica*) subgroups. The species of the *anthracina* group are not represented in Japan. The usual arrangement of 1 presutural and 3 postsutural dorso-central bristles is found only in the *rubi* group, but most Japanese species have 1+4 *dc* or more presutural or postsutural dorso-centrals. The species of the *rubi* group, excepting *nigrescens japonica*, are not provided with the mid-tibial bristle. The endophallus of the *reptans* group is folded ventrad, while that of the *rubi* group is straight and very weakly sclerotized. The distal lobes of endophallus are numerous striated and spinose ventrally in species of the *reptans* subgroup, and the surstylus is provided with numerous spines, differing from that of the *albipennis* subgroup. The species of the *rubi* subgroup are considered to be highly specialized, the cercus of the male is provided with many spines on the anteroventral part and the spermatheca with the partite proximal end. The blade of the ejaculatory apodeme is usually plectrum- or fan-shaped and the bulb is small, but in the species of the *spiraeae* subgroup the bulb is extremely dilated and larger than the blade. All the species of the *albipennis* subgroup, which are grass-miners, have the shining mesonota and the egg guides with long processes covered with setae. On the other hand, species of the *reptans* subgroup, which are miners in dicotyledons, have the mesonotum subshining, the processes of egg guides short and not originated proximally, and the spermathecae striated. The long, suboval and serrated egg guides in species of the *rubi* group are remarkably different from those of the *reptans* group, although they are of the same type as found in *Japanagromyza*, *Melanagromyza* and allied genera.

The larva of *A. oryzae* is unusual in having large and hemispherical anterior spiracles. The larvae of the Japanese species except for *A. rubi* and *rufipes* have 3 large bulbs on each posterior spiracle, and those of *A. albipennis*, *phragmitidis* and *yanonis* have hair tufts

beside the bulbs. All the mature larvae of the Japanese species abandon their mines to transform.

KEY TO ADULTS

1. Mesonotum with 1+4 *dc*, or more presutural and postsutural *dc*, presutural pairs very weakly developed, often not differ from setulae, but posterior 3 pairs strong, 1st of 1+4 behind level of *prs* 2
 Mesonotum with 1 + 3 *dc*, each strongly developed, 1st pair of *dc* situated usually before level of *prs* 12
- 2 (1). Wing tip between terminations of R_{4+5} and M_{1+2} 3
 Wing tip situated near termination of M_{1+2} **rubi**
- 3 (2). Mesonotum with inner post-alar and prescutellar bristles strong..... 4
 Mesonotum without *ipa* and *prsc*..... **cinerascens**
- 4 (3). Mesonotum subshiny, densely dusted with gray. Larvae mine leaves of plants of class Dicotyledoneae 5
 Mesonotum strongly shining, slightly pollinose. Larvae mine leaves of plants of family Gramineae 7
- 5 (4). Fringe of calypter yellowish white; all tibiae yellow to yellowish brown..... 6
 Fringe of calypter dark brown; tibiae brown..... **wistariae**
- 6 (5). Femora black. Mesonotum shiny, gray pollinose..... **reptans**
 Knees of all legs yellowish brown. Mesonotum subshiny, densely gray-dusted **rufipes**
- 7 (4). Costa reaching apex of R_{4+5} 8
 Costa reaching apex of M_{1+2} 9
- 8 (7). Fringe of calypter blackish brown..... **mobilis**
 Fringe of calypter whitish yellow **yanonis**
- 9 (7). Front almost as broad as length between vertical margin and base of antennae, and 1.5-2 × as wide as either eye 10
 Front narrower than long (5 : 7), as wide as eye 11
- 10 (9). Margin and fringe of calypter brownish black..... **lunulata**
 Margin and fringe of calypter yellow **albipennis**
- 11 (9). Ocellar bristles short; margin and fringe of calypter dark brown to black... **oryzae**
Oc long; margin and fringe of calypter yellowish white **phragmitidis**
- 12 (1). Fringe of calypter dark brown..... 13
 Fringe of calypter whitish yellow 14
- 13 (12). Front as broad as long; parafrontalia, in profile, distinctly extending beyond upper eye-margin; gena 1/6 eye height **spiraee**
 Front narrower than long; parafrontalia and gena very narrow **betulae**
- 14 (12). Costa reaching apex of R_{4+5} **cinerascens**
 Costa reaching apex of M_{1+2} **nigrescens japonica**

KEY TO ADULTS, WITH REGARD TO MALE AND FEMALE TERMINALIA

1. Endophallus folded ventrally. Egg guides without serration 2

- Endophallus straight and weakly sclerotized. Egg guides with serration..... 9
- 2 (1). Egg guide with elongate process; cerci of ♀ without setulae..... 3
Egg guide without process; cerci of ♀ ventrally covered with setulae ... **wistariae**
- 3 (2). Surstylus with 45–50 spines; endophallus striated. Egg guide with process shorter than its own length..... 4
Surstylus with 9–23 spines; endophallus smooth. Egg guide with process as long as or longer than its own length..... 5
- 4 (3). Ejaculatory apodeme with a basal projection. Spermatheca suboval, numerous-ly and slightly striated **reptans**
Ejaculatory apodeme without projection. Spermatheca fusiform, broadened apically, distinctly about 14-striated **rufipes**
- 5 (3). Endophallus longer than paraphallus 6
Endophallus shorter than paraphallus..... 8
- 6 (5). Surstylus with about 10 spines. Sternite 9 with 4 long and 4 short *nsm*; spermatheca excavated proximally 7
Surstylus with about 20 spines. Sternite 9 with 5 pairs of long *nsm*; spermatheca striated, excavated proximally and distally..... **phragmitidis**
- 7 (6). Surstylus with 11–13 spines. Spermatheca suboval **yanonis**
Surstylus with 7–9 spines. Spermatheca elongated oval..... **mobilis**
- 8 (5). Spermatheca suborbicular, with neck longer than capsule. Ventral receptacle about 4 × length of spermathecal duct **albipennis**
Spermatheca oval, with neck about 1/2 as long as capsule. Ventral receptacle shorter than spermathecal duct..... **oryzae**
- 9 (1). Cercus of ♂ with many spines anteroventrally. Spermatheca with partite proximal end 10
Cercus of ♂ without spine. Spermatheca with smooth proximal end..... 11
- 10 (9). Endophallus membranous proximally. Ejaculatory apodeme plectrum-shaped, bulb about 1/2 as high as blade. Egg guide with indistinct serration. Ventral receptacle very short and setulose basally **rubi**
Endophallus with long rod-like processes proximally. Ejaculatory apodeme fan-shaped, bulb about 1/5 as high as blade. Egg guide with minute serration. Ventral receptacle long and coiled..... **cinerascens**
- 11 (9). Postgonite with 3–5 setulae ventrally. Egg guide with loose serration; spermatheca spherical, with duct slender..... 12
Postgonite with about 10 setulae. Egg guide with distinct teeth; spermatheca less chitinized hemispherically, with duct expanded at distal end..... **nigrescens japonica**
- 12 (11). Surstylus with a heavy spine **betulae**
Surstylus with 4–6 spines **spiraeae**

KEY TO LARVAE

1. Larvae mine leaves of plants of family Gramineae 2
Larvae mine leaves of plants of class Dicotyledoneae 7
- 2 (1). Anterior spiracle small, knob-like, with 6–18 bulbs..... 3
Anterior spiracle large, hemispherical, with numerous spiracular bulbs **oryzae**

- 3 (2). Mandible with 2-3 teeth..... 4
 Mandible with 4 teeth..... 6
- 4 (3). Head without cuticular process ventrad of mandibles. Posterior spiracle with 3- or 4-branched hairs between bulbs 5
 Head with rows of cuticular processes immediately ventrad of mandibles. Posterior spiracle without hair **mobilis**
- 5 (4). Head with filaments just above mandibles..... **phragmitidis**
 Head without filament **cinerascens**
- 6 (3). Abdominal segment 8 with a pair of fleshy protuberances immediately ventrolaterad to posterior spiracles..... **albipennis**
 Abdominal segment 8 with a pair of fleshy protuberances dorsolaterad to anus **yanonis**
- 7 (1). Bulbs of posterior spiracle elongate, about 1/2 as long as spiracular length 8
 Bulbs of posterior spiracle small, about 1/3 length of spiracle 9
- 8 (7). Anterior spiracle with 9-12 bulbs; posterior spiracle not curved; cuticular processes pale brown, 3-4·2-3 on abdominal segment 3..... **nigrescens japonica**
 Anterior spiracle with 14-34 bulbs; posterior spiracle curved proximally; cuticular processes brown, 5-6·4-5 on abdominal segment 3 **wistariae**
- 9 (7). Posterior spiracle without hair tuft..... 10
 Posterior spiracle with large hair tufts beside bulbs..... **reptans**
- 10 (9). Posterior spiracle with 6 bulbs. Mesothoracic segment without cuticular process **rubi**
 Posterior spiracle with 3 bulbs. Mesothoracic segment with rows of cuticular processes 11
- 11 (10). Anterior spiracle with 6-7 bulbs; teeth of mandible pointed terminally..... **rufipes**
 Anterior spiracle with 9 bulbs; teeth of mandible angulated terminally ... **spiraeae**

Agromyza albipennis Meigen, 1830, Syst. Besch. bekann. eur. zweifl. Insekt. 6: 171. Fig. 1

Male and female terminalia generally similar to those of *oryzae*, but praegonites smaller, postgonites each with 5 minute sensory setae, ejaculatory apodeme fan-shaped, 168 μ long and 170 μ wide. Ovipositor sheath with pubescence on distal 2/3; tergite 9 120 μ long, sternite 135 μ long, with 3 pairs of *nsm*; spermathecae suborbicular with truncate proximal end, 100 \times 116 to 128 \times 144 μ , about 0.18 length of ducts, necks 128 μ long; ventral receptacle colorless, 2840 μ long; ducts of accessory glands longer than spermathecal ducts, 740 μ long, 10 μ in diameter, dilated on distal 1/6.

Mature larva milky white, 5-6 mm in length, 1.5 mm in width. Head with 3 pairs of colorless sensory filaments just above mandibles and minute subconical processes on cephaloventral part of mandibles; mandible with 4 teeth; mandibular abductor apodeme very narrow. Anterior spiracles each with 12-13 bulbs; posterior spiracles approximate at bases, 94 μ long, 1.6 \times as long as anterior, angle of divergence between two adjacent bulbs about 80°. Spinal pattern: on dorsal, 3T, 4A=3·2, 1-3A=3·3, 5A=2·2, 6-7A=1·1; on lateral, 1T=6·0, 2T=1·2, 3T-4A=3-4·3-4, 5-6A=2·2, 7A=1·1, 8A=1·3; on ventral side 2-3T=6·0, 1-2A=4·0, 3-4A=3·0, 5-6A=2·1, 7-8A=1·1.

Numerous adults were reared from mines in grasses at various localities in Japan.

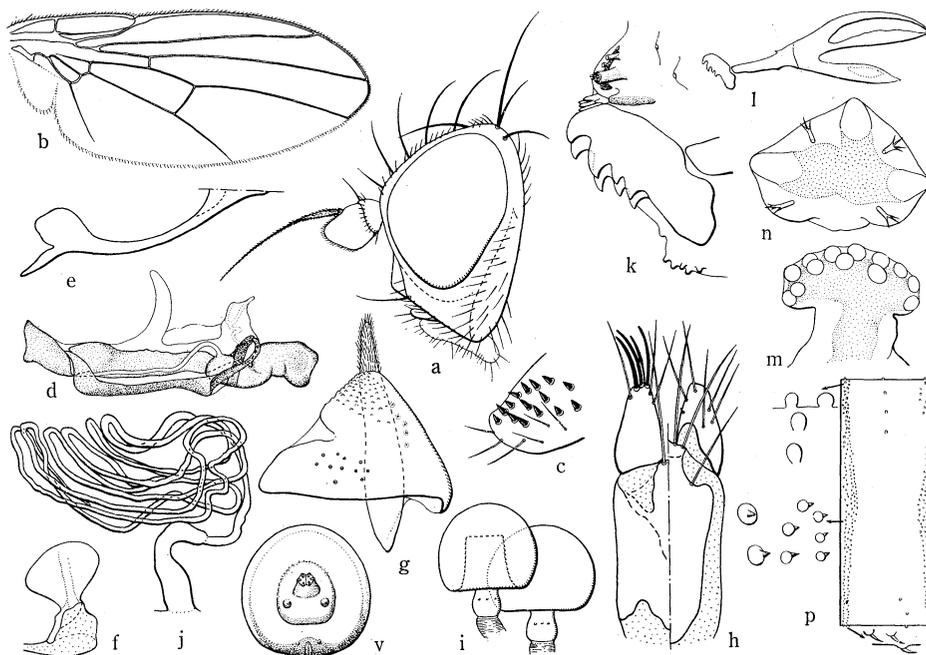


Fig. 1. *Agromyza albipennis* Meigen.

DISTRIBUTION: Europe, Japan.

Hendel, in 1931, noted "1 Exemplar aus Kantschatka zeigt beiderseits 3 gleichstarke ori." The specimens from Japan exhibit a remarkable variation in number of lower fronto-orbital bristles, 50.0 % of specimens examined has 3 bristles on both sides, 23.5 % with 3 on one side, 26.5 % with 2 on either side. Also, the number of dorsocentral bristles varies as follows: 2+4, 2+4—47.1 %, 1+4, 2+4—20.6 %, but other examples shown as 1+4, 1+4 (1♂); 1+4, 1+5 (1♀); 2+4, 3+4 (1♂, 1♀); 2+4, 3+5 (1♀); 2+5, 2+5 (1♂, 2♀); 3+4, 3+4 (1♀); 3+5, 3+5 (2♂), may be considered as aberrant forms.

HOSTS: *Hordeum vulgare* var. *hexastichon* Aschers. and var. *nudum* Hook., *Triticum aestivum* L., *Secale cereale* L., *Oryza sativa* L., *Phleum pratense* L., *Phalaris erucaeformis*, *P. arundinacea* var. *picta* L., *Agropyrum semicostatum*.

Agromyza betulae Sasakawa, n. sp. Fig. 2.

ADULT. Male: Black, dull, heavily grayish pollinose. Head black except for dark ferruginous frontalia and genae; ocellar triangle, parafrontalia and face subshining; antennae and palpi blackish brown. Wings hyaline, veins fuscous; margin and fringe of calypter brown. Legs brownish black, but knees of fore-femora and tarsi yellow, tibiae brown but proximal ends yellowish.

Head: Front $1.2 \times$ as wide as eye, narrower than long (12 : 16), sides converging ventrally; several slender hairs on arch of frontalia dorsad of lunule; parafrontalia rela-

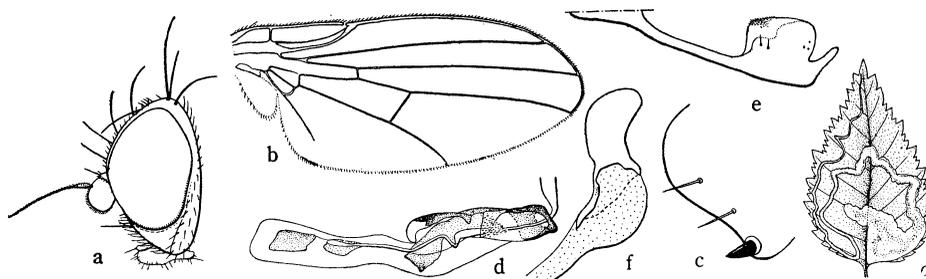


Fig. 2. *Agromyza betulae* Sasakawa, n. sp.

tively broad, nearly $1/4$ width of front. Ocellar triangle with ventral tip scarcely extending beyond level of 1. *ors*, bearing about 10 setulae plus *oc*. Lunule deeply sunken, semi-circular, about $1/3$ as high as distance between its dorsal margin and anterior ocellus. Parafrontalia bearing 4 pairs of *or*; 1. *ors* directed up- and outwards, 2. *ors* up- and slightly inwards and located before middle of front; *ori* directed inwards; *oh* densely arranged in a row. As viewed in profile, parafrontalia slightly extending beyond upper eye-margin; eye $1.3 \times$ as high as wide; gena $1/8$ eye height, extremely narrow near vibrissal angle; several slender setae dorsad of long *vi*; *pm* in 2 rows, 6-7 setae of dorsal row more or less upturned, 3-4 setae of ventral one proclinate. Antennae approximate at base; segment 3 suborbicular, with moderately long pile subequal to basal arisal thickness, arista $2 \times$ as long as whole length of antenna, swollen on basal $1/5$. *Thorax*: Mesonotum with $1+3$ *dc*, equally spaced, 1. *dc* less than $1/2$ length of 4. and located before level of *prs*, 3. *dc* a little behind level of *sa*; 6 rows of *acr*, becoming sparser caudad of 3. *dc* and extending to level of 4. *dc*; *prsc* strong; *ia* long; 4 rows of setulae between rows of *dc* and *sa*; *ipa* scarcely $1/3$ length of *opa*; humerus with about 10 setulae plus a long *h*. Mesopleura with 9-11 dorsally directed setulae; sternopleura with a seta and a few setulae cephalad of *sp*. *Wing*: Costa with sections 2-4 in proportion of 50 : 11 : 10; r-m at middle or slightly distad from middle of discal cell; m-m about $2/3$ length of penultimate section of M_{1+2} and at an angle of 70-90 to that; ultimate section of M_{1+2} $3-4 \times$ as long as penultimate; ultimate section of M_{3+4} about $3/4$ length of penultimate (25 : 19). *Abdomen*: Each tergite rather densely covered with setae; 6th $3/5$ length of 5th, and with *mar* not so long as those on other tergite. *Terminalia*: Epandrium $1/2$ length of tergite 6; surstyli each with a heavy spine on caudoapical angle and a few setae near mesal margin; cerci as high as epandrium. Hypandrium with apodeme and sidepieces narrow; praegonites large. Distiphallus broadly membranous; many setulae on ventral membrane between basiphallus and distiphallus; endophallus weakly sclerotized. Ejaculatory apodeme somewhat projected bluntly into one angle, 89μ long, 44μ wide. *Length*: Body about 2 mm; wing 2.2. Female unknown.

DISTRIBUTION: Japan.

Holotype ♂, Sapporo, Hokkaido, on *Betula*, 7 May 1950, Y. Nishijima; 1 paratype, same data.

This species is very closely allied to *A. spiraeae* Kaltenbach, but in the latter the front and genae are much narrower. The surstylus of *betulae* is provided with a heavy spine,

while that of *spiraeae* with 4–6 spines. The species may be also separable from the European *Betula*-miner, *A. alnibetulae* Hendel, by having the fringe of brown hairs on the calypter, and not having the mid-tibial bristle.

BIONOMICS. *Host*: *Betula tauschii* Koidz. *Mine*: Greenish white, ophistigmatonome, of upper surface type; minute grains of frass deposited in 2 rows along both sides of the linear mine, but later on scattered in the blotch mine. Long serpentine mine usually begins at tip of leaf, and extends towards the base along the leaf margin; E.

Agromyza cinerascens Macquart, 1835, Hist. Nat. Insect., Dipt. 2: 610. Fig. 3.

Male terminalia similar to that of *rubi*, but surstylus with sparser, longer spines; cercus with 27 spines, hypandrium as long as distiphallus, with long apodeme; endophallus very long. Postgonites with inner processes spinulate at distal ends. Ejaculatory apodeme broadened apically, 172 μ long, 160 μ wide, duct relatively broad, 16 μ in diameter.

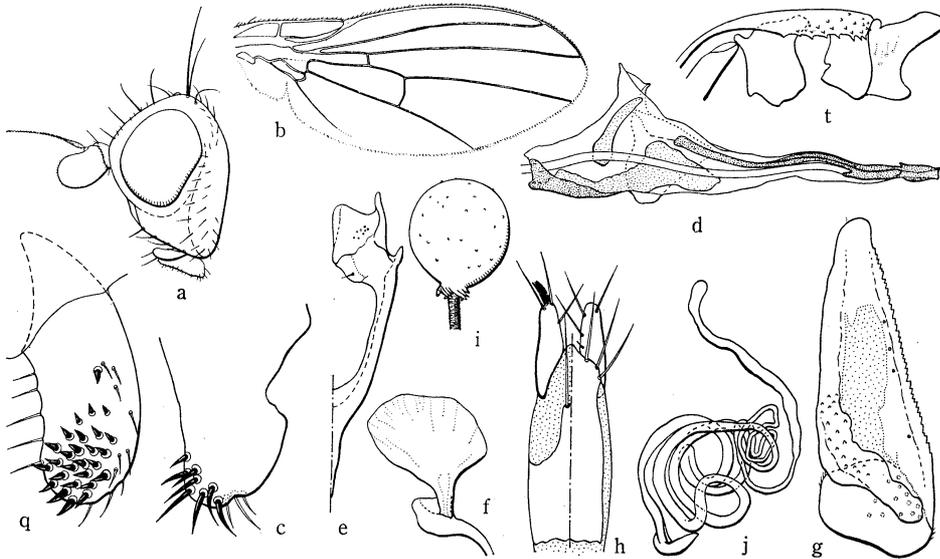


Fig. 3. *Agromyza cinerascens* Macquart.

Ovipositor sheath 1.7–2 \times as long as tergite 6, with pubescence on distal 1/3; apodeme pouched on distal 1/2. Egg guides large, 220 μ long, about 3.5 \times as long as broad, indistinctly and minutely 37-serrated ventrally. Tergite 9 small, 132 μ long, tapered on apical 1/2; sternite 9 with 3 pairs of *nsm*; cerci 80 μ long; *ts* 1/4 length of cercus. Spermathecae spheroidal, spinulate, with partite proximal ends, 124 \times 104 to 144 \times 144 μ , with necks short, ducts slender, 600 μ long, 10 μ in diameter; ventral receptacle 2000 μ long, proximal 3/5 brown, folded about 7 \times .

Many $\sigma\sigma$ and ♀♀ were collected at Kibune, Kyoto, 12–16 Apr. 1958, Sasakawa.

DISTRIBUTION: Europe, Japan, N. Africa.

This species is remarkably different from the other grass-miners, especially in the absence of the inner post-alar and prescutellar bristles, and the possession of the spinulae on the cerci and the spermathecae. The more primitive species, *A. rubi* Brischke is also provided with spines on the anteroventral parts of the cerci, but sparser than the present species. The spinulose spermathecae and the large and serrated egg guides are found generally in the species of the genus *Japanagromyza*.

HOSTS: *Dactylis* and *Secale* spp.

Agromyza lunulata Sasakawa, 1956, Saikyo Univ., Sci. Rep. Agr. 8: 124.

Fig. 4.

DISTRIBUTION: Japan.

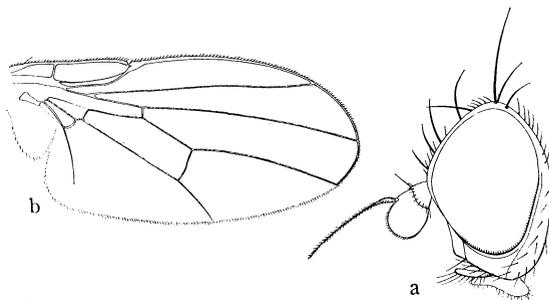


Fig. 4. *Agromyza lunulata* Sasakawa.

Agromyza mobilis Meigen, 1830, Syst. Besch. bekannt. eur. zweifl. Insekt. 6: 169. Fig. 5.

Terminalia very similar to that of *yanonis*, but surstylus with 7-9 heavy spines and 2 setae at tip; endophallus almost as long as distiphallus, with spinules at apex; ejaculatory apodeme 180-200 μ long, 100-112 μ wide.

Ovipositor sheath as long as tergite 6, pubescent on distal 2/3. Egg guides 108 μ long. Tergite 9 rather short, 105 μ long, sternite 140 μ long; cerci 72 μ long, each with 4 long *ts*. Spermathecae elongate-oval, 130 \times 60 to 280 \times 100 μ , necks and ducts short but broad,

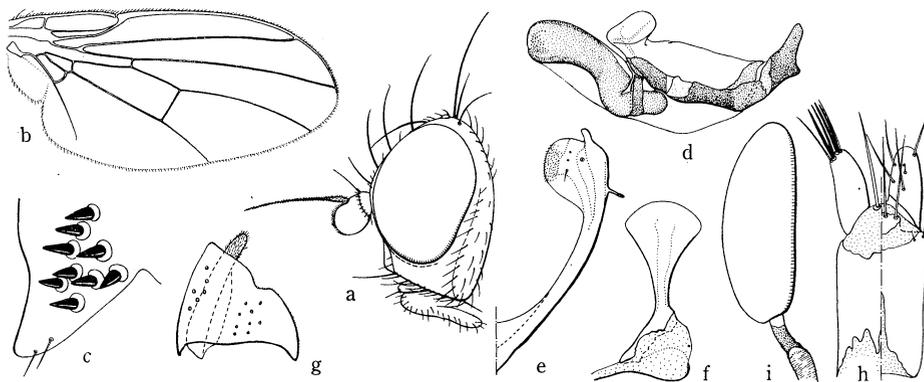


Fig. 5. *Agromyza mobilis* Meigen.

in the former $36\ \mu$ long, $25\ \mu$ broad and in the latter $500\ \mu$ long and $20\ \mu$ in diameter; ventral receptacle $580\ \mu$ long, tail about $4\times$ as long as basal body.

Many, Kibune, Kyoto, 12 Apr. 1958, Sasakawa; Mt. Tsurugi, Tokushima, Shikoku, 2-3 June 1957, Sasakawa.

DISTRIBUTION: Europe, Japan, N. America.

The larvae of this species mine the leaves of grasses.

Agromyza nigrescens japonica Tsujita, 1951, Kyushu Univ., Sci. Bull., Fac. Agr. 13 (1/4): 53. Fig. 6.

Male terminalia similar to that of *spiraeeae*, but surstylus with 3 sharp spines; basiphallus with brownish minute hairs dorsally; postgonite with 10-12 sensory setae; ejaculatory apodeme $92\ \mu$ long, $32\ \mu$ broad. Ovipositor sheath $1.5\times$ as long as tergite 6. Egg guides $208\ \mu$ long, with about 20 teeth of serration. Tergite 9 is $108\ \mu$ long, fused with sternite laterally, sternite about $1.5\times$ as long as tergite, bearing 3 pairs of *nsm*; cerci $84\ \mu$ long, each with 4 short *ts*. Spermathecae characteristic club-shaped, weakly chitinized at apex, 100×76 to $120\times 72\ \mu$, with necks colorless, $48\ \mu$ long, $32\ \mu$ broad, ducts about $7\times$ as long as length of capsule, $848\ \mu$ long and $19\ \mu$ in diameter; ventral receptacle $3920\ \mu$ long, with tail extremely long, brownish on basal $1/2$, coiled about $8\times$ but apical $1/2$ colorless and loosely coiled.

Spinal pattern of larva: on dorsal side, 1T=6-7.0, 2-3T=4.0, 1-3A=2.1, 4-7A=1.1; on lateral, 2T=3.0, 3T-4A=3.4-2-3, 5-7A=2-3.1, 8A=1.0; on ventral, 1T=3.0, 2T=4.0, 3T-4A=2.1, 5-7A=1.1, 8A=1.0.

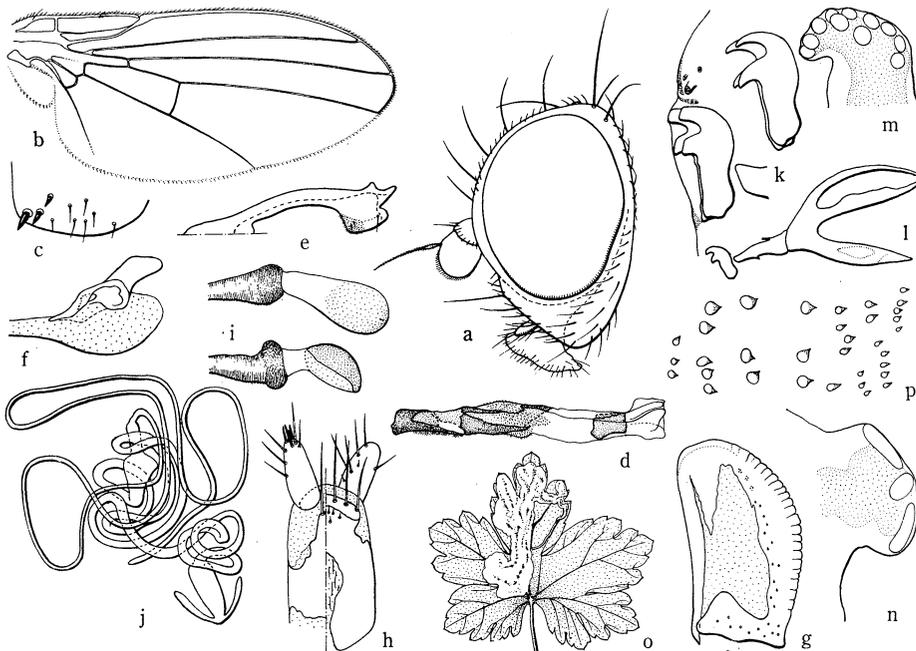


Fig. 6. *Agromyza nigrescens japonica* Tsujita.

Additional material, including larvae, at Shibeche, Hokkaido, 20 June 1954; Kibune, Kyoto, 29 Apr. 1958; Tsurugisan, Shikoku, 2 June 1957; Hikosan, Kyushu, 3 May 1956, Sasakawa.

DISTRIBUTION: Japan.

HOST: *Geranium nepalense* Sweet.

Agromyza oryzae (Munakata) Figs. 7-9.

Oscinis oryzae Matsumura, Munakata, 1910, Konchu Sekai **14** (9): 7.

Agromyza oryzae (Munakata): Kato, 1956, Nat. Inst. Agr. Sci., Bull. Ser. C, no. 6: 25.

Agromyza oryzae Hendel, 1931, IN Lindner: Die Flieg. palaearkt. Reg. **59**: 142.

Oscinis oryzella Matsumura, 1915, Man. Inj. Ins. Japan **2**: 53.

ADULT. *Male*: Head black, ocellar triangle and parafrontalia subshiny; sometimes front dorsally, genae posteriorly and antennae tinged with brown; lunule and antennal segment 1 brownish black; palpi black. Thorax and abdomen shiny black, grayish pollinose, more densely in the latter. Wings hyaline, with faint brownish tinge; veins yellowish brown, costa darker; calypteres yellowish white, with pale yellow-brown margins and fringe of dark brown to black hairs. Legs black, with tarsi blackish brown, but proximal 4 tarsal segments and fore-knees yellowish brown.

Head: Front $1.3-1.5\times$ as wide as eye, as wide as long, almost parallel-sided; parafrontalia about $1/5$ width of front. Ocellar triangle with ventral tip extending near to level of 2. *ors*; *oc* relatively short, about $1/2$ length of 1. *ors*, accompanying 6-8 setulae. Lunule less than semicircular, about $1/5$ length of front. Fronto-orbitals commonly 5-7 pairs; *ors* 2, reclinate, 1. *ors* slightly outwards; *ori* usually 4 (3-5), directed up- and inwards; *oh* comparatively long, sparsely arranged in a row. In profile parafrontalia and parafacialia distinctly extending beyond eye-margin; parafacialia about $2/3$ as wide as diameter of antennal segment 1; eyes $1.4\times$ as high as wide, with sparse hairs; gena $1/6-1/7$ eye height. Face slightly wider than long; carina narrow; antennal grooves deep. Antennal segment 3 broader than long, axe-shaped, somewhat angulated apically, pilose; arista about $1.5\times$ as long as whole length of antenna, swollen on a basal $1/4$, pubescent. *Vi* long; *pm* 7-12 in 1 or 2 rows. *Thorax*: Mesonotum with 2+4 *dc*, shortened anteriorly, 2. *dc* just behind level of *prs*, 5. *dc* behind level of *sa*; *acr* in 5-6 rows, becoming sparser behind level of 5. *dc*, ending before *prsc*; 5 or 6 rows between 4. *dc* and *sa*; *ia* and *sa* each long; *ipa* about $1/2$ as long as *opa*; humerus with 16-20 setulae plus *h*. Mesopleura with 7-15 dorsally directed setulae; sternopleura usually with 3(2-4) setae before *sp*. *Wing*: Costa with sections 2-4 in proportion of 59:18:11.5; r-m distad beyond middle of discal cell; m-m shorter than penultimate section of M_{1+2} and at angle of $100-110^\circ$ to that; ultimate section of M_{1+2} approximately $4\times$ (3.6-3.9, rarely 3.1) as long as penultimate; ultimate section of M_{3+4} $1/2-2/3$ length of penultimate. *Leg*: Fore-tibia with 2 dorsal rows of erect setae; mid-tibia with 2 posterodorsal bristles. Fore-tarsus with yellowish white hairs densely on ventral side, being subequal in length to width of tarsal segment. *Abdomen*: Tergite 6 slightly longer than 5th (10:8), tergite 7 about $1/5$ of 6th. *Terminalia*: Epandrium about $1/2$ length of tergite 6; surstylus with 11-14 heavy spines in about 4 rows; cerci almost as high as epandrium (fig. 8, A). Hypandrium medium-sized; praegonites about $1/3$ length of hypandrium, each with 2 short setae and 3-4 sensory pores

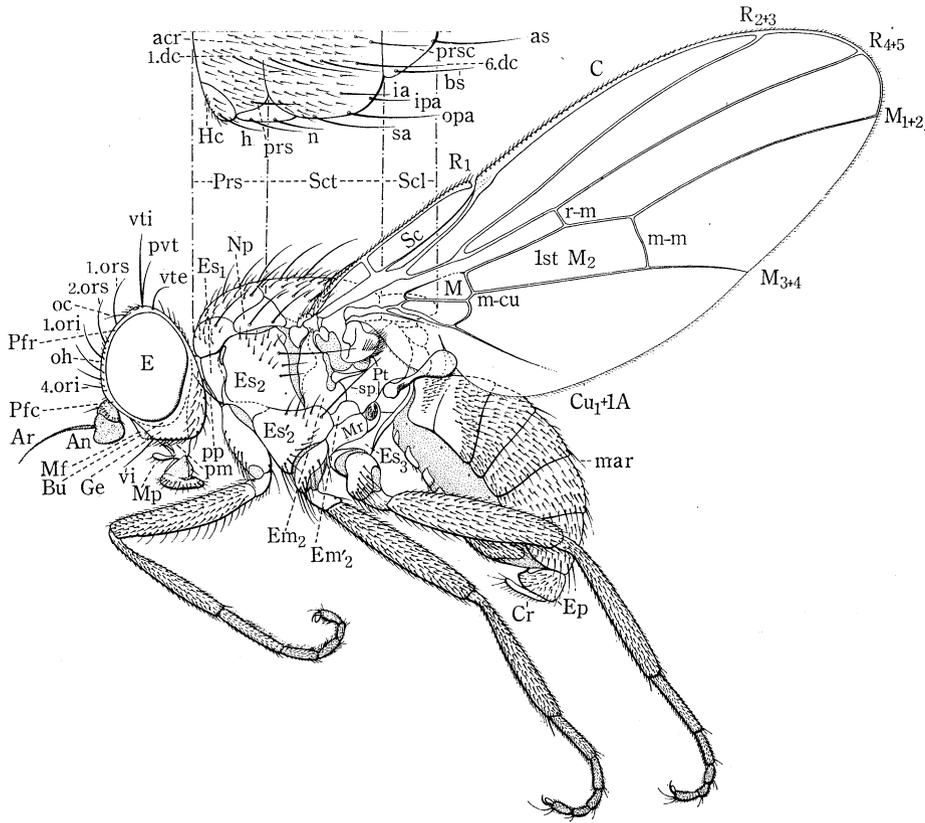


Fig. 7. *Agromyza oryzae* (Munakata). ♂, lateral view. An: antenna; Ar: arista; Bu: bucca; Cr: cercus; E: compound eye; Em₂: pteropleuron; Em'₂: hypopleuron; Ep: epandrium; Es₁: episternum of propleuron; Es₂: mesopleuron; Es'₂: sternopleuron; Es₃: episternum of metapleuron; Ge: gena; Hc: humeral callus; Mf: face; Mp: maxillary palpus; Mr: meron of mesocoxa; Np: notopleuron; Pfc: parafacialia; Pfr: parafrontalia; Prs: prescutum; Pt: pleurotergite; Scl: scutellum; Sct: scutum. Setal groups:—acr: acrostichal; as: apical scutellar; bs: basal scutellar; 1. & 6. dc: 1st and 6th dorsocentrals; h: humeral; ia: intra-alar; ipa: inner post-alar; mar: marginal setae of abdomen; n: notopleural; oc: ocellar; oh: orbital; 1. & 4. ori: 1st and 4th lower fronto-orbitals; 1. & 2. ors: 1st and 2nd upper fronto-orbitals; opa: outer post-alar; pm: peristomal; pp: propleural; prs: presutural; prsc: prescutellar; pvt: postvertical; sa: supra-alar; sp: sternopleural; vi: vibrissa; vte: outer vertical; vti: inner vertical. Veins:—C: costa; Sc: subcosta; R₁: radius 1; R₂₊₃: radius 2 and 3; R₄₊₅: radius 4 and 5; M₁₊₂: media 1 and 2; M₃₊₄: media 3 and 4; Cu₁+1A: cubitus 1 and anal 1; r-m: radio-medial; m-m: medial; m-cu: medio-cubital; M: second basal cell; 1st M₂: discal cell.

on ventral surface. Distiphallus well sclerotized, with ventrodistally large process; paraphallus with pointed process at middle; endophallus curved ventrally, spinulose distally and setulose internally. Phallapodeme about 1.5× as long as hypandrium. Postgonite with 3 short setae, with inner dorsal process spinulose ventrally on posterior 1/2. Ejaculatory apodeme broadened apically, 172 μ long, 100 μ wide. *Length*: Body and wing 2.8–3mm.

Female: Similar to ♂, but front slightly wider; gena about 1/5 eye height. Fore ti-

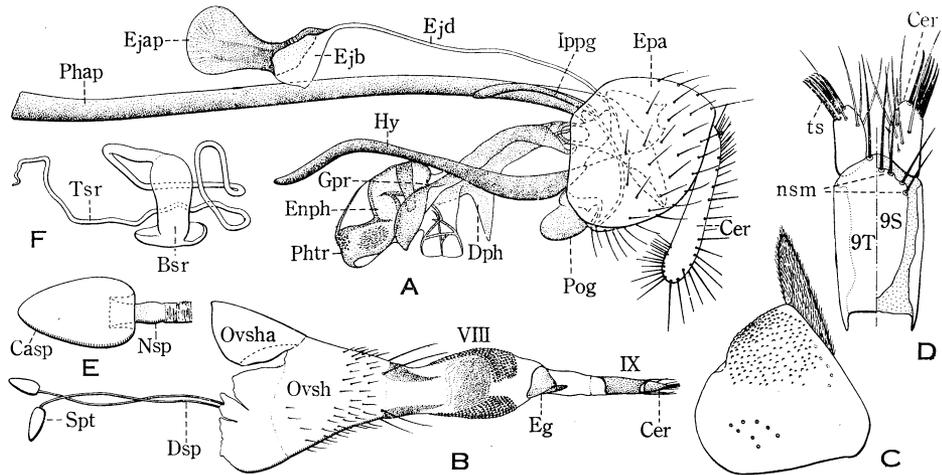


Fig. 8. Male and female terminalia of *A. oryzae*. A: Lateral view of male terminalia, pregenital segments removed. B: Lateral view of female terminalia. C: Egg-guide, lateral view. D: Ninth segment and cerci. E: Spermatheca. F: Ventral seminal receptacle. Bsr: body of ventral receptacle; Casp: capsule of spermatheca; Cer: cercus; Dph: distiphallus; Dsp: spermathecal duct; Eg: egg guide; Ejap: Ejaculatory apodeme; Ejb: ejaculatory bulb; Ejd: ejaculatory duct; Enph: endophallus; Epa: epandrium; Gpr: gonopore; Hy: hypandrium; Ippg: inner process of postgonite; Nsp: neck of spermatheca; nsm: marginal setae of 9th segment; Ovsh: ovipositor sheath; Ovsha: apodeme of ovipositor sheath; Phap: phallapodeme; Phtr: phallotreme; Pog: postgonite; Spt: spermatheca; Tsr: tail of ventral receptacle; ts: tactile sensillae; VIII: 8th segment; IX: 9th segment; 9S: 9th sternum; 9T: 9th tergum.

biae and tarsi without distinct setae and hairs as in ♂. Abdominal tergites with *mar* much longer than in ♂; tergite 6 as long as 5th. *Terminalia*. Ovipositor sheath shiny, (fig. 8, B) slightly longer than tergite 6, with pubescence on posterodorsal 1/4, but on posterior 1/2 laterally and on its entire length ventrally; apodeme strongly chitinized, 1.5 × as long as broad, pouched on distal 1/2-2/3. Egg guides (C) triangular, 128 μ long, each with numerous spinulae on laterodistal part, many sensillae on outer and inner side, inner prolonged processes covered with dense setae. Segment 9 (D) medium-sized; tergite 180 μ long and 110 μ broad, overspreading laterally, sternite shield-shaped, 120 μ long, with 2 pairs of *nsm* distally and 1 or 2 pairs laterally, sometimes a short seta mesally. Cerci 64 μ long, each with 4-5 long *ts*, which are 3/4 as long as length of cercus, 3 setae on dorsal side, 5 setae and 2 setulae ventrally. Spermathecae (E) relatively large, elliptical, with truncate proximal ends, 152 × 88 to 172 × 120 μ, necks weakly chitinized on both ends, 70 μ long and 16 μ broad, ducts 1080 μ long and 18 μ in diameter; ventral receptacle (F) with body broad, tail transversely folded about 5×, 780 μ long. *Length*: Body about 3 mm; wing 3.33-3.5.

LARVA. Mature larva (fig. 9, A) yellowish white, 4.5-5.2 mm in length, 1-1.5 in height. Antennae (B) about 2/3 as long as maxillary palpi; maxillary palpi each with about 9 basiconic sensillae; 3 pairs of minute sensillae between antennae and maxillary palpi. Mandibles (C) black, subrectangular, concave shallowly where labial sclerite connected, asymmetric, each with 5 teeth, labial sclerite longer than mandible; paraclypeal

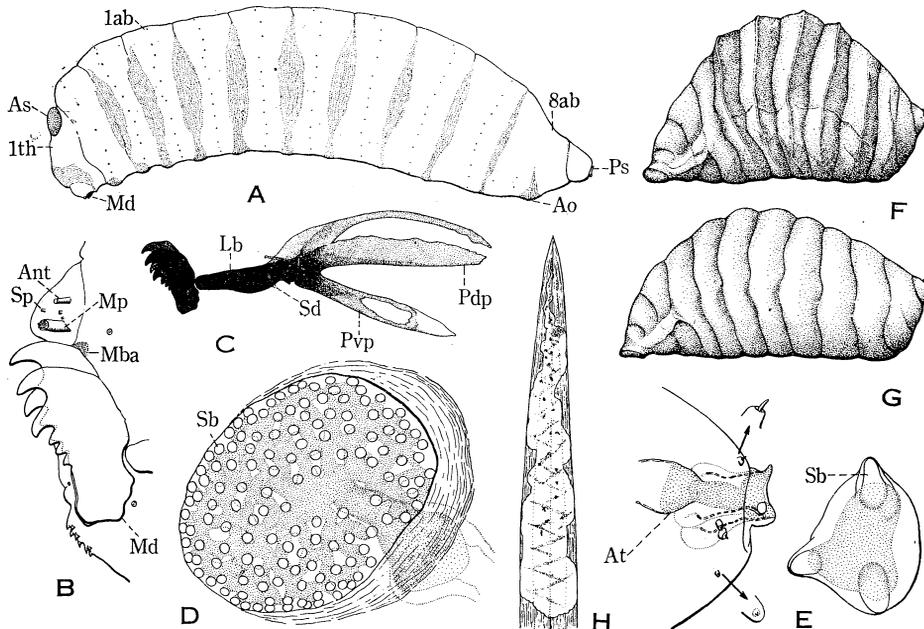


Fig. 9. Larva, puparia and mine of *A. oryzae*. A: 3rd instar larva, lateral view. B: Head, lateral view. C: Cephalopharyngeal sclerites, lateral view. D: Anterior spiracle, dorsal view. E: Posterior spiracle, lateral and dorsal views. F: Puparium of hibernant type, lateral view. G: Puparium of non-hibernant type. H: Mine on a leaf of *Oryza sativa* L. Ant: antenna; Ao: anal opening; As: anterior spiracle; At: atrium; Lb: labial sclerite; Mba: mandibular abductor apodeme; Md: mandible; Mp: maxillary palpus; Pdp: dorsal process of paraclypeal phragma; Ps: posterior spiracle; Pvp: ventral process of paraclypeal phragma; Sb: spiracular bulb; Sd: salivary duct; Sp: sensory papilla; lab & 8ab: 1st and 8th abdominal segments; 1th: prothoracic segment.

phragma brown, dorsal arm of dorsal process narrow, curving gently, ventral arm broad, straight, about $2\times$ as long as labial sclerite, ventral process shorter than dorsal. Mandibular abductor apodeme brown, small. Anterior spiracles (D) large, somewhat hemispherical, about $300\ \mu$ in length, each with 108 to 154 bulbs; posterior spiracles (E) on thick, cylindrical standing of last abdominal segment, approximate, each with 3 bulbs, angle of divergence between 2 adjacent bulbs about 90° ; 4 pairs of sensillae around posterior spiracles. Cuticular processes absent dorsad of sensory organs on head, but present just below mandibles, processes on dorsal side of each segment colorless, hemispheric, those on lateral sides brown, subconical, pointed distally, becoming larger posteriorly, and those on ventral side longest; pattern as follows: on dorsal, T=0.0, 1-7A=1.1, 8A=3.0; on lateral, 1T=8.0, 2T=0.3, 3T=5.5, 1-5A=5-6.4, 6A=4.3, 7A=2.4, 8A=1.0; on ventral side, 2T=15.0, 3T=13.0, 1A & 3-4A=8.0, 2A=10.0, 5A=4.1, 6A=4.2, 7A=2.4, 8A=2.0; 4 rows laterad of anus.

PUPARIUM. *Hibernant type* (fig. 9. F): Dull black, rarely brownish black; about 2.6 mm in length, 1.7 in width, 1.5 in height. Strongly convex dorsally; abdominal segment 1 without keel, segments 2-5 more or less subshiny, each with a distinct transverse

keel, segments 6-7 each with weakly developed keels laterally, segment 8 without keel; ventral side somewhat concave, without black stripe. Anterior spiracles protruded rather laterad.

Non-hibernant type (fig. 9, G): Pale greenish brown, brown to dark brown, rarely blackish, shiny; about 2.8 mm in length, 1.6 in width, 1.4 in height. Each segment without keel; moderately convex dorsad; ventral side comparatively flattened, generally blackened along ventral median line. Anterior spiracles protruded rather ventrad.

DISTRIBUTION: Japan, E. Siberia.

The rice leaf-miner, *A. oryzae*, is one of the most serious insect pests of the rice plant and is widespread in the northern districts of Japan.

This species was identified by Matsumura from specimens collected by Munakata at Aomori Prefecture. Munakata (1910) reported before Matsumura's description, on structures of the egg, larva, puparium and adult, the life-history, the control measures, etc., with the scientific name mentioned above. Hence the author's name is accepted as Munakata according to Article 21 of the International Rules of Zoological Nomenclature.

The types (syntypes, 4 ♀, Aomori, 30 May 1910, in coll. Ent. Lab., Hokkaido Univ.) of Munakata's *oryzae* and Hendel's one from East Siberia (syntypus ♂, Nikoisk-Ussurijsa, Süd-Ussurigebiet, 24 Juli 1928, Engelhardt, in naturhistorischen Museums in Wien) were studied carefully by Kato (1956) who made the synonymy.

BIONOMICS. *Hosts*: *Oryza sativa* L., *Zizania latifolia* Turcz. *Mine*: Greenish white, ophistigmatonome (fig. 9, H), its first linear part 6-11 mm in length and less than 1 mm in width, begins usually from apex of the leaf, broadened irregularly towards base of leaf and stretched over entire width of the leaf at last; conspicuous secondary feeding tracks somewhat zigzag; greenish black, small pellets of frass deposited in center of the linear mine, twisted near the beginning of the blotch mine, and later large pellets distributed rather centrally. *Tenancy*: Mostly 1, rarely 2-3 mines per leaf. *Pupation*: Full grown larva usually escapes the mine through the slit and the transformation takes place on leaf in very short distance (2 to 6 mm) from the end of mine, larva directing downwards. Puparium of the non-hibernant type adheres closely to the leaf, but that of the hibernant type does not. Several pellets of frass are deposited between end of mine and puparium. *Development*: Usually 2 (1-3) generations in a year; hibernation in the pupal stage.

Agromyza phragmitidis Hendel, 1922, Wien. Ent. Ztg. 39: 65. Fig. 10.

Terminalia: Surstylus with about 20 spines; ejaculatory apodeme 230 μ long, 172 μ wide, with many sensillae in several rows proximally.

Ovipositor sheath pubescent on distal 1/2; egg guides subtriangular, 120 μ long, setulose posterolaterally, inner processes covered with sharp spines. Tergite 9 is 200 μ long, sternite 9 somewhat U-shaped, provided with 5 pairs of *nsm*; cerci each with 4 long *ts*. Spermathecae swollen proximally, excavated distally, 80 \times 116 to 100 \times 108 μ , about 0.12 of ducts, necks 88 μ long and 36 μ broad, ducts 24 μ in diameter; ventral receptacle similar to *oryzae*, but about 2 \times as long.

DISTRIBUTION: Europe, Japan.

HOSTS: *Phragmites communis* Trin., *Alopeculus aequalis* Sobol., *Setaria viridis* Beauv.

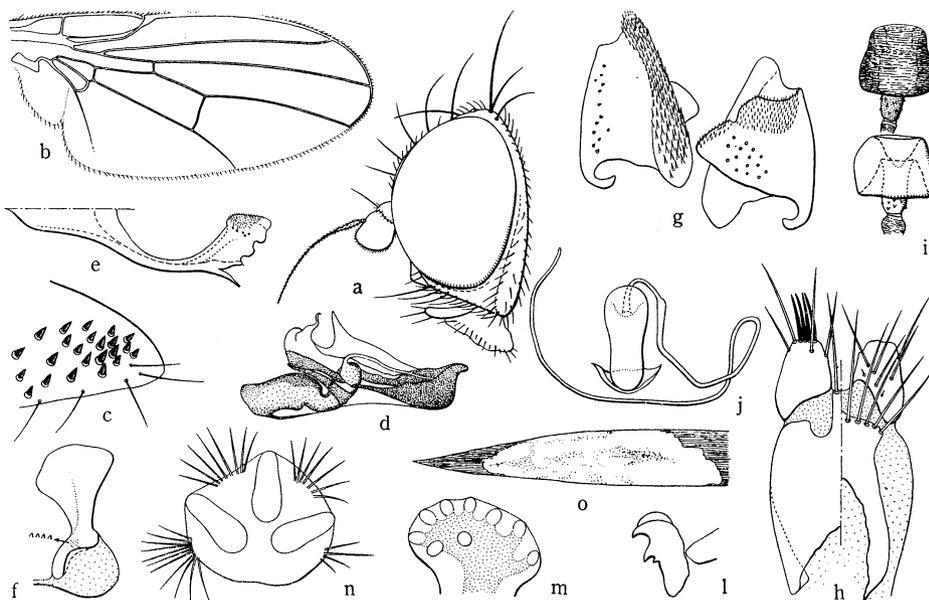


Fig. 10. *Agromyza phragmitidis* Hendel.

Agromyza reptans Fallén, 1823, Dipt. Suec., Agromyzid. 2 (37): 3. Fig. 11.

Terminalia: Epandrium $1/3$ as long as tergite 6; surstylus bearing about 50 spines. Hypandrium with apodeme, sidepieces narrow. Distiphallus well sclerotized, endophallus with numerous striae and spinules. Phallapodeme $1.6\times$ as long as hypandrium. Postgonites with many setulae ventrally. Ejaculatory apodeme somewhat claviform, $200\ \mu$ long, $80\ \mu$ broad, bearing an accessory projection.

Ovipositor sheath almost as long as tergite 5, pubescent on posterior $2/3$; apodeme weakly chitinized excepting dorsomesal part, pouched on apical $1/2$. Egg guides simple, $136\ \mu$ long, with long and bare process. Tergite 9 is $120\ \mu$ long, with a pair of long setae and 2 pairs of setulae at apex; sternite 9 inverted V-shaped, $140\ \mu$ long, with 2 pairs of *nsm* and several setulae; cerci each bearing 4 short *ts*. Spermathecae suboval, depressed apically, numerous but shallowly striated, 128×108 to $136 \times 116\ \mu$, 0.16 – 0.28 length of ducts, necks rather long but very narrow, $80\ \mu$ long and $10\ \mu$ broad; ducts also narrow; ventral receptacle extremely short, about $90\ \mu$ long, without basal stipule.

Many specimens, including larvae, Arashiyama, 20 May 1956, Kibune, Kyoto, 16 Apr. 1958, on *Boehmeria nipononivea*; Amami-Oshima, 13 May 1957, Sasakawa.

DISTRIBUTION: Europe, Asia Minor, Japan, W. North America.

HOST: *Urticaceae*.

Agromyza rubi Brischke, 1881, Schrift. naturf. Ges. Danzig 5: 250. Fig. 12.

Terminalia: Surstyli narrow, each with 11 or 12 sharp spines. Cerci each bearing 10–13 spines on anteroventral end. Hypandrium shorter than distiphallus, without apodeme;

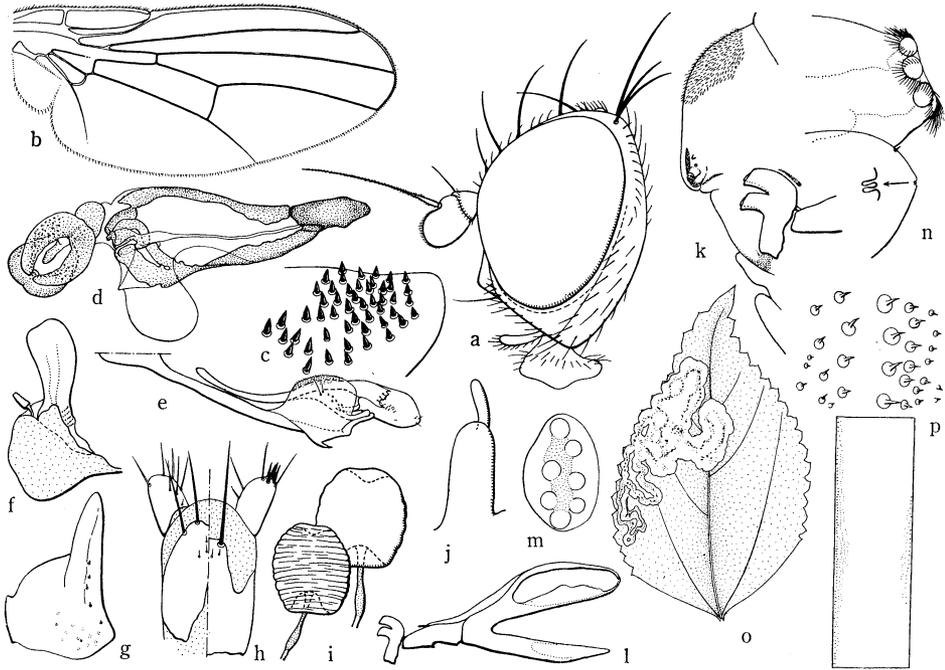


Fig. 11. *Agromyza reptans* Fallén.

praegonites narrowly united to that. Hypophallus extremely broad, but endophallus short. Ejaculatory apodeme very narrow, $100\ \mu$ long, $20\ \mu$ wide, duct $10\ \mu$ in diameter.

Ovipositor sheath slightly longer than tergite 6. Egg guides medium-sized, somewhat elongated oval, $132\ \mu$ long, with about 7 indistinct denticles. Segment 9 small, tergite $100\ \mu$

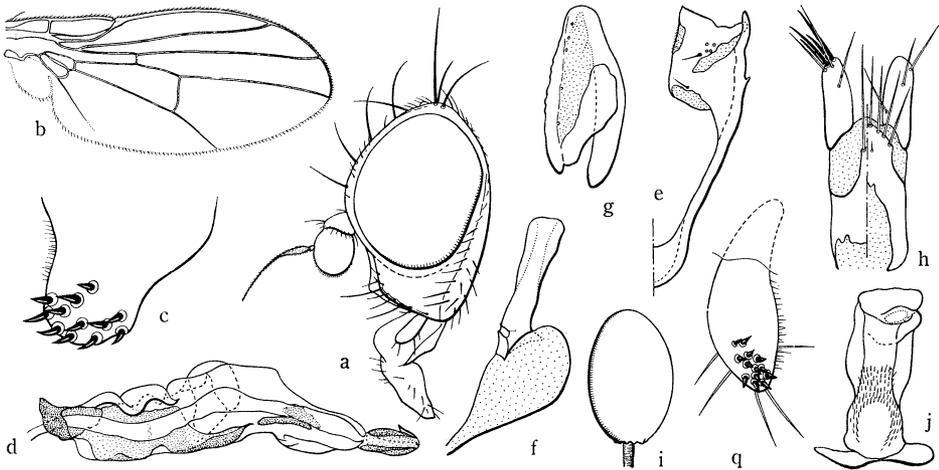


Fig. 12. *Agromyza rubi* Brischke.

long, sternite 120 μ long, U-shaped, with 4 pairs of *nsm* and a pair of short setae; cerci 1/2 length of sternite 9, with 4 long *ts*. Spermathecae very small, oval, with minutely partite proximal ends, 84 \times 48 to 84 \times 60 μ long, with necks and ducts exceedingly short, 10 μ and 252 μ respectively; ventral receptacle equal in length to egg guide, curved, setulose proximally.

Many, collected at Kibune, Kyoto, 16 & 29 Apr. 1958, Sasakawa.

DISTRIBUTION: Europe, Japan, N. America.

HOSTS: *Filipendula*, *Potentilla*, *Rubus* and *Sanguisorba* spp.

***Agromyza rufipes* Meigen, 1830, Syst. Besch. bekannt. eur. zweifl. Insekt. 6: 169. Fig. 13.**

Terminalia: Terminalia similar to that of *reptans*, but epandrium about 3/4 as long as tergite 6; surstylus with 45–50 striated spines; ejaculatory apodeme without basal projection. Egg guides 200 μ long, covered with setulae; tergite 9 medium-sized, sternite less sclerotized apically, bearing 3 pairs of *nsm*; cerci 68 μ long, each with 3 short *ts*; spermathecae relatively large, cross-striated about 14 \times , 136 \times 62 to 150 \times 80 μ , necks 36 μ long and 18 μ broad, ducts 520 μ long; ventral receptacle 960 μ long, tail loosely folded.

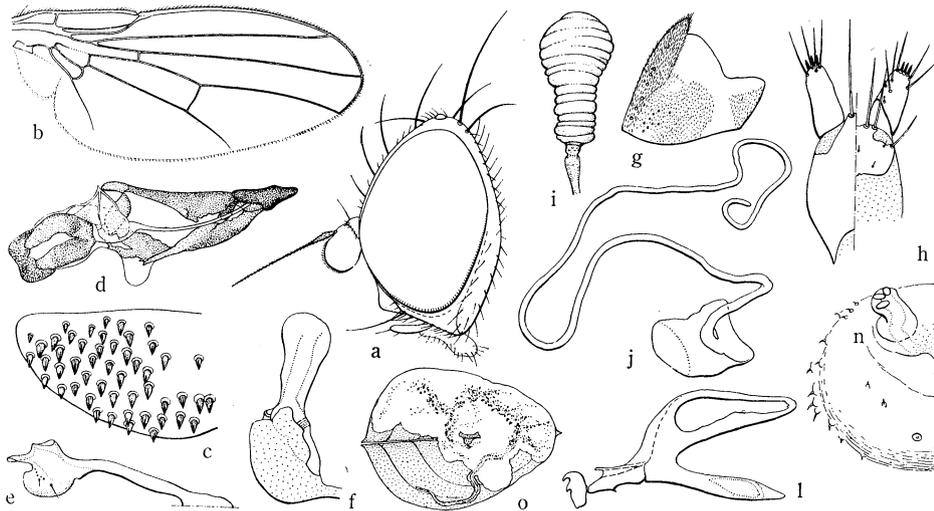


Fig. 13. *Agromyza rufipes* Meigen.

Many were reared from larvae mining in leaves of *Trigonotis brevipes*, at Daihizan, Kyoto, 16–19 May 1954, Sasakawa; Mt. Hiko, Fukuoka, 23 Apr. 1957, H. Kuroko.

DISTRIBUTION: Europe, Japan.

HOST: *Boraginaceae*.

***Agromyza spiraeae* Kaltenbach, 1867, Naturh. Ver. preuss. Rheinl. Westphal., Verh. 24: 104.**

Fig. 14.

Terminalia: Epandrium about 1/3 as long as tergite 6; surstyli each with 4–6 spines;

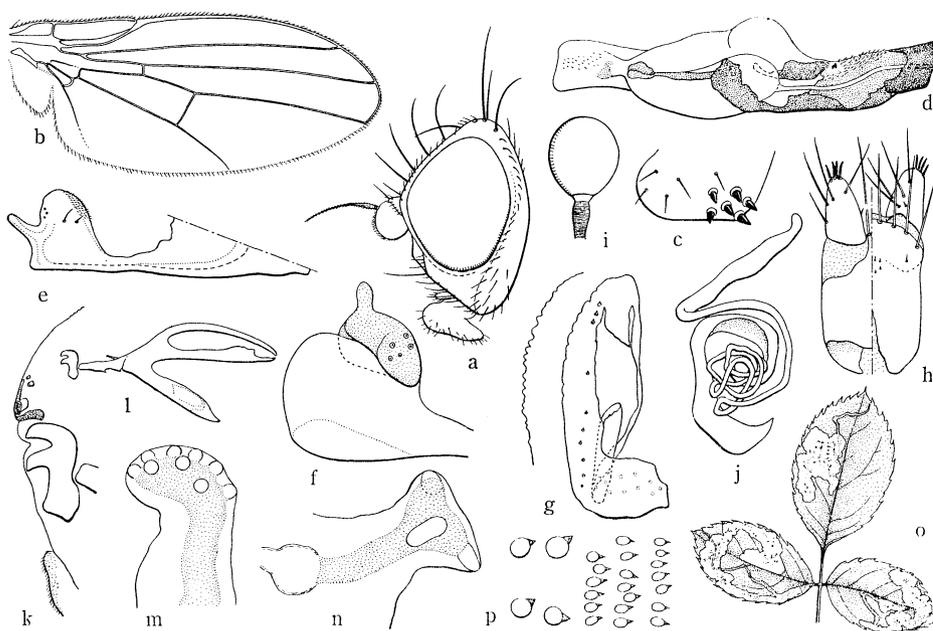


Fig. 14. *Agromyza spiraeae* Kaltenbach.

hypandrium broadly sclerotized anteriorly. Hypophallus short, but paraphallus broad, covered with setulae ventrally, endophallus membranous, vastly longer than paraphallus. Postgonites each bearing several setulae ventrally. Ejaculatory apodeme specially small, 52μ long and wide basally, with about 8 sensillae.

Ovipositor sheath shorter than tergite 6, pubescent on posterolateral $1/2$ and ventral side, egg guides 188μ long, loosely and irregularly serrated; tergite 9 is 120μ long, sternite slightly longer than tergite, bearing 4 pairs of *nsm*; cerci 56μ long, each with 4 short *ts*. Spermathecae very small, spherical, 88×61 to $96 \times 88 \mu$, with necks 32μ long and 20μ wide, ducts slender, 576μ long; ventral receptacle similar to that of *cinerascens*, but shorter, 1520μ in length, with tail coiled about $5.5 \times$.

DISTRIBUTION: Europe, Manchuria, Japan, America.

HOSTS: *Rosa multiflora* Thunb., *wichuraiana* Crep., *Rosa* cultivated var., *Sanguisorba officinalis* L., *Filipendula multijuga* Maxim., *Geum japonicum* Thunb., *Potentilla matsumurae* Wolf., *Rubus commersoni illecebrosus* Makino, *hirsutus* Thunb., and *Fragaria*, *Alchemilla*, *Comarum* spp.

Agromyza wistariae Sasakawa, n. sp. Fig. 15.

ADULT. *Female*: Black; frontalia matt brownish black, genae dark brown, lunule brown; parafrontalia subshiny, face and parafacialia gray-white pruinose; antennae pale to dark brown, segments 1 and 2 distally paler; palpi black. Thorax and abdomen shining, slightly dusted with gray; lateral sides from notopleura to postalar callus somewhat

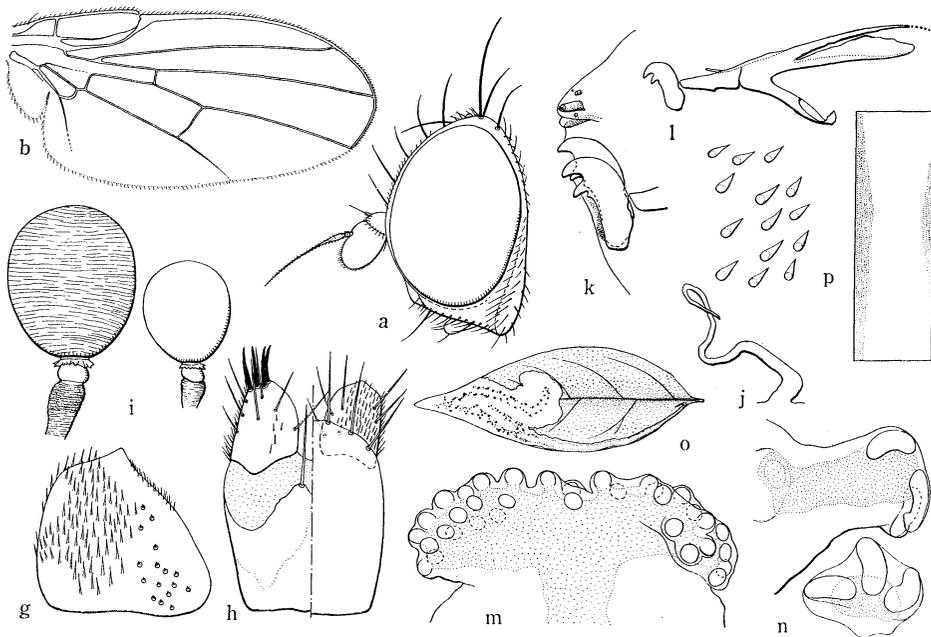


Fig. 15. *Agromyza wistariae* Sasakawa, n. sp.

brown-tinged; mesopleural sutures and bases of wings brown. Wings hyaline; veins pale yellowish brown, costa darker; calypteres white, with yellowish margins, and fringe of dark brown hairs. Legs black, but tibiae brown, with basal ends yellowish, tarsi brown-yellow.

Head: Front $1.5-1.8 \times$ as wide as eye, as broad as long, sides parallel or a trifle converging ventrally; parafrontalia about $1/5$ width of front, almost parallel-sided. Ocellar triangle with ventral tip almost on level of 1. *ors*, bearing 14-19 setulae plus *oc*. Lunule flat, lower than semicircular, $1/4-1/5$ as high as length between its tip and anterior ocellus. Fronto-orbitals 4 or 5 pairs; 1. *ors* directed up- and slightly outwards, 2. *ors* up- and slightly inwards; *ori* 2 or 3, directed in- and upwards; *oh* minute, arranged in a row. In profile parafrontalia and parafacialia slightly extending beyond above eye-margin; eye about $1.4 \times$ as high as wide, almost bare; gena $1/10-1/15$ eye height; 3-4 short setae dorsad of *vi*, 8-9 *pm* in a row. Face almost vertical, as high as broad, with carina sharp on dorsal $1/3$; antennal grooves rather shallow; parafacialia linear. Antennae separated narrowly at base; segment 3 slightly longer than broad, more or less narrowing distally; arista $1.2-2 \times$ as long as length of antenna, swollen on basal $1/5$. Palpi somewhat broadened apically. **Thorax:** Mesonotum with 1+4 *dc* (rarely 1+5), 1. *dc* subequal to *acr* in length, situated behind level of *prs*, closer to transverse suture than 2 to that, 2. *dc* about $1/2$ length of 3, 3. *dc* located before level of *sa*; *acr* in about 8 rows, extending before level of *prsc*; about 5 rows of setulae between *dc* and *ia*-row; *ipa* about $1/3$ length of *opa*. Humerus with 11-15 setulae plus *h*. Mesopleura with 7-10 dorsally directed setulae; sternopleura with about 5 setulae cephalad to *sp*. **Wing:** Costa with sections 2-4 in proportion of 75 : 23 : 19; r-m slightly distad beyond middle of discal cell; ultimate section of

M_{1+2} about 2.5-3 \times as long as penultimate; ultimate section of M_{3+4} about $2/3$ length of penultimate. *Leg*: Middle tibia without or with 2 posterodorsal bristles. *Abdomen*: Tergite 6 almost as long as 5. *Terminalia*: Ovipositor sheath glossy black, dorsally as long as tergite 6, pubescent on proximal $1/5$, setigerous only distally; apodeme more or less weakly chitinized except for dorsomesal part, pouched on apical $1/2$. Egg guides subtriangular, indistinctly pointed distally, 120μ long, with many sensillae. Tergite 9 very weakly developed, 72μ long, sternite 112μ long, bearing 3 pairs of *nsm*; cerci 52μ long, pubescent ventrally, each with 4 relative long *ts*. Spermathecae subglobular, indistinctly but densely striated, very different in size from each other, 75×64 to $110 \times 88 \mu$, necks very short, 20μ long and 16μ broad, with specific serrated band apically, ducts longer, 1020μ long. Ventral receptacle simple, 240μ long. *Length*: Body 2.33-2.67 mm; wing 3-3.75 mm. Male unknown.

LARVA. Mature larva yellow, 4.5 mm in body length, about 1 mm in width. Mandibles each with 2 teeth, subequal in size, sometimes with a small tooth; paraclypeal phragma with dorsal arm of dorsal process narrow. Anterior spiracles large, $140-170 \mu$ long, somewhat 2-lobed, each with 14-34 bulbs; posterior spiracles about $1/2$ as long as anterior, $80-95 \mu$ long, each with 3 large bulbs. Head with a semicircular, large patch of spines just above sensory organs. Cuticular processes of lateral sides of thoracic and 1st to 5th abdominal segments brown, but those of others almost colorless; spinal pattern: on dorsal, 1T=7.0, 2T=9.3-4, 3T-1A=6-7.3-4, 2A=4.5-2-3, 3-7A=4-5.0, 8A=2.0; on lateral, 1T=8.0, 2T=4.4-5, 3T-2A=6-8.5-6, 3-4A=5-6.4-5, 5-6A=5.4, 7A=5.2, 8A=4.3 (below spiracles); on ventral side, T=2-3.0, 1-4A=3-4.0, 5-6A=3.1, 7A=3.2, 8A=3.8 (laterad to anus).

PUPARIUM: Dark brown; about 2.5 mm in body length and 1.5 in width.

DISTRIBUTION: Japan (Honshu, Shikoku, Kyushu).

Holotype ♀, Onohara, near Mino, Osaka Pref., on *Wistaria*, 7 Apr. 1953, Sasakawa; paratypes: 2 ♀♀, same data; 1, Mt. Sara, Shikoku, 10 June 1954, Yano; 4 ♀♀, Kibune, Kyoto, 29 Apr. 1960; 3 ♀♀, Mt. Hiko, Fukuoka Pref., 26 May 1957, Sasakawa.

On the basis of known Japanese species, there are no closely allied species. The new species seems to be somewhat similar to the European *A. igniceps* Hendel in having the black fringe on the calypter. But it may be separated from the latter by the following characters: the frontalia brownish black and the tarsi brown-yellow, while in *igniceps* the former red-yellow to dark yellow-brown and the latter black; the genae narrower (in *igniceps* about $1/6$ eye height); 1+4 pairs of dorsocentral bristles.

BIONOMICS: *Hosts*: *Wistaria brachybotrys* Sieb. & Zucc. and *Millettia japonica* A. Gray. *Mine*: Whitish green in color; the ophistigmatonome, of the upper surface type, sometimes changes into the lower surface type near end of the stigmatonome, and very rarely through the whole mine, the upper epidermis is swollen blister-like; it runs along the leaf-margin from the base towards the apex of leaf, 30-45 mm in length and 0.3-2.5 in breadth, after then it turns back to form a large stigmatonome, 1.5-3.5 cm² in area; the frass is deposited in 2 rows in the linear mine, almost regularly, but larger pellets are scattered irregularly near the centre of blotch mine; E. *Tenancy*: Usually 1 larva occupies a single leaflet.

Agromyza yanonis (Matsumura) Fig. 16.

Oscinis yanonis Mats., 1916, *Konchû Sekai* 20 (231): 443.

Oscinis yanonella Mats., 1930, *Nokonchûgaku*, p. 269.

Stomacrypeolus ambigua Isitani (*nec* Enderlein, 1936), 1938, *Ôyô-kontyû* 1: 103.

Agromyza ambigua yanonis (Mats.): Kato, 1950, *Icon. Ins. Japon.*, p. 1673, f. 4817.

ADULT. Black; head with frontalia, inner margins of parafrontalia, lunule, genae and antennae brown to dark brown, antennal segment 3 darkened distally; parafrontalia subshiny; face and parafacialia densely grayish pruinose. Thorax slightly gray-dusted, with more or less bluish lustre. Wings hyaline, tinged brownish; veins yellowish brown; calypteres with fringe of whitish yellow hairs. Legs black, but fore knees slightly brownish, all tarsi yellowish brown to brown. Abdomen black, somewhat brownish, more shining posteriorly.

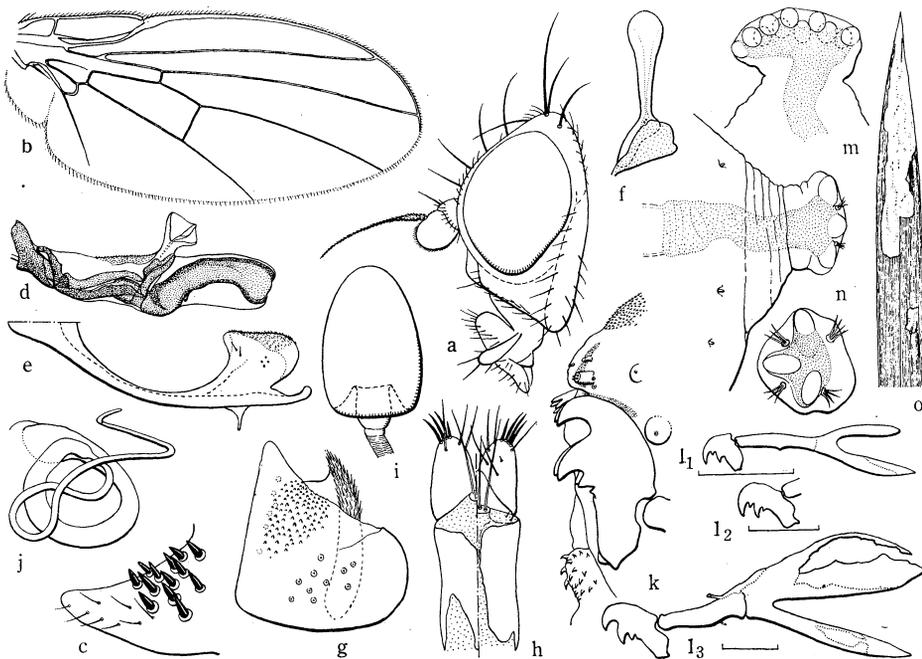


Fig. 16. *Agromyza yanonis* (Matsumura). 1₁: cephalopharyngeal sclerite of 1st instar larva; 1₂: 2nd instar; 1₃: 3rd instar.

Head: Front 1.5–1.9 × as wide as eye, as broad as long, sides almost parallel; parafrontalia about 1/6 width of front. Ocellar triangle with anterior tip extending midway between level of 1. and 2. *ors*, *oc* with 8–10 setulae. Lunule weakly concave, semicircular, 1/3–1/4 length between its dorsal tip and anterior ocellus. Fronto-orbitals 4 pairs, 1. *ors* reclinate, 2. *ors* directed in- and upwards, 1. *ori* in- and slightly upwards, 2. *ori* inwards, rarely an additional inwardly directed short seta; *oh* sparsely arranged in a row. In profile parafrontalia and parafacialia exceedingly extending beyond upper eye-margin; para-

facialia about $1/2$ as wide as diameter of antennal segment 1; eyes bare, $1.3-1.6 \times$ as high as wide; gena usually $1/4$ eye height. Antennae separated at base by carina; segment 3 as broad as long, dorsal side straight; arista about $1.5 \times$ as long as length of antenna, swollen on basal $1/6$, pubescent. *Vi* relatively short; about $10 \mu m$ in 2 rows, anteriormost of ventral row long. *Thorax*: Mesonotum with $2+4$ *dc*, presutural 2. *dc* very short, 1. *dc* about $1/4$ length of 5, located before level of *prs*; 6 rows of *acr*, extending to level of 4. *dc*, becoming distinctly sparser between 4. and 5. *dc*; *prsc* long; about 5 rows of setulae between *dc*- and *ia*-row; *ipa* about $1/3$ length of *opa*; humeri each with 10-12 setulae plus long *h*. Mesopleura with 5-8 dorsally directed setulae; sternopleura with 3-4 setulae cephalad of *sp*. *Wing*: Costa with 3 sections in proportion of $57 : 18 : 15$; r-m distad beyond middle of discal cell ($17 : 12$); m-m slightly shorter than penultimate section of M_{1+2} ($10.5 : 12$) and at angle of $80-90^\circ$ to that; ultimate section of M_{1+2} about $4 \times$ as long as penultimate; ultimate section of M_{3+4} slightly shorter than penultimate. *Abdomen*: Tergite 6 as long as or slightly shorter than 5; sternite 6 relatively broad, about $1/2$ as long as 5. *Terminalia*: Similar to that of *oryzae*; distiphallus with basal sclerites slender and short, but endophallus elongated, longer than the former; basal membrane with microscopic spines ventrally. Ejaculatory apodeme plectrum-shaped, about $3 \times$ as long as wide, $204-252 \mu$ long, $56-96 \mu$ wide. Tergite 9 of ♀ somewhat tripod-shaped, distally less sclerotized, 140μ long; sternite slightly longer than tergite, bearing 2 pairs of *nsm* on distal small plate and 2 short setae on lateral ends of membrane; cerci short but broad, 60μ long, each bearing 2-3 long and 1-2 short *ts*. Spermathecae subovoid, 128×72 to $168 \times 112 \mu$, with necks relatively long, 56μ long, 40μ in diameter, ducts 608μ long; ventral receptacle colorless, 760μ long, coiled about $4 \times$. *Length*: Body 2.25-3 mm; wing 2.25-3.25.

LARVA. Body pale yellow-green, 3-5 mm long. Differs from *albipennis* in following points: 1) Mandible with lowest tooth inconspicuous, sometimes absent, and caudal incision deeper. 2) Cuticular processes immediately below mandibles brown, pointed sharply and arranged densely. 3) Posterior spiracles smaller, about 60μ long, much shorter than anterior spiracles, with 3-4 forked hairs, angle of divergence between 2 adjacent bulbs $70-75^\circ$. Basal standing of posterior spiracles without papilla. 4) Bands of cuticular processes broader, except for narrow ventral; on dorsal, $1T=4.2$, $2T=4.0$, $3T-3A=5.6.7-8$, $4-7A=3-4.5-7$; on lateral, $2T=1.3$, $3T=4-5.4-5$, $1-5A=5-6.4-5$, $6-7A=5.3$; on ventral side, $1T=0$, $2T-1A=2-3.0$, $2-5A=3-4.0$, $5-7A=0$. 5) Posterior end with a pair of fleshy protuberances dorsolaterad to anus.

PUPARIUM. Reddish brown, shining, about 3 mm long, 1.3 mm broad.

Many bred from leaf-mines, in many districts, Mar.-June, 1947-1957, Sasakawa.

DISTRIBUTION: Japan.

This species is very readily distinguished from the Holarctic *ambigua* Fallén by the different coloration of the tarsi, which are black in the related species, and direction of the second lower fronto-orbital bristles, which are directed upwards in *ambigua*. Moreover, the larva of the allied species described by de Meijere (1925) is quite different from that of *yanonis*, the larva of *ambigua* has only two teeth and no hairs on the posterior spiracles.

The number of *ori* varies from 1 to 3 pairs, 2 being most common (81%), 3 on one side 12%, 3 on both sides 5%, 1 on one side only 2%. Also, the number of presutural *dc* varies from 1 to 3 pairs, but in most cases it is 2 pairs as follows: $2+4$, $2+4$ in 47.6%

of the specimens, 1+4, 2+4 in 14.4 %; 2+4, 3+4 in 11.9 %; 1+4, 1+4 in 21.4 %; 1+4, 0+4 in 4.7 %.

BIONOMICS. *Hosts:* *Hordeum vulgare hexastichon* Aschers., *Triticum aestivum* L. and *Alopecurus aequalis* Sobol. *Mine:* Greenish white, ophistigmatonome, usually begins from the apical part of leaf, runs basally, linear part about 0.25 mm broad, 10.5 (7-13) mm long, extending between 2 veins of leaf, after 1st moult 18-34 mm long between 3-5 veins, after 2nd moult 3.5-7 mm in width; feeding area 20-55 mm²; E. Frass in ophionome arranged along lateral sides of mine, but in stigmatonome centrally and irregularly. *Development:* 1 generation occurs in a year; hibernation in pupal stage.

2. Genus *Japanagromyza* Sasakawa, 1958

Japanagromyza differs from *Melanagromyza* by the presence of the prescutellar bristles, the coloration of the halteres, and the structures of the male and female terminalia. Moreover, it comes near *Agromyza*, on account of the presence of a pair of prescutellar bristles, and the mining habit, but may be easily distinguishable from the latter by the peculiar male and female terminalia. The fore-tibial bristle of *Japanagromyza*, which was an oversight in the original description except for that of *J. duchesneae*, is an important characteristic.

The following 6 species may be placed in this genus. The species of both *duchesneae*- and *elaegni*-group are not at all easy to separate from each other because they are almost uniform in the external structure. However, in each of those species either the male or female terminalia is of an unusual form and the larval characters are also rather different from each other. The larvae make the ophistigmatonome on the leaf and abandon their mines to transform through the slits.

KEY TO ADULTS

1. Front wider than eye; 1. *ors* directed up- and outwards, 2. *ori* in- and upwards 2
Front narrower than width of either eye; *or* all reclinate..... **yanoi**
2. Front narrower than long; parafrofrontalia with 4 pairs of *or*..... 3
Front as broad as long; parafrofrontalia with 5 pairs of *or*..... **kammuriensis**
3. Genae 1/8-1/10 eye height. Mesonotum with 10 regular rows of *acr*..... **duchesneae**
Genae 1/10-1/15 eye height. Mesonotum with 8-10 rows of *acr* 4
4. Phallic hood rugose or serrulate at posterodorsal end; endophallus forked distally.
Ventral seminal receptacle with chitinous cotyledonous lobe at end..... **variihalterata**
Phallic hood smooth; endophallus membranous distally, not forked. Ventral receptacle without cotyledonous lobe 5
5. Surstyli gradually narrowing distally, each with about 35 spines; phallic hood bearing 3 long processes posterolaterally. Spermathecae orbicular **elaegni**
Surstyli extremely tapering, each with a spine; phallic hood without process. Spermathecae suboval **quercus**

KEY TO LARVAE

1. Posterior spiracles with more than 8 bulbs..... 2

- Posterior spiracles each with 3 large bulbs..... **yanoi**
2. Posterior spiracles not projected, trifurcated, with numerous bulbs..... 3
 Posterior spiracles knoblike, each with 8-10 bulbs..... **duchesneae**
3. Anterior spiracles each with 3 bulbs; posterior spiracles each with about 30 bulbs
 **elaeagni**
- Anterior spiracles with more than 3, and posterior spiracles more than 35 bulbs..... 4
4. Mandibles each with a large terminal tooth and 4 indistinct teeth **quercus**
 Mandibles each with 6 well-defined teeth **varihalterata**

Japanagromyza duchesneae (Sasakawa), 1954, Saikyo Univ., Sci. Rep., Agr. 6: 106. Fig. 17.

Terminalia: Surstyli produced downwards, only slightly incurved distally, about $3/5$ as high as epandrium, each bearing 15 or 16 stout and 10-12 slender spines plus a few long setae. Hypandrium long, sidepieces narrow, about $2/3$ length of phallapodeme, with apodeme short. Phallic hood weakly sclerotized on anterior $3/4$, rugose at posterior end, about $2/5$ length of phallapodeme. Distiphallus united tightly with basiphallus, paraphallus about $1/3$ as long as phallapodeme, ventral process broadly membranous, with L-shaped sclerite, uniting basally with paraphallus, endophallus with a pair of tendons, ventral one long and coiled, dorsal one short and forked. Ejaculatory apodeme about 190μ long, 60μ in greatest width, stem with 2 minute sensillae at base.

Ovipositor sheath shorter than tergite 6; apodeme subrectangular, almost $2 \times$ as long as broad, pouched on anterior $1/6$. Egg guides 200μ long, with 50-55 teeth of serration laterally and many rows of spinules on dorsoproximal median membrane. Tergite 9 is

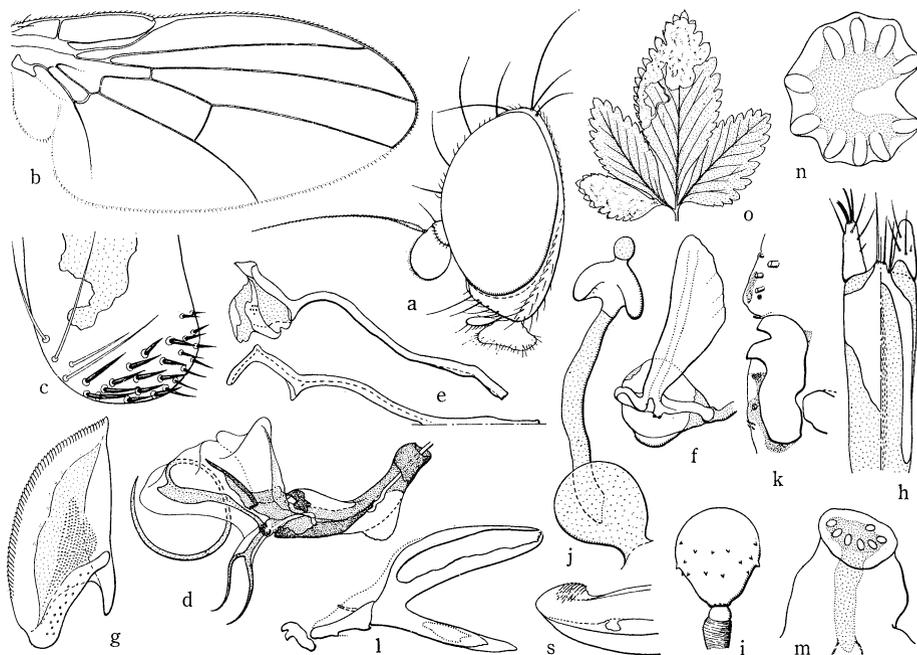


Fig. 17. *Japanagromyza duchesneae* (Sasakawa).

160 μ long, 64 μ wide, about 4/5 as long as sternite, sternite U-shaped, with 2 pairs of *nsm*, setulose mesally; cerci 60 μ long, with 4 *ts* which are almost 1/2 of cercus length. Spermathecae minute, suboval, slightly constricted at near proximal 1/3, 32 \times 28 to 44 \times 32 μ , spinulose, with necks short and narrow, 10 μ long and 8 μ wide, ducts 312 μ long, slightly broader than necks; ventral receptacle colorless, 320 μ long, tail with chitinous, cotyledonous lobe at end. Accessory glands 880 μ long, 8 μ in diameter.

LARVA. Dark yellow, 2.7–3 mm in length. Head with simple maxillary palpi, 2 rows of cuticular processes just before ventral ends of mandibles. Mandibles equal in size, with 2 teeth. Anterior spiracles conical, about 50 μ high, with 5–7 bulbs; posterior spiracles more separated from each other at bases and slightly higher than anterior, much broadened apically, 80 μ in diameter, each with 8–10 bulbs. Cuticular processes pale brown, sharply pointed; spinal pattern: on dorsal, head with 2 rows of paler processes at caudal part; 1T=few groups of 4 to 8 processes on median line before anterior spiracles, 2T=2 short rows at middle of dorsomedian line, 1-5A=2.0, 6A=1-2.0, 7-8A=0; on lateral, 1T=0, 2T=2 dorsolaterally only, 3T=3.2, 1-7A=4.2, 8A=2-3.0; on ventral side, 1-2T=5.0, 3T=3.0, 1-5A=3.0, 6-8A=1-2.0, processes in anterior 2 of 4 rows along cephalic margin of segment larger than others. Posterior end with 2 pairs of small papillae dorsolaterad of anus, a few rows of processes surround anus.

Additional material was collected at Mt. Tsurugi, Shikoku, 2 June 1957; Mt. Hiko, Kyushu, 16 June 1957, Sasakawa.

DISTRIBUTION: Japan.

HOST: *Duchesnea indica* Focke.

Japanagromyza elaeagni (Sasakawa), 1954, Shikoku Ent. Soc., Trans. 4 (3): 38. Fig. 18.

Terminalia: Surstylus with 30–38 spines; hypandrium about 1/2 length of phallapodeme. Basiphallus not quite tubular; distiphallus subequal in length to phallapodeme, ventral process weakly sclerotized, bearing numerous minute setulae almost all over surface; endophallus long, broadly membranous. Phallic hood about 1/6 as long as phallapodeme, broader than long, projecting lateroposteriorly, bearing 3 laterally directed processes at both ends. Ejaculatory apodeme rod-like, 160 μ long, with a small, conical and weakly chitinized projection at base of stem.

Ovipositor sheath shorter than tergite 6, apodeme subrectangular, pouched on apical 1/2; egg guides 264 μ long, with about 30 teeth of serration, without spinules dorsally. Tergite 9 is 140 μ long, about 2/3 as long as sternite, sternite bifurcated, with 2 pairs of *nsm* and 6 sensillae, setulose centrally and laterally; cerci 60 μ long, each with 4 long *ts*. Spermathecae orbicular, 24 \times 24 to 28 \times 24 μ , necks spinulate, 12 μ long and 8 μ broad, ducts 132 μ long and 12 μ in diameter; ventral receptacle almost colorless, except for pale brown stipules, as long as spermathecal duct, with tail short and slightly expanded apically.

Additional material, including larvae and pupae, Minoo, Osaka, 27 Apr. 1955, on *Elaeagnus*, Sasakawa; Mt. Hiko, Fukuoka, 11 Aug. 1956, Kuroko.

DISTRIBUTION: Japan.

HOSTS: *Elaeagnus multiflora* Thunb. and *umbellata* Thunb.

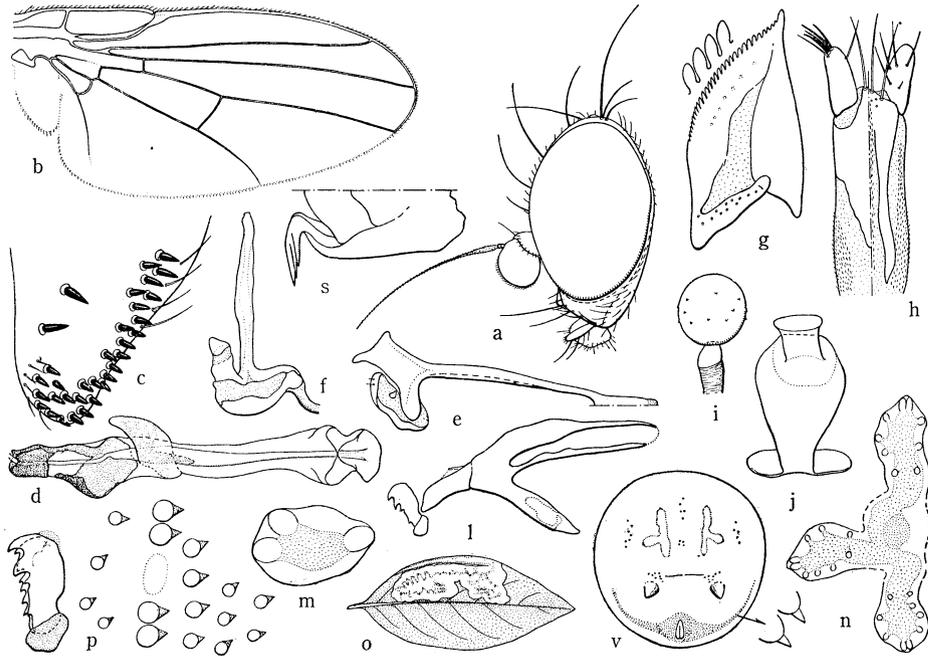


Fig. 18. *Japanagromyza elaeagni* (Sasakawa).

***Japanagromyza kammuriensis* (Sasakawa), NEW COMBINATION** Fig. 19.

Melanagromyza kammuriensis (Sasakawa), 1954, Shikoku Ent. Soc., Trans. 4 (3): 40.

DISTRIBUTION: Japan.

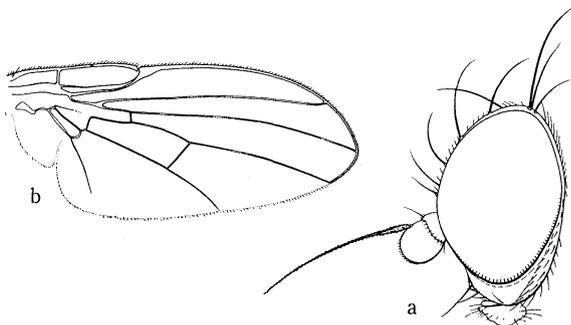


Fig. 19. *Japanagromyza kammuriensis* (Sasakawa).

***Japanagromyza variihalterata* (Malloch), NEW COMBINATION** Fig. 20.

Agromyza variihalterata Malloch, 1914, Mus. Nat. Hung., Ann. 12: 329.

Melanagromyza variihalterata (Malloch), Hennig, 1941, Ent. Beihefte 8: 175.

ADULT. *Male*: Black; head very slightly gray-dusted, parafrofrontalia shiny, ocellar

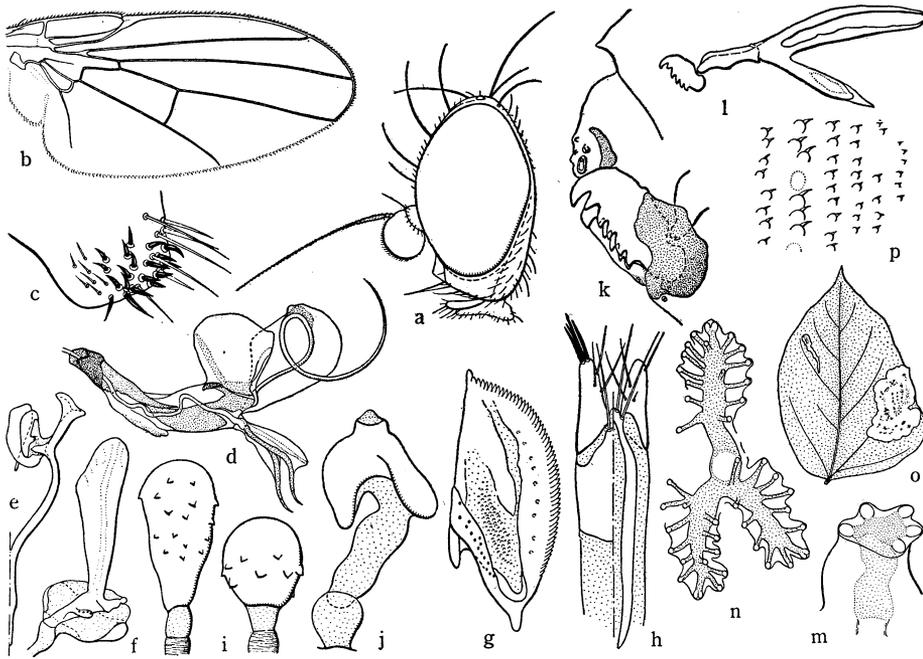


Fig. 20. *Japanagromyza variihalterata* (Malloch).

triangle subshiny; lunule dark brown, silverly pruinose; genae somewhat brownish; antennae and palpi black; proboscis brown. Thorax and abdomen shiny, the former more densely gray-dusted than the latter; wings hyaline, veins brown; calypteres white, with margins and fringe brownish black; legs black.

Head: Front almost as wide as eye (14 : 13), narrower than long (14 : 18), almost parallel-sided, bearing several hairs along ventral margin above lunule; parafrofrontalia not convex excepting bases of *or*, about 1/5 width of front. Ocellar triangle slightly convex, its ventral tip obscurely extending to level of 2. *ors*; *oc* parallel, accompanied by 8–19 setulae. Lunule flat, lower than semicircular, a little less than 1/4 distance between its tip and anterior ocellus; median furrow distinct. Fronto-orbitals 4 pairs; *ors* directed up and slightly outwards, 1. *ori* upwards, 2. *ori* in- and upwards; rarely a seta below 2. *ori*; *oh* minute, in a row. In profile parafrofrontalia and parafacialia not beyond upper eye-margin; eyes about 1.5 × as high as wide, with sparse minute hairs; parafacialia linear; genae 1/10–1/13 eye height. Face concave, as high as broad; carina nearly 1/4 as wide as diameter of antennal segment 1, about 1/2 height of face. Antennae narrowly separated at base; segment 3 slightly shorter than broad, with minute pile; arista more than 2.5 × as long as whole length of antenna, swollen on basal 1/5, microscopically pubescent. **Thorax:** Mesonotum with 0+2 *dc*, anterior *dc* situated on or slightly behind level of *sa*; *acr* irregularly in 8–9 rows, becoming sparser behind anterior *dc* 6–7 rows of them ending before *prsc*; *prsc* nearly 2/3 length of anterior *dc*; 6–7 rows of setulae between rows of *dc* and *sa*; *ia* slightly shorter than anterior *dc*; *ipa* 1/3–1/5 length of *opa*; humerus with usually 7 setulae plus *h*. Mesopleura with 6–9 dorsally directed setulae; sternopleura with usually

4 long setae before *sp.* *Wing*: Costa reaching M_{1+2} , with 3 sections in proportion of 59 : 19 : 14; r-m before middle of discal cell (13 : 20); ultimate section of M_{1+2} about $2.5 \times$ as long as penultimate; ultimate section of M_{3+4} about $3/4$ length of penultimate (24.5 : 32). *Abdomen*: Tergites with *mar* longer excepting those on tergite 6; tergite 6 almost as long as 5; sternite 5 about $1.5 \times$ as broad as long, deeply incised on caudal $1/3$. *Terminalia*: Extremely similar to that of *duchesneae* but epandrium shorter, about $1/3$ as long as tergite 6; surstyli more densely setigerous; cerci slightly higher than epandrium; ejaculatory apodeme slightly smaller. *Length*: Body 2.5 mm; wing about 3.

Female: Similar to ♂, but *mar* on tergite 6 longest. *Terminalia*: Resembling that of *duchesneae*, tergite 9 less developed, being about $1/2$ length of sternite, 80μ long, sternite without setulae on mesal membranous part; *ts* either $1/3$ or $2/3$ length of cercus; spermathecae 32×28 to $40 \times 24 \mu$, ducts 28μ long; ventral receptacle shorter than egg guides, 124μ long.

LARVA. White, somewhat greenish; 4-4.5 mm in length. Maxillary palpi narrow ring-like; mandibles deeply incised near ventrocaudal end, left mandible slightly larger than right, each with 6 teeth, mandibular adductor apodeme weakly sclerotized, wing-like dorsally; a pair of crescent-shaped sclerites laterad of sensillae and immediately dorsad of mandibles. Prothorax with a papillary process at cephalodorsal end. Anterior spiracles brown, about 40μ long, separated from each other in distance of $4-5 \times$ as wide as own diameter, each with 4-6 bulbs; posterior spiracles pale brown, with bulbs only slightly projected, trifurcated, 340 to 400μ long, each with 37-48 small bulbs. Cuticular processes on prothoracic segment spine-like, on abdominal segment rounded basally and pointed apically and beside anus setae-like; spinal pattern: on dorsal, $1-2T=0$, $3T-7A=1-2$ rows somewhat behind segmental boundary, $8A=0$; on lateral, $1T=6-7.0$, $2T=4.2$, $3T=4.1$, $1-6A=4-5.1$, $7A=4-5.2-3$, $8A=4-5.3$; on ventral side, $1T=3.0$, $2-3T=2.0$, $1-5A=3-4.0$, $6-8A=2-3.0$; numerous processes beside posterior spiracles and anus. Posterior end with a pair of large papillae, which are provided with 2 sensillae, dorsolaterad of anus.

PUPARIUM. Brown, oval, about 3 mm long, 1.5 mm broad; ventral side somewhat flattened; segmentation distinct.

Many, including larvae, Saga, Kyoto, 8-9 June 1953; Katsura, Kyoto, 29 May-1 June 1954, Sasakawa.

DISTRIBUTION: Taiwan, Japan.

In 1943, Nawa first recorded this species as a new pest and gave only the Japanese name "Daizu-kuro-hamoguri-bae" (Soybean black leaf-miner), Konchu Sekai, 47 (1943): 193, 214.

BIONOMICS. *Hosts*: *Glycine soja* Sieb. & Zucc., *Pueraria hirsuta* Matsum. *Mine*: Whitish green, ophistigmatonome of upper surface type, rarely lower surface in small area, first linear part 5-15 mm long, blotch part 2-2.5 cm² in area; usually extending near leaf-margin; greenish black isolated grains of frass almost centrally; *E. Tenancy*: Usually 1 (1-5) mine per a single leaf. *Development*: 2 generations occur in a year; larvae usually in period from May to July.

Japanagromyza quercus (Sasakawa), 1954, Shikoku Ent. Soc., Trans. 4 (3): 35. Fig. 21.

Terminalia: Surstyli incurved, each tapering distinctly and with a sharp spine at tip.

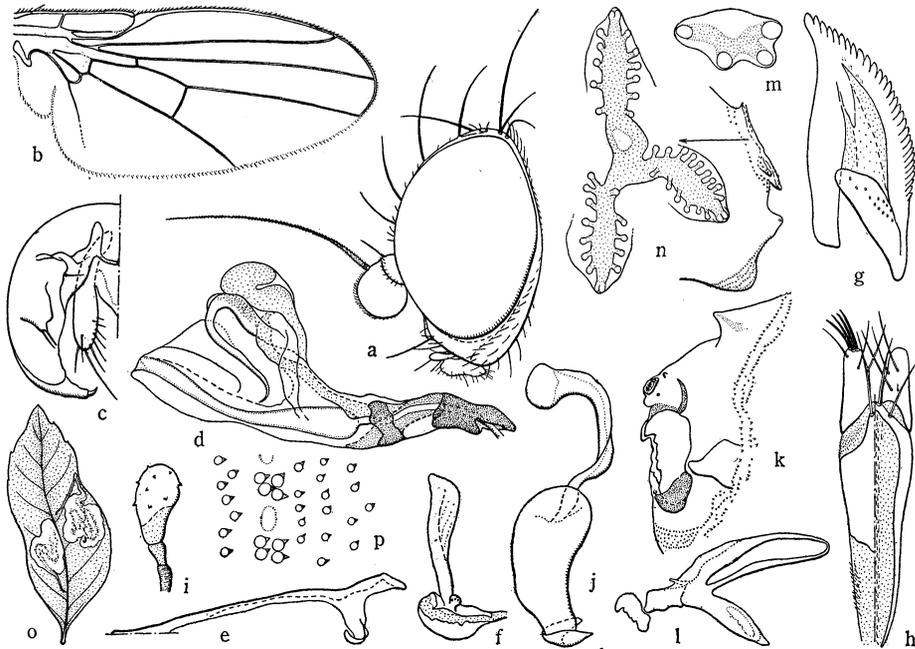


Fig. 21. *Japanagromyza quercus* (Sasakawa).

Hypandrium slightly longer than phallapodeme (17 : 15). Phallic hood sclerotized, without spine dorsally. Basiphallus as long as paraphallus, distiphallus with large ventral process, endophallus membranous about 3/4 whole length of distiphallus. Ejaculatory apodeme slightly broadened apically, stem with a small projection at base, 200 μ long, 40 μ in greatest width.

Female terminalia similar to that of *elaegni*, but apodeme of sheath 2.5–3 \times as long as broad, pouched on apical 1/8; egg guides 200 μ long; tergite 9 is 108 μ and sternite 192 μ long; cerci 48 μ long; spermathecae suboval, weakly chitinized, especially proximally, spinulose, 28 \times 18 to 30 \times 22 μ , necks short and narrow, ducts also short, 152 μ long and 6 μ in diameter; ventral receptacle larger, 280 μ long; accessory glands 480 μ long.

LARVA. Similar to *quercus*, but body yellow, about 3 mm in body length; mandibles each with a large terminal tooth and 4 indistinct teeth; mandibular adductor apodeme smaller, slightly wider than width of mandible; anterior spiracles each with 3–5 bulbs; posterior spiracles each with 42–46 bulbs; spinal pattern: on dorsal, 1T=5.0, 2–3T=0, 1–8A=1.0; on lateral, 1T=7–10.0, 2T=3–4.1, 3T=2.1, 1A=2.2, 2–5A=3–4.2, 6A=3–4.1, 7–8A=3.0; on ventral side, 1T=3.0, 2–3T=2.0, 1–2=2.1, 3–4A=2.0, 5–7A=1.0, 8A=2.0, 1 row around posterior spiracles, 4 rows around anus. Additional material, including larvae, in garden Kyoto Palace, 16 July 1957, Sasakawa; Mt. Hiko, Fukuoka, 10 Sept. 1956, Kuroko.

DISTRIBUTION: Japan.

HOST: *Quercus glauca* Thunb.

Japanagromyza yanoi (Sasakawa), NEW COMBINATION. Fig. 22.

Melanagromyza yanoi Sasakawa, 1955, Shikoku Ent. Soc., Trans. 4 (5-6): 87.

Óvipositor sheath as long as tergite 6; apodeme weakly chitinized, rectangular, about $5.5\times$ as long as broad. Egg guides subtriangular, $160\ \mu$ long, each with 13-15 teeth of small serration and numerous setulae. Tergite 9 much shorter than sternite, $108\ \mu$ long, but sternite narrow, bearing 4 pairs of *nsm* and many setulae at apex; cerci $80\ \mu$ long, each with 4 long *ts* and many setulae on ventrolateral side. Spermathecae spheroidal, with truncate proximal ends, 64×60 to $68 \times 68\ \mu$ in size, necks $40\ \mu$ long and $20\ \mu$ wide, ducts $480\ \mu$ long.

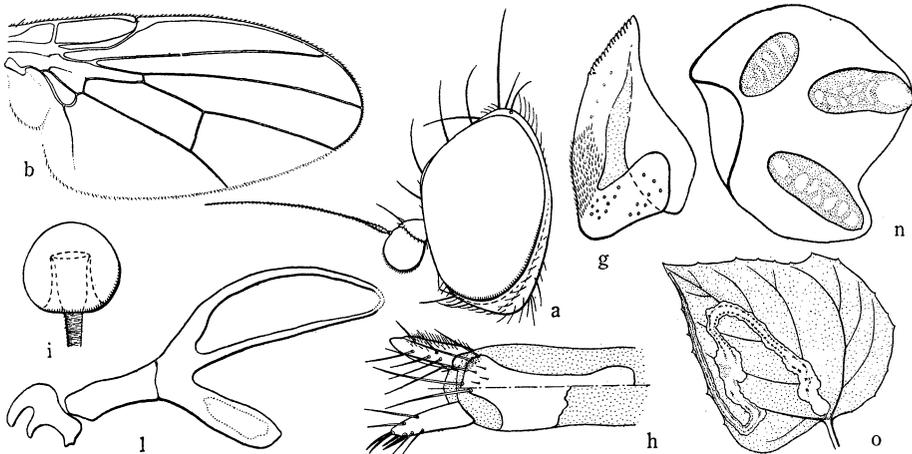


Fig. 22. *Japanagromyza yanoi* Sasakawa.

Several were reared from larvae, Minoo, Osaka, 21 Oct. 1957, Sasakawa.

DISTRIBUTION: Japan.

HOST: *Mallotus japonicus* Muell. Arg.

3. Genus *Melanagromyza* Hendel, 1920

Melanagromyza is well represented in Japan as compared with numbers of species of other genera in this subfamily, and it contains a few Oriental species. The Japanese species consist of 5 stem-miners, 3 leaf-miners, 4 gall-makers and 1 species of unknown biology. Of these species, bean flies, *M. dolichostigma* and *sojiae*, are important in agriculture.

The species of this genus in the Palaearctic region are divided into 5 groups by the direction of the orbital hairs, color of fringe on the calypteres, and the degree of projection of the parafrontalia and parafacialia above eye-margin. *M. artemisiae* is a unique representative of its group that has the orbital hairs proclinate, in Japan. The *aeneiventris* group with the proclinate orbital hairs and the fringe of brown to black hairs on the calypteres is not represented in Japan. In the group allied to *M. cunctans*, the orbital hairs are directed upwards and the fringe on the calypteres is whitish. This group con-

tains *M. dubia*, *M. galeolae* and *M. sojæ*. The third is the *pulicaria* group. The large number of species found in Japan was surprising considering that only 2 are known in the Palaearctic region. The fringe on the calypter is dark and the parafrontalia do not extend beyond the eye-margin. The fourth may be called the *schineri* group. This is characterized by a dark fringe on calypteres, and prominent parafrontalia and parafacialia. I find that in the Japanese species it is difficult to recognize well-defined species groups, basing their groupings only on the structure of the ♂ or ♀ terminalia. In species of the *schineri* group the surstyli are numerous spinose, and the posterior spiracles of the larva consist of 3 bulbs. The egg guides of the stem-mining species in this genus are extremely long (300 to 600 μ in length). *M. sojæ* is unusual in having short egg guides, which are found in all of the leaf-mining species groups.

KEY TO ADULTS

1. Orbital hairs reclinate..... 2
Orbital hairs proclinate **artemisiae**
- 2 (1). Calypteres with fringe of brown to black hairs'..... 6
Calypteres with fringe of yellowish white hairs 3
- 3 (2). Cross-vein r-m almost at middle of discal cell..... 4
r-m distad to middle of discal cell **sojæ**
- 4 (3). Orbital hairs in 2-3 rows 5
Oh in 1 row..... **dolichostigma**
- 5 (4). *Oh* sparser; parafacialia linear..... **galeolae**
Oh denser; parafacialia about 1/3 as wide as diameter of antennal segment 1
..... **dubia**
- 6 (2). Parafrontalia and parafacialia in profile not visible above eye 7
Parafrontalia and parafacialia produced above eye 10
- 7 (6). Gena 1/5-1/6 eye height..... 8
Gena narrower than 1/8 eye height..... 9
- 8 (7). Mesonotum with 8 rows of *acr* **pulicaria**
Mesonotum with 10 rows of *acr*..... **tokunagai**
- 9 (7). Gena 1/8 eye height..... **theae**
Gena 1/16-1/18 eye height..... **styricicola**
- 10 (6). Mesonotum with 0+2 *dc* 11
Mesonotum with 0+3 or 0+4 *dc*..... **websteri**
- 11 (10). Anterior *dc* behind level of *sa*..... 12
Anterior *dc* almost on level of *sa* **lappivora**
- 12 (11). Mesonotum with 8 rows of *acr* **schineri**
Mesonotum with 10 rows of *acr*..... **paederiae**

MALE TERMINALIA

1. Surstylus with 7-28 spines 2
Surstylus with 30-60 spines..... 9
- 2 (1). Endophallus with spinulae on dorsal or lateral sides..... 3
Endophallus without spinulae..... 7

- 3 (2). Endophallus with dorsal lobes about 1/3 length of distiphallus 4
 Endophallus with dorsal lobes about 1/2 length of distiphallus 6
- 4 (3). Paraphallus broadly united with hypophallus, forming a ring basally; surstylus with long spines 5
 Paraphallus united with hypophallus at dorsoproximal ends; surstylus with about 23 short spines **pulicaria**
- 5 (4). Surstylus with about 13 spines, distiphallus without ventral process **styricicola**
 Surstylus with about 20 spines; distiphallus with large, membranous ventral process **theae**
- 6 (3). Surstylus with about 10 spines..... **sojae**
 Surstylus with about 25 spines **artemisiae**
- 7 (2). Hypandrium with long apodeme 8
 Hypandrial apodeme indistinct; distiphallus with long ventral process.. **dolichostigma**
- 8 (7). Surstylus with about 20 spines..... **tokunagai**
 Surstylus with about 25 spines **galeolae**
- 9 (1). Paraphallus united with hypophallus at proximal ends 10
 Paraphallus broadly united with hypophallus.....**websteri**
- 10 (9). Surstylus with 30-36 spines; endophallus without setula..... **schineri**
 Surstylus with 50-60 spines; endophallus setulose ventrally **paederiae**

FEMALE TERMINALIA

1. Egg guides short, 2-3× as long as broad 2
 Egg guides long, 4-6× as long as broad 6
- 2 (1). Sternite 9 shorter than tergite 5
 Sternite 9 longer than tergite 3
- 3 (2). Egg guides each with 20-40 minute teeth; sternite 9 broadly sclerotized at proximal part 4
 Egg guides each with about 12 large teeth of serration; sternite 9 narrow stripe-shaped **pulicaria**
- 4 (3). Spermathecae truncate proximally..... **styricicola**
 Spermathecae partite proximally..... **theae**
- 5 (2). Spermathecae orbicular..... **schineri**
 Spermathecae oval..... **sojae**
- 6 (1). Sternite 9 about 1/4 as long as tergite 7
 Sternite 9 subequal to tergite in length 8
- 7 (6). Egg guides with about 20 large teeth of serration; spermathecae semispherical **websteri**
 Egg guides with about 80 minute teeth; spermathecae suboval **galeolae**
- 8 (6). Egg guides each with 30-40 teeth of serration..... 9
 Egg guides each with 50-60 teeth of serration..... **artemisiae**
- 9 (8). Spermathecae elliptical, partite proximally..... **dubia**
 Spermathecae radiate 3× **lappivora**

KEY TO LARVAE

1. Posterior spiracles each with a short, central process..... 2

- Posterior spiracles without process 3
- 2 (1). Posterior spiracular processes horny.....*artemisiae*
Posterior spiracular processes cylindric, somewhat partite apically *sojae*
- 3 (1). Posterior spiracles each with 3 bulbs..... 4
Posterior spiracles each with more than 9 bulbs..... 8
- 4 (3). Mandibles each with 6-9 small teeth 5
Mandibles each with a large terminal tooth and sometimes a few minute teeth... 6
- 5 (4). Each tooth smooth ventrally; spinal pattern on abdominal segment 3 as 3+
2·0+3..... *theae*
Each tooth with a few denticulations on ventral cutting surface; spinal pat-
tern as 4+2·1+3 *styrlicola*
- 6 (4). Paraclypeal phragma with dorsal process broad, both arms uniting with each
other..... 7
Paraclypeal phragma with dorsal process bifurcated posteriorly *schineri*
- 7 (6). Mandibles with 1-2 teeth; labial sclerite about 1/2 as long as length of dorsal
process of paraclypeal phragma..... *paederiae*
Mandibles with a large terminal tooth and 2-3 indistinct teeth; labial sclerite
about 1/3 length of dorsal process of paraclypeal phragma..... *websteri*
- 8 (3). Head without process 9
Head with a claviform process dorsad of sensillae *dolichostigma*
- 9 (8). Mandibles each with a large terminal tooth and a few indistinct teeth; labial
sclerite almost as long as mandible; paraclypeal phragma with dorsal arm
of dorsal process narrower than ventral arm..... 10
Mandibles each with 2 notched teeth; labial sclerite about 2× length of man-
dible; paraclypeal phragma with dorsal arm of dorsal process subequal in
width to ventral arm *pulicaria*
- 10 (9). Posterior spiracles each with about 20-25 bulbs.....11
Posterior spiracles each with 9 bulbs.....*lappivora*
- 11 (10). Mandibles each with a large terminal tooth and 3 minute notches; anterior
spiracles each with about 14 bulbs *tokunagai*
Mandibles each with a large terminal and a small tooth; anterior spiracles
each with about 20 bulbs *galeolae*

Melanagromyza artemisiae Spencer, 1957, R. Ent. Soc. Lond., Proc. B 26: 186. Fig. 23.

Terminalia: Epandrium about 1/2 as long as tergite 5; hypandrium about 1/2 length of phallapodeme. Phallus subequal to hypandrium in length; basal sclerites of distiphallus less sclerotized; postgonites with 8 sensillae. Ejaculatory apodeme asymmetric, proximal end uniting with sclerites of bulb, about 175 μ long, 60 μ broad.

Ovipositor sheath almost as long as tergite 6. Egg guides about 390 μ long, each with 50-60 minute teeth of serration and many sensillae laterally, numerous sharp spines on mesal membranous part. Tergite 9 nearly 5× as long as wide, 320 μ long; sternite somewhat cuneiform, bearing 3 pairs of *nsm* and about 10 sensillae, setulose on lateral membranes; cercus 64 μ long, with 4 *ts* which are about 3/5 cercus length. Spermathecae strawberry-shaped, partite proximally, differing in size from each other, 100 × 60 μ and 85 × 45 μ respectively, 0.18 of duct length, necks about 40 μ long; ventral receptacle

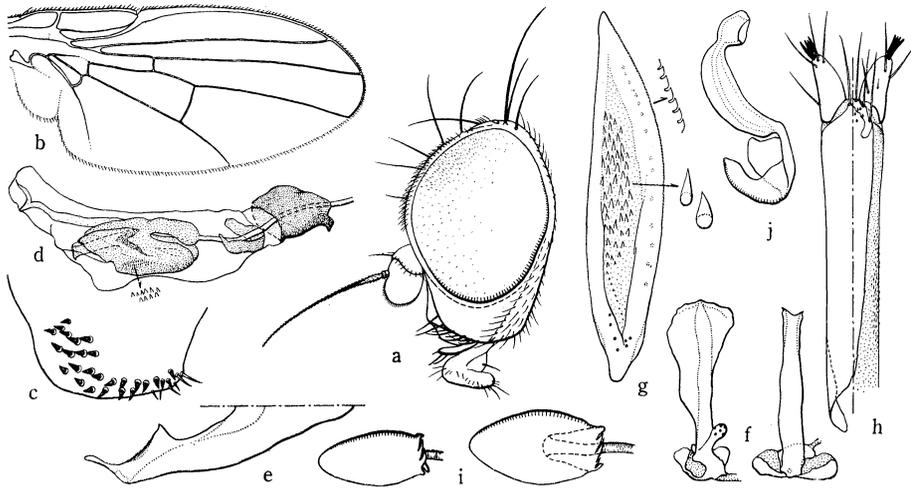


Fig. 23. *Melanagromyza artemisiae* Spencer.

pale brown, distal tail curved, constricted near end. Accessory glands somewhat brownish dilated subelliptically at apices, ducts slightly shorter than spermathecal ducts.

Many, Sapporo, Kamishihoro, Nukabira, Ashoro, Akan, Kitami, Hokkaido, 13-23 June 1954; Kibune, Kyoto, 16 May 1954, Sasakawa.

DISTRIBUTION: Europe, Japan.

Spencer stated that "4 lower orbitals directed inwards". However, the Japanese species exhibits considerable variation in number of lower fronto-orbital bristles, that is, 29% of specimens examined have 3 pairs, 24% have 3 bristles on one side, 24% with 2 pairs and other abnormal examples as follows: 2+3, 2+4 (1 ♂, Kibune); 2+2, 2+4 (1 ♀, Sapporo); 2+4, 2+4 (1 ♂, Sapporo); 2+5, 2+5 (1 ♂, Nukabira).

HOST: *Artemisia vulgaris* L.

Melanagromyza dolichostigma de Meijere, 1922, Bijdr. Dierk. 22: 19. Fig. 24.

Terminalia: Surstylus with 16-20 spines; hypandrium shorter than distiphallus, apodeme indistinct. Distiphallus about 3/4 length of phallapodeme. Ejaculatory apodeme narrow, 200 μ long, 60 μ wide.

Mature larva white, about 4 mm long. Head with a rod-like process dorsad of sensillae; mandibles each with a tooth. Anterior spiracles clavate, browned apically, 180 μ long, each with 24-28 bulbs in 2 rows; posterior spiracles two-lobed, 140 μ long, 110 μ broad, each with 29-38 bulbs.

Several were reared from larvae, in *Glycine*, Makari, Hokkaido, 9 June 1949, Y. Nishijima.

DISTRIBUTION: Java, Japan.

HOST: *Glycine max* Merrill.

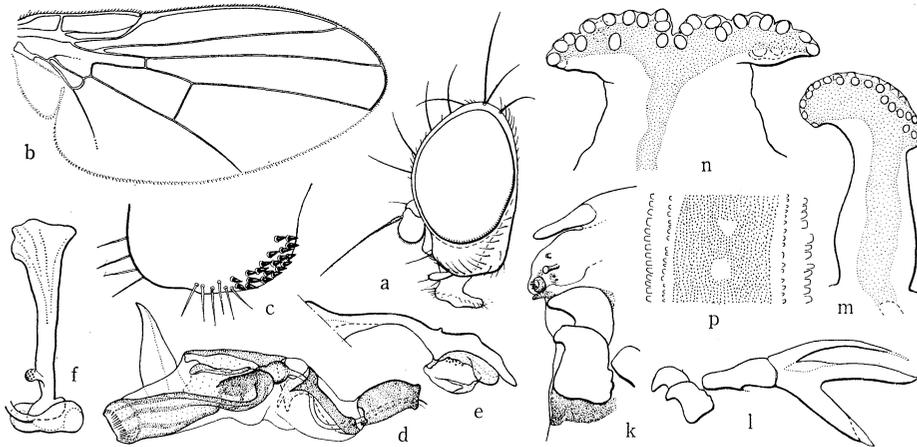


Fig. 24. *Melanagromyza dolichostigma* de Meijere.

Melanagromyza dubia Sasakawa, n. sp. Fig. 25.

ADULT. Female: Body entirely black; frontalia and orbits mat, ocellar triangle and parafrontalia shiny, lunule gray pruinulent; antennae and palpi black; proboscis pale brown. Mesonotum dusted with gray, gleaming green-bluish; abdomen more brilliant coppery than mesonotum; ovipositor sheath shiny black. Wings hyaline, veins brown; calypteres white, with margins orangish, fringe orangish white. Legs black.

Head: Front about 1.4 × as wide as eye (18 : 13), narrower than length between vertical angle and base of antennae (18 : 25), sides very slightly converging ventrally; parafrontalia convex, about 1/6 width of front, almost parallel-sided. Ocellar triangle with anterior tip extending to level of 2. *ors*; *oc* accompanying 2 or 3 setulae behind that. Lunule large, almost flat, as high as basal width, about 3/5 length of front. Parafrontalia with 4 pairs of *or*; 1. *ors* directed up- and outwards, 2nd up- and inwards; *ori* in- and upwards; *oh* minute, upwards, in 2 rows, becoming denser in 3 rows below 2. *ors*. Face lower than

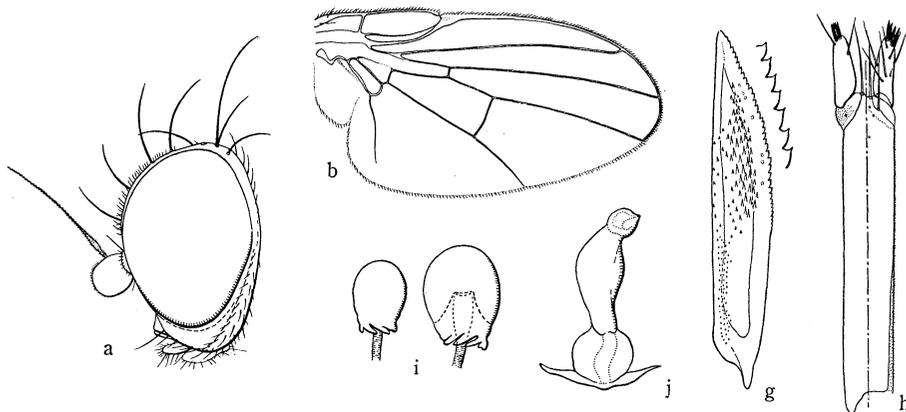


Fig. 25. *Melanagromyza dubia* Sasakawa, n. sp.

broad; carina narrow; antennal grooves deep. In profile parafrontalia slightly extending beyond eye-margin; parafacialia nearly $1/3$ width of antennal segment 1; eyes about $1.3 \times$ as high as wide, sparsely haired; gena about $1/9$ eye height. Antennae narrowly separated at bases; segment 3 subspherical, with minute pile; arista $2.5 \times$ as long as whole length of antenna, swollen on basal $1/6$, pubescent. *Vi* long, accompanying with about 5 μ m and a few setulae above it. Palpi each bearing several distinct setae ventrally. *Thorax*: Mesonotum with $0+2$ *dc*, anterior pair located behind level of *sa*; *acr* in 10 irregular rows, becoming much sparser behind anterior *dc*, reaching level of posterior *dc*, 2-5 setulae behind that; *ia*, *sa* each strong; *ipa* very weak, about $1/5$ length of *opa*. Humerus with about 12 setulae plus *h*. Mesopleura with about 7 dorsally directed setulae; sternopleura with 1 or 2 setae before *sp*. *Wing*: Costa reaching M_{1+2} , with sections 2-4 in proportion of $63 : 20 : 15$; r-m slightly distad beyond middle of discal cell ($20 : 13-16$); m-m subequal to length of penultimate section of M_{1+2} ; ultimate section of M_{1+2} about $3.5 \times$ as long as penultimate; ultimate section of M_{3+4} about $2/3$ length of penultimate ($33 : 23.5$). *Leg*: Mid tibia with 2 or 3 posterodorsal bristles. *Abdomen*: Sterna more densely setigerous than terga; 6th tergite $1.5 \times$ as long as 5. *Terminalia*: Ovipositor sheath shorter than tergite 6, densely setigerous on distal $2/3$, pubescent on anterolateral halves and all over ventral surface; apodeme similar to that of *artemisiae*. Egg guides extremely long, slightly shorter than tergite 6, 360μ long, each with 30-37 teeth of serration and numerous sharp spines on posterodorsal membranous part. Tergite 9 equal to egg guides in length, sternite 280μ , with 2 pairs of *nsm* and several sensillae; cerci 60μ long, with *ts* $1/3$ length of cercus. Spermathecae suboval, 52×40 to $80 \times 60 \mu$, partite proximally, ducts excessively long, 1080μ , $27 \times$ as long as necks; ventral receptacle 140μ long. *Length*: Body and wing 3 mm. Male unknown.

DISTRIBUTION: Japan (Honshu).

Holotype ♀, Arashiyama, Kyoto, 10 June 1956, Sasakawa; 1 paratype, same data.

This new species is closely related to *galeolae* n. sp., but may be distinguished by its denser orbital hairs, broader genae and parafacialia, and shorter egg guides. This species also differs from the European *M. albocilia* Hendel and *cunctans* Meigen in the genal height.

HOST: Unknown. This species may be a stem-miner, judging from the shape of the egg guides.

Melanagromyza galeolae Sasakawa, n. sp. Fig. 26.

ADULT. *Male*: Shiny black; frontalia, face and genae mat, with thinly grey pollen; ocellar triangle and median part of parafrontalia glossy; lunule brownish black in ground color, grayish pruinose; genae tinged with brownish; antennae and palpi black; proboscis fuscous. Thorax slightly gray-dusted; abdomen pollinose as in mesonotum, with metallic lustre. Wings hyaline, veins brown; calypteres whitish, with margins and fringe pale to dark yellow. Legs black.

Head: Front $1.3-1.4 \times$ as wide as eye, narrower than long, sides slightly converging ventrally; parafrontalia $1/4-1/5$ width of front, almost parallel-sided. Ocellar triangle slightly convex, with ventral tip reaching to or beyond level of 2. *ors*, bearing 5-7 pairs of setulae plus *oc*. Lunule large, flat or slightly convex, higher than semicircular, about $4/5$ as high as distance between its dorsal tip and anterior ocellus, median furrow linear.

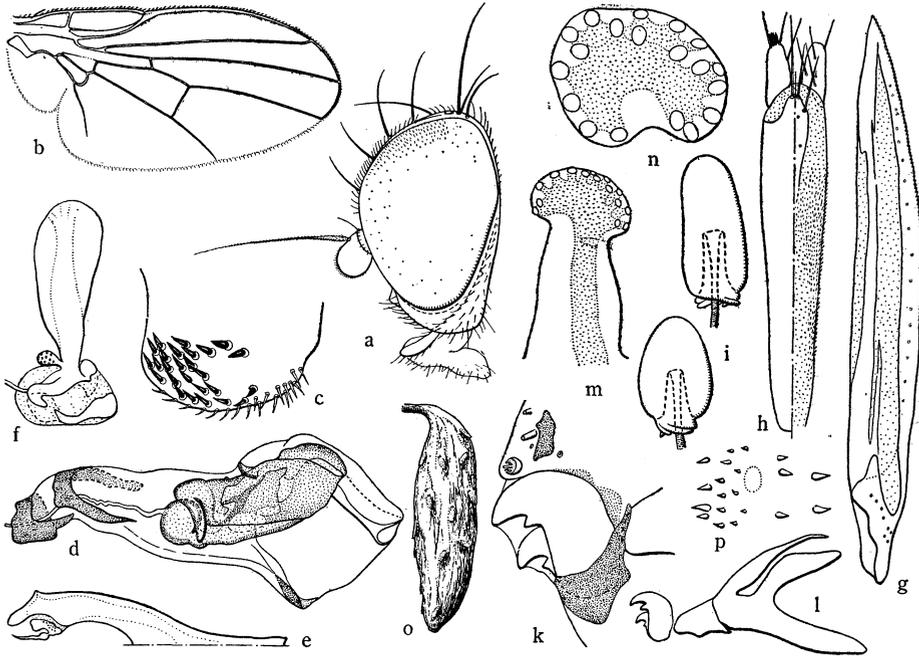


Fig. 26. *Melanagromyza galeolae* Sasakawa, n. sp.

Parafrontalia bearing 4 pairs of *or*; 1. *ors* directed up- and outwards, 2nd up- and slightly inward; *ori* in- and slightly upwards; rarely additional short 1 below 2. *ori* on one side; *oh* reclinate, densely in a row, but in 2 rows ventrad of 1. *ori*. In profile parafrontalia and parafacialia not extending beyond eye-margin; eyes $1.3 \times$ as high as broad, distinctly hairy on anterodorsal part; genae $1/12-1/13$ eye height; *vi* short, peristome bearing 5–9 *pm* in 2 rows. Face broader than high; carina very narrow; antennal grooves deep; parafacialia linear. Antennae approximate at bases; segment 3 small, somewhat shorter than broad, with distinct pile; arista $2 \times$ as long as whole length of antenna, swollen on basal $1/5$, pubescent. *Thorax*: Mesonotum with 0+2 *dc*, anterior *dc* behind level of *sa*, rarely a short seta before either anterior *dc*; *acr* in 10–12 rows, becoming sparser behind anterior *dc*, about 8 rows of that ending at level of posterior *dc*; *ia* shorter than anterior *dc*; 6–7 rows of setulae between rows of *dc* and *sa*; *sa* long; *ipa* about $1/5$ length of *opa*; humeri each with 10–15 setulae plus *h*. Mesopleura with 5–8 dorsally directed setulae; sternopleura with 2 setae and many setulae before *sp*. *Wing*: Costa reaching M_{1+2} , with sections 2–4 in proportion of 58 : 17 : 14; r-m distad beyond middle of discal cell (17 : 13); m-m subequal to penultimate section of M_{1+2} in length, perpendicular to that; ultimate section of M_{1+2} about $3.5 \times$ as long as penultimate (47 : 13), ultimate section of M_{3+4} $2/3$ length of penultimate. *Leg*: Mid tibia with 2 posterodorsal bristles. *Abdomen*: Each tergite with long *mar* except for those on dorsomedian parts of tergites 5–6; tergite 6 distinctly longer than 5; sternite 5 about $3/4$ as long as broad, incised shallowly at caudal margin. *Terminalia*: Epandrium $1/3$ as long as tergite 6; surstyli each with 23–26 spines

anteriorly and 18-21 setae along ventral margin; cerci about $1/2$ as high as epandrium. Hypandrium about $2/3$ as long as phallapodeme, with long apodeme. Phallus shorter than hypandrium; distiphallus with basal sclerite subequal to basiphallus; endophallus long. Praegonites small, each with 11-13 sensillae. Ejaculatory apodeme expanded distally, 200-240 μ long, about 80 μ wide. *Length*: Body 2-3 mm; wing 2.25-2.75.

Female: Similar to σ , but eyes without dense hairs dorsally; abdomen more glossy, very slightly pollinose, tergite 6 with long *mar*; sternite 6 quadrangular, about $1/2$ as long as broad. *Terminalia*: Ovipositor sheath shorter than tergite 6, setigerous on lateral sides, pubescent on posterior $1/2$; apodeme cylindric, flattened, longer than sheath, about $2.5 \times$ as long as wide, pouched on anterior $3/4$. Egg guides very long, about $7 \times$ as long as wide, 540-600 μ long, with about 80 minute teeth of serration, without spinules dorsally. Tergite 9 is 360 μ long, about $6 \times$ as long as wide; sternite very short, 80 μ long, with 2 pairs of *nsm* and 4-6 sensillae; cerci 50 μ long, bearing 4 *ts* which are $1/4$ as long as length of cercus. Spermathecae suboval, with partite proximal end, highly variable in size, 88×56 to $110 \times 50 \mu$, necks 50 μ long, ducts 540 μ long, brown in color on proximal $1/4$; ventral receptacle of normal form.

PUPARIUM. Dark brown; 3-3.5 mm in length, 1.5 mm in width and height. Oval; segmentation not constricted, distinguishable by bands of cuticular processes; thoracic cuticular processes minute, developed on only lateral sides, $2T=3.0$, $3T=3.2$; abdominal processes distinct, those of antero- or posteromost row of each band largest, on lateral side $1-2A=2.2-3$, $3-6A=2.2$, $7A=1.1$, decreasing in number of row dorsally and ventrally, but on ventral side 2 short additional rows before middle of each segment except for last $1/8$. Larval exuviae; head with a pair of sclerites laterad of antennae; mandibles large, but right one smaller, each with 2 teeth. Anterior spiracles knob-like, about 200 μ high, each with about 20 bulbs in 2 rows; posterior spiracles united with each other at bases as in *tokunagai*, projected posterolaterally, each with 18-25 bulbs. Posterior end without papillae; 2 pairs of sensillae between spiracles and anus.

DISTRIBUTION: Japan (Shikoku).

Holotype σ , on *Galeola*, Kuma-cho, Kamiukena-gun, Ehime Pref., 2 Oct. 1958, M. Utsunomiya; allotype φ , 22 paratypes, puparia, same data.

The larval structures of this species are very similar to those of *M. tokunagai* Sasakawa, on *Cymbidium*. But, the allied species belongs to the *pulicaria*-group, differing from the present species by the coloration of fringe on the calypter.

BIONOMICS: The larvae of this species mine the rind of fruits of *Galeola septentrionalis* Reichb. fil; *M. Tenancy*: 5-35 larvae on a fruit.

Melanagromyza lappivora Koizumi, 1953, Okayama Univ., Sci. Rep. Fac. Agr. 3: 46. Fig. 27.

Ovipositor sheath somewhat shorter than tergite 6; apodeme conical, strongly chitinized, $2.5 \times$ as long as wide, pouched on anterior $2/3$. Egg guides about 340 μ long, about $4 \times$ as long as broad, each with 30-34 large teeth of serration, numerous spines on dorsomesal membranous part and many sensillae. Segment 9 weakly sclerotized, similar to that of *pulicaria*, about $2.5 \times$ as long as broad; tergite 200 μ long; sternite with 2 pairs of *nsm* and sensillae, many setulae on lateral parts; cerci about 50 μ long, each with 4 *ts* which are $1/3$ length of cercus. Spermathecae pale brown, minute, radiate as in flower of

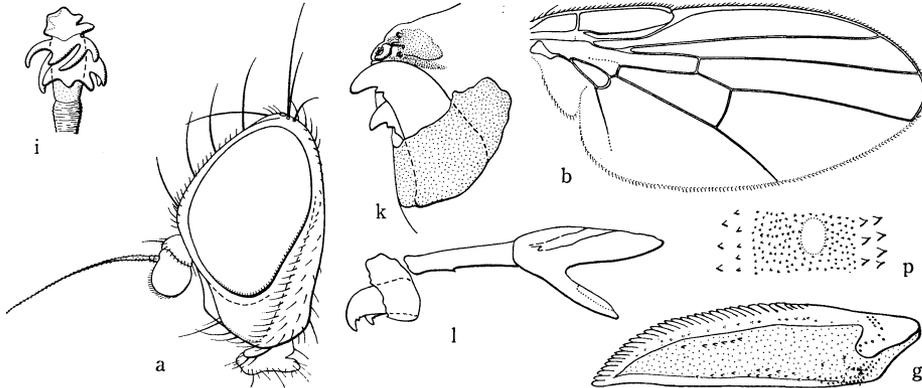


Fig. 27. *Melanagromyza lappivora* Koizumi.

chrysanthemum, about $20 \times 12 \mu$, necks 20μ long, ducts 240μ long and 8μ in diameter; ventral receptacle brown, sigmoid, 150μ long, with large stipules. The ovaries contain 24 ovarioles.

Koizumi gave the following character which is distinguishable from *pubescens* in his original description: ".....mid-tibiae have no minute spines on posterior surface near the middle". As the result of my reexamination of the paratypes, it is unacceptable for the specific character, because the mid tibia is provided with a distinct bristle.

This species is more like *M. subpubescens* Sasakawa (= *subpubescence* Sasakawa, 1956, syn. nov.) from Manchuria, differing in the structures of the lunule and parafrofrontalia, and in the coloration of the tibiae and the tarsi.

DISTRIBUTION: Japan.

HOST: *Arctium lappa* L.

Melanagromyza paederiae Sasakawa, 1954, Shikoku Ent. Soc., Trans. 4: 45. Fig. 28.

DISTRIBUTION: Japan.

The larvae of this species make the galls on the twig of *Paederia chinensis* Hance.

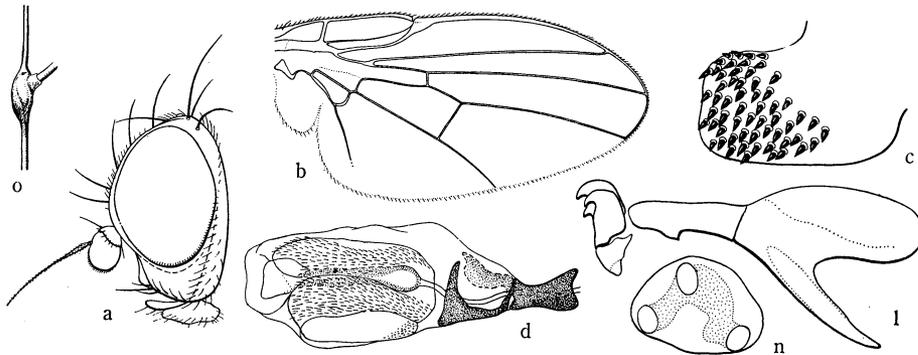


Fig. 28. *Melanagromyza paederiae* Sasakawa.

Melanagromyza pulicaria (Meigen), 1830, Syst. Besch. bekannt. eur. zweifl. Insekt. 6: 170.
Fig. 29.

Terminalia: Epandrium about $1/3$ length of tergite 6; surstyli each with 23-26 spines. Hypandrium strongly vertically curved, with indistinct apodeme, sidepieces narrow, about $2/3$ length of phallapodeme. Distiphallus about $4 \times$ length of sidepieces of hypandrium; endophallus as long as paraphallus, spinulose distally. Ejaculatory apodeme spatulate, 300μ long, 150μ wide.

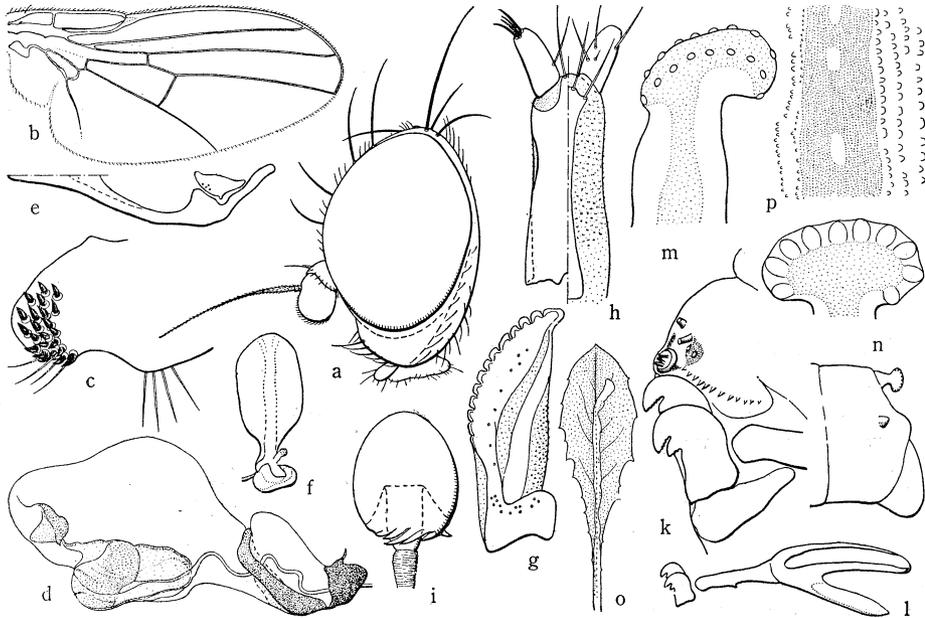


Fig. 29. *Melanagromyza pulicaria* (Meigen).

Ovipositor sheath as long as or slightly longer than tergite 6; apodeme triangular, chitinized only dorsomesally, pouched on apical $1/3$. Egg guides 260μ long, with about 12 large teeth of serration, many sensillae and spinules dorsally. Tergite 9 is 160μ long, sternite very narrow, but slightly longer than tergite, bearing 2 pairs of *ns*; cerci 52μ long, each with 4 *ts* which are $1/3-1/2$ length of cercus. Spermathecae suboval, 60×56 to $64 \times 56 \mu$, partite proximally, necks 36μ long and 20μ wide, ducts about $5.5 \times$ as long as capsule; ventral receptacle similar to that of *artemisiae*, but shorter, 132μ long.

LARVA. White, slightly yellowish, about 3.5 mm long. Head with distinct longitudinal sclerite and a row of large processes laterad from maxillary palpi and a small patch of spinulae dorsad of sensillae; mandibles each with 2 teeth, dorsal tooth with usually 4 minute notches. Anterior spiracles about 100μ long, each with 14-19 bulbs in 2 rows; posterior spiracles subequal in length to anterior, each with 10-14 bulbs. Spinal pattern: on dorsal, $1T=3.0$, on lateral side, $1T=6.0$, $2T=3+2.0$, $3T=4+2.1-2+8$, $1-7A=2-3.1-2$, numerous rows of minute spinulae between them; $8A=4.0$.

DISTRIBUTION: Europe, Siberia, Persia, China, Manchuria, Japan, North America.

HOSTS: *Taraxacum officinale* L., *Lactuca debilis* Maxim., *denticulata* Maxim., *Helianthus tuberosus* L., *Sonchus oleraceus* L.

Melanagromyza schineri (Giraud), 1861, Zool.-Bot. Ges. Wien, Verh. 11: 484. Fig. 30.

Terminalia: Similar to *paederiae*, but surstyli more sparsely spinose, basiphallus shorter, dorsal lobes of endophallus covered with minute spinulae, ejaculatory apodeme 180–320 μ in length and 60–160 μ in greatest width, duct 4 μ in diameter.

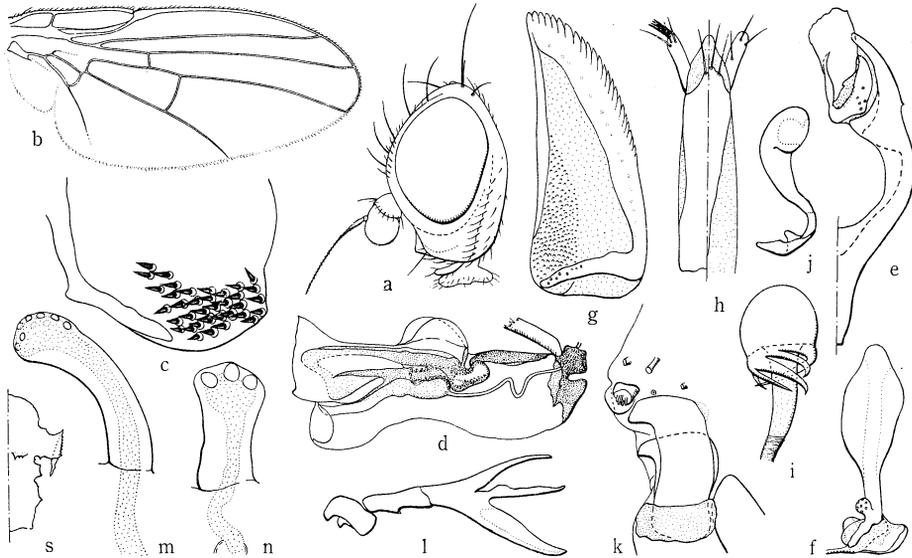


Fig. 30. *Melanagromyza schineri* (Giraud).

Ovipositor sheath slightly shorter than tergite 6, pubescent; apodeme elongate-conical, strongly chitinized, 2 \times as long as broad, pouched on anterior 4/5. Egg guides 220 μ long, 80 μ broad, each with 23–25 teeth of serration, numerous spinulae on dorsomesal membrane. Tergite 9 is 200 μ long, sternite with 2 pairs of *nsm*; cerci 50 μ long, bearing 4 *ts*. Spermathecae suborbicular, partite proximally, 20 \times 30 to 30 \times 30 μ , necks slightly depressed into capsule, 36 μ long, ducts about 400 μ long, 4 μ in diameter.

LARVA. Milky white, 3–3.5 mm long. Mandibles with a terminal large tooth; paraclypeal phragma with ventral processes largely translucent, as long as dorsal. Anterior spiracles about 100 μ long, each with 8–10 bulbs; posterior spiracles 65 μ long, each with 3 large brownish bulbs. Cuticular processes on metathoracic to abdominal segments arranged as in *pulicaria*. Posterior end with a pair of sensillae on midline between bases of posterior spiracles and anus.

Many were reared from larvae in galls, on *Salix*, Okayama, 7 May 1955, K. Koizumi.

DISTRIBUTION: Europe, Japan, N. America.

Shinji (1941, Kontyu Sekai 45: 227) recorded the occurrence of this species.

HOSTS: *Salix bakko* Kimura, *Salix* spp., *Populus* spp.

Melanagromyza sojae (Zehnter), 1900, Indische Natuur, Bijblad Arch. Java suiker industr. Soerabaja 1: 113. Fig. 31.

Terminalia: Surstylus with 8-10 spines; cercus each with a vertical row of 6-8 strong bristles on anteroventral part. Phallic hood large, pentagonal dorsally. Ejaculatory apodeme 130-145 μ long and 65-84 μ wide.

Ovipositor sheath as long as tergite 6; apodeme 2 \times as long as broad, pouched on anterior 1/3. Egg guides 200 μ long and 80 μ wide, with 27-29 teeth of serration and many sensillae laterally, minute setulae on dorsodistal part of membrane arranged in a comb pattern. Segment 9 about 180 μ long, 60 μ broad, sternite with 2 pairs of *nsm* and 5 pairs of sensillae; cerci 45 μ long, with 4 long *ts*. Spermathecae suboval, with partite proximal ends, each subequal in size, 80 \times 60 μ , necks 36 μ long and 16 μ broad, ducts 300 μ long 6 μ in diameter; ventral receptacle similar to that of *artemisiae*, but smaller, about 150 μ long.

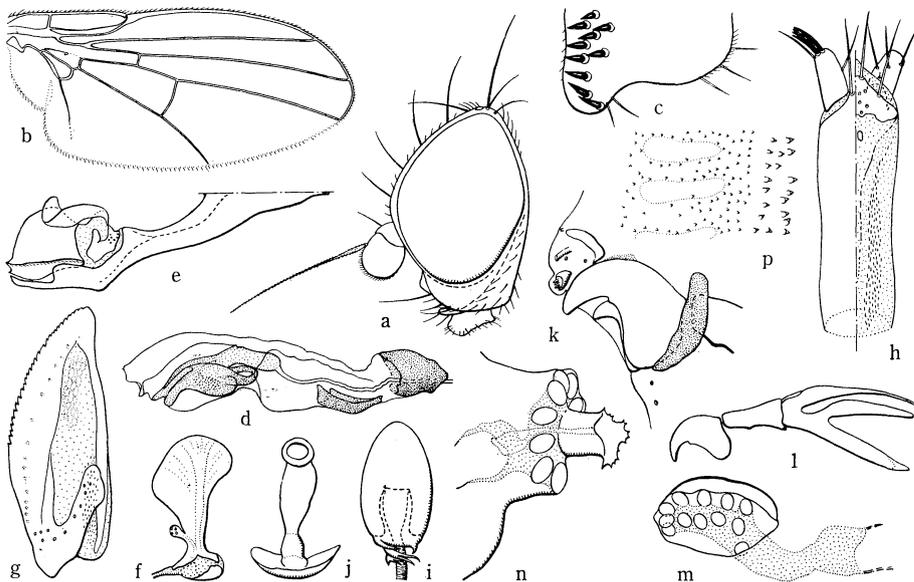


Fig. 31. *Melanagromyza sojae* (Zehnter).

LARVA. Mature larva milky white, 4-4.8 mm in body length. Mandibles each with a large tooth; anterior spiracles minute, visible in small holes, each with 10-12 bulbs; posterior spiracles pale brown, prominent, each with brown and cylindrical process at centre and 5-9 bulbs. Cuticular processes almost colorless, arranged in 7-10 rows dorsad from cephalolateral parts of prothorax; 2-3T=D, 5-6.0, L-V absent; 1-4A=L, 10-12, but decreasing dorsally and ventrally; 5A=5 short; remaining caudal segments without processes.

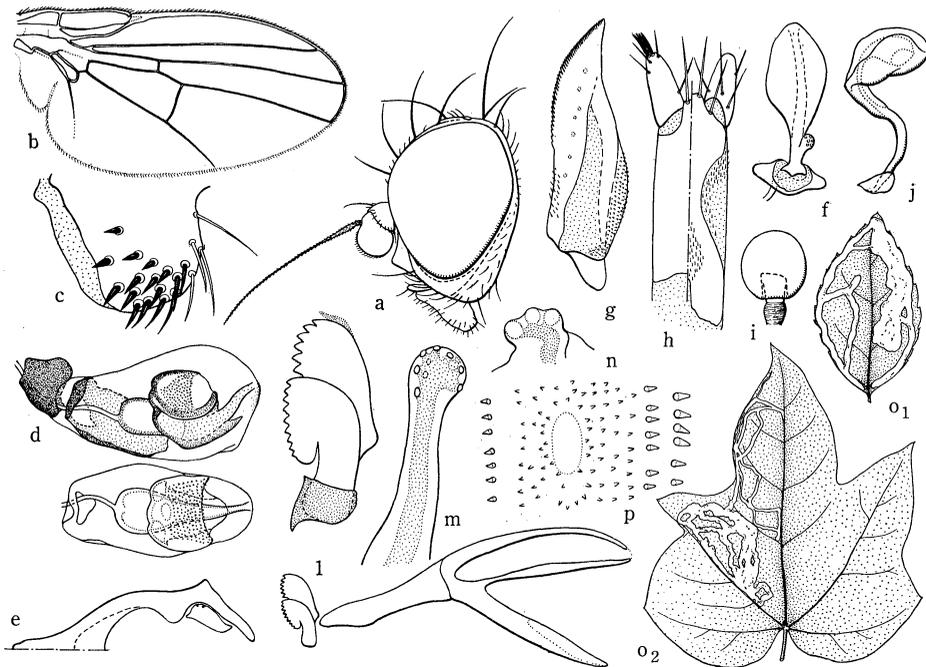
Several were reared from larvae, in *Glycine*, Kurashiki, Okayama, Sept. 1952, Y. Yasue; Konosu, Saitama, 30 Oct. 1958, A. Naito.

DISTRIBUTION: Java, Japan.

HOST: *Glycine soja* Sieb. & Zucc.

Melanagromyza styricicola Sasakawa, 1954, Shikoku Ent. Soc., Trans. 4: 42. Fig. 32.

Terminalia: Ovipositor sheath almost as long as tergite 6, apodeme weakly chitinized, $2.5 \times$ as long as broad. Egg guides 204μ long, with about 40 minute teeth of serration. Tergite 9 about $2 \times$ as long as wide, 140μ long, sternite strongly constricted at middle, 180μ long, with 2 pairs of *nsm* and a group of setulae; cerci 52μ long, each with 4 *ts*. Spermathecae minute, orbicular, with truncate proximal ends, 28×24 to $40 \times 36 \mu$, necks 18μ long and 15μ wide, ducts 260μ long, 6μ in diameter; ventral receptacle about 130μ long. Ejaculatory apodeme 160μ long, $30\text{--}60 \mu$ wide.

Fig. 32. *Melanagromyza styricicola* Sasakawa.

Spinal pattern of larva: on dorsal, $1T=1$ just behind bases of spiracles, on lateral side, $T=0$, $1A=2\cdot0+3$, $2A=3+2\cdot0+2-3$, $3-7A=4+2\cdot1+3$.

Additional, were reared from larvae, on *Euonymus*, Okayama, 10 Nov. 1955, K. Koizumi; on *Celastrus*, Tsu, Mie Pref., 13 Oct. 1956, Sasakawa; on *Fraxinus*, Mt. Hiko, Kyushu, 7 July 1955, on *Marlea*, Mt. Sobo, Kyushu, 21 Aug. 1956, on *Ilex*, Mt. Hiko, 15 Sept. 1956, on *Actinidia*, Mt. Hiko, 10 Sept. 1956, H. Kuroko; on *Pittosporum*, Asani, Amami-Oshima, 23 Apr. 1956, Sasakawa.

DISTRIBUTION: Japan.

The following are main differences between *M. styricicola* and *theae*.

	<i>M. styricicola</i>	<i>theae</i>
Parafrontalia in profile	not beyond (above) eye	slightly beyond (above) eye
Height of gena	$1/16\text{--}1/18$ of eye height	about $1/8$ of eye height

	<i>M. styricicola</i>	<i>theae</i>
Acrostichals	6 rows	8 rows
Mid-tibial bristle	always 1	0-1
Spermatheca	proximal end truncate	partite proximally
Spinal pattern on abdominal segment 3 of larva	4+2·1+3	3+2·0+3
Host	polyphagy	Theaceae (monophagy)

HOSTS: *Actinidia arguta* Planch., *Celastrus orbiculatus* Thunb., *Euonymus japonica* Thunb., *Fraxinus verecunda* Koidz., *Ilex pedunculosa* Miq., *Marlea platanifolia macrophylla* Makino (fig. 32, O₂), *Pittosporum tobira* Ait., *Styrax japonica* Sieb. & Zucc. (O₁) and *Tylophora aristolochioides* Miq.

Melanagromyza theae (Green), 1896, Indian Mus. Not. 3: 28.—Hotta, 1920, Tea Injur. Ins., p. 149. Fig. 33.

Terminalia: Surstylus with 19-22 long spines; sidepieces of hypandrium about 3/4 length of phallapodeme, with short apodeme; distiphallus with basal sclerites tubular only at proximal end, endophallus spinulose laterally; ejaculatory apodeme 140 μ long, 60 μ broad.

Egg guides with 35 minute teeth of serrations on laterodistal 1/3; spermathecae suboval, partite proximally, rarely 3 in number, 28 \times 24 to 32 \times 28 μ , necks 16 μ long, 14 μ wide, ducts 260 μ long and 8 μ in diameter.

Spinal pattern of larva: on dorsal, 1T=2-3 immediately behind bases of anterior spiracles, 2T=0, 3T=1·0, A=0, on lateral side, T=0, 1A=2-3·1-2, 2-7A=3+2·2-3, 8A=5·0.

Many were reared from larvae, Shimogamo, Kyoto, 10 Nov. 1952, Sasakawa; Kanaya,

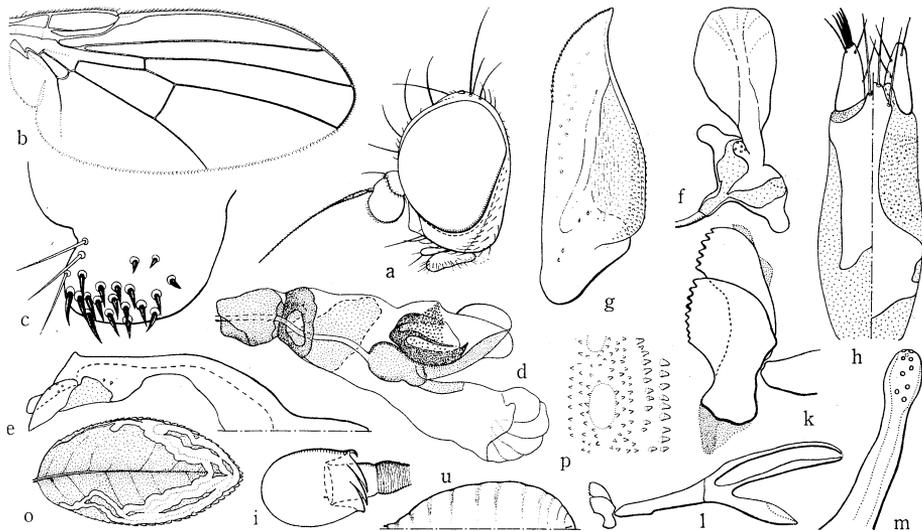


Fig. 33. *Melanagromyza theae* (Green).

Shizuoka Pref., 11 Jan. & 20 Nov. 1948, J. Minamikawa.

DISTRIBUTION: Japan, Okinawa Is., Taiwan, Java, Madagascar.

HOSTS: *Thea sinensis* L., *Camellia japonica* L., *thea* Link.

Melanagromyza tokunagai Sasakawa, 1953, Saikyo Univ., Sci. Rep., Agr. 4: 10. Fig. 34.

DISTRIBUTION: Japan.

HOST: *Cymbidium virescens* Lindl.

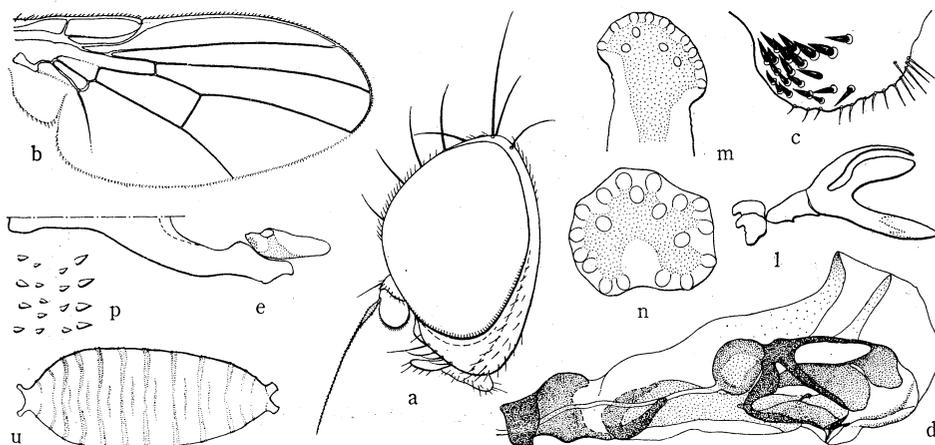


Fig. 34. *Melanagromyza tokunagai* Sasakawa.

Melanagromyza websteri (Malloch), 1913, Ent. Soc. Amer., Ann. 6: 325. Fig. 35.

Terminalia: Epandrium narrow, less than 1/3 length of tergite 6; surstyli slightly incised before posterior angles, each with 35-43 spines and a seta. Hypandrium about 3/5 length of phallapodeme; praegonites with about 18 sensillae. Distiphallus about 1/2 length of phallapodeme. Ejaculatory apodeme 36 μ long, 176 μ wide.

Ovipositor sheath as long as tergite 6; apodeme similar to that of *artemisiae*. Egg guides extremely long, about 6.5 \times as long as broad, 420 μ long, with about 22 large teeth of serration. Tergite 9 is 360 μ long, but sternite conspicuously short, 92 μ long, with 2 pairs of *nsm* and 3 pairs of sensillae; cerci 60 μ long, each with 4 *ts* which are 28 or 20 μ in length. Spermathecae semispherical, partite proximally, 68 \times 40 to 76 \times 56 μ , necks 24 μ long, 20 μ broad; ducts about 10 \times as long as length of spermathecae, 704 μ long, 12 μ in diameter; ventral receptacle same form as in *artemisiae*, 180 μ long.

LARVA. White, 4-4.5 mm in length. Head with longitudinal sclerite; right mandible small, left with elongated terminal tooth and a few indistinct teeth below that, paraclypeal phragma with dorsal process not bifurcated; mandibular adductor apodeme large, dorsally connecting with abductor apodeme. Anterior spiracles about 80 μ in diameter, each with 7-9 bulbs; posterior spiracles almost as long as anterior, about 40 μ in height, each with usually 3 (3-4) bulbs. Spinal pattern: on dorsal, 1T=20.2, 2T=2.0, 3T-4A=numerous minute processes between 3-4 anterior rows and 4-5. posterior rows of distinct processes,

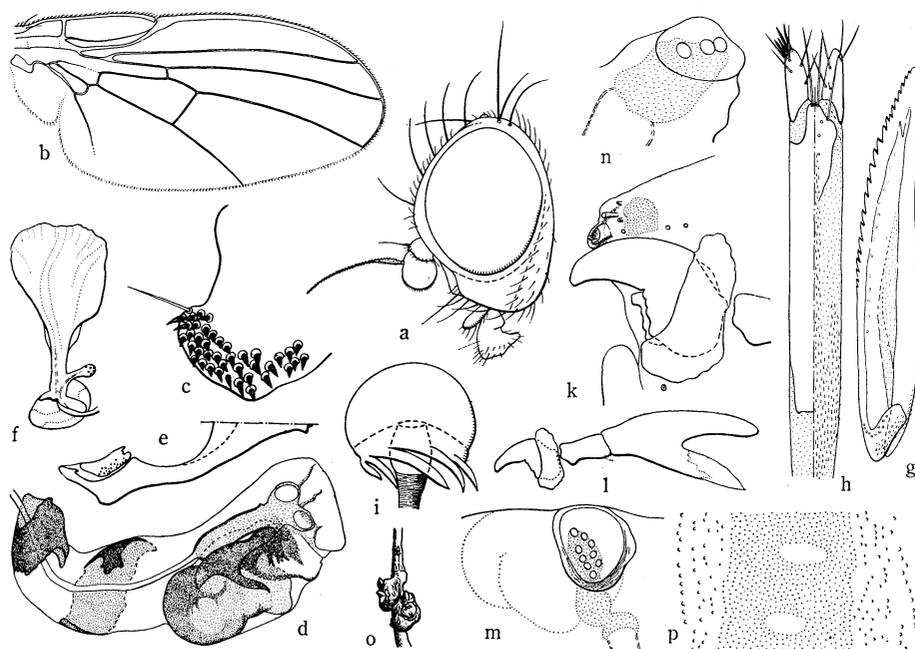


Fig. 35. *Melanagromyza websteri* (Malloch).

5-8A=0; on lateral, 1T=20.4, other segments similar as those on dorsal, but number of rows of large processes decreasing posteriorly, that is 5A=3-4-2, 6A=2.1-2, 7A=1-2.3-4, 8A=0; on ventral side entirely absent. Posterior end without papilla.

Many were reared from larvae, Okayama, 13 Apr. 1956, K. Koizumi; Mt. Hiei, Kyoto, 5 Apr. 1960, M. Sasakawa.

DISTRIBUTION: Japan, N. America.

HOSTS: *Wistaria* spp.

4. Genus *Carinagromyza* Sasakawa, 1954

Carinagromyza heringi Sasakawa, 1954, *Kontyû* 22 (1/2): 23. Fig. 36.

Terminalia: Surstylus with 25-27 spines; basiphallus long, distiphallus slightly shorter than hypandrium, about 2/5 as long as phallapodeme; ejaculatory apodeme about 120 μ long, 40-50 μ wide, stem with 2 projections in vertical plane of blade.

Ovipositor sheath almost as long as tergite 6; apodeme rectangular, scarcely 2 \times as long as wide, pouched on anterior 1/3. Egg guides 220 μ long, about 3 \times as long as broad, with about 22 teeth of serration, many rows of spinulae dorsoproximally, and many sensillae dorsally and ventrally. Tergite 9 is 180 μ long, sternite sclerotized only centrally and narrowly, with 2 pairs of *nsm* and many setulae on lateroproximal membranes; cerci 40 μ long, each with 4 short *ts*. Spermathecae minute, partite proximally, more or less spirally, 12 \times 20 to 20 \times 20 μ , necks 12 μ long, ducts 360 μ long, 5 μ in diameter;

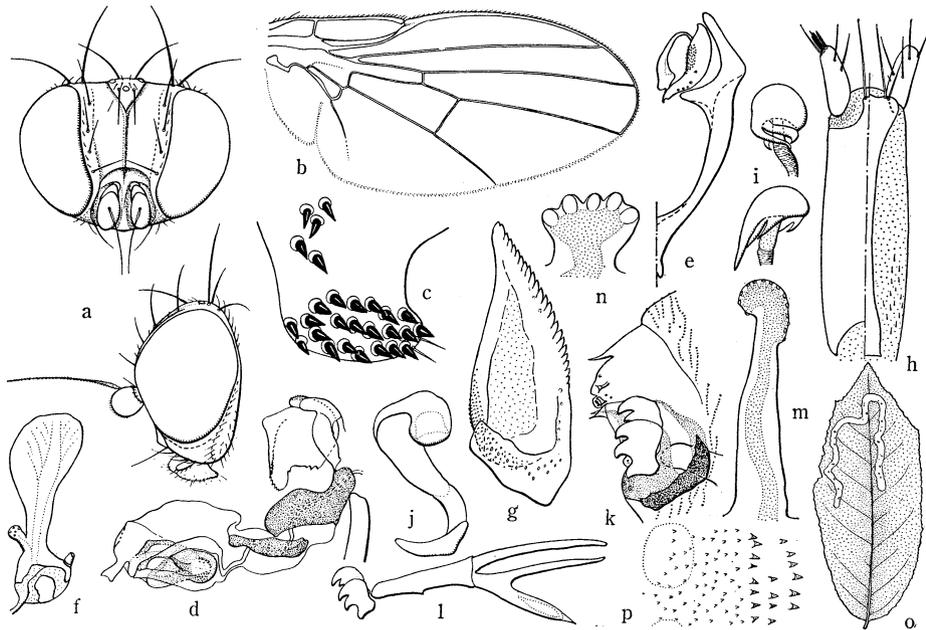


Fig. 36. *Carinagromyza heringi* Sasakawa.

ventral receptacle pale brown, except for colorless basal stipules, 108 μ in length.

Additional material, including larvae, on *Elaeagnus*, Mt. Hiei, Kyoto, 30 May 1956; Kibune, 27 June 1956; Mt. Nachi, Wakayama, 6 May 1957; Matsuyama, Shikoku, 13 July 1954; Kagoshima, Kyushu, 20 Sept. 1955, Sasakawa.

DISTRIBUTION: Japan.

HOST: *Elaeagnus pungens* Thunberg.

5. Genus *Ophiomyia* Braschnikov, 1897

KEY TO ADULTS

- 1. Gena narrower than 1/5 eye height..... 2
- Gena about 1/3 eye height **melandryi**
- 2. Gena about 1/8 eye height
- Gena about 1/5 eye height..... **kwansonis**

Ophiomyia kwansonis Sasakawa, n. sp. Fig. 37.

ADULT. *Male*: Head black; frontalia opaque; ocellar triangle slightly shining; lunule and carina shiny, gray-dusted; parafrontalia and genae with brown tinge; antennae and palpi black; proboscis pale brown. Thorax shiny black, more or less densely gray-dusted; wings hyaline, veins brown; calypteres whitish gray, with margins and fringe brownish black; halteres brownish black; legs black. Abdomen glossy, slightly gray-dusted; epan-drium subshiny.

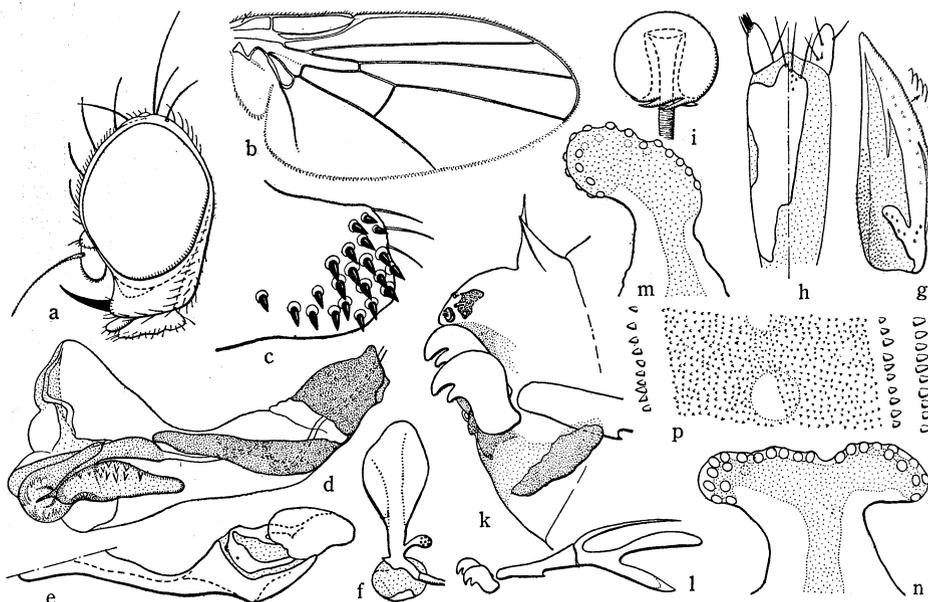


Fig. 37. *Ophiomyia kwansonis* Sasakawa, n. sp.

Head: Front about $1.5 \times$ as wide as eye, narrower than long, sides almost parallel or more or less converging ventrally; parafrontalia about $1/5$ width of front, almost parallel-sided. Ocellar triangle convex, with ventral tip extending midway between levels of 1. and 2. *ors* or to level of 2. *ors*; *oc* long, accompanying 3 pairs of setulae. Lunule flat, lower than semicircular, about $1/4$ length between its tip and anterior ocellus; median furrow indistinct; ptilinal suture deep. Fronto-orbitals 4 pairs; 1. *ors* directed up- and somewhat outwards, 2. *ors* up and slightly inwards, *ori* in- and upwards; *oh* rather densely in irregular row, several setulae mingled with row of *or*. In profile parafrontalia extending beyond eye, parafacials linearly visible, but exceedingly broadening ventrad, in broadest part about $1/2$ height of genae; eyes almost bare, about $1.3 \times$ as high as wide; genae $1/4$ - $1/6$ eye height. Vibrissal angles somewhat projected with 80° , *vi* composed of large conspicuous fasciculi; several short setae near *vi*; peristomal setae about 6 in 2 rows. Face vertical, almost as high as wide; carina fusiform, about $2/3$ as wide as diameter of antennal segment 1, reaching ventrally tip of small triangular epistoma; antennal grooves deep. Antennae broadly separated at base; segment 3 as long as broad, with distinct pile; arista nearly $2 \times$ as long as whole length of antenna, broadened on basal $1/5$, pubescent microscopically. **Thorax:** Mesonotum with $0+2$ *dc*, anterior *dc* located on level of *sa*; *acr* in 8 rows, becoming sparser behind anterior *dc*, about 6 rows of them ending at or just behind level of posterior *dc*; *ia* and *sa* each long; about 5 rows of setulae between rows of *dc* and *sa*; *ipa* $1/4$ length of *opa*; humeri each with 6-9 setulae plus long *h*. Mesopleura with 4 dorsally directed setulae; sternopleura usually with 2 short setae before *sp*. **Wing:** Costa reaching M_{1+2} , with 3 sections in proportion of $50 : 13 : 12$; R_{2+3} almost straight; r-m distad beyond middle of discal cell; m-m subequal in length to penultimate

section of M_{1+2} and at angle of 80° to that; ultimate section of M_{1+2} about $5 \times$ as long as penultimate; ultimate section of M_{3+4} almost as long as penultimate (21 : 22). *Leg*: Mid tibia with a distinct bristle. *Abdomen*: Each tergite densely covered with setae, *mar* longer; tergite 6 as long as 5; sternite 5 about $1.5 \times$ as broad as long, with caudal incision deep, being $1/2$ of greatest length. *Terminalia*: Epandrium slightly shorter than $1/2$ length of tergite 6, broadening ventrally; surstyli about $1/2$ as long as epandrium, each bearing 16–22 spines and a few setae posteriorly; cerci about $1/2$ as high as epandrium. Hypandrium with sidepieces moderately broad, about $2/3$ as long as phallapodeme; apodeme distinct. Phallic hood $1/8$ as long as phallapodeme, weakly sclerotized in inverted T-form, with lateroventrally a pair of large lobes which are sclerotized vertically only. Basiphallus almost as long as aedeagal hood; endophallus subequal to basal sclerites in length, dorsal lobes bearing about 30 spines internally. Ejaculatory apodeme $180\text{--}200 \mu$ long and $80\text{--}96 \mu$ wide, duct 4μ in diameter. *Length*: Body and wing 2–2.5 mm.

Female: Similar to σ with usual sexual differences, *vi* normal; *pm* in a row. *Terminalia*: Ovipositor sheath shining black, pubescent on anterolateral $1/3$, apodeme similar to that of *maura*. Egg guides about $3 \times$ as long as broad, 250μ long, with about 43 minute teeth of serration and many rows of spinulae dorsoproximally. Tergite 9 is 200μ long; sternite cuneiform, with 2 pairs of *nsm* and about 8 sensillae; cerci 44μ long, with 4 short *ts*, which are approximately $1/4$ length of cercus. Spermathecae suborbicular, 56×52 to $56 \times 56 \mu$, with partite proximal end; necks 42μ and ducts 440μ in length, each 8μ in diameter.

LARVA. Yellow, about 5.5 mm in body length, about 0.8 mm in width. Head with a palmate dorsal process just before anterior margin of prothorax and a pair of rectangular sclerites laterad bases of antennae; mandibles black, each with 2 teeth, terminal large tooth 8- or 9-denticulated, ventral small tooth 3- or 4-denticulated; labial sclerite about $2 \times$ as long as mandible; paraclypeal phragma with ventral arms of dorsal process about $1.5 \times$ as long as labial sclerite; mandibular apodeme distinct. Anterior spiracles relatively long, knob-like, brown apically, 160μ high, each with 18–25 bulbs in 2 rows; posterior spiracles two-lobed, 120μ high, each with usually 30 (27–34) bulbs. Cuticular processes arranged only laterally in broad bands, head with about 5 rows, $1T=0.2$ on only dorsal $1/2$, $2T=0.5+1$ on dorsal $1/2$, $3T-7A$ =processes of central 27–30 rows minute, that of anterior 1 and posterior 2 (2–3) rows large, $8A$ =anterior row of large processes absent, but posteriorly 4 rows distinct. Posterior end without papilla.

PUPARIUM. Pale brown, 3–3.5 mm in body length, 1 mm in greatest width. Oblong, dorsal and ventral sides flattened; segmentation only distinguishable by bands of cuticular processes, not constricted.

DISTRIBUTION: Japan (Honshu).

Holotype σ , Shimogamo, Kyoto, on *Hemerocallis*, 21 May 1956, Sasakawa; allotype φ , paratypes and immature stages, same data.

The present new species is somewhat allied to *O. maura* and *melandryi* but quite different in the shape of the endophallus, the egg guides and the posterior spiracles of larva.

BIONOMICS. *Host*: *Hemerocallis fulva kwanso* Regel. *Mine*: Whitish, long ophionome, usually begins from the lower surface type in the upper part of leaf, sometimes changes into the lower surface type, later on usually runs downwards along the mid-vein of leaf,

1.5 mm in greatest breadth. *Tenancy*: Usually 1 mine occurs on a single leaf. *Pupation*: The mature larva pupates in the mine at basal part of leaf. *Development*: 3 generations in a year, twice in duration from May to July and once in September to October.

Ophiomyia maura (Meigen), 1838, Syst. Besch. bekann. eur. zweifl. Insekt. 7: 399. Fig. 38. *Ophiomyia asteris* Kuroda, 1954, Kontyû 21: 82. New Synonymy.

All the Japanese specimens examined are provided with a distinct mid-tibial bristle.

Male terminalia similar to that of *kwansonis*. Ovipositor sheath almost as long as tergite 6, densely setigerous dorsally; apodeme conical but only sclerotized dorsomesally. Egg guides 3-3.5 × as long as broad, 290 μ long, with 6-10 blunt teeth of serration, many rows of spinulae dorsoproximally and many sensillae dorsally and ventrally. Tergite 9 is 180 μ long, sternite narrow, but longer than tergite, with 2 pairs of *nsm* and 6-8 sensillae, setulose on ventrolateral membranes; cerci short, with 4 short *ts*. Spermathecae suborbicular, partite proximally, 40 × 36 to 48 × 48 μ, necks 32 μ long and ducts 360 μ long, 8 μ in diameter; ventral receptacle brown but basal body paler, sigmoid as viewed in profile, 124 μ long. Accessory glands about 300 μ long, 6 μ in diameter, dilated on apical 1/4.

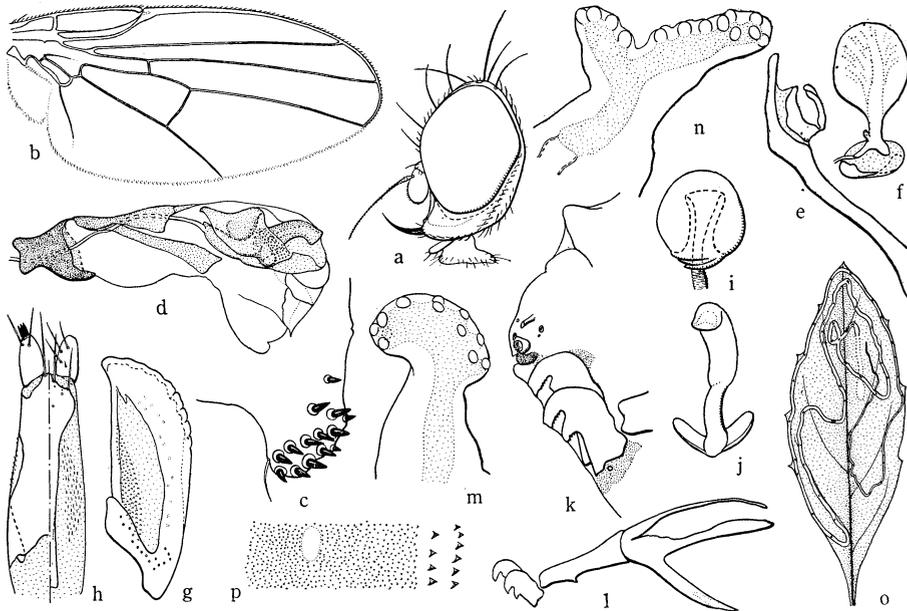


Fig. 38. *Ophiomyia maura* (Meigen).

LARVA. Differs from *kwansonis* in the following points: head with a longitudinal sclerite; anterior spiracles 100 μ high, each with about 12 bulbs in 2 rows; posterior spiracles black apically, as high as anterior spiracles, dorsal lobe extremely smaller than ventral, the former with 5-6 and the latter with 9-12 bulbs; head with 6-8 rows just behind mandibles, 1T=0.4 on dorsal 1/2, 2T=0.4+1-2 on dorsal 1/2, 3T-2A=each band not extending

to dorsomedian line, processes of anterior 1 row before central rows of minute processes and of posterior 2 or 3 rows larger, 3-8A = each band not extending both dorso- and ventromedian lines, anterior row of large processes absent.

DISTRIBUTION: Europe, Manchuria, Japan, N. America.

HOSTS: *Aster indicus* L., *Erigeron annuus* L., *Solidago virgaurea* L., *Eupatorium* spp.

Ophiomyia melandryi de Meijere, 1924, Tijdschr. Ent. 67: 137. Fig. 39.

Terminalia: Surstyli about 1/3 width of epandrium, each bearing 10-13 stout spines; hypandrium about 1/2 as long as phallapodeme. Endophallus with a long aedeagal filum. Ejaculatory apodeme about 200 μ long and 140 μ wide.

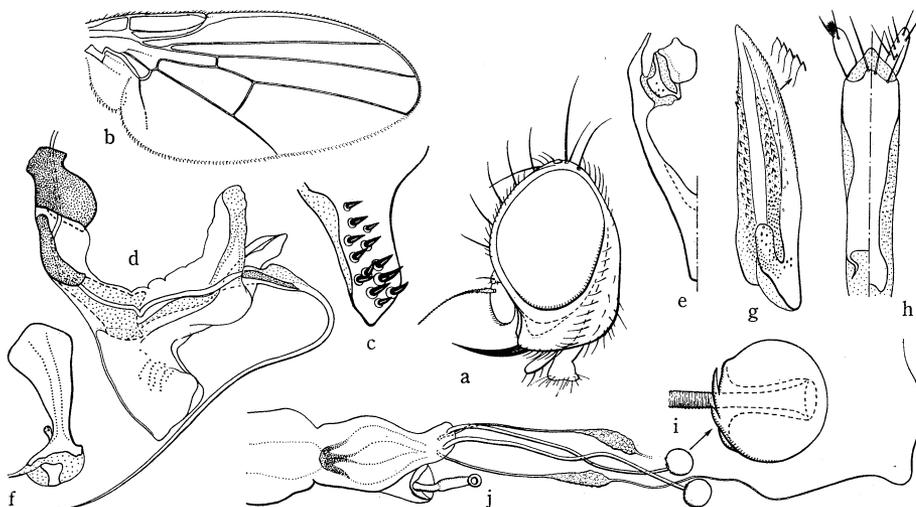


Fig. 39. *Ophiomyia melandryi* de Meijere.

Ovipositor sheath longer than tergite 6, densely setigerous, pubescent on anterior 1/5. Egg guides 400 μ long, about 4 \times as long as broad, each with 40-45 teeth of serration laterally, 4 rows of dark brown, conspicuous spines on dorsal membrane. Tergite 9 is 260 μ long, sternite with 2 pairs of *nsm*; cerci 60 μ long, each with 4 *ts* which are 1/3 length of cercus. Spermathecae suborbicular, each with a slight partite proximal end, 52 \times 64 μ ; necks about 50 μ long, ducts about 500 μ long, 8 μ in diameter; ventral receptacle and accessory glands as in *maura*.

Many, Jyozankei, Hokkaido, 10 June 1954, Sasakawa.

DISTRIBUTION: Europe, Siberia, Japan.

HOSTS: The larvae mine in the pith of stem of *Melandryum* spp.

6. Genus *Tylomyza* Hendel, 1931

Tylomyza madizina (Hendel), 1920, Archiv Naturg. A 84: 130. Fig. 40.

Terminalia: Epandrium deeply incised posterior just above surstyli; surstyli about 1/2

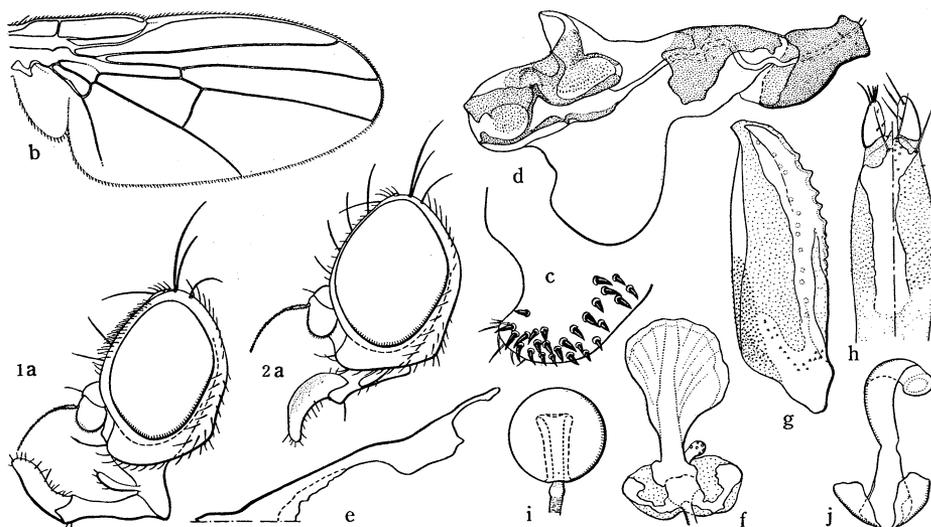


Fig. 40. *Tylomyza madizina* (Hendel). 1a : ♂; 2a : ♀.

as wide as epandrium, each bearing 27 spines and several setae along anterodistal margin; cerci about 1/2 as high as epandrium; hypandrium with short apodeme. Phallic hood heavily sclerotized anteriorly; distiphallus with basal sclerites subequal in length to basiphallus, ventral membrane extremely dilated; endophallus with numerous spinules. Ejaculatory apodeme 220 μ long, 140 μ wide; ejaculatory bulb with a pair of narrow sclerites.

Ovipositor sheath as long as tergite 6, with pubescence on basal 1/3, apodeme large, somewhat conical, pouched on apical 1/2, strongly chitinized dorsomesally. Egg guides subtriangular, about 3 \times as long as broad, 290 μ long, with about 10 blunt teeth of serration, many rows of spinulae dorsoproximally and many sensillae dorsally and ventrally. Segment 9 weakly sclerotized; tergite almost as long as broad, 68 μ long, sternite 160 μ long, with 2 pairs of *nsm* and many sensillae, densely setulose ventrally; cerci short, 40 μ long, each with 4 short *ts*. Spermathecae orbicular, 68 \times 64 to 68 \times 76 μ , with necks very long, 60 μ long, ducts 520 μ long and 12 μ in diameter; ventral receptacle similar to that of *Ophiomyia maura*, 152 μ long.

Several, Kamishihoro, Shibechea, Hokkaido, 10-13 June 1954, Sasakawa.

DISTRIBUTION: Europe, N. Africa, Japan.

Subfamily Phytomyzinae Fallén

7. Genus *Phytobia* Lioy, 1864

This large genus, consisting of 10 better defined subgenera, is represented in Japan at present by 25 species in 9 subgenera. The subgenus *Phytobia* (s. str.) is considered generalized on the basis of the adult characters: the female flies are provided with very long segment 9 and the suboval spermathecae, because the larvae mine the cambium. The male terminalia of the subgenus *Nemorimyza* Frey has a structure which is quite unlike other

subgenera. The subgenus *Amauromyza* Hendel may be easily distinguished by the numerous spinose endophallus, the strongly sclerotized bulb of ejaculatory apodeme and the disc-like spermathecae. The subgenus *Cephalomyza* Hendel is perhaps to be regarded as an intermediate stage between *Nemorimyza* and *Amauromyza*, basing upon the structure of the endophallus. The larvae of *Phytobia* (*Cephalomyza*) *cepa* Hering severely attack the onion. In the subgenus *Poëmyza* Hendel, the surstylus is densely setigerous or spinose, and sternite 9 of the female is well-developed, differing quite from subgenus *Dizygomyza*. The larvae of *Phytobia semiposticata*, belonging to the group has a pair of strong *prsc*, mines only the leaf of Cyperaceae; the larvae of other 6 Japanese species without *prsc* mine the leaves of Gramineae. *Phytobia okazakii* is one of the important pests of barley and wheat in Japan. The tubules of the endophallus in subgenus *Dizygomyza* Hendel are rather long and curved, as found in *Poëmyza* and *Icteromyza* Hendel. The larvae of this subgenus have 3 bulbs and they mine the leaves of Cyperaceae and Iridaceae. The larvae of subgenus *Calycomyza* Hendel have 3-8 posterior spiracles and they mine the leaves of Compositae and Campanulaceae. Subgenus *Praspedomyza* is most specialized because the larvae have a peculiar structure of the posterior spiracles.

KEY TO ADULTS

1. Knobs of halteres brown to black (*Amauromyza* subgen.).....23
Knobs of halteres white to yellow..... 2
- 2 (1). Lunule greatly higher than semicircular; frontalia at least ventral 1/2 brown to black; parafrontalia usually broadened laterad of lunule (*Poëmyza* subgen.)... 13
Lunule almost semicircular in outline 3
- 3 (2). Antennal bases widely separated; lunule large, about 1/2 as high as length between base of antennae and anterior ocellus..... 4
Antennal bases approximate or nearly so; lunule small, about 1/3 length between base of antennae and anterior ocellus 5
- 4 (3). Frontalia brown to black; ocellar triangle small (*Dizygomyza* subgen.) 19
Frontalia yellow; ocellar triangle ventrally reaching lunule (*Icteromyza* subgen.) **geniculata**
- 5 (3). Prescutellar bristles present; wing tip near termination of R_{4+5}6
Prsc absent; wing tip near termination of M_{1+2}7
- 6 (5). Mesonotum with 1+3 *dc*; fringe of calypter blackish (*Phytobia* subgen.).... **lineata**
Mesonotum with 0+3 *dc*; fringe of calypter whitish (*Nemorimyza* subgen.)....
..... **posticata**
- 7 (5). Gena 1/3-1/2 eye height; mesopleura without dorsally directed setula (*Cephalomyza* subgen.)..... 12
Gena 1/4-1/6 eye height; mesopleura with dorsally directed setula.....8
- 8 (7). Mesonotum with 1+3 *dc* (*Praspedomyza* subgen.)..... 9
Mesonotum usually with 0+3 *dc* (*Calycomyza* subgen.)..... 10
- 9 (8). Frontalia blackish brown; antennae partially yellow..... **morio**
Frontalia yellowish brown; antennae black..... **subapproximata**
- 10 (8). Front and mesonotum black **gyrans**
Front and lateral stripes of mesonotum yellow..... 11

- 11 (10). Fringe of calypter blackish brown.....**artemisiae**
 Fringe of calypter yellowish white..... **humeralis**
- 12 (7). Antennal segment 3 with pointed angle dorsoapically.....**cepa**
 Antennal segment 3 oval in form **nipponensis**
- 13 (2). *Prsc* present **semiposticata**
Prsc absent.....14
- 14 (13). Femora narrowly yellow at distal ends..... 15
 Femora yellow on distal 1/3-1/2 **setariae**
- 15 (14). Fringe of calypter blackish brown 16
 Fringe of calypter white to yellow..... 17
- 16 (15). Orbital hairs arranged in 2 rows..... **bisetiorbita**
Oh in a row..... **sasae**
- 17 (15). Mesonotum with brown lateral stripes..... 18
 Mesonotum with yellow lateral stripes **lateralis**
- 18 (17). Mesonotum with 1+3 *dc*.....**okazakii**
 Mesonotum with 0+3 *dc*.....**atra**
- 19 (4). Mesonotum with about 6 rows of *acr* 20
 Mesonotum with 4 rows of *acr* 21
- 20 (19). All knees yellow **iraeos**
 Fore knees only yellow.....**flavicornis**
- 21 (19). All knees yellow 22
 Fore knees only yellow..... **luctuosa**
- 22 (21). Ultimate section of M_{3+4} longer than penultimate.....**morosa**
 Ultimate section of M_{3+4} shorter than penultimate..... **iridicola**
- 23 (1). Antennal segment 3 longer than broad..... **abnormalis**
 Antennal segment 3 subspherical..... 24
- 24 (23). Wings fuscous-hyaline..... **nigripennis**
 Wings hyaline..... **plectranthi**

Phytobia (Phytobia) lineata Sasakawa, 1955, Saikyo Univ., Sci. Rep., Agr. 7: 63. Fig. 41.

Ovipositor sheath almost as long as tergite 6, densely pubescent, with apodeme long

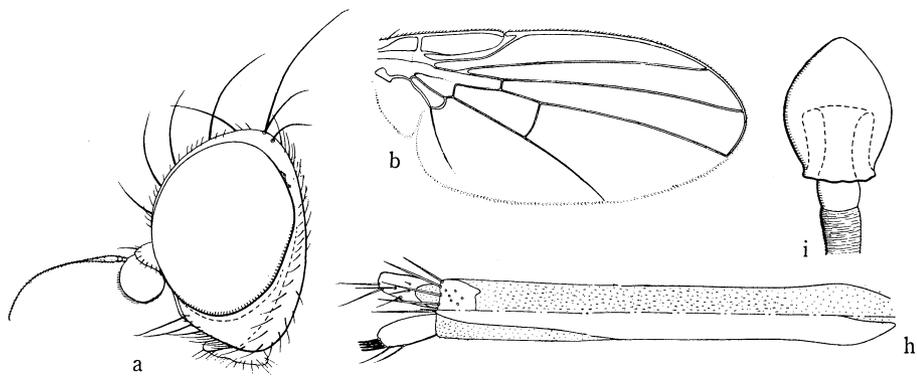


Fig. 41. *Phytobia (Phytobia) lineata* Sasakawa.

rectangular, 1.7× times as long as sheath, pouched on anterior 1/8. Egg guide small, subtriangular, slightly sclerotized proximally. Segment 9 extremely long, about 7× as long as broad, tergite 450 μ long; sternite only 40 μ long, with 4 pairs of *nsm* and many sensillae; cerci normal, bearing 4 *ts* which are about 1/3 length of cercus. Spermathecae acronshaped, 44 × 36 μ , necks as long as capsule, ducts brownish distally, 460–540 μ long, 12 μ in diameter; ventral receptacle normal.

Additional, Kibune, Kyoto, 2 June 1956, Sasakawa.

DISTRIBUTION: Japan.

Phytobia (Nemorimyza) posticata (Meigen), 1830, Syst. Besch. bekann. eur. zweifl. Insekt. 6: 172. Fig. 42.

Terminalia: Surstyli narrow, lobed, separated broadly by membrane, each with about 45 slender spines; processus longus with dorsal lobes bearing a pair of strong spines and numerous spinulae. Hypandrium about 1/2 as long as phallapodeme. Phallic hood about 1/3 as long as phallapodeme, bearing numerous spines, which are directed posteriorly, on ventrolateral parts. Distiphallus as long as sidepieces of hypandrium; endophallus with dorsal lobes hairy on lateral sides. Ejaculatory apodeme about 160 μ long and 80 μ broad.

Ovipositor sheath as long as tergite 6; apodeme as long as sheath, pouched on anterior 1/4. Egg guides small, weakly sclerotized, 80 μ long, 100 μ broad. Tergite 9 triforked, 240 μ long, 160 μ broad, sternite membranous, bearing 5 pairs of *nsm* and 5 pairs of sensillae, numerous setulae on tergal and sternal membranous parts; cerci 60 μ long, each with 4 *ts* which are 1/5 length of cercus. Spermathecae semiorbicular, 70 × 100 to 76 × 130 μ ; necks 40–50 μ long, ducts pale brown, colorless on proximal 1/4, about 520 μ long

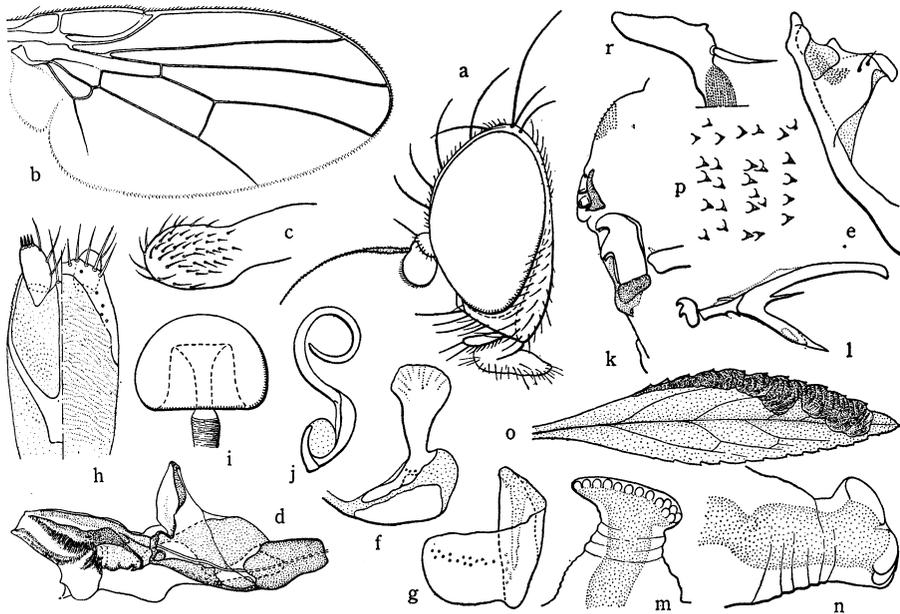


Fig. 42. *Phytobia (Nemorimyza) posticata* (Meigen).

and $20\ \mu$ in diameter; ventral receptacle pale brown, $220\ \mu$ long.

DISTRIBUTION: Europe, Japan, N. America.

HOSTS: *Aster indicus* L., *A. trinervius congestus* Franch. & Sav., *A. trinervius adustus* Maxim., *Solidago Virga-aurea* L., *S. serotina* Ait.

Phytobia (Amauromyza) abnormalis (Malloch), 1913, Ent. Soc. Amer., Ann. 6: 320. Fig. 43.

Terminalia: Surstyli not separated from epandrium, each with about 20 setae. Processus longus membranous, setulose, with dorsal lobes chitinized, subovoid, bearing 4 bristles at ventral apices. Distiphallus slightly longer than hypandrium, paraphallus subequal to endophallus in length, hypophallus extremely broad, ventral membranous lobes of endophallus with many black, heavy spines. Postgonites shorter than $1/3$ length of phallopodeme. Ejaculatory apodeme $215\ \mu$ long, with several sensillae basally; bulb $3/4$ as long as blade; duct $12\ \mu$ in diameter.

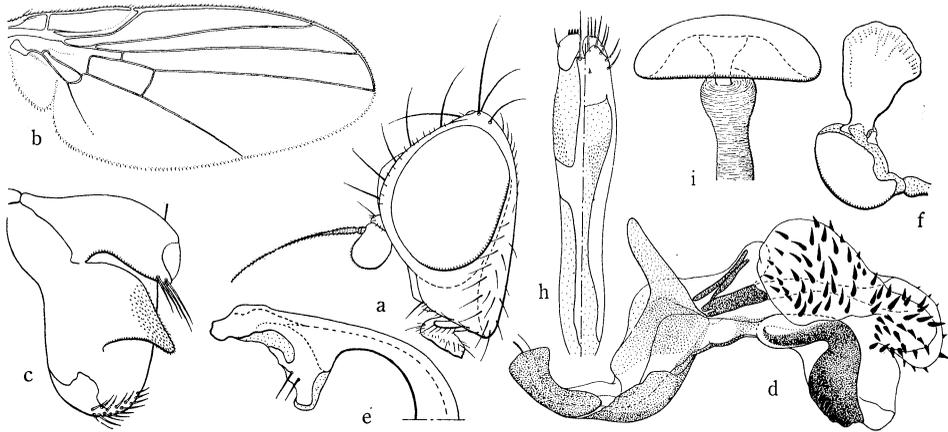


Fig. 43. *Phytobia (Amauromyza) abnormalis* (Malloch).

Ovipositor sheath about $1.5\times$ as long as tergite 6, bearing a pair of setae laterally; apodeme as long as sheath, pouched on anterior $1/2$. Egg guides normal, $60\ \mu$ long. Segment 9 slender, tergite cruciform, slightly shorter than sternite, sternite $400\ \mu$ long, with 5 pairs of *nsm*; cerci about $1/8$ length of tergite 9, with 4 *ts* which are $1/6$ of cercus length. Spermathecae somewhat disc-like, $36\times 100\ \mu$, necks flask-shaped, about $25\ \mu$ long, proximally deeply excavated into capsule, ducts $400\ \mu$ long, pale brown and broadened on distal $1/2$, about $25\ \mu$ in diameter; ventral receptacle of normal form, $60\ \mu$ long, tail $4/5$ length of body. Uterus with numerous spinules internally at anterior end.

DISTRIBUTION: Europe, Japan, N. America.

HOSTS: *Amaranthus* sp. in N. America and *Chenopodium album* L. in Europe.

Phytobia (Amauromyza) nigripennis Sasakawa, n. sp. Fig. 44.

ADULT. *Male*: Entirely black; dorsal $1/2$ of front, lunule, genae and antennal seg-

ment 1 tinged with brown; ocellar triangle and parafrontalia faintly shining; proboscis fuscous. Thorax and abdomen densely gray-dusted, the latter with slight brown tinge; mesopleural sutures and bases of wings brown. Wings distinctly fuscous-hyaline; veins dark brown; calypteres whitish brown, with margins and fringe brownish black. Legs black.

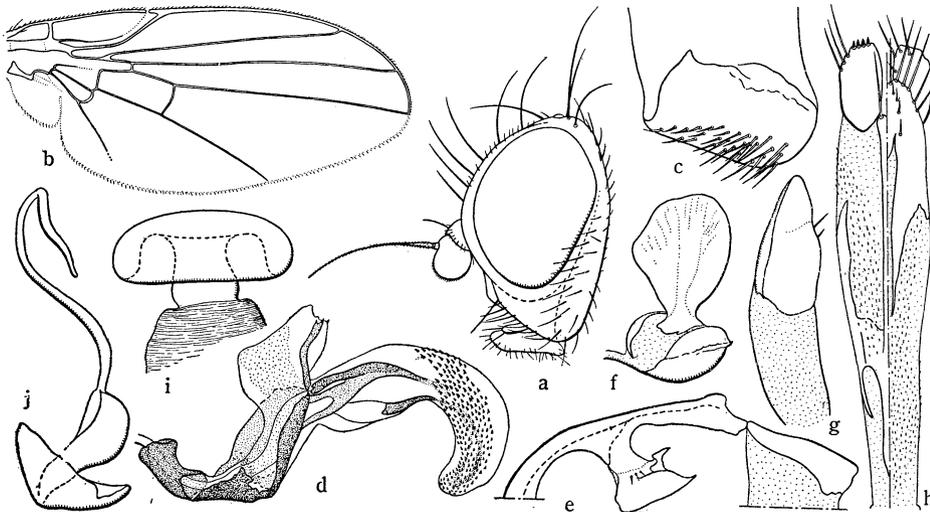


Fig. 44. *Phytobia (Amauomyza) nigripennis* Sasakawa, n. sp.

Head: Front $1.5-1.8 \times$ as wide as eye, as broad as long, its lateral sides parallel or slightly converging ventrally; parafrontalia nearly $1/4$ width of front, narrowing ventrally, but slightly broadened laterad of lunule. Ocellar triangle small, with dorsal margin narrower than $1/2$ width of vertex, ventral tip not reaching level of 1. *ors*, bearing a pair of setulae plus *oc*. Lunule flat-convex, semicircular, about $1/3$ as high as length between its dorsal tip and anterior ocellus, median furrow shallow. Fronto-orbitals 6 pairs; 1. *ors* directed up- and slightly outwards, 2. upwards; *ori* usually 4 (3-4), for- and inwards; *oh* minute, in a row. In profile parafrontalia and parafacialia extending beyond upper eye-margin; eyes about $1.3 \times$ as high as wide, very sparsely with minute hairs; genae about $1/4$ eye-height. Face almost vertical, as high as broad; 8-12 *pm* in 2 rows. Parafacialia near antennal base almost $3/4$ as wide as diameter of antennal segment 1. Antennae slightly separated at bases; segment 3 almost as long as broad, minutely pilose; arista $2-2.5 \times$ as long as whole length of antenna. **Thorax:** Mesonotum with 1+3 *dc*, 1. *dc* situated behind level of *prs*, 3. *dc* almost on level of *sa*; 4 rows of *acr* extending posteriorly level of 4. *dc*; 3 rows of setulae between rows of *dc* and *sa*; *ia* long; *ipa* about $1/2$ length of *opa*; humeri each with 11-14 setulae plus *h*. Mesopleura with 5-10 dorsally directed setulae; sternopleura with 2-3 short setae before *sp*. **Wing:** Costa with 3 sections in proportion of 50 : 19 : 14; r-m mostly slightly before middle of discal cell; M_{1+2} terminating at wing tip, with ultimate section $5-7 \times$ as long as length of penultimate; ultimate section of M_{3+4} nearly $2 \times$ as long as length of penultimate. **Abdomen:** Tergite moderately covered with dense setae, *mar* long; tergite 6 longer than 5; 5th sternite $2 \times$

as broad as long, posteriorly with very shallow incision. *Terminalia*: Epandrium about $1/2$ as long as tergite 6, without dorsodistal process; surstyli somewhat projected anteriorly, bearing about 30 setae; cerci almost $1/2$ as high as epandrium. Hypandrium with sidepieces relatively short, about $1/3$ length of phallapodeme. Processus longus with dorsal lobes $1/2$ length of hypandrial sidepiece, bearing 2-3 pairs of setae at both caudal angles. Distiphallus $1.5 \times$ as long as length of hypandrium, endophallus longer than paraphallus, bearing numerous, black spines on lateral sides of membranous lobes. Ejaculatory apodeme about 300μ long and broad; bulb broad, large, duct 20μ in diameter. *Length*: Body and wing 1.75-2 mm.

Female: Similar to ♂, although front more or less broader, (1.8-2 \times); tergite 6 with caudal margin narrowly pale brown; sternite 5 slightly smaller than 6, $4 \times$ as broad as long, 6th sternite $3 \times$ as broad as long. *Terminalia*: Ovipositor sheath shiny black, as long as or $1.5 \times$ as long as tergite 6, densely setigerous on lateral sides; apodeme strongly chitinized, slightly longer than sheath, pouched on anterior $1/2$. Egg guides suboval, 120μ long, each bearing 2 sensory setae on mesal side. Tergite 9 cruciform, laterally uniting with narrow pleural sclerites, 260μ long; sternite 200μ long, with 5-6 pairs of *nsm* and 3-4 pairs of short setae on mesal part; cerci each with 3-4 short *ts* which are about $1/10$ length of cercus. Spermathecae disk-shaped, proximally deeply excavated, each variable in size, larger one 40×88 to $40 \times 95 \mu$, small one 24×68 to $28 \times 80 \mu$; necks broad, 35μ long; ducts brown, about 500μ long, broadened on distal $1/2$, about 60μ in diameter; ventral receptacle normal, tail $3 \times$ as long as body, folded 1 or 2 \times . Uterus provided with numerous dark brown spinules, which are directed posteriorly, internally at anterior end. *Length*: Body 2-2.25 mm; wing 2.25-2.75.

DISTRIBUTION: Japan (Shikoku).

Holotype ♂, allotype ♀, Mt. Tsurugi, Tokushima, Shikoku, 4 June 1957, Sasakawa; 20 paratypes, same data.

This is a fairly large and almost entirely black species. *P. nigripennis* may be distinguished from *P. strobli* Hendel, the only Palaearctic species having the fuscous-hyaline wings known to me, by the narrow genae, the chaetotaxy on the mesonotum and the wing venation. In the related species, the genae are $1/2$ as high as the eye-height, the 1st dorso-central bristles situated before level of paired presutural bristles and as far apart from the transverse suture as the 2nd from that, and the ultimate section of M_{3+4} about $1.5 \times$ as long as length of penultimate. This new species is also easily separated from the Palaearctic species of the *lamii*-group by the number of fronto-orbital bristles, the coloration and venation of the wing. The spines on the endophallus are smaller but more densely arranged than that of *abnormalis*.

The species exhibits considerable variation in the number of lower fronto-orbital bristles, 56% of specimen examined have 4 bristles on each side, 13% with 3 on each, 18% 3 on one side, 13% 5 on one side,

Phytobia (Amauromyza) plectranthi Sasakawa, n. sp. Fig. 45.

ADULT. Female: Black; head slightly gray-dusted, front tinged with brown, frontalia paler mesally; parafrontalia and ocellar triangle subshiny; lunule blackish brown, gray-whitish pruinose; genae dark brown; antennae and palpi black; proboscis pale yellow-

brown. Thorax subshiny, densely gray-dusted; mesopleural sutures and bases of wings brownish yellow. Wings hyaline; veins pale brown; calypteres brownish white, with margins and fringe blackish brown; halteres brown, with knobs darkened. Legs black. Abdomen blackish brown, slightly dusted, tergite 1 paler proximally, tergite 6 with yellow caudal margin; ovipositor sheath glossy, black.

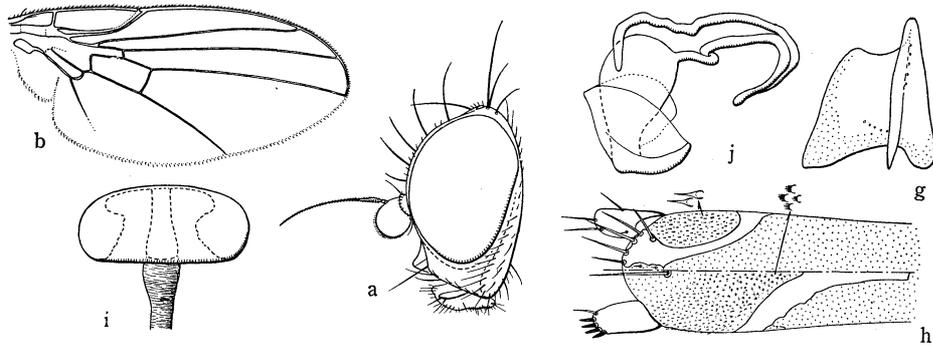


Fig. 45. *Phytobia (Amauromyza) plectranthi* Sasakawa, n. sp.

Head: Front about $1.5 \times$ as wide as eye, distinctly narrower than long, sides almost parallel; parafrontalia not convex, $1/5$ width of front, slightly converging ventrally. Ocellar triangle convex, with ventral tip extending level of 1. *ors*, bearing 4 pairs of setulae plus *oc*. Lunule flattened, semicircular, about $1/3$ as high as length between its dorsal margin and anterior ocellus; median furrow distinct. Fronto-orbitals 5 pairs; *ors* directed up- and slightly outwards, *ori* 3, up- and inwards; *oh* minute, in a row. In profile parafrontalia scarcely projecting above eye-margin; eyes $1.3 \times$ as high as wide, almost bare; genae about $1/7$ eye height; 5–7 *pm* in a row. Face concave, lower than wide. Parafrontalia about $1/3$ as wide as diameter of antennal segment 1. Antennae with bases approximate; segment 3 as long as broad, with distinct pile; arista $2 \times$ as long as whole length of antenna, swollen on basal $1/4$. **Thorax:** Mesonotum with 1+4 *dc*, 1. *dc* $1/3$ – $1/4$ length of 5, situated slightly before level of *prs*, 4. *dc* situated slightly behind level of *sa*; 4 rows of *acr* ending at level of 5. *dc*; 3–4 rows of setulae between rows of *dc* and *sa*; *ia*, *sa* each long; *ipa* nearly $1/2$ length of *opa*; humeri each with 11–13 setulae plus *h*. Mesopleura with 10–14 dorsally directed setulae; sternopleura with 3–4 short setae before *sp*. **Wing:** Costa with 3 sections in proportion of 50 : 14 : 12; r-m almost on middle of discal cell; m-m slightly shorter than penultimate section of M_{1+2} and perpendicular to that; ultimate section of M_{1+2} $6 \times$ as long as penultimate; ultimate section of M_{3+4} approximately $2 \times$ as long as penultimate. **Abdomen.** Each tergite covered sparsely with setae, *mar* long; tergite 6 slightly longer than 5; sternite 6 about $3 \times$ as wide as long, almost equal in size to 5. **Terminalia:** Ovipositor sheath almost as long as tergite 6, densely setigerous on posterior $1/2$ and pubescent on anterior $1/2$; apodeme $1.3 \times$ as long as sheath, pouched on anterior $1/2$. Egg guides about 80μ long and broad. Tergite 9 inverted Y-shaped, 140μ long, 90μ broad; sternite V-shaped, 100μ long, bearing 5 pairs of *nsm* and 4 setulae; numerous spinulae on both tergal and sternal membranous parts; cerci 50μ long, with 4 *ts* which are $1/4$ length of cercus. Spermathecae semispherical, each variable in

size, 36×84 or $44 \times 100 \mu$, excavated deeply; necks about 25μ long; ducts $380-500 \mu$ long, distal $4/5$ pale brown, 12μ wide; tail of ventral receptacle folded $2\times$, about 300μ long. *Length*: Body 2.5 mm; wing 2.8 .

DISTRIBUTION: Japan (Kyushu).

Holotype ♀; 2 paratopotypes, on *Plectranthus*, Mt. Hiko, Fukuoka, 20 June 1955, Kuroko.

This new species is somewhat allied to *P. abnormalis* Malloch, but the two species are distinctive by specific structures of the antennae and the female terminalia. This species also somewhat resembles the European *P. lamii* Kaltenbach, on the leaves of Labiatae, but in *lamii* the thorax is shiny bluish black and slightly grayish pollinose, while in *plectranthi* it is densely gray-dusted as in *abnormalis*, the genae are $1/4$ of eye height, the presutural dorsocentral bristles are absent, the acrostichal setulae are arranged in 6 to 7 rows.

Phytobia (Cephalomyza) cepae (Hering), 1927, Tierw. Deutschl. 6: 50. Fig. 46.

Terminalia: Epandrium about $1/3$ as long as tergite 6, broadened ventrally, bearing 2 (rarely 3) sharp and incurved spines at posteroventral angles; surstyli short, cylindrical, each bearing about 7 setae at tip; hypandrium with sidepieces narrow. Phallic hood with a pair of sharply and ventrally pointed processes at posterior end. Distiphallus about $1/2$ length of phallopodeme, endophallus extremely long, strongly sclerotized laterally; ventral process bearing many hairs on anterior surface. Ejaculatory apodeme 180μ long, 140μ wide, duct 760μ long, 8μ in diameter.

Ovipositor sheath almost as long as tergite 6, pubescent on basal $4/5$; apodeme slight-

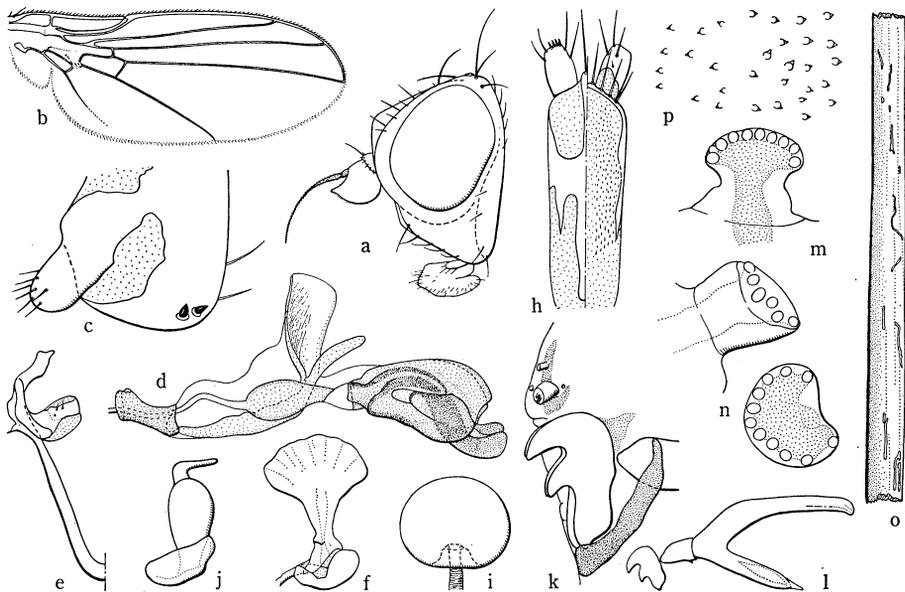


Fig. 46. *Phytobia (Cephalomyza) cepae* (Hering).

ly longer than sheath, pouched on anterior 1/2. Egg guides triangular, 60μ long. Tergite 9 is $200\text{--}240 \mu$ long and $60\text{--}80 \mu$ broad; sternite with 8–9 *nsm*; cerci 60μ long, each with 4 short *ts* which are about 1/7 length of cercus. Spermathecae suborbicular, with truncate proximal ends, 72×80 to $72 \times 88 \mu$; necks about 12μ long; ducts pale brown but colorless on proximal 1/5, $300\text{--}320 \mu$ long, 12μ in diameter; ventral receptacle pale brown excepting colorless tail, body about 50μ long.

Many, including immature stages, on *Allium*, Shimogamo, Kyoto, 4–6 July 1957, Sasakawa; Taihei-mura, Fukuoka, 20 Oct. 1957, T. Miyamoto.

DISTRIBUTION: Europe, Japan.

HOSTS: *Allium bakeri* Regel., *cepa* L., *fistulosum* L., and *odorum* L.

Phytobia (*Cephalomyza*) *nipponensis* Sasakawa, 1955, Saikyo Univ., Sci. Rep., Agr. 7: 63.

Fig. 47.

DISTRIBUTION: Japan.

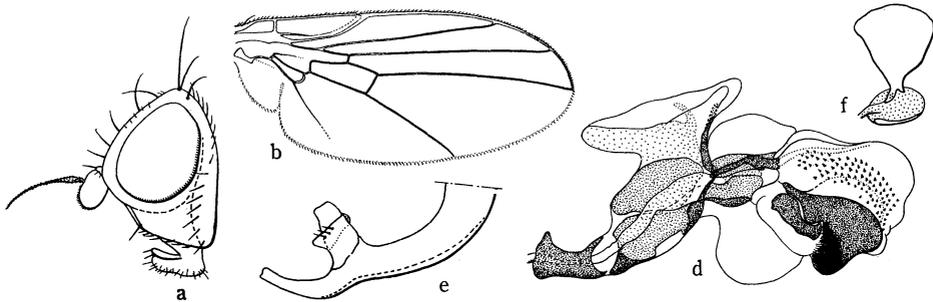


Fig. 47. *Phytobia* (*Cephalomyza*) *nipponensis* Sasakawa.

Phytobia (*Poëmyza*) *atra* (Meigen), 1830, Syst. Besch. bekann. eur. zweifl. Insekt. 6: 178.

Fig. 48.

Terminalia: Epandrium 1/2 as long as tergite 6, bearing about 20 short spines on each caudoventral angle; surstyli not separated from epandrium, directed in- and upwards, each bearing 5–7 spines along distal margin processus longus about 1/2 length of epandrium, somewhat hamate distally, dorsal lobes united with each other. Distiphallus 4/5 as long as phallapodeme, paraphallus slender, about 1/3 length of endophallus, ventral processes very large. Ejaculatory apodeme 140μ long, 100μ broad.

Ovipositor sheath almost as long as tergite 6, pubescent on basal 1/8, apodeme $1.3 \times$ as long as sheath, pouched on anterior 1/4. Egg guides subtriangular, about 35μ long. Tergite 9 cruciform, weakly sclerotized, 220μ long, sternite U-shaped, 60μ long, with 4 pairs of *nsm* and a pair of sensillae; cerci each with 4 *ts* which are 1/2 length of cercus. Spermathecae semiorbicular, 44×60 to $60 \times 62 \mu$, necks 40μ long and 16μ wide, ducts brownish on distal 1/2, 360μ long, 12μ in diameter; body of ventral receptacle 70μ long, tail $1.4 \times$ as long as length of body, folded once.

Several, Ashoro and Akan, Hokkaido, 16–17 June 1954, Sasakawa.

DISTRIBUTION: Europe, Japan, N. America.

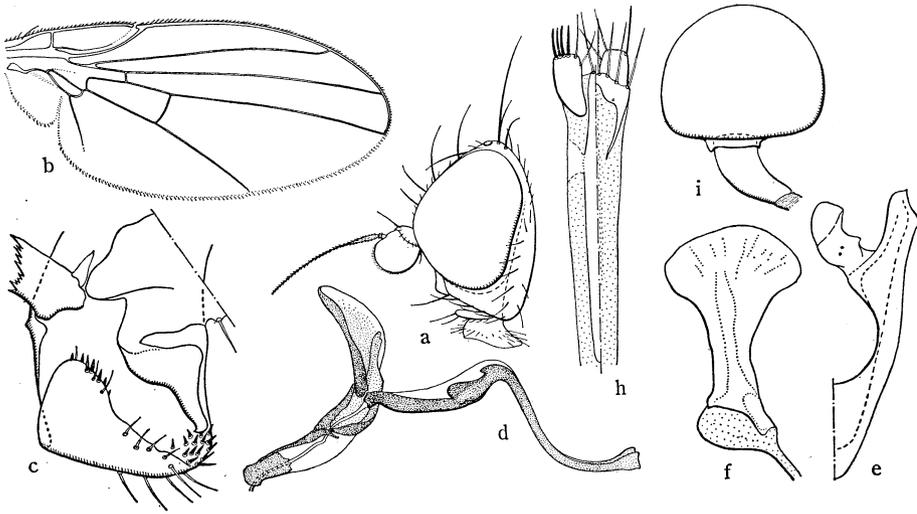


Fig. 48. *Phytobia (Poemyza) atra* (Meigen).

HOSTS: *Phragmites communis* Trin., *Phalaris arundinacea* L.

Phytobia (Poemyza) bisetiorbita Sasakawa, 1955, Saikyo Univ., Sci. Rep., Agr. 7: 64; 1956, *ibid.* 8: 126. Fig. 49.

Terminalia: Epandrium a little shorter than 1/3 length of tergite 6, with short dorsal

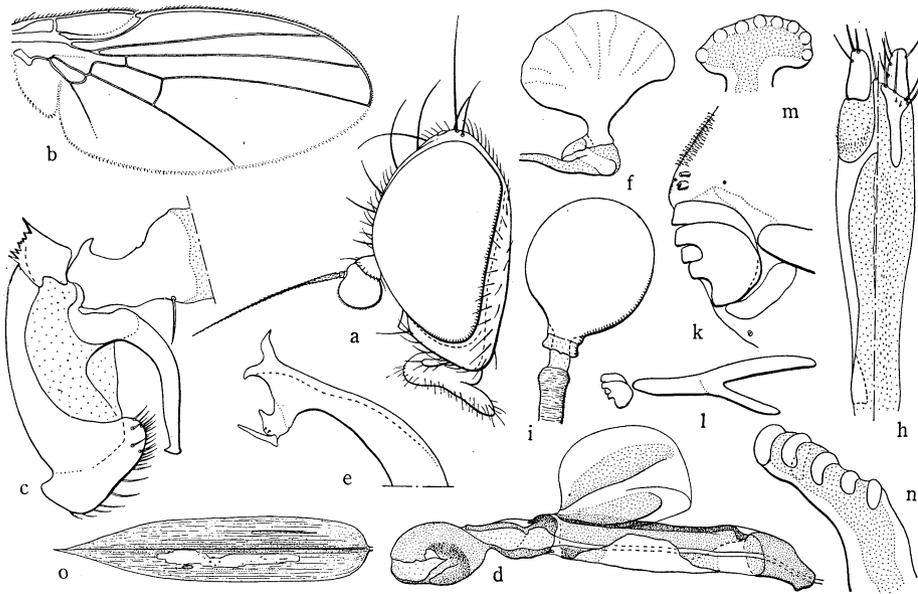


Fig. 49. *Phytobia (Poemyza) bisetiorbita* Sasakawa.

process; surstylus with about 20 setae; sidepieces of hypandrium broad, about $1/3$ length of phallapodeme. Processus longus extremely long, hamate distally, dorsal lobes separated from each other by membrane. Distiphallus subequal to hypandrium in length, paraphallus well developed, slightly longer than endophallus, ventral process very large, endophallus broadened distally. Ejaculatory apodeme strikingly expanded apically, $150\ \mu$ long, $160\ \mu$ wide; bulb small, with narrow sclerite.

Ovipositor sheath $2/3$ length of tergite 6, pubescent on lateroproximal $1/3$; apodeme almost $1.5\times$ as long as tergite 6, $3\times$ as long as wide, pouched on anterior $2/3$. Egg guides subtriangular, about $60\ \mu$ long. Tergite 9 two-forked, mesally scarcely sclerotized, $300\ \mu$ long; sternite $80\ \mu$ long, with 4 pairs of *nsm* and 2 pairs of sensillae; cerci about $50\ \mu$ long, each with 2 long *ts*. Spermathecae orbicular, $60\times 50\ \mu$, produced annularly at proximal end; necks $16\ \mu$ long and wide; ducts $280\text{--}320\ \mu$ long, browned and broadened on distal $1/2$, $8\ \mu$ in diameter; ventral receptacle with body about $35\ \mu$ long, tail narrow, with one fold.

Larva distinctly differs from *semiposticata* in the number of bulbs of spiracles.

DISTRIBUTION: Japan.

HOST: *Arundinaria pygmaea glabra* (Makino).

Phytobia (Poëmyza) lateralis (Macquart), 1835, Host. Nat. Insect., Dipt. 2: 609. Fig. 50.

Terminalia: Epandrium about $1/3$ as long as tergite 6, bearing 15–22 spines on each posteroventral angle, with dorso-distal process about $1/2$ length of epandrium, almost as long as cercus; surstyli more or less projected anteriorly, each with 8–12 spines proximally and 12–14 setae marginally. Processus longus as long as epandrium, with several notches at ventrodistal end, dorsal lobes distinctly separated from each other by membrane. Distiphallus about $2/3$ as long as phallapodeme, ventral process short, endophallus narrow

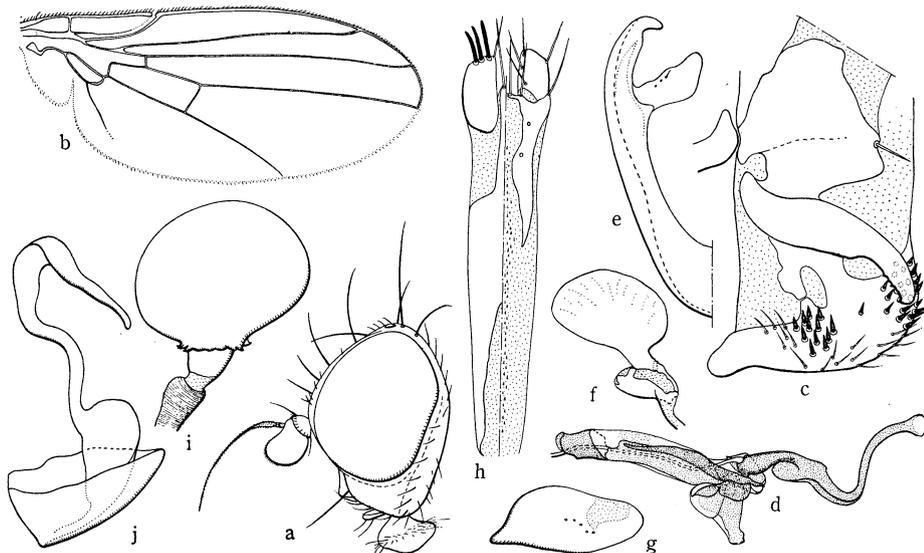


Fig. 50. *Phytobia (Poëmyza) lateralis* (Macquart).

but long. Ejaculatory apodeme expanded asymmetrically, $120\ \mu$ long and broad; bulb with large sclerite.

Ovipositor sheath almost as long as tergite 6, pubescent narrowly on dorsolateral sides; apodeme longer than sheath, slightly pouched at anterior end. Egg guides weakly sclerotized, with 5 sensillae. Tergite 9 rather broadly sclerotized, $280\ \mu$ long; sternite $140\ \mu$ long, bearing 3 pairs of *nsm* and 2 pairs of sensillae; cerci each bearing 2-3 long *ts*. Spermathecae semispherical, slightly excavated proximally, 40×76 to $56 \times 84\ \mu$, necks $20\ \mu$ long, ducts colorless but brownish at apical ends, $360-407\ \mu$ long, $12\ \mu$ broad distally; body of ventral receptacle with large stipules, $60\ \mu$ long, tail with a fold.

DISTRIBUTION: Europe, N. Africa, Japan, N. America.

HOSTS: *Agropyrum repens* L., *Agrostis spica venti* L., *Hordeum vulgare* L., *Phleum pratense* L., *Phragmites communis* Trin., *Poa compressa* L., *Triticum aestivum* L., and *spelta* L.

Phytobia (Poëmyza) okazakii (Matsumura), NEW COMBINATION Fig. 51.

Oscinis okazakii Matsumura, 1916, *Konchū Sekai (Ins. World)* 20: 444.

ADULT. *Male*: Front blackish brown, parafrontalia shiny, with inner margins pale brown; ocellar triangle subshiny, black; lunule black, whitish pruinose; genae brown; face brownish black; antennae and palpi black; proboscis brownish yellow. Thorax black, subshining, densely with gray pollen, With lateral stripes blackish brown; mesopleural sutures and bases of wings dark yellow. Wings hyaline, with milky tinge; veins yellowish; calypteres yellowish white, with yellow margins and whitish fringe; halteres yellow. Legs brown-

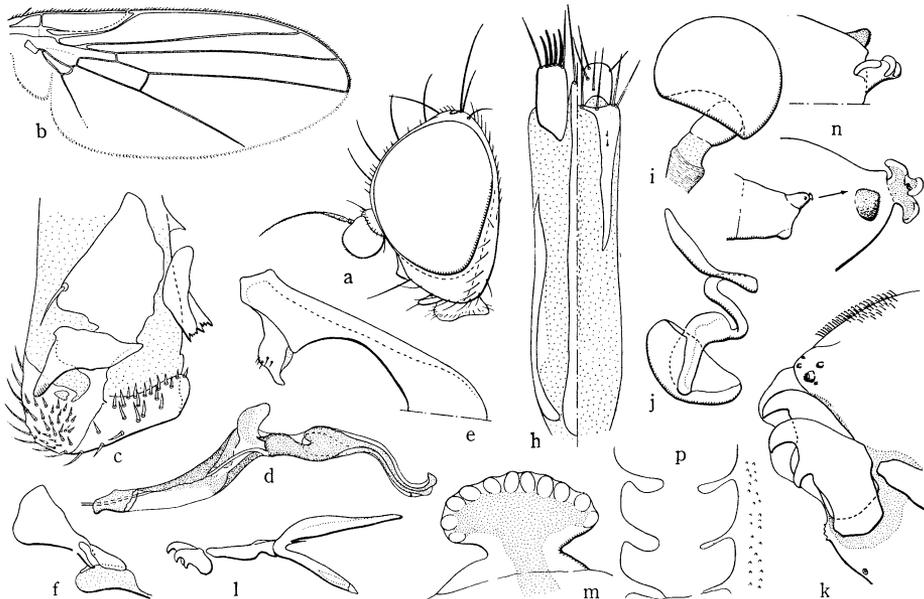


Fig. 51. *Phytobia (Poëmyza) okazakii* (Matsumura).

ish black, but fore knee narrowly yellow, posterior 2 knees more or less brownish, fore tibia dark yellow-brown, all tarsi pale or yellowish brown. Abdomen shiny, dark brown to brownish black, slightly pruinose, excepting on median part of tergite 6, tergite 2-5 with yellow-whitish caudal margins.

Head: Front $1.3-1.5 \times$ as wide as eye, narrower than long (13:16), almost parallel-sided; parafrontalia slightly convex, about $1/4$ width of front, but broadening below from level of 1. *ori*. Ocellar triangle with ventral tip extending to level of 1. *ors*, anterior angle between ocelli more or less acute than 90° , bearing 3-5 pairs of setulae plus *oc*. Lunule dorsally scarcely extending to level of 2. *ors* and beyond midline between anterior ocellus and base of antennae. Fronto-orbitals 4 pairs; *ors* directed up- and slightly outwards; *ori* 2, rarely 3 on one side, up- and inwards; *oh* sparsely in a row. In profile parafrontalia and parafacialia extending very slightly beyond upper eye-margin; eyes about $1.3 \times$ as high as wide, with very sparse hairs; genae $1/7-1/9$ eye height. Face slightly concave, as high as broad; carina narrow but sharply keeled; antennal grooves deep. Parafacialia broadened near antennal bases, approximately $1/3$ as wide as diameter of antennal segment 1. Antennae slightly separated from each other by carina; segment 3 slightly shorter than broad, with minute pile; arista $2 \times$ as long as whole length of antenna, broadened on basal $1/4$, microscopically pubescent. *Thorax*: Mesonotum with 1+3 *dc* (rarely 1+4), 1. *dc* about $2/3$ length of 3, situated behind level of *prs*, 3. *dc* about $2/3$ length of 4, located on or behind level of *sa*; *acr* in 4-6 irregular rows, ending before or behind level of 4. *dc*; 3-4 rows of setulae between rows of *dc* and *sa*; *ia* and *sa* each long; *ipa* about $1/3$ length of *opa*; humeri each with 8-13 setulae. Mesopleura with 2-3 dorsally directed setulae; sternopleura with 2-5 setulae before *sp*. *Wing*: Costa with 3 sections in proportion of 41:11:8.5; r-m situated at or slightly beyond middle of discal cell; ultimate section of M_{1+2} 6-8 \times as long as penultimate; ultimate section of M_{3+4} 1.6-2.3 \times as long as penultimate. *Abdomen*: Tergite rather sparsely covered with setae, *mar* long; tergite 6 about $1.5 \times$ as long as 5; sternite 5 slightly shorter than tergite 6, about $1/2$ as long as broad, incised on caudal $1/3$. *Terminalia*: Epandrium about $1/3$ as long as tergite 6, minutely projected on dorsodistal tip; surstyli each bearing about 20 spines. Processus longus short, with notches apically. Distiphallus with paraphallus narrow but long, about two-fifths of its whole length, ventral process short. Ejaculatory apodeme slightly expanded distally, 120-140 μ long, 60-88 μ broad; bulb small, without chitinous plate; duct 8 μ in diameter. *Length*: Body 1.66-2.33 mm wing 2-2.75.

Female: Similar to σ but tergites distinctly with pale caudal margins but broadly brownish on 6; sternite 5 slightly smaller than 6, almost $3 \times$ as wide as long. *Terminalia*: Ovipositor sheath almost as long as tergite 6; apodeme as long as sheath, pouched on anterior $1/4$. Egg guides 60 μ long, with 4 sensillae. Tergite 9 stripe-shaped, 260 μ long; sternite 160 μ long, bearing 4 pairs of *nsm* and 2 pairs of sensillae; cerci with 4 *ts*. Spermathecae slightly excavated proximally, 52×64 to $48 \times 68 \mu$; necks $1/2$ length of capsule; ducts 360 μ long, proximally 4 μ in diameter, but broadened and browned distally, $4 \times$ wider than proximal diameter; tail of ventral receptacle folded twice.

LARVA. Full-grown larva 4 mm long; white. Head with numerous brown, hooked setae dorsad of sensillae; mandibles narrowed dorsally, each with 2 teeth; labial sclerite with deep incision before posteroventral end, dorsal process of paraclypeal phragma almost $2 \times$ as long as labial sclerite; adductor apodeme rather distinct. Anterior spiracles broad-

ly separated from each other, small, knob-like, 55μ long, 36μ high, each with 8-11 bulbs; posterior spiracles situated on large conical process, each with 3 large bulbs; a pair of papillae which are covered with blackish brown spinulae laterad bases of spiracles. Cuticular processes minute; several large processes just cephalad of ventral ends of mandibles, about 7 rows of brownish processes laterad of cephalopharyngeal sclerite, on lateral side $1T=0.3$, $2T=2.0$, $3T-7A=2-3.0$, $8T=0$, a row of scale-like processes between each segment, but absent on both dorsal and ventral sides. Anal lobes produced, with a pair of minute papillae beside anus.

PUPARIUM. Black, shiny, 2.3-2.7 mm long, 1.2-1.5 mm broad, suboval, dorsal and ventral sides somewhat flattened.

Many were reared from larvae, in *Hordeum*, Shimogamo, Kyoto, 20-22 May 1955; in *Phalaris*, Kibune, Kyoto, 28 July 1955; in *Calamagrostis*, Mt. Hiko, Fukuoka Pref., 8 May 1956; Mt. Tsurugi, Tokushima, 3 June 1957; Oshidomari, Rishiri I., 1 Aug. 1958, Sasakawa.

This species is extremely similar to the Holarctic species, *P. incisa* (Meigen), but recognized by the narrower parafacialia and yellowish marginate abdominal tergites, moreover by the posterior spiracular processes of the larva.

HOSTS: *Hordeum vulgare* var. *hexastichon* Aschers., *Triticum aestivum* L., *Phalaris arundinacea* L., *Calamagrostis epigeios* Roth. **Mine:** Whitish in color, large stigmatonome, similar to that of *Agromyza yanonis*. **Pupation:** Takes place in the mine, differing from *A. yanonis*; the puparium is provided with a few threads of silk at posterior end.

Phytobia (Poëmyza) sasae Sasakawa, n. sp. Fig. 52.

ADULT. Male: Front and lunule blackish brown, dorsal 1/2 of frontalia and inner margins of parafrontalia yellow; ocellar triangle shiny black, with lateral margins yellow; occiput black; face yellow, antennal grooves brown; genae yellowish brown, ventrally yellowish; antennae black, but segment 1 and arista brownish; palpi brown. Thorax black, densely dusted with gray, with brown lateral stripes, caudal margins of notopleura testaceous; mesopleural sutures and bases of wings yellow. Wings hyaline; veins pale yellow-brown; calypteres yellowish white, with margins and fringe blackish brown; halteres yellow.

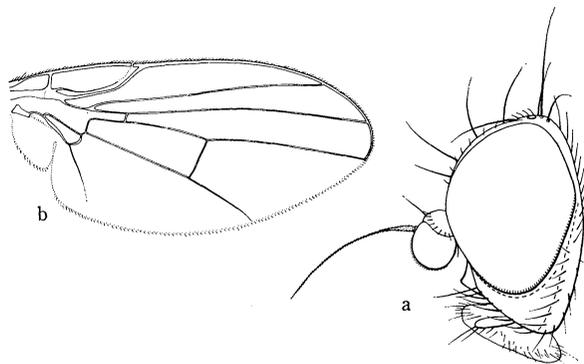


Fig. 52. *Phytobia (Poëmyza) sasae* Sasakawa, n. sp.

Legs black, but all knees yellow, tibiae and tarsi with somewhat brownish tinge. Abdomen shiny, dark brown, posteriorly yellowish brown; epandrium blackish brown, with dorsal process and cerci yellowish brown. **Head:** Front $1.5 \times$ as wide as eye, almost as broad as long, sides slightly converging ventrally; parafrontalia $1/5$ width of front, gradually diverging ventrad to level of 1. *ori* but converging below that level. Ocellar triangle with ante-

rior tip almost reaching level of 1. *ors*, bearing 6 pairs of setulae plus *oc*. Lunule flat, as high as its basal width, dorsally extending level of 2. *ors*, about 2× as high as length between its dorsal tip and anterior ocellus. Fronto-orbitals 4 pairs; *ors* directed up- and outwards; *ori* up- and inwards; *oh* sparsely in a row. In profile parafrontalia linearly extending beyond above eye-margin; eyes 1.3 × as high as wide, with minute sparse hairs; genae about 1/8 eye height; 6–7 *pm* in a row. Face concave, slightly lower than broad, with carina distinct but narrow; parafacialia linear. Antennae slightly separated by carina; segment 3 as long as broad, minutely pilose; arista 2 × as long as whole length of antenna, broadened proximally. *Thorax*: Mesonotum with 0+3 *dc*, 3. *dc* situated before level of *sa*; *acr* in 6–7 irregular rows, ending just behind level of 4. *dc*; about 5 rows of setulae between rows of *dc* and *sa*; *ia* long; *ipa* approximately 1/2 length of *opa*; humeri each with 10–12 setulae plus *h*. Mesopleura with 5–7 dorsally directed setulae; sternopleura with 3 short setae before *sp*. *Wing*: Costa with 3 sections in proportion of 55 : 17 : 11; r-m extremely before middle of discal cell; m-m 1/2 length of penultimate section of M_{1+2} , perpendicular to that; ultimate section of M_{1+2} about 1.8 × as long as penultimate; ultimate section of M_{3+4} about 2/3 length of penultimate. *Abdomen*: Tergite 6 is 1.5 × as long as 5; dorsal process of epandrium about 1/2 its own length. *Length*: Body 2.25 mm, wing 2.66.

Holotype ♂, Sapporo, Hokkaido, 23 Jan. 1956, on *Sasa*, T. Kumata, larva collected on 18 Nov. 1955.

DISTRIBUTION: Japan (Hokkaido).

The present new species is placed in the *pygmaea*-group in the coloration of the fringe on the calypteres, and extremely similar to the Palearctic species *P. morula* Hendel. But in the related species the head is entirely black, the mesonotum provided with 1+3 *dc*, r-m situated at middle of the discal cell, differing from *sasae*.

BIONOMICS. The larva makes a whitish ophionome on the leaf of *Sasa paniculata* Makino & Shibata.

Phytobia (Poëmyza) semiposticata (Hendel), 1920, Archiv Naturg. A 84: 131. Fig. 53.

Terminalia: Epandrium with a small dorsodistal process; surstyli in- and upturned, each with 6–9 spines and 8–9 setae at apex. Hypandrium with sidepieces broad, nearly 1/2 as long as phallapodeme. Processus longus as long as epandrium, with a large terminal tooth and indistinct notches. Phallic hood hamate at posterior end, about 1/3 length of phallapodeme. Distiphallus 2/3 length of phallapodeme. Ejaculatory apodeme 200 μ long, 160 μ broad, with a distinct sensillae proximally, bulb with a narrow chitinized plate.

Ovipositor sheath as long as tergite 6, dorsoproximally pubescent; apodeme weakly sclerotized, pouched on anterior 1/2. Egg guides suboval, weakly sclerotized, with 4 sensillae. Tergite 9 cruciform, 220 μ long, sternite U-shaped, bearing 5 pairs of *nsm*; cerci relatively short, with 4 *ts* which are 2/3 length of cercus. Spermathecae semispherical, proximally deeply excavated, 36 × 68 to 40 × 64 μ, necks about 30 μ long, ducts colorless excepting brown apical ends, 200–240 μ long, 12 μ in diameter; ventral receptacle with body 80 μ long.

DISTRIBUTION: Europe, Japan.

HOSTS: *Carex* spp.

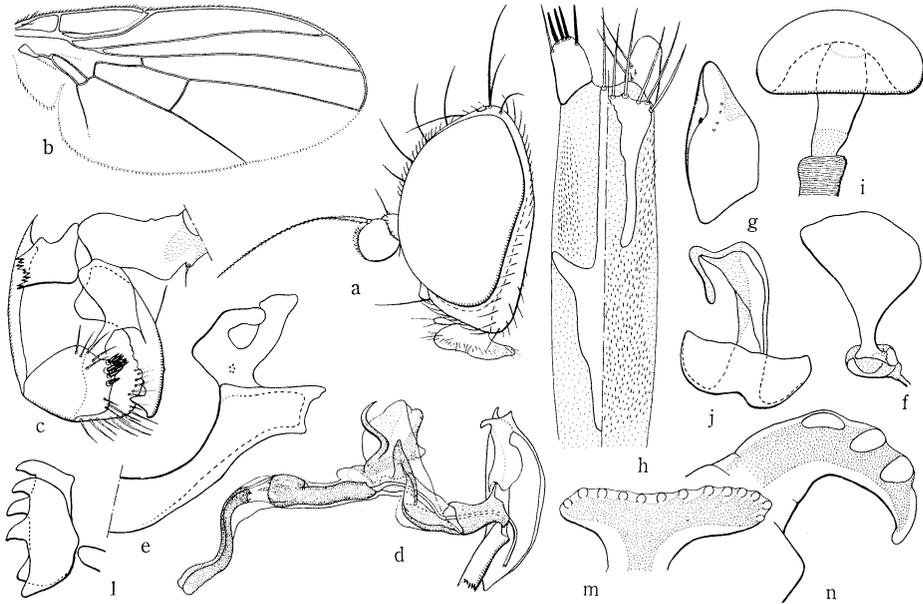


Fig. 53. *Phytobia (Poemyza) semiposticata* (Hendel).

Phytobia (Poemyza) setariae Spencer, 1959, R. Ent. Soc. Lond., Trans. **111**: 308. Fig. 54.

The Japanese specimens are quite identical with the original description except for the following significant characters:

Antennal segments 1-2 and palpi light testaceous, 3 and arista brown; fringe on calypter pale brown; *ori* 2, rarely 3; *gena* 1/6 eye height; *acr* in 6 rows.

Terminalia: Epandrium yellowish brown, 1/3 as long as tergite 6, broadened ventrally, with yellow dorsal process which is 1/3 length of epandrium; surstyli in- and upturned, bearing about 5 setae; cerci yellow; hypandrium with sidepieces narrow, about 1/2 length of phallapodeme; processus longus as long as dorsal length of epandrium, with several notches apically, dorsal lobes also large. Phallic hood slightly shorter than hypandrium, hooked at posteroventral end. Distiphallus with para- and hypophallus weakly sclerotized, endophallus longer than sidepiece of hypandrium, about 4 × as long as paraphallus. Ejaculatory apodeme 140 μ long, 100 μ broad, bulb with chitinized plate, duct brown basally, 6 μ in diameter.

Ovipositor sheath shiny black, as long as tergite 6, pubescent on proximal dorsolateral 1/3 and on ventroproximal 1/4; apodeme long, 1.3 × as long as sheath, pouched on anterior 1/4. Egg guides subquadrate, with mesal chitinized process, about 50 μ long. Segment 9 narrow, 9 × as long as broad, tergite 260 μ long; cerci with 4 *ts*. Spermathecae semiorbicular, with sinuate proximal end, 28 × 50 to 32 × 56 μ, necks brown, 20-30 μ long, ducts 360 μ long, broadened on distal 1/3, 16 μ in diameter; ventral receptacle with body 55 μ long, tail folded about 7 ×.

Length: Body 1.67-2 mm; wing 1.75-2.25.

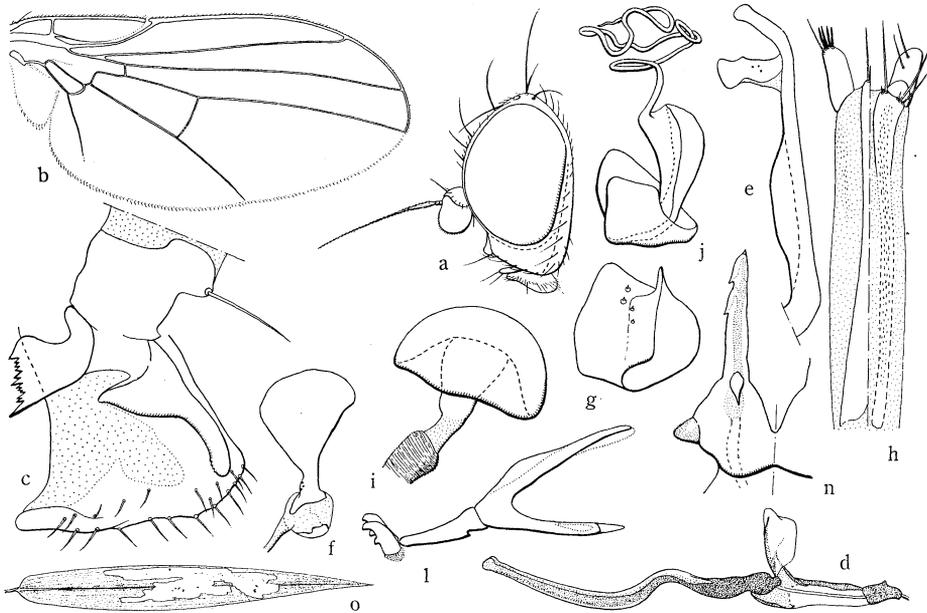


Fig. 54. *Phytobia (Poemyza) setariae* Spencer.

PUPARIUM. Brown, about 2 mm long, 1 mm broad, oval, dorsal and ventral sides more or less flattened; segmental constriction distinct but shallow. Mandibles each with 2 teeth, dorsal process of paraclypeal phragma 2 × as long as labial sclerite (larval exuvia). Posterior spiracles projected dorsally, each situated on tubercles which are united with each other at base and provided with spinulate processes laterally, stick-like, 200 μ long, with 3 bulbs, proximal one distinctly hooked posteriorly. Cuticular processes developed only on lateral sides, arranged in pattern of 3-4-2, those of posterior rows minute. De Meijere's description of the puparium (1940) is inaccurate.

Many, Nase, Amami-Oshima I., 23 Apr. 1956, Sasakawa; Cape Sata, Kagoshima Pref., on *Setaria*, 20 Nov. 1956, H. Kuroko; Matsuyama, Ehime Pref., on *Setaria*, 21-31 July 1954, T. Yano.

DISTRIBUTION: Sierra Leone, Japan.

BIONOMICS. *Hosts:* *Setaria viridis* and *viridis* f. *pachystachys* Makino. *Mine:* Greenish white in color, ophionome of upper surface type, gradually broadening and forming irregular secondary stigmatonome. The frass is black, scattered in some places in rather large grains. *Pupation:* Takes place in the ground.

***Phytobia (Dizygomyza) flavicornis* Sasakawa, 1955, Saikyo Univ., Sci. Rep., Agr. 7: 70.**

Fig. 55.

DISTRIBUTION: Japan.

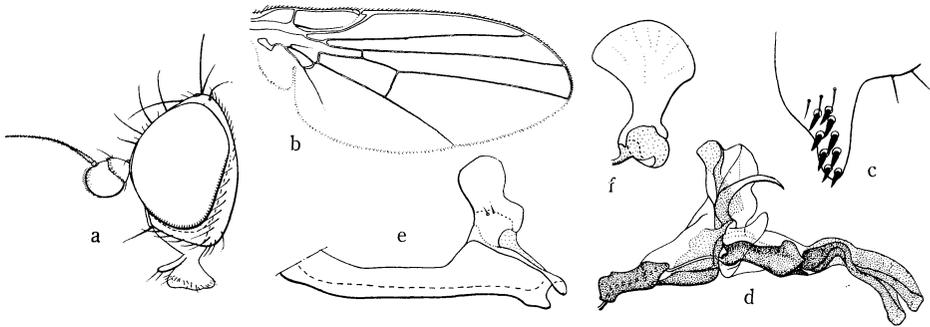


Fig. 55. *Phytobia (Dizygomyza) flavicornis* Sasakawa.

Phytobia (Dizygomyza) iraeos Robineau-Desvoidy, 1851, Rev. Mag. Zool., Pure et Appl. (2) 3: 393. Fig. 56.

Terminalia: Epandrium with a short dorsal process; surstyli each with about 7 spines and 8 setae; processus longus hooked distally, with dorsal lobes bearing a pair of setae. Distiphallus a little longer than $4/5$ as long as phallapodeme, endophallus distally somewhat sigmaform. Ejaculatory apodeme about 180μ long, about 150μ broad, bulb without sclerite.

Ovipositor sheath shorter than tergite 6, pubescent on anterior $1/2$; apodeme subrectangular, $2.5 \times$ as long as broad, $1.5 \times$ as long as sheath, pouched on anterior $1/2$. Egg

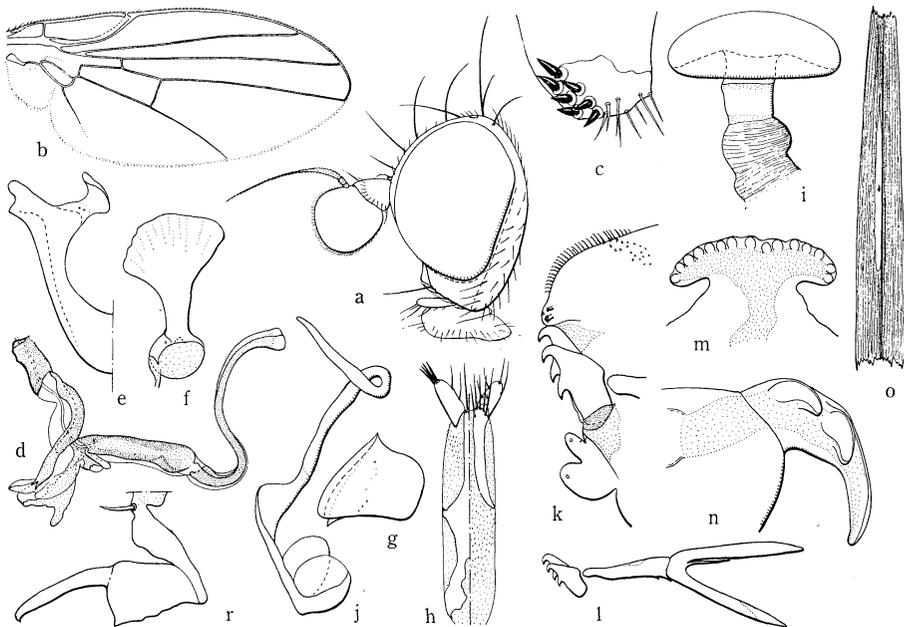


Fig. 56. *Phytobia (Dizygomyza) iraeos* Robineau-Desvoidy.

guides quadrate, slightly pointed caudoventrally, weakly sclerotized, about $50\ \mu$ long. Tergite 9 sclerotized centrally, $220\ \mu$ long; sternite $100\ \mu$ long, bearing 5 pairs of *nsm* and numerous setulae; cerci $45\ \mu$ long, each with 4 long *ts*. Spermathecae discoidal, 28×84 to $32 \times 88\ \mu$, necks about $20\ \mu$ long and broad, ducts $360\ \mu$ long, distally slightly brownish and broadened, $24\ \mu$ in diameter, but colorless on proximal $4/5$, $8\ \mu$ in diameter; ventral receptacle with body brown, about $100\ \mu$ long, tail transparent, $130\ \mu$ long.

LARVA. Anterior spiracles somewhat 2-lobed, about $70\ \mu$ long, each with 13–15 bulbs; posterior spiracles pale brown, projected downwards in finger-form, $130\ \mu$ long, each with 3 bulbs, of which inner one larger than lateroproximal. Head with a tripelaloid lobe immediately ventrad of mandibles; mesothoracic segment with a large papilla, which is about $120\ \mu$ in length, at cephaloventral end; spinal pattern: 1T=D-V, 3.0, 2T-8A=D & V, 0, on lateral side, 2T=4.0, 3T=6.4-5, 1A=10.4, 2-4A=12.3, 5-6A=10.2, 7A=6.1, 8A=4.0.

Many, Yonezawa, Yamagata Pref., on *Iris*, July 1959, K. Koizumi.

DISTRIBUTION: Europe, Japan.

HOSTS: *Iris ensata hortensis* Makino & Nemoto, *Nertchinskia* Lod., *pseudacorus* L. and *tectorum* Max., *Belamcanda chinensis* L.

Phytobia (Dizygomyza) iridicola (Koizumi), 1953, Okayama Univ., Sci. Rep. Fac. Agr. 2: 48. Fig. 57.

Ovipositor sheath nearly $2 \times$ as long as tergite 6, densely covered with setae, pubescent on proximal $1/2$; apodeme as long as tergite 6, pouched on anterior $1/2$. Egg guides suboval, about $90\ \mu$ long, slightly sclerotized laterodistally, with many spinules on dorso-mesal parts. Tergite 9 cruciform, $300\ \mu$ long; sternite $1/2$ length of tergite, bearing 4 pairs of *nsm*; cerci with 4 long *ts*. Spermathecae higher than semiorbicular, $36 \times 52\ \mu$; necks $12\ \mu$ long, somewhat constricted at middle, with minute processes; ducts distally pale brown, $16\ \mu$ in diameter; ventral receptacle with body $70\ \mu$ long, tail folded $2 \times$.

LARVA. Differs from *iraeos* in following points: teeth of mandibles not sharply pointed; anterior spiracles each with 11–15 bulbs, posterior spiracles each with 3 finger-like bulbs; spinal pattern: on dorsal, 1T=10.4, 2T=4.0, 3T=2.0, 1A=3.0, 2-8A=0; on lateral, 1T=10.4, 2T=4.3, 3T=3.3, 1-2A=7-8.4, 3-5A=9-10.4, 6A=8.2, 8A=4.0; on ven-

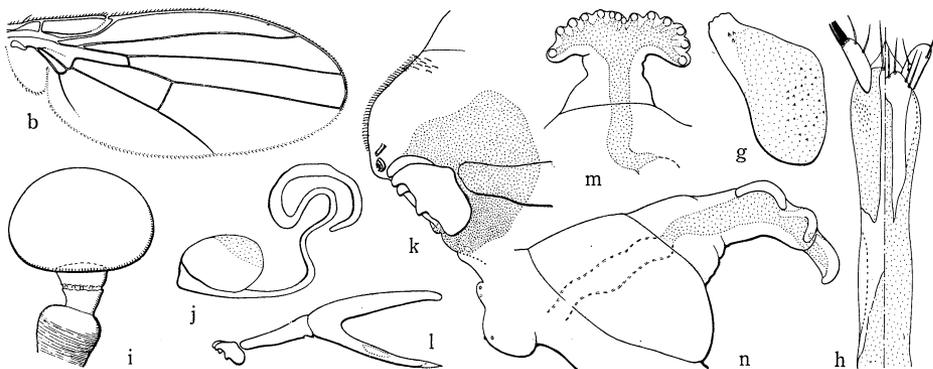


Fig. 57. *Phytobia (Dizygomyza) iridicola* (Koizumi).

tral side, $1T-7A=0$, $8A=3.0$. Koizumi confused the number of teeth of the mandibles but either right or left mandible is provided with only 2 teeth.

This species shows similarity to species of the *luctuosa*-group in the sparse acrostichals. It seems to me, however, to indicate a species of the intermediate group because all the important characters of the ♀ terminalia and the larva are similar to those of the *iraeos*-group.

DISTRIBUTION: Japan.

The larvae of this species mine in the basal part of the leaf of *Iris ensata hortensis*, while in *iraeos* at the middle part.

Phytobia (Dizygomyza) luctuosa (Meigen), 1830, Syst. Besch. bekannt. eur. zweifl. Insekt. 6: 170. Fig. 58.

Terminalia: Epandrium with distinct dorsal process; surstyli somewhat tapering distally, bearing 4-5 spines; sidepieces of hypandrium broad, approximately 1/2 as long as phallapodeme. Processus longus almost as long as epandrium, with a sharp tooth at distal end, dorsal lobes narrow. Phallic hood posteriorly sharply pointed and curved ventrally. Distiphallus 1/2 length of phallapodeme, endophallus 3 × as long as hypophallus. Ejaculatory apodeme 230-240 μ long, 160-200 μ broad.

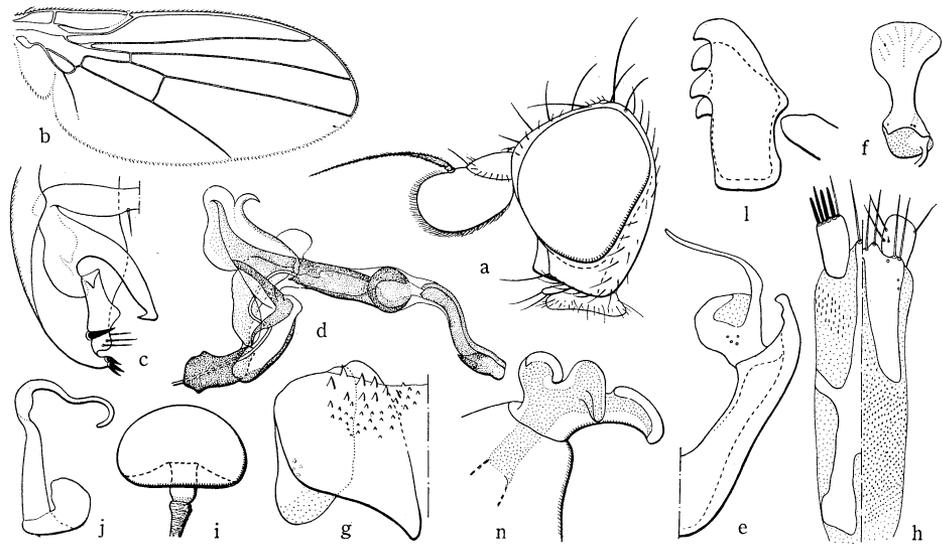


Fig. 58. *Phytobia (Dizygomyza) luctuosa* (Meigen).

Ovipositor sheath slightly shorter than tergite 6; apodeme 1.5 × as long as sheath, pouched on anterior 1/2. Egg guides trapezoidal, weakly sclerotized, with 4 sensillae; many minute processes on ventral membrane between guides. Tergite 9 cruciform, 225 μ long, sternite about 100 μ long, bearing 4 pairs of *nsm* and 3 pairs of sensillae; cerci 40 μ long, each with 4 long *ts* which are about 4/5 length of cercus. Spermathecae semiorbicular, shallowly excavated proximally, 32 × 60 to 40 × 68 μ, necks about 15 μ long and broad, ducts 300 μ long, pale brown on distal 2/3 and 10 μ in diameter; ventral recepta-

cle with body 60μ long.

DISTRIBUTION: Europe, Japan, N. Africa, N. America.

HOSTS: *Carex curvicolis* Franch. & Sav., *Luzula campestris capitata* Miq.

Phytobia (Dizygomyza) morosa (Meigen), 1830, Syst. Besch. bekannt. eur. zweifl. Insekt. 6: 170. Fig. 59.

Terminalia: Differ from *luctuosa* as follows: dorsodistal process of epandrium short, being $1/5$ length of epandrium; sidepieces of hypandrium narrow, as long as phallapodeme, distiphallus longer than phallapodeme, endophallus almost $4 \times$ as long as hypophallus; ejaculatory apodeme 130μ long, 80μ wide, bulb with a small chitinous plate. Ovipositor sheath as long as tergite 6; egg guides 60μ long, 40μ wide, bearing 6 sensillae mesally; sternite 9 with 5 pairs of *nsm* and 4 pairs of sensillae; spermathecae 24×48 to $28 \times 60 \mu$, ducts 440μ long, pale brown and 14μ in diameter on distal $1/2$; body of ventral receptacle about 100μ long, tail 150μ long.

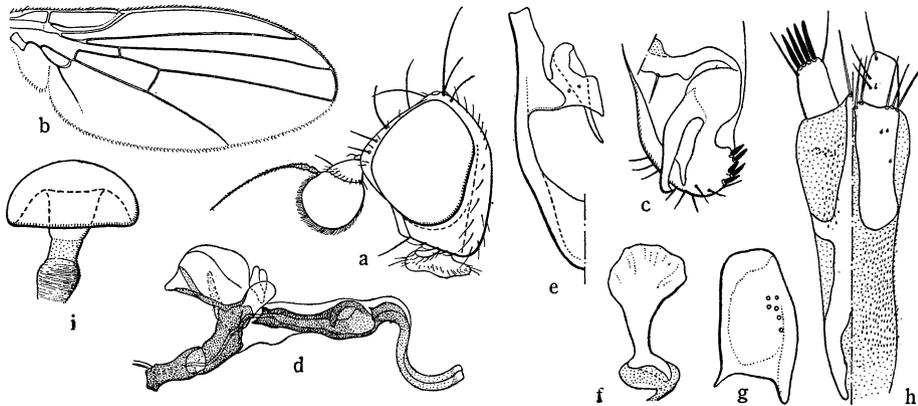


Fig. 59. *Phytobia (Dizygomyza) morosa* (Meigen).

DISTRIBUTION: Europe, Japan, N. Africa.

subsp. **suturalis** (Hendel) (1931, IN Lindner, Die Flieg. palaearkt. Reg., 59: 91)

Many, on *Carex*, Dôya, 29 Apr. 1949, Nishijima; Kotoni, Sapporo, 30 May 1951, Nishijima; Jyôzankei, 10 June 1954, Sasakawa; Sapporo, 6 July 1956, Kumata.

DISTRIBUTION: Europe, Japan.

HOSTS: *Carex* spp.

Phytobia (Icteromyza) geniculata (Fallén), 1823, Dipt. Suec., Agromyzid. 2: 6. Fig. 60.

Terminalia: Epandrium with short dorsal process, bearing 3 distinct teeth and 16–20 setae at each inner posteroventral angle; surstyli weakly sclerotized, each with 11–17 setae. Processus longus with minute notches apically, dorsal lobes strongly sclerotized, united each together. Distiphallus only slightly shorter than phallapodeme, paraphallus broadened dis-

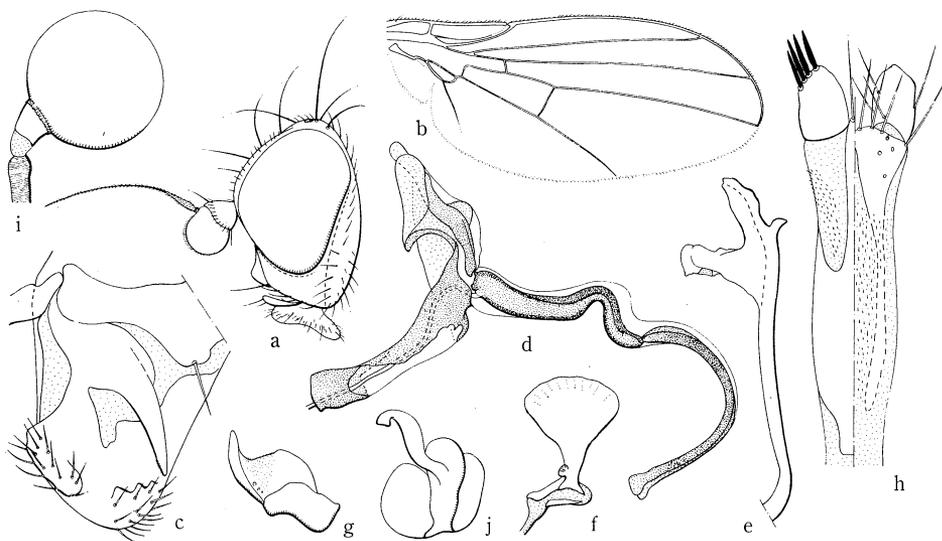


Fig. 60. *Phytobia (Icteromyza) geniculata* (Fallén).

tally, subequal to sidepieces of hypandrium in length, endophallus longer than $2 \times$ length of paraphallus. Ejaculatory apodeme $120\text{--}130 \mu$ long, $70\text{--}100 \mu$ wide, with a proximal process; bulb with narrow plate.

Ovipositor sheath as long as tergite 6, pubescent on basal $1/2$, densely setigerous distally; apodeme $1.4 \times$ as long as sheath, pouched on anterior $1/2$. Egg guides subquadrate, pilose dorsally. Tergite 9 relatively broad, 180μ long; sternite indistinctly developed at proximal end. Spermathecae orbicular, $62 \times 72 \mu$, necks 16μ long, ducts pale brown, $200\text{--}240 \mu$ long; body of ventral receptacle 50μ long.

Many, Oshidomari, Rishiri I., 30 July 1958; Ohara, Kyoto, 5 May 1955; Shimogamo, Kyoto, 27 Mar. 1959; Nishinakama, Amami-Oshima I., 20 Apr. 1956, Sasakawa.

DISTRIBUTION: Europe, Manchuria, Japan, Africa.

Phytobia (Calycomyza) artemisiae (Kaltenbach), 1856, Naturh. Ver. preuss. Rheinl. Westphal., Verh. 13: 236. Fig. 61.

Terminalia: Epandrium nearly $1/2$ as long as tergite 6, bearing 30-36 spines on each caudoventral angle; surstyli rather broad, bearing 26-31 spines; cerci about $2/3$ as high as epandrium. Hypandrium slender, weakly sclerotized. Processus longus with dorsal lobes uniting each together. Distiphallus with very large ventral processes. Ejaculatory apodeme about 260μ long and broad, bulb with a small sclerite.

Ovipositor sheath and apodeme as long as tergite 6. Egg guides subtriangular, weakly sclerotized, about 40μ long and broad, with 4 sensillae mesally. Tergite 9 cruciform, 100μ long, usually without seta at caudal end; sternite with 5 pairs of *nsm* and 2 pairs of sensillae; cerci about 50μ long, *ts* $1/6$ length of cercus. Spermathecae orbicular, $65 \times 65 \mu$, or semiorbicular, $50 \times 80 \mu$, necks about 20μ long, ducts $300\text{--}328 \mu$ long, pale brown

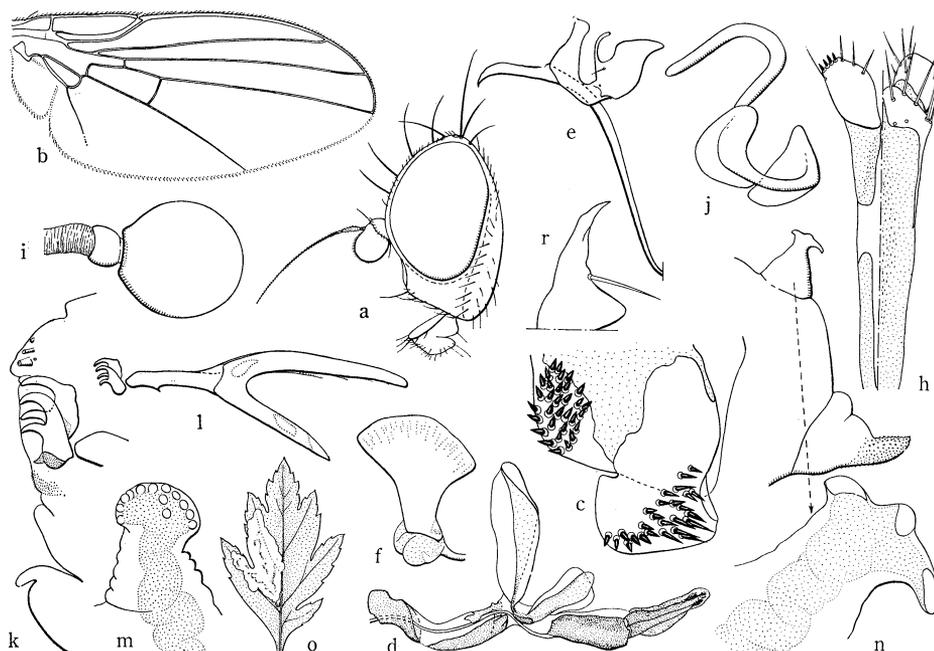


Fig. 61. *Phytobia (Calycomyza) artemisiae* (Kaltenbach).

and about 15μ in diameter on distal 1/2; ventral receptacle with tail 125μ long, brownish basally, folded once.

LARVA. Yellowish white, 3–3.5 mm in body length. Mandibles each with 2 sickle-shaped teeth; dorsal process of paraclypeal phragma with a hole anteriorly. Anterior spiracles 40μ long, with 10–16 bulbs; posterior spiracles each with 3 brown bulbs. Spinal pattern: on dorsal, 1T=0.2, 2–3T=4.0, 1–2A=5.0, 3A=5.1, 4A=6.1, 5A=4.1, 6–7A=3.0, 8A=4.0, on lateral, 1T=0.2, 2T=3.2, 3T=4.5–3, 1–2A=6.3, 3–4A=5.3, 5A=5.2, 6A=4.1, 7A=3.3–4, 8A=9–11.0, on ventral side 1T=0.3, 2T=2.1, 3T–2A=3.1, 3–4A=2.1, 5–6A=1.1, 7A=1.0, 8A=2.0; several rows ventrolaterad of posterior spiracles. Posterior end with 3 pair of colorless papillae on lateral sides; anal lobes extremely elongate, bearing numerous, brown-black cuticular processes.

DISTRIBUTION: Europe, Japan, N. America.

HOSTS: *Artemisia vulgaris* var. *indica* Maxim. and var. *vulgatissima* Bess., *Eupatorium sachalinense* Makino.

***Phytobia (Calycomyza) gyrans* (Fallén), 1823, Dipt. Suec., Agromyzid. 2: 4. Fig. 62.**

Terminalia: Ovipositor sheath as long as tergite 5, sparsely setigerous; apodeme as long as tergite 6, pouched on anterior 1/2. Egg guides 60μ long, bearing 3 sensory setae at posterior apices. Tergite 9 trifurcated posteriorly, 140μ long, sternite 80μ long, with 6 pairs of *nsm* and a pair of short setae. Spermathecae semiorbicular, 32×56 to $40 \times 64 \mu$, deeply excavated, necks 8μ long, ducts 260 – 350μ long, pale brown and 8μ in diameter on distal 4/5; ventral receptacle about 100μ long.

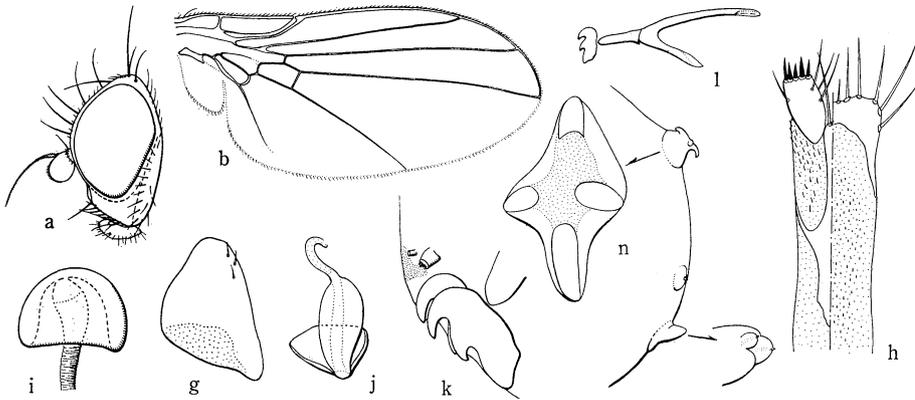


Fig. 62. *Phytobia (Calycomyza) gyrans* (Fallén).

Larva differs from *artemisiae* as follows: head with numerous processes just above longitudinal sclerite; teeth of mandibles short; anterior spiracles each with 6-9 bulbs, posterior spiracles each with 3-5 bulbs; spinal pattern sparser; anal lobes bare, with 2 sensillae at apices.

Several were reared from larvae, on *Adenophora* sp., Kenebetu, Nemuro, 7 July 1956, T. Kumata; Wakasugiyama, Fukuoka Pref., 24 May 1957, Sasakawa.

DISTRIBUTION: Europe, Japan.

HOSTS: *Adenophora*, *Campanula*, *Phyteuma* spp.

Phytobia (Calycomyza) humeralis (von Roser), 1840, Korresp. -Bl. württ. landw. Ver. 8: 63. Fig. 63.

Terminalia: Differ from *artemisiae* in following points: epandrium with about 28 spines on each caudoventral corner; surstyli cylindrical, directed downwards, each with 2 setae and 13-15 spines; cerci about 1/2 height of epandrium; endophallus with 2 short tubes distally; ejaculatory apodeme 120 μ long, 80 μ wide. Ovipositor sheath 1.5 \times length of tergite 6; tergite 9 about 150 μ long, sternite bearing 3 pairs of *nsm* and sensillae; *ts* 1/4 length of cercus. Spermathecae 44 \times 48 μ , necks 8 μ long, ducts 230 μ long.

Larva differs from *artemisiae*: teeth of mandibles smaller; anterior spiracles yellowish brown, each with 5-7 bulbs, posterior spiracles dark brown apically, each with 8-10 finger-like bulbs; spinal pattern: on dorsal, 2T=2.1, 3T=1.0, 1-2A=2.0, 3A=1.0, 4-8A=0, on lateral, 1T=0.2, 2T=4.3, 3T=7.5, 1-5A=7-9.5-7, 6A=7-9.4, 7A=6.4, 8A=5.0, on ventral side absent; anal lobes slightly projected.

Many were reared from larvae, on *Aster*, Kagoshima City, 29 Oct.-2 Nov. 1955; Mt. Hiko, Fukuoka, 21-24 May 1957, Sasakawa.

DISTRIBUTION: Europe, S. Africa, Japan, N. America.

HOSTS: *Aster*, *Erigeron*, *Solidago* spp., etc.

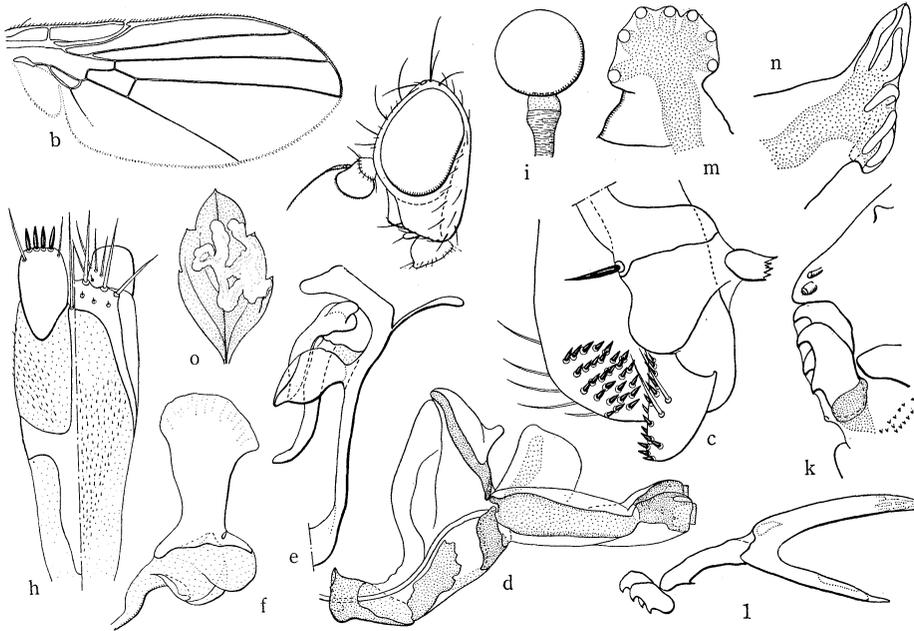


Fig. 63. *Phytobia (Calycomyza) humeralis* (von Roser).

Phytobia (Praspedomyza) morio (Brischke), 1880, Naturf. Ges. Danzig., Schrift. p. 26.
Fig. 64.

I have not seen the type but it can easily be identified by Hendel's description, although it is not clear as to presence of the mid-tibial bristle.

Terminalia: Ovipositor sheath as long as tergite 6, pubescent all over surface, densely setigerous; apodeme subrectangular, almost 2 × as long as tergite 6, pouched on anterior 1/2. Egg guides small, subrectangular, 30 μ long, slightly chitinized laterally and proximally. Tergite 9 laterally with long but narrow sclerites, 160 μ long; sternite with 5-6 *nsm*. Spermathecae orbicular, about 50 × 50 μ, necks 8 μ long, ducts 240-260 μ long,

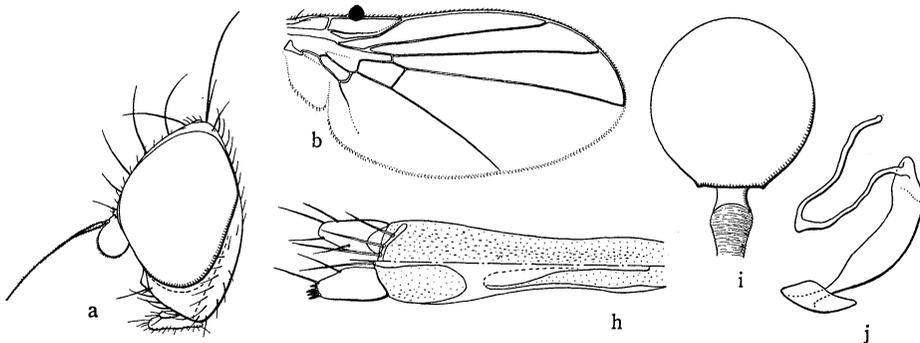


Fig. 64. *Phytobia (Praspedomyza) morio* (Brischke).

brown and $12\ \mu$ in diameter distally; body of ventral receptacle $60\ \mu$, tail $110\ \mu$ long.

Several, Otsu, Shiga Pref., 14 Nov. 1952, Sasakawa.

DISTRIBUTION: Europe, Japan.

HOSTS: *Asperula* and *Galium* spp.

Phytobia (*Praspedomyza*) subapproximata Sasakawa, 1955, Saikyo Univ., Sci. Rep., Agr. 7: 69. Fig. 65.

Terminalia: Ovipositor sheath and apodeme as long as tergite 6, the latter pouched on anterior 3/4. Egg guides small, foliaceous, curved laterally, $80\ \mu$ long, $30\ \mu$ wide. Segment 9 weakly sclerotized, tergite $240\ \mu$ long, sternite with 3 pairs of *nsm*, cerci each with 2-3 *ts* which are 1/3 length of cercus. Spermathecae orbicular, with rugose narrow ring proximally, $140 \times 140\ \mu$, necks $20\ \mu$ long, ducts pale brown, about $600\ \mu$ long, $20\ \mu$ in diameter; ventral receptacle with pale brown and large stipules, $60\ \mu$ long, tail $160\ \mu$ long.

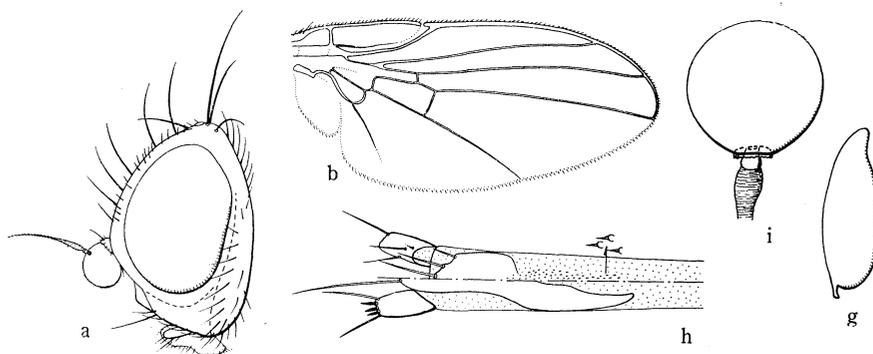


Fig. 65. *Phytobia (Praspedomyza) subapproximata* Sasakawa.

Additional, Mt. Tsurugi, Tokushima Pref., 4 June 1957, Sasakawa.

DISTRIBUTION: Japan.

8. Genus *Cerodontha* Rondani, 1861

KEY TO ADULTS

1. Antennal segment 3 with a distinct spine; thorax and legs mostly yellow (*Cerodontha* s. str.); mesonotum black, without or with 2 rows of *acr* 2
- Antennal segment 3 without spine; thorax and legs entirely black (*Xenophytomyza* Frey); mesonotum with about 6 rows of *acr* *biseta*
2. Mesonotum with 2 rows of *acr* *fulvipes*
- Mesonotum without *acr* 3
3. Mesopleura yellow, browned ventrally; scutellum dorsally yellow *denticornis*
- Mesopleura black, with yellow dorsal margin narrowly; scutellum dorsomesally

faintly yellowish **denticornis nigroscutellata**

Cerodontha (Cerodontha) denticornis (Panzer), 1806, Fauna German., No. 104, f. 22. Fig. 66.

Terminalia: Epandrium nearly 1/2 length of tergite 6, surstyli directed inwards, bearing about 20 setae at distal margins; processus longus tapering distally, dorsal lobes small, without seta. Hypandrium with sidepieces moderately broad, 1/2 length of phallapodeme. Distiphallus about 2/3 length of phallapodeme, paraphallus uniting with hypophallus, endophallus with a pair of long tubes. Ejaculatory apodeme 140 μ long, 80 μ broad, with several sensillae at base, bulb with chitinous plate, duct 12 μ in diameter.

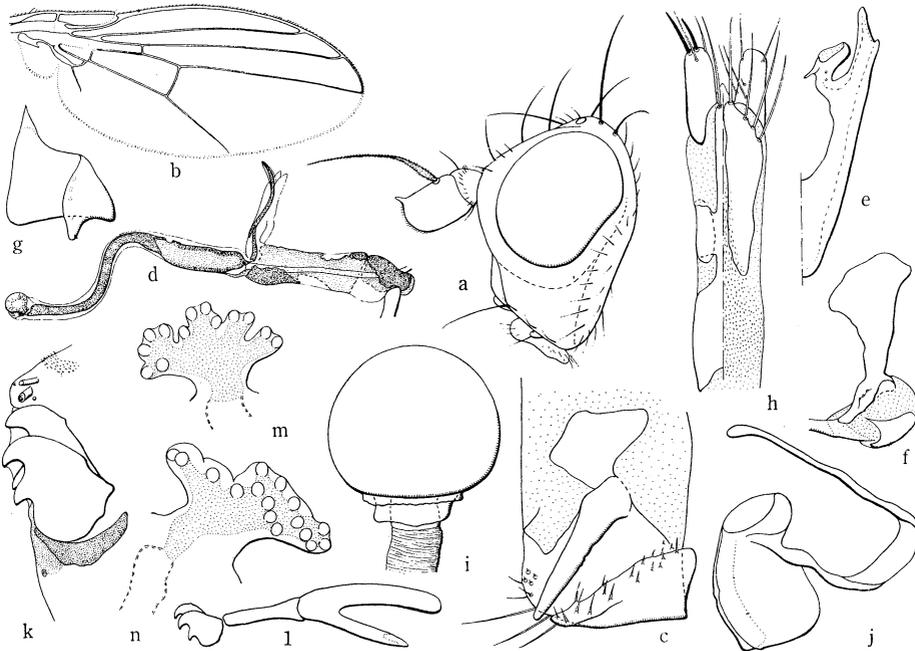


Fig. 66. *Cerodontha (Cerodontha) denticornis* (Panzer).

Ovipositor sheath as long as tergite 6, with pubescence except for posterior 1/5-1/6; apodeme longer than tergite 6, pouched on anterior 1/2. Egg guides subrectangular, but pointed posteriorly, about 80 μ long, with 5 sensillae mesally. Tergite 9 cruciform, crossbar extending ventrally, 220 μ long; sternite 120 μ long, with 4 pairs of *nsm*; cerci each with 2 *ts* which are 1/3 length of cercus. Spermathecae orbicular, somewhat truncate proximally, 80 \times 84 to 80 \times 92 μ , with proximal rings about 20 μ long, necks 16 μ long, ducts 340 μ long, brown and extremely broadened on distal 3/5, about 20 μ in diameter; ventral receptacle with very large plates laterad of body, tail almost 3 \times as long as body, with one fold.

Many, Sapporo, Hokkaido, 7 Sept. 1950 & 5-8 June 1951, Nishijima; Akan, Hokkaido, 17 June 1954, Sasakawa.

subsp. *nigroscutellata* (Strobl, 1900)

Several, Kamishihoro, Hokkaido, 13 June 1954, Sasakawa.

DISTRIBUTION: Europe, America, N. Africa, C. Asia, Japan, Taiwan.

HOSTS: *Hordeum vulgare* var. *hexastichon* Aschers., *Triticum aestivum* L., *Agropyron* sp., *Holcus mollis* L. and *lanatus* L., *Phleum pratense* L., *Poa* sp., etc.

Cerodontha (*Cerodontha*) *fulvipes* (Meigen), 1830, Syst. Besch. bekann. eur. zweifl. Insekt. 6: 174. Fig. 67.

Male terminalia differ from *denticornis* in the following points: surstylus with about 37 setae; dorsal lobes of processus longus with a pair of long setae; ejaculatory apodeme 200 μ long, 140 μ broad, duct 20 μ in diameter.

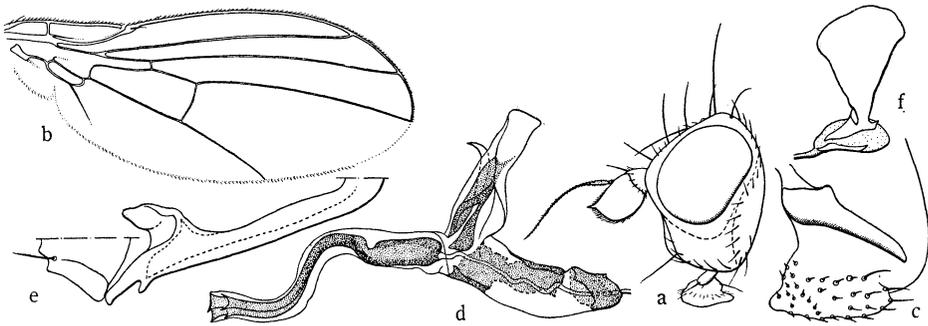


Fig. 67. *Cerodontha* (*Cerodontha*) *fulvipes* (Meigen).

Two, Oshidomari, Rishiri I, Hokkaido, 8 Aug. 1958, Sasakawa.

DISTRIBUTION: Europe, Japan.

Cerodontha (*Xenophytomyza*) *biseta* (Hendel), 1920, Archiv Naturg. A 7: 135. Fig. 68.

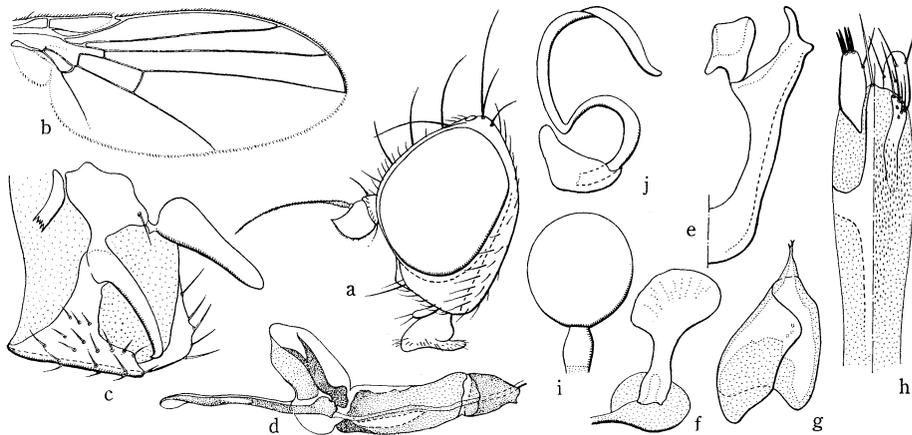


Fig. 68. *Cerodontha* (*Xenophytomyza*) *biseta* Hendel.

Terminalia: Differ from *denticornis* in the following points: surstyli proximally $2/3$ as long as epandrium, each with 15–18 setae; processus longus hooked distally, with dorsal lobes bearing a pair of setae; distiphallus $1/2$ length of phallapodeme, para- and hypophallus uniting at proximal end, endophallus slender; ovipositor sheath $4/5$ length of tergite 6, pubescent on ventroproximal $1/2$; egg guides minutely forked at posterior ends; sternite 9 short, bearing 3–4 pairs of *nsm*; spermathecae 36×36 to $40 \times 40 \mu$; necks pale brown, ducts about 300μ long, brown and broadened on distal $3/4$, 10μ in diameter; ventral receptacle with body about 80μ long, tail $1.5 \times$ as long as body.

Many, Kibune, Kyoto, 16 May 1954, Sasakawa; Aburayama, Fukuoka, 26 May 1957, Sasakawa.

DISTRIBUTION: Europe, Japan.

9. Genus *Liriomyza* Mik, 1894

Although superficially like *Metopomyza* and *Haplomyza* it may not really be closely allied to them at all. In *Liriomyza* the parafrontalia is usually $1/5$ as wide as width of the front, the humerus is yellow, with a small brown spot, and the epandrium is provided with a spine on each inner caudoventral angle, while the parafrontalia is $1/3$ width of the front, the humerus is black and the epandrium with 2 rows of many spines in the species of *Metopomyza*. *Haplomyza* is not represented in Japan, but it is more specialized having the mesonotum with dense gray pollinosity, 2 rows of the acrostichals, the cross-vein m-m absent and only 1 upper fronto-orbital. Of the 20 described species from Japan, 5 are Palaearctic and 2 are Holarctic. The *philadelphi* group and *L. takakoae* have the distinct intra-alars, and also some unusual features in either the male or female terminalia as well as in the *brassicae* group. Most of the known larvae have normally 3 bulbs on each posterior spiracle but the larvae of *L. amoena* and *sonchi* have 6–8 bulbs; the larvae abandon their mines to transform with only exception of *L. anaphalidis* and *cardamines*.

KEY TO ADULTS

1. Mesonotum with a prescutellar yellow rectangular area between rows of *dc*, extending anteriorly midway between 3. and 4. *dc* 2
- Mesonotum without such a prescutellar yellow area 4
- 2 (1). Antennal segment 3 yellow..... 3
- Antennal segment 3 brown *jezoensis*
- 3 (2). Abdomen brown, tergites with yellow lateral and caudal margins..... *philadelphi*
- Abdomen yellow, tergites 2–4 with a pair of brown spots..... *decempunctata*
- 4 (1). Antennal segment 3 entirely yellow..... 5
- Antennal segment 3 brown distally *katoi*
- 5 (4). Mesopleura not more than $3/4$ brown to black 6
- Mesopleura black, with a narrow yellow dorsal margin *takakoae*
- 6 (5). Femora black..... 7
- Femora yellow 8
- 7 (6). Head with both *vt* arising from black area..... *pulchella*
- Head with *vii* on yellow part *praeusta*

8 (6).	Mesonotum with 2-4 rows of <i>acr</i>	9
	Mesonotum with 6 rows of <i>acr</i>	amoena
9 (8).	Mesonotum with 4 rows of <i>acr</i>	10
	Mesonotum with 2 rows of <i>acr</i>	18
10 (9).	Head with both <i>vt</i> arising from black area, usually <i>vti</i> at edge of black.....	11
	Head with <i>vti</i> arising from yellow part.....	14
11 (10).	Parafrontalia brown between bases of <i>or</i> and orbits.....	12
	Parafrontalia yellow.....	fasciola
12 (11).	Antennal segment 3 rounded at tip.....	13
	Antennal segment 3 with an obtuse angle dorsoapically.....	securicornis
13 (12).	Face with antennal grooves brown ventrally; humerus with 1-2 setulae.....	
	anaphalidis
	Face entirely yellow; humerus with 3-5 setulae.....	brassicae
14 (10).	Head with <i>vte</i> arising from black area.....	15
	Head with <i>vte</i> arising from yellow area.....	17
15 (14).	Mesopleura with a brown triangle along whole length of ventral margin.....	16
	Mesopleura with a brown spot at ventromesal part.....	debilis
16 (15).	Front 2 × as wide as eye; ultimate section of M_{3+4} 2.5 × as long as the penultimate.....	cannabis
	Front 1.3 × as wide as eye; ultimate section of M_{3+4} less than 2 × as long as the penultimate.....	asterivora
17 (14).	Postorbital dorsally black in short distance.....	bryoniae
	Postorbital entirely yellow.....	sonchi
18 (9).	Ultimate section M_{3+4} 3.5 × as long as the penultimate; <i>ipa</i> subequal in length to <i>acr</i>	trifolii
	Ultimate section of M_{3+4} 2 × as long as the penultimate; <i>ipa</i> long.....	19
19 (18).	Humerus with 3 setulae.....	nipponallia
	Humerus without or with a setula.....	cardamines

Liriomyza amoena (Meigen), 1830, Syst. Besch. bekannt. eur. zweifl. Insekt. 6: 187. Fig. 69.

Ovipositor sheath slightly longer than tergite 6, pubescent on dorsoproximal 1/2; apodeme slightly longer than sheath, pouched on anterior 1/2. Egg guides subtriangular, weakly sclerotized, 55 μ long, each bearing 3 sensillae. Tergite 9 is 160 μ long, sternite 100 μ

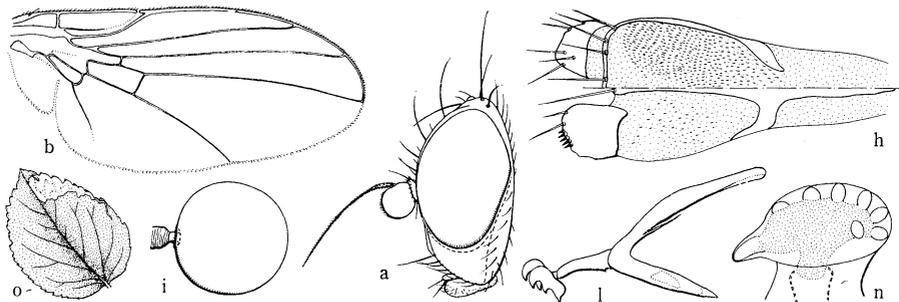


Fig. 69. *Liriomyza amoena* (Meigen).

long, with 4 pairs of *nsm*; cerci each with 5 minute *ts*. Spermathecae orbicular, 80×80 to $82 \times 80 \mu$; necks $1/10$ length of capsule; ducts 220μ long, brown and broadened on distal $4/5$, 12μ in diameter.

Several, including puparia, Nagayama, Hokkaido, 21 July 1947, Y. Nishijima.

DISTRIBUTION: Europe, Japan.

HOST: *Sambucus buergeriana* Blum.

Liriomyza anaphalidis Sasakawa, n. sp. Fig. 70.

ADULT. *Female*: Head yellow; ocellar triangle, occiput and postgenae black, excepting yellow ventral margins, extending to dorsal halves of postorbital and anteriorly to orbits as brown in color, *vti* growing at edge of black area and all *or* arising at edge of pale brown area; antennal grooves with brown tinge ventrally; antennae and palpi yellow, antennal segment 3 somewhat orangish distally, arista brownish. Mesonotum shiny black, slightly pollinose, with yellow lateral stripes; scutellum with dark brown lateral triangles, posteriorly extending just before bases of *as*; pleura yellow, but pro- and hypopleura brownish, mesopleura brown on ventral $1/2$ and sternopleura brown on ventral $2/3$, pteropleura brownish at some places. Wings hyaline; veins pale brown; calypteres yellow, with brown margins and fringe. Legs yellow, but coxae and femora proximally slightly brownish, tibiae and tarsi yellowish brown. Abdomen shiny, blackish brown, slightly pollinose, each tergite posteriorly with yellow margin; ovipositor sheath shining black.

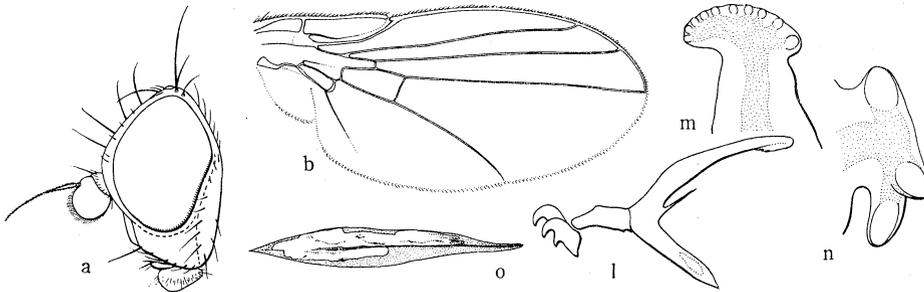


Fig. 70. *Liriomyza anaphalidis* Sasakawa, n. sp.

Head: Front about $1.5 \times$ as wide as eye, almost as broad as long, its sides converging ventrally; parafrontalia $1/5$ width of front, parallel-sided, somewhat broadened laterad of lunule. Ocellar triangle of normal size, with anterior angle between ocelli about 70° , bearing 2 pairs of setulae plus *oc*. Lunule flattened, semicircular, slightly lower than $1/2$ length between its dorsal tip and anterior ocellus. Fronto-orbitals 4 pairs; *ors* directed upwards; *ori* for- and inwards; *oh* sparsely in a row. In profile parafrontalia and parafacialia slightly extending beyond eye, but distinctly near antennal bases; eyes $1.5 \times$ as high as broad, sparsely with minute hairs; genae about $1/5$ eye height. Face almost vertical, slightly higher than wide; parafacialia about $1/3$ as wide as diameter of antennal segment 1. Antennae with bases approximated; segment 3 subspherical, as long as wide, with pile longer than basal thickness of arista; arista $1.7 \times$ as long as whole length of antenna,

swollen in spindle form on basal $1/4$, pubescent microscopically. *Thorax*: Mesonotum with $1+3$ *dc*, 1. *dc* located on level of *prs*, as far from transverse suture as 2 from that, 3. *dc* slightly before level of *sa*, distance between 3 and 4. *dc* nearly $2 \times$ as long as that between 2 and 3; 4 rows of *acr*, extending posteriorly midway between 3 and 4. *dc*; 9-11 *ia*-setulae behind suture; *ipa* $1/2$ length of *opa*; humeri each with 1-2 setulae plus *h*. Mesopleura with 3 dorsally directed setulae; sternopleura with or without setula before *sp*. *Wing*: Costa with sections 2-4 in proportion of $32 : 9 : 8$; r-m situated almost at middle of discal cell; m-m subequal to penultimate section of M_{1+2} ; ultimate section of M_{1+2} $8.5 \times$ as long as penultimate; ultimate section of M_{3+4} approximately $2.5 \times$ of penultimate. *Abdomen*: Tergites sparsely covered with setae, *mar* long; tergite 6 slightly longer than 5. *Terminalia*: Ovipositor sheath $1.5 \times$ as long as tergite 6, pubescent on proximal $1/2$. *Length*: Body 1.5 mm; wing 1.67.

PUPARIUM: Brown, about 1.5 mm in length; dorsal and ventral sides flattened; segmental constriction distinct. Head with short longitudinal sclerites; mandibles each with 2 teeth (larval exuviae). Anterior spiracles knob-like, each with about 10 bulbs; posterior spiracles 50μ high, each with 3 large bulbs. Cuticular processes subequal in size, absent on dorsomesal part, on abdominal segment 3 as 4-5-2-3 laterally, on ventromesal part 2 short rows just behind anterior rows of each segment. Posterior end with a pair of distinct papillae on lateromedian part, a pair of minute papillae just laterad of anal lobes.

DISTRIBUTION: Japan (Honshu).

Holotype ♀, Mt. Hira, Shiga Pref., 7 Oct. 1954, on *Anaphalis*, ♀ asakawa.

This new species is closely allied to *L. brassicae* and the European species *L. orbitella* Hendel, but may be easily distinguished from them by the presence of long pile on antennal segment 3 and the details of venation.

BIONOMICS. *Host*: *Anaphalis yedoensis* Maxim. *Mine*: Whitish in color, the ophiome, of the upper surface type, about 50 mm long, 1.5 mm wide; begins near basal margin of leaf, runs towards top of leaf and turns back again towards base. The grains of frass are arranged in either a short thread or a separated mass. *Tenancy*: 1 mine to a single leaf. *Pupation*: Takes place at the end of mine; dorsal side of puparium is attached beneath lower epidermis of leaf and anterior spiracles are projected on surface of leaf.

Liriomyza asterivora Sasakawa, 1956, Saikyo Univ., Sci. Rep., Agr. 8: 127. Fig. 71.

Male terminalia similar to *cannabis*. Ovipositor sheath $1.5 \times$ as long as tergite 6; apodeme as long as sheath, pouched on anterior $1/3$. Egg guides suboval, weakly sclerotized posteriorly, about 80μ long, each with 3 sensillae. Tergite 9 is 140μ long, sternite 120μ long, bearing 3 pairs of *nsm*; cerci each with 6 *ts* which are scarcely $1/6$ length of cercus. Spermathecae orbicular, 72×68 to $84 \times 72 \mu$, necks very short, ducts $240-280 \mu$ long, infuscated and broadened on distal $2/3$, 12μ in diameter. Ventral receptacle with body rather strongly curved at distal end, 80μ long.

Spinal pattern of larva: on dorsal, $1T=0.2$, $2T=1.0$, $1-8A=2.0$, on lateral, $1T=7.2$, $2T=2.0$, $3T-1A=3-4.1-2$, $2-7A=4-5.2$, $8A=3.0$, on ventral side, $2T-8A=2.0$.

DISTRIBUTION: Japan.

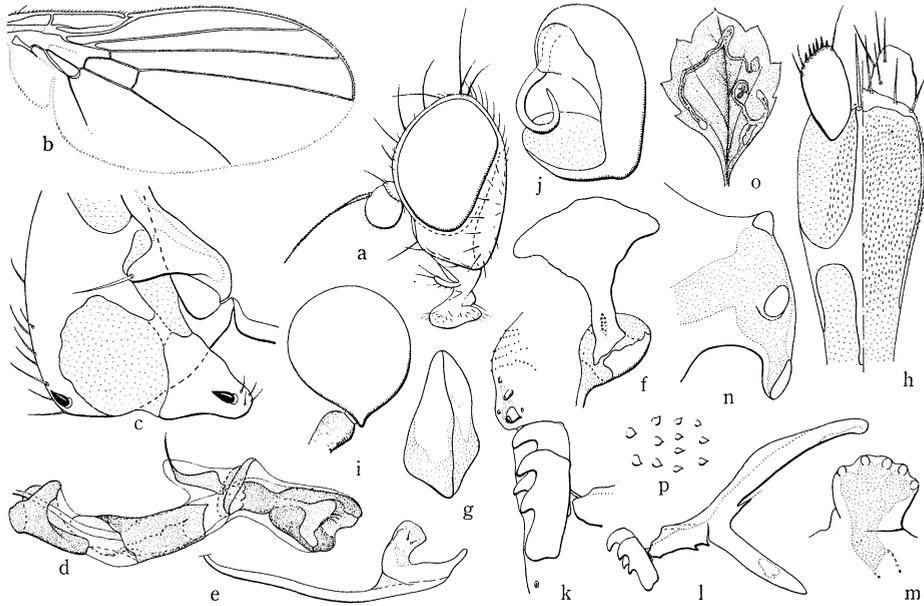


Fig. 71. *Liriomyza asterivora* Sasakawa.

HOST: *Aster indicus* L.

Liriomyza brassicae (Riley), 1884, U. S. Dept. Agr., Ann. Rep. 1884 : 322. Fig. 72.

Head yellow; vertical angles and dorsal halves of postorbis blackish brown, parafrofrontalia slightly brown-tinged between bases of *or* and orbits; antennae and palpi yellow. Thorax black; mesonotum shiny, slightly pruinose; dorsal 1/3 of mesopleura, dorsal margin of sternopleura yellow. Legs with coxae and femora yellow, but proximally and dorsally

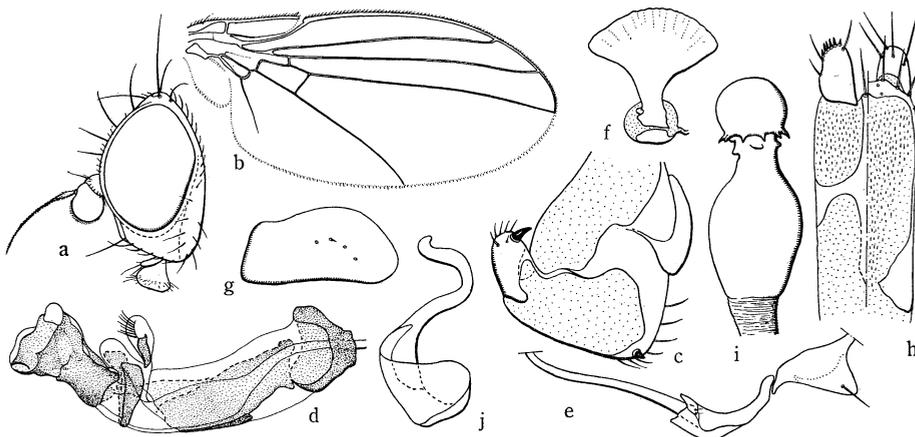


Fig. 72. *Liriomyza brassicae* (Riley).

brownish, tibiae and tarsi brown. Abdomen shiny, brownish black, tergites with yellow caudal margins; epandrium brown, cerci yellow.

Male terminalia normal. Ovipositor sheath as long as tergite 5, pubescent on anterior 2/3; apodeme strongly chitinized, subequal in length to sheath, pouched on anterior 1/2. Egg guides subquadrate, with several sensillae. Tergite 9 is $145\ \mu$ long; sternite as long as tergite, bearing 4 pairs of *nsm*; cerci each with 6 *ts* which are about 1/5 of cercus length. Spermathecae minute, suborbicular, with distinct teeth along basal margin, $30 \times 32\ \mu$; necks very long and broad, $60\text{--}72\ \mu$ long, with minute processes apically; ducts variable in length, $300\text{--}400\ \mu$ long, brown-tinged and broadened on distal 4/5, $12\text{--}16\ \mu$ in diameter; ventral receptacle with large stipules.

Many, Jyōzankei, Ashoro & Shibechea, Hokkaido, 10-22 June 1954; Kibune, Kyoto, 16 May 1954; Nase, Nishinakama & Koniya, Amami-Oshima I., 18-22 Apr. 1956, Sasakawa.

DISTRIBUTION: Europe, Japan, N. America.

This species differs from the Japanese *L. anaphalidis* and *securicornis* in the following points: face entirely yellow; 4 rows of *acr* extending posteriorly to level of 2. *dc*; 7-9 *ia*-setulae; ultimate section of M_{3+4} more than $3 \times$ as long as the penultimate. The larvae of this species make whitish, narrow ophiome, of lower surface type, on the leaves of a large number of cruciferous plants.

Liriomyza bryoniae (Kaltenbach), 1858, Naturh. Ver. Rheinl. Westf., Verh. 15: 158. Fig. 73.

Male terminalia normal, endophallus small, less sclerotized, minutely spinulose; ejaculatory apodeme with stem narrow, expanded distally, $100\ \mu$ long and wide. Ovipositor sheath longer than tergite 6, pubescent on proximal 1/3; apodeme as long as tergite 6, pouched on anterior 1/2. Egg guides subtriangular, $50\ \mu$ long, each with 4-5 spines mesally. Tergite 9 is $160\ \mu$ long; sternite $50\ \mu$ long, bearing 4 pairs of *nsm*; cerci each with 5 *ts* which are 1/6 length of cercus. Spermathecae oval, 72×56 to $80 \times 60\ \mu$, necks short, ducts $160\ \mu$ long, brown-tinged and broadened on distal 3/4, $12\ \mu$ in diameter.

DISTRIBUTION: Europe, Japan.

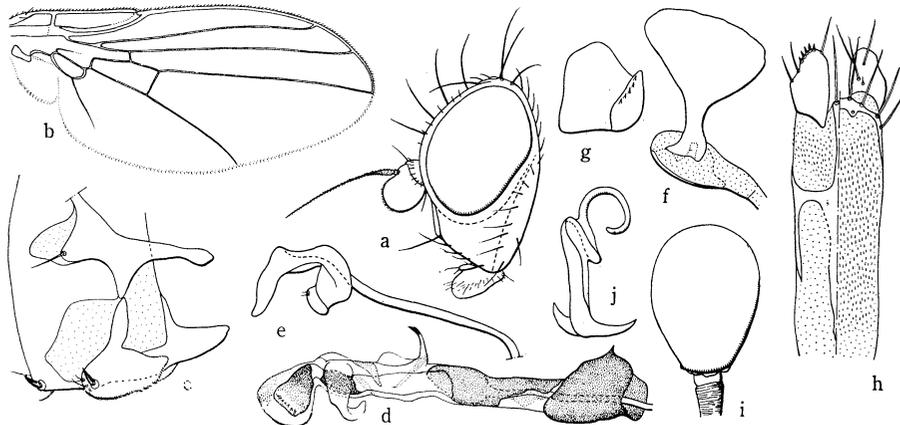


Fig. 73. *Liriomyza bryoniae* (Kaltenbach).

HOSTS: Many plants of Solanaceae, Scrophulariaceae, Labiatae, Umbelliferae, Compositae, etc.

Liriomyza cannabis Hendel, 1931, IN Lindner: Die Flieg. palaearkt. Reg. 59: 211. Fig. 74.

Terminalia: Epandrium broadened ventrally; surstyli subconical, as long as dorsal length of epandrium, each with a spine; processus longus with a pair of setae. Distiphallus subequal in length to hypandrium; endophallus broadened on distal 2/3; ventral process bearing a setal fascicle. Ejaculatory apodeme 120 μ long, 100 μ broad, stem with a number of sensillae.

Ovipositor sheath almost as long as tergite 6, pubescent on proximal 1/2; apodeme shorter than sheath, pouched on anterior 1/4. Egg guides triangular, 40 μ long, with several sensillae. Tergite 9 is 170 μ long; sternite 110 μ long, bearing 6-7 *nsm*; cerci each with 5 *ts* which are 1/5 length of cercus. Spermathecae orbicular, 80 \times 80 μ ; necks 4 μ long, ducts 200 μ long, brown-tinged and broadened on distal 4/5, 12 μ in diameter.

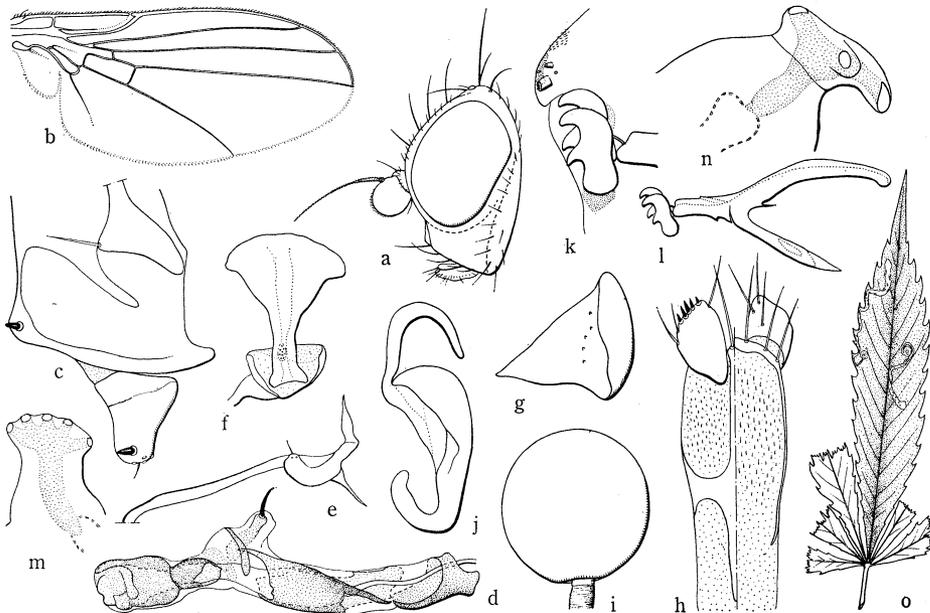


Fig. 74. *Liriomyza cannabis* (Hendel).

Many were reared from larvae, Sapporo, Hokkaido, 14 July 1957; Motodomari, Rishiri I., 2 Aug.-20 Sept. 1958, on *Cannabis*, Sasakawa.

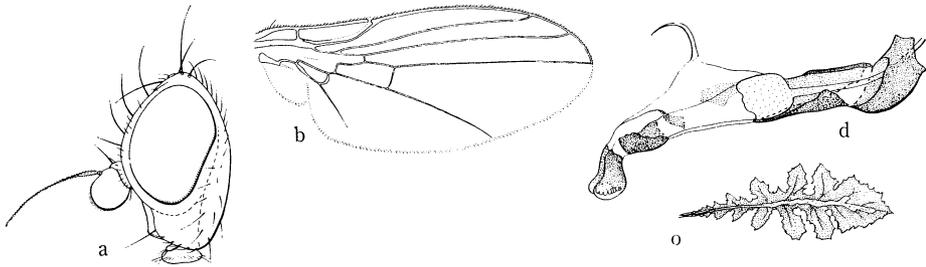
DISTRIBUTION: Europe, Japan.

HOST: *Cannabis sativa* L.

Liriomyza cardamines Sasakawa, 1954, Saikyo Univ., Sci. Rep., Agr. 6: 113. Fig. 75.

DISTRIBUTION: Japan.

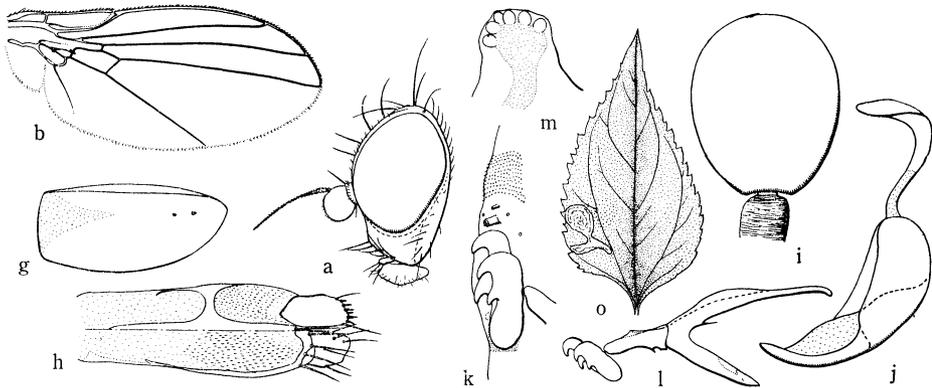
HOST: *Cardamine scutata* Thunb.

Fig. 75. *Liriomyza cardamines* Sasakawa.**Liriomyza debilis** Sasakawa, 1956, *op. cit.* 8: 128. Fig. 76.

Ovipositor sheath as long as tergite 6, rather densely setiferous, pubescent on proximal 1/8; apodeme 1.5 × as long as sheath, pouched on anterior 1/2. Egg guides suboval, about 60 μ long, each with 2 sensillae. Tergite 9 is 140 μ long, sternite with 4 pairs of *nsm*; cerci each with 5-6 *ts*, which are 1/5 length of cercus. Spermathecae orbicular, 75 × 82 to 80 × 90 μ; necks 4 μ long; ducts 360 μ long, slightly brown-tinged and broadened on distal 1/2, 25 μ in diameter. Ventral receptacle of normal form, body almost as long as tail, about 50 μ long, tail with a slight brown tinge.

DISTRIBUTION: Japan.

HOST: *Helianthus debilis* Nutt.

Fig. 76. *Liriomyza debilis* Sasakawa.**Liriomyza decempunctata** Sasakawa, n. sp. Fig. 77.

ADULT. Male: Head yellow; front ventrally darker, orangish; ocellar triangle subshiny, *oc* growing at edge of pale brown central area; occiput and dorsal halves of postgenae brown, extending laterally to postorbital in short length, *vt* and *pvt* growing on yellow area; antennae and palpi yellow, arista brown. Thorax yellow; mesonotum with 5 shiny black stripes, median one cruciform, posteriorly extending midway between 4. *dc* and suture, cross-bar not reaching bases of *prs*, lateral 2 between transverse suture and level of *pa* and usually connecting at anterior part; posterior *dc* usually growing on yellow line,

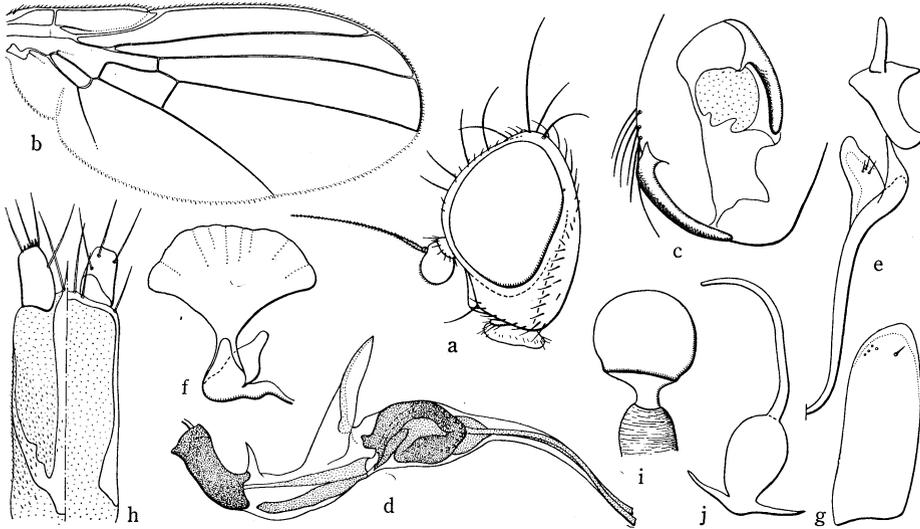


Fig. 77. *Liriomyza decempunctata* Sasakawa, n. sp.

ia on yellow or black, *sa* at edge of black and *pa* on yellow area; sterno- and hypopleura each with small brown triangle. Wings hyaline; veins yellowish brown; calypteres yellow, with margins and fringe brown. Legs yellow, tibiae and tarsi slightly tinged with brown. Abdomen yellow, tergites 2-6 each with a pair of brown suboval spots; epandrium brown, but dorsomesally and cerci yellow.

Head: Front $1.7 \times$ as wide as eye, almost as broad as long, sides slightly converging ventrally or parallel; parafrontalia nearly $1/4$ width of front. Ocellar triangle with 4-5 pairs of setulae plus *oc*. Lunule $1/3-1/2$ as high as distance between its dorsal tip and anterior ocellus. Fronto-orbitals 4 pairs; 1. *ors* directed up- and slightly outwards, 2. *ors* up- and inwards; *ori* in- and slightly upwards; *oh* minute, in an irregular row. In profile parafrontalia and parafacialia slightly extending beyond upper eye-margin; eyes $1.3-1.4 \times$ as high as broad, almost bare; gena $1/4-1/5$ eye height; 4-6 *pm* in a row. Face concave, as high as wide; carina low; parafacialia about $1/3$ as wide as diameter of antennal segment 1. Antennae very slightly separated from each other at bases; segment 3 orbicular, as long as wide, minutely pilose; arista about $2 \times$ as long as whole length of antenna, swollen on basal $1/4$. **Thorax:** Mesonotum with 1+3 *dc*, 1. *dc* situated on level of *prs*, 3. *dc* slightly before level of *sa*; 4 rows of *acr* extending posteriorly level of 4. *dc*; *ia* $3-4 \times$ as long as *acr*, accompanying with 12-18 setulae in 3 rows; *ipa* $1/2$ length of *opa*; humeri each with 5-10 setulae plus *h*. Mesopleura with 3-5 dorsally directed setulae; sternopleura with 1-2 setulae before *sp*. **Wing:** Costa with 3 sections in proportion of 60 : 18 : 17; r-m far distad beyond middle of discal cell; ultimate section of M_{1+2} about $10 \times$ as long as penultimate; ultimate section of M_{3+4} nearly $2 \times$ length of penultimate. **Abdomen:** Tergite 6 as long as 5; *mar* long; sternite 5 is $1.5 \times$ as long as wide, with shallow posterior incision. **Terminalia:** Epandrium and surstyli each with an extremely long spine; processus longus hooked posteriorly. Hypandrium with sidepieces slender, about $3/5$ length of phallopodeme. Distiphallus as long as hypandrium; endophallus very long. Ejaculatory apo-

deme 230μ long, 280μ broad; bulb with large wing-like plate. *Length*: Body 3 mm; wing 2.75.

Female: Similar to ♂, sternite 6 about $2 \times$ as wide as long. *Terminalia*: Ovipositor sheath shining black, as long as tergite 6, densely setigerous; apodeme nearly $2 \times$ as long as sheath, pouched on anterior $1/3$. Egg guides suboval, 150μ long, with 5 sensillae. Tergite 9 trifurcate, about 200μ long, sternite U-shaped, 120μ long, bearing 4 pairs of *nsm*; cerci each with 6 short *ts*. Spermathecae orbicular, with truncate proximal end, $52 \times 56 \mu$, necks 10μ long, ducts 540μ long, brown-tinged and broadened on distal $1/2$, about 40μ in diameter; ventral receptacle of normal form.

DISTRIBUTION: Japan (Honshu).

Holotype ♂, allotype ♀, Momoyama, Kyoto, 8 May 1959, Sasakawa; 6 paratypes, same data; Minagi, Okayama, 2 May 1955, K. Koizumi.

This new species somewhat resembles *L. melanorhabda* Hendel and *oldenbergi* Hering from Europe, but can be distinguished by its yellow mesopleura.

HOST: *Ophiopogon japonicus* Ker-Gawl.

Liriomyza fasciola (Meigen), 1835, Syst. Besch. bekannt. eur. zweifl. Insekt. 7: 402. Fig. 78.

Male terminalia with following modifications: distiphallus with a pair of setae on basal membrane, endophallus extremely dilated; ejaculatory apodeme 140μ long, 120μ wide. Ovipositor sheath as long as tergite 6, pubescent on proximal $1/3$; apodeme $3/4$ length of sheath, pouched on anterior $1/2$. Egg guides subquadric, 72μ long, with about 6 sensillae. Tergite 9 is 180μ long, sternite with 4 pairs of *nsm*; cerci each with 6 *ts* which are about $1/6$ of cercus length. Spermathecae orbicular, with truncated basal end, 84×88 to $100 \times$

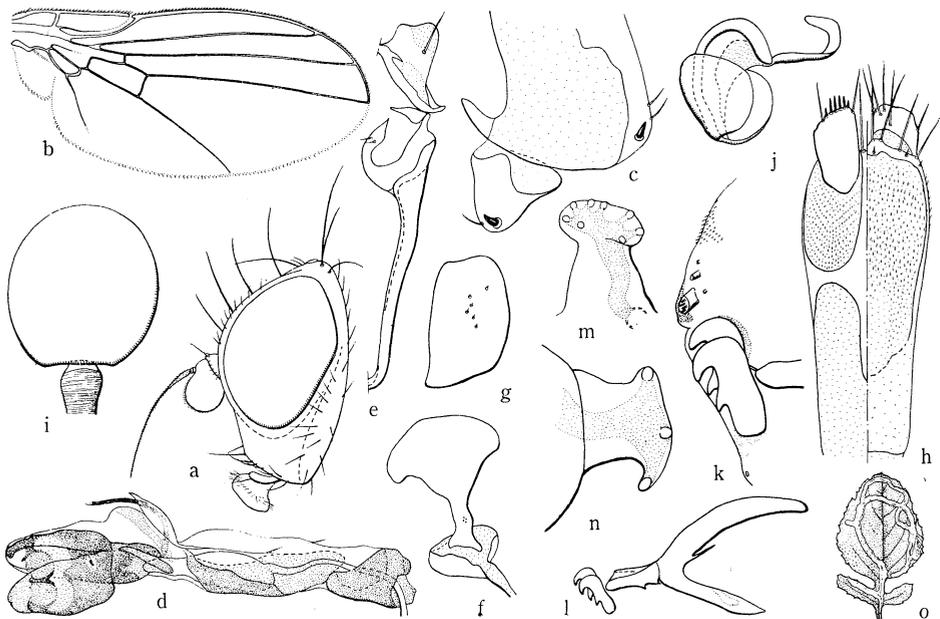


Fig. 78. *Liriomyza fasciola* (Meigen).

92 μ ; necks only 4 μ long; ducts brownish, 280 μ long, 16 μ in diameter.

Spinal pattern of larva: on dorsal, 1T=7.0, 2T & 2A=5.0, 3T-1A=4.0, 3-5A=3-4.0, 6-7A=2-3.0; on lateral, 1T=6.0, 2T=4.1, 3T=4.2, 1A=4-5.2, 2-3A=6.2, 4-5A=5-6.2, 6A=4-5.2, 7A=4.1-2, 8A=3-4.0; on ventral side, 1T=6.0, 2T=4.0, 3T=3.0, 1A=2.0, 2-8A=0.

Many, Morioka, Iwate Pref., 26 Apr. 1954; Kibune, Kyoto, 29 Apr. 1953; Shimogamo, Kyoto, 29 Apr. & 8 May 1956, on *Aster*; Izuhara, Tsushima Islands, Nagasaki Pref., 31 July 1959, on *Arabis*, Sasakawa.

DISTRIBUTION: Europe, Manchuria, Japan, N. Africa.

HOSTS: *Aster indicus* L., *Arabis* sp., *Bellis perennis* L., *Callistephus* sp., *Solidago* sp.

Liriomyza jezoensis Sasakawa, n. sp. Fig. 79.

ADULT. *Male*: Head yellow, excepting dark brown occiput, dorsal halves of postgenae, antennal segment 3 and arista; ocellar triangle with pale brown spot centrally; palpi yellow. Thorax yellow; mesonotum with 3 brownish black stripes which are separated by yellow lines along *dc*-rows, slightly pollinose, median stripe extending posteriorly midway between 3 and 4. *dc*, *prs* growing at edge of yellow, *sa* and *pa* at edge of black area; scutellum slightly brown-tinged lateroproximally; mesopleura with a small brownish triangle at anteroventral corner; sterno- and hypopleura each with brown triangle. Wings hyaline, with slight yellow-brown tinge; veins pale brown, yellow basally; calypteres yellowish, with margins and fringe dark brown. Legs yellow, tibiae and tarsi brownish yellow, but paler in fore legs. Abdomen subshiny yellow, slightly brown-tinged; epandrium brown, cerci yellow.

Head: Front 2.7 \times as wide as eye, broader than long, sides slightly converging ventrally; parafrontalia about 1/4 width of front, parallel-sided. Ocellar triangle ventrally reaching midline between 2 *ors*, bearing 5 pairs of setulae plus *oc*. Lunule flattened, lower than semicircular, about 1/3 as high as length between its dorsal tip and anterior ocellus. Fronto-orbitals 3 pairs; 1. *ors* directed up- and outwards, 2. *ors* upwards; *ori* for- and inwards; *oh* minute, arranged irregularly and densely. In profile parafrontalia and parafacialia slightly extending beyond eye-margin; eye 1.3 \times as high as wide, with sparse minute hairs; gena about 1/4 eye height. Face vertical, as high as wide; carina broad but low, divergent ventrally; antennal grooves shallow. Parafacialia nearly 1/3 as wide as diameter of antennal segment 1. Antennae approximated at base; segment 3 subspherical, as long as broad, with pile subequal in length to basal thickness of arista; arista about 2 \times as long as whole length of antenna, swollen on basal 1/5, pubescent. *Thorax*: Meso-

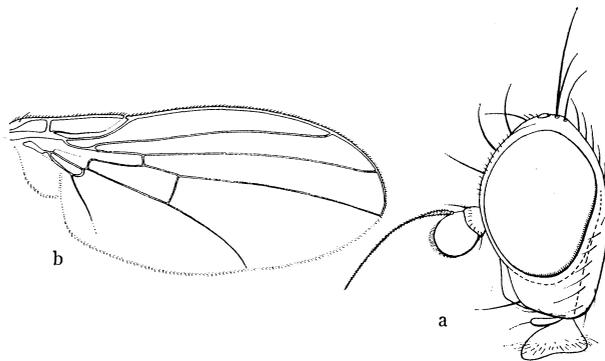


Fig. 79. *Liriomyza jezoensis* Sasakawa, n. sp.

notum with 1+3 *dc*, 1. *dc* located slightly before level of *prs*, 3. *dc* before level of *sa* and about 1.5 × as far apart from 4. *dc* as from 2; 2 rows of *acr*, ending at level of 4. *dc*; *ia* long, with 2-3 setulae before it; *ipa* 1/2 length of *opa*; humeri each with 7 setulae plus *h*. Meso- and sternopleura each with a dorsally directed setula. *Wing*: Costa with sections 2-4 in proportion of 60 : 17 : 13; r-m far distad beyond middle of discal cell; m-m slightly shorter than penultimate section of M_{1+2} ; ultimate section of M_{1+2} about 6 × as long as penultimate; ultimate section of M_{3+4} about 1.2 × length of penultimate. *Abdomen*: Tergites rather densely covered with setae, *mar* long; tergite 6 as long as 5. *Length*: Body 2.5 mm; wing 2.75. Female unknown.

DISTRIBUTION: Japan (Hokkaido).

Holotype ♂, Jyozankei, Hokkaido, 10 July 1954, M. Sasakawa.

This new species is one of two having the mesonotum posteriorly yellow from the midline between dorsocentral bristles 3-4 to scutoscutellar suture. The other, *L. philadelphia* n. sp., differs clearly from the present species by the coloration of antennal segment 3. The pile on antennal segment 3 is relatively as long as in *L. striata* Hendel and *fasciata* Hendel known from Europe. But these species are smaller in size and have the cross-vein r-m at middle of discal cell. Bionomics unknown.

Liriomyza katoi Sasakawa, n. sp. Fig. 80.

ADULT. Male: Head yellow; frontalia somewhat darker; ocellar triangle, occiput and dorsal halves of postgenae black, extending to dorsal parts of postorbis in short distance, both *vt* arising from yellow part; antennae yellow, segment 3 more or less brownish distally, rarely testaceous excepting proximal margin, arista brown; anteclypeus yellow to pale brown; palpi yellow. Mesonotum shining black, excepting yellow sides and posterolateral corners, *opa* growing at edge of yellow spot; humeri each with brown small spot; scutellum with brown lateral triangles; pleura yellow, mesopleura faintly brownish on ventromedian part; black triangles of sterno- and hypopleura broadly separated. Wings hyaline; veins pale brown, basally yellowish; calypteres yellowish, with margins and fringe brown. Legs yellow, tarsi slightly brown-tinged. Abdomen shiny, brown to blackish brown, tergites with yellow caudal and broad lateral margins; epandrium blackish brown, cerci yellowish brown.

Head: Front 1.5-1.8 × as wide as eye, almost as broad as long, sides a little convergent ventrally; parafrontalia about 1/4 width of front, slightly narrowing ventrally. Ocellar triangle of normal size, bearing a pair of setulae plus *oc*. Lunule flat, semicircular, about 1/3 as high as length between its dorsal tip and anterior ocellus. Fronto-orbitals usually 4 pairs; *ors* 2, rarely 1 or 3, directed up- and slightly outwards; *ori* 2, rarely 3, directed in- and slightly upwards; *oh* minute, sparsely in a row. In profile parafrontalia and parafacialia linearly extending beyond eye-margin; eyes 1.3 × as high as wide, almost bare; genae 1/4 eye height. Face as high as broad; parafacialia linear. Antennae with bases approximated; segment 3 subspherical, with pile almost as long as basal thickness of arista; arista 2 × as long as whole length of antenna, swollen on basal 1/4, pubescent. **Thorax**: Mesonotum with 1+3 *dc*, 1 and 2. *dc* only slightly longer than *acr*, 1. *dc* located almost on level of *prs*, 3. *dc* before level of *sa* and about 3 × as far from 4 as from 2; 4 rows of *acr*, becoming sparser behind 3. *dc*, 1-3 pairs before 4. *dc* directed inwards; 2 rows of 5-8 *ia*-setulae behind suture; *ipa* about 1/5 length of *opa*, sometimes absent; humeri each

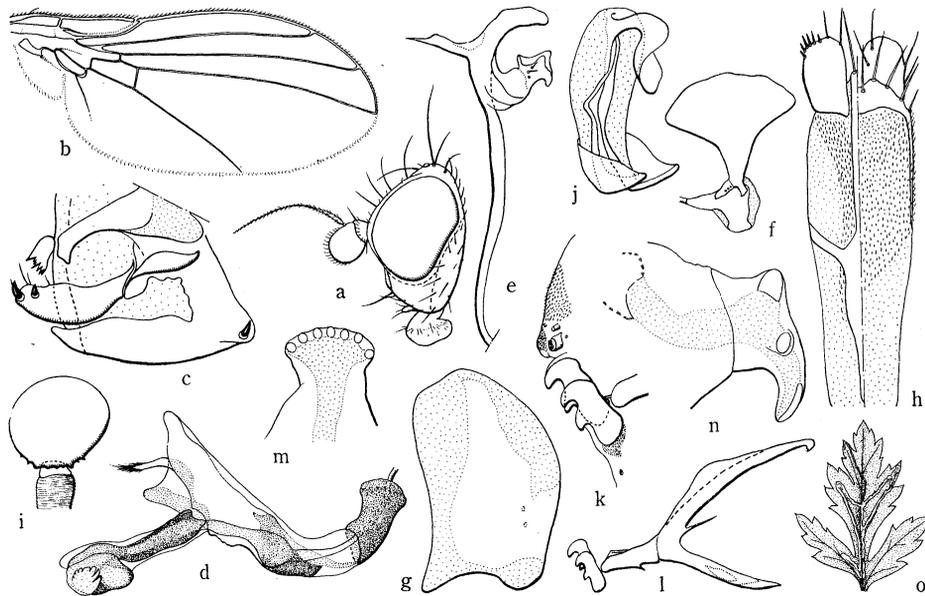


Fig. 80. *Liriomyza katoei* Sasakawa, n. sp.

with 3–5 setulae plus *h*. Mesopleura with 2–4 dorsally directed setulae; sternopleura with a setula before *sp*. *Wing*: Costa with section 2–4 in proportion of 36 (33–40) : 11 : 10; r-m situated at or slightly distad beyond middle of discal cell; m-m subequal to penultimate section of M_{1+2} ; ultimate section of M_{1+2} 10–12 \times as long as penultimate; ultimate section of M_{3+4} is 2.5–3 \times as long as penultimate. *Abdomen*: Tergites sparsely covered with setae, *mar* long; tergite 6 as long as 5; sternite 5 is 1.5 \times as wide as long, incised on caudal 1/2. *Terminalia*: Surstyli subcylindric, each with 2 spines and a few setae near tip. Hypandrium with sidepieces about 3/5 length of phallapodeme. Basiphallus rather long; distiphallus with large ventral process, endophallus much longer than paraphallus, spinose on inner side of distal lobes. Ejaculatory apodeme 130 μ long, 140 μ wide; stem with 3 sensillae. *Length*: Body 1.33–1.67 mm; wing 1.5–1.75.

Female: Similar to σ , but sternite 5 about 3 \times as wide as long, slightly smaller than 6. *Terminalia*: Ovipositor sheath shiny black, about 1.5 \times as long as tergite 6, pubescent on basal 1/2; apodeme 2/3 length of sheath, pouched on anterior 2/3. Egg guides subquadrate, 80 μ long, with 2 sensillae. Tergite 9 is 180 μ long; sternite 80 μ long, bearing 5 pairs of *nsm*; cerci each with 6 *ts* which are about 1/5 length of cercus. Spermathecae suborbicular, with notch ventrally, 28 \times 36 to 36 \times 32 μ ; necks extremely short, 4 μ long; ducts 180 μ long, brown-tinged and broadened on distal 3/4, 12 μ in diameter. *Length*: Body 1.5–1.75 mm; wing 1.5–1.8.

LARVA. Full-grown larva pale yellow; about 2 mm in length, 0.5 mm in width. Head with a large patch of minute spines dorsad of sensillae; longitudinal sclerite small; mandibles each with 2 teeth. Anterior spiracles pale brown, knob-like, 40 μ high, each with 8 bulbs; posterior spiracles pale brown, each with 3 bulbs. Cuticular processes brownish

yellow, spinal pattern: on dorsal, 2-3T=3.0, 1-3 & 6-8A=3.0, 4-5A=4.0; on lateral, 1T=6.0, 2T=3-4.0, 3T-1A=4.2, 2-6A=5.3, 7A=5.2, 8A=3.0; on ventral side, T=0, 1-2A=2.0, 3-5A=4.5.0, 6-8A=2.0. Posterior end with a pair of small tubercles on mid-line between posterior spiracles and anus.

PUPARIUM. Pale brown; about 1.5 mm in length, 0.8 mm in width; dorsal side arched, ventral flattened; segmental constriction distinct.

DISTRIBUTION: Japan (Hokkaido, Honshu).

Holotype ♂, Shimogamo, Kyoto, 24 Sept. 1955; allotype ♀, 15 Sept. 1955, on *Artemisia*, Sasakawa; 33 paratypes, Akan, Ashoro & Shibeche, Hokkaido, 16-19 June 1954; Shimogamo, Kyoto, 8 Sept.-2 Oct. 1955, on *Artemisia*, Sasakawa.

This new species is clearly distinct from any of the Japanese species of this genus by the dark antennal segment 3. It may be separated from the European *L. gudmanni* Hering and *L. umbilici* Hering by having the dorsal parts of postorbis briefly brown and the mesonotum with 2 rows of 5-8 intra-alar setulae. It also differs from *L. demejerei* Hering on *Artemisia* in Europe by having minute inner post-alar bristles and shorter ultimate section of M_{3+4} .

BIONOMICS. *Host:* *Artemisia vulgaris* var. *indica* Max. *Mine:* Whitish green, but first delicate tracing becomes pale brown later on; ophionome, of upper surface type; it usually begins to run near the leaf-margin and entangled irregularly. The black grains of frass are continuous as a short line. *Pupation:* The full-grown larvae abandon their mines and fall on the ground for pupation.

***Liriomyza nipponallia* Sasakawa, n. sp. Fig. 81.**

ADULT. Female: Head yellow; ocellar triangle, occiput and dorsal 2/3 of postgenae dark brown, extending dorsolaterally to postorbis in short distance, both *vt* arising on yellow area; antennae and palpi yellow, but antennal segment 3 orangish, arista yellowish brown. Mesonotum shiny, black, slightly pollinose, with yellow lateral stripes and caudolateral spots before scutellum, *prs* and *ipa* growing at edge of yellow and *opa* at edge of black area; scutellum with brown lateral triangles small; *bs* growing at edge of yellow part; *h* arising on yellow part; pleura yellow, mesopleura with a brown triangle ventrally, about

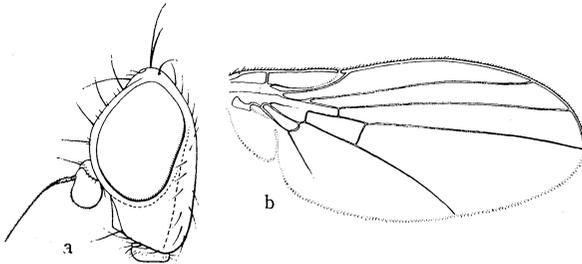


Fig. 81. *Liriomyza nipponallia* Sasakawa, n. sp.

1/2 as wide as width of ventral margin, brown triangles of sterno- and hypopleura widely separated from each other. Wings hyaline; veins pale brown, proximally yellow; calypteres yellow, with margins and fringe pale brown. Legs yellow, tibiae and tarsi brownish yellow. Abdomen subshiny, blackish brown, gray dusted, posteriorly narrowly yellow, broadest on tergite 6; ovipositor sheath shining black.

Head: Front about 1.5 × as wide as eye, slightly narrower than long, its sides con-

verging ventrally; parafrontalia nearly $1/5$ width of front, almost parallel-sided. Ocellar triangle with ventral tip extending slightly beyond level of 1. *ors*, anterior angle between ocelli about 50° , bearing 2 pairs of setulae plus *oc*. Lunule about $1/3$ as high as length between its dorsal tip and anterior ocellus. Fronto-orbitals 4 pairs; *ors* directed upwards; *ori* in- and slightly upwards; *oh* minute, arranged in a row near *or*-row. In profile parafrontalia and parafacialia extending beyond upper eye-margin; eye about $1.5 \times$ as high as wide, with sparse minute hairs; gena $2/5$ eye height; parafacialia almost $1/2$ as wide as diameter of antennal segment 1. Face narrower than high, sharply keeled; antennal grooves deep. Antennae with bases approximated; segment 3 subspherical, as long as broad, minutely pilose; arista about $2 \times$ as long as whole length of antenna, microscopically pubescent. *Thorax*: Mesonotum with 1+3 *dc*, 1. *dc* only slightly longer than *acr* and located just behind level of *prs*, 3. *dc* before level of *sa*; 2 rows of *acr* extending posteriorly midway between 3 and 4. *dc*; 3 *ia*-setulae; *ipa* $2/3$ length of *opa*; humeri each with 3 setulae plus *h*. Mesopleura and sternopleura each with a dorsally directed setula. *Wing*: Costa with sections 2-4 in proportion of 44 : 11 : 9.5; r-m slightly beyond middle of discal cell; m-m slightly shorter than penultimate section of M_{1+2} , at angle of 80° to that; ultimate section of M_{1+2} is $8.5 \times$ length of penultimate; ultimate section of M_{3+4} about $2 \times$ of penultimate. *Abdomen*: Tergites sparsely covered with setae, *mar* long; tergite 6 as long as 5. *Terminalia*: Ovipositor sheath as long as tergite 6, pubescent on proximal $1/3$. *Length*: Body 1.67 mm; wing 2.

DISTRIBUTION: Japan (Hokkaido).

Holotype ♀, Kotoni, Sapporo, Hokkaido, 4 July 1947, on *Allium*, Y. Nishijima.

There are 2 onion-miners, *L. allia* Frost and *L. allivora* Frick from N. America. In *nipponallia* the brown area of postgenae narrowly reaches to the postorbits, abdominal tergites not yellow on sides, costal section 2 is $4 \times$ as long as length of 3, ultimate section of M_{3+4} is $2 \times$ the penultimate, differing from the allied species.

HOST: *Allium fistulosum* L.

Liriomyza philadelphia Sasakawa, n. sp. Fig. 82.

ADULT. *Male*: Head yellow; ocellar triangle centrally pale brown, *oc* and *pvt* growing on yellow area; occiput and dorsal $3/4$ of postgenae dark brown, extending dorsolaterally to postorbits, both *vt* growing on yellow; antennal grooves with slight brown tinge; antennae and palpi yellow; arista brown. Thorax yellow; mesonotum shining black except for yellow lateral and posterior margins, slightly pollinose, *prs* and *opa* growing at edge of yellow area, *ipa* on yellow, posterior yellow part extending anteriorly midway between 3 and 4. *dc* and laterally between 4. *dc*; mesopleura with brown stripes along ventral margins, anteriorly about $2/3$ as high as its own height but narrowing posteriorly; pro-, sterno- and hypopleura broadly brownish ventrally. Wings hyaline; veins pale brown, basally yellowish; calypteres yellowish, with margins and fringe dark brown. Legs with coxae and femora brown, tibiae yellowish brown, trochanters, knees and tarsi yellow. Abdomen brown, subshining, slightly pruinose, broadly yellow on lateral sides and narrowly along posterior margin, tergite 6 without yellow posterior margin; cerci yellow.

Head: Front nearly $1.5 \times$ as wide as eye, as broad as long, converging ventrally; parafrontalia about $1/4$ width of front, almost parallel-sided. Ocellar triangle ventrally not

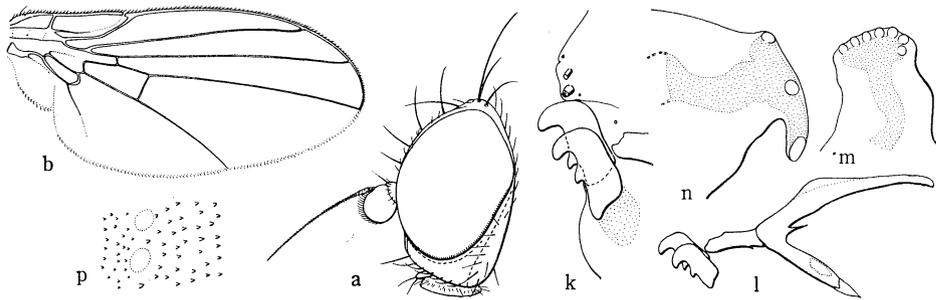


Fig. 82. *Liriomyza philadelphi* Sasakawa, n. sp.

reaching to level of 1. *ors*, with a pair of setulae plus *oc*. Lunule semicircular, $1/3$ as high as length between its dorsal tip and anterior ocellus. Fronto-orbitals 4 pairs; *ors* directed up and slightly outwards; *ori* in- and slightly upwards; *oh* sparsely in a row. In profile parafrontalia linearly extending beyond eye; eyes $1.3 \times$ as high as broad, almost bare; genae $1/8$ eye height; peristome loosely arcuate, bearing 6 short *pm*. Face concave, slightly narrower than high; parafacialia linear. Antennae approximated at bases; segment 3 small, as broad as long, with long pile apically; arista longer than $2 \times$ as long as whole length of antenna, swollen on basal $1/5$, minutely pubescent. *Thorax*: Mesonotum with $1+3$ *dc*, 1. *dc* situated on level of *prs*, distance between 3 and 4. *dc* $1.5 \times$ as long as that between 2 and 3. *dc*; 4 rows of *acr* extending posteriorly just behind level of 3. *dc*; *ia* shorter than *ipa*, accompanying about 9 setulae in 3 rows; *ipa* $1/2$ length of *opa*; humeri each with 6-8 setulae plus *h*. Mesopleura with 4-5 dorsally directed setulae; sternopleura with 2 setulae before *sp*. *Wing*: Costa with sections 2-4 in proportion of $35 : 11 : 10$; r-m located almost at middle of discal cell; ultimate section of M_{1+2} about $7 \times$ as long as penultimate section; ultimate section of M_{3+4} about $2 \times$ penultimate. *Abdomen*: Tergite moderately covered with setae, *mar* long; tergite 6 slightly longer than 5. *Length*: Body 1.5 mm; wing 1.67.

Female: Similar to ♂, but abdomen darker, yellow margins of tergites narrower, only broader on 6. Ovipositor sheath shiny black, as long as tergite 6, pubescent on basal $1/2$.

LARVA. Full grown larva yellow, 2.7 mm in body length. Head without spinule dorsad of sensory organs; longitudinal sclerite weakly sclerotized; mandibles rectangular, each with 2 teeth. Anterior spiracles small, 40μ high, broadly separated from each other at base, each with 7 bulbs; posterior spiracles brown, each with 3 bulbs. Cuticular processes brown, triangular, spinal pattern: on lateral side, $1T=5.3$, $2T=2-3.0$, $3T=3-5.2$, $1A=3-5.3-4$, $2-6A=5-6.3-4$, $7A=4-5.4$, $8A=4.0$, on ventral, $3T-8A=2-3.0$; $D=0$. Posterior end without distinct papilla.

PUPARIUM. Brown, oval, narrowing posteriorly, about 2 mm in length; ventral side flattened; segmental constriction distinct.

DISTRIBUTION: Japan (Honshu).

Holotype ♂, allotype ♀, Kibune, Kyoto, 6 June 1956, on *Philadelphus*, Sasakawa.

This new species may be distinguished from *L. decempunctata* by the dark mesopleura, femora and abdomen. *L. philadelphi* is most closely related to *L. melanorhabda* Hendel but

differs from the latter by the long pile on the antennal segment 3, the dense rows of the acrostichals, the distinct intra-alar bristles.

BIONOMICS. *Host*: *Philadelphus satsumi* Sieb. *Mine*: Greenish white in color, ophi-stigmatonome, of the upper surface type. *Pupation*: Takes place in the ground.

Liriomyza praeusta Sasakawa, n. sp. Fig. 83.

ADULT. Male: Head yellow; ocellar triangle, occiput and postgenae dark brown, extending dorsally to dorsal 1/3 of postorbis and midway between bases of *vte* and *vti*; *vti* growing on yellow part of vertex; face slightly tinged with brown; antennae and palpi dark yellow, arista brown. Thorax black; mesonotum subshining, grayish pruinose, with yellow lateral stripes and caudolateral spots, *prs* and *ipa* growing at edge of black area and *opa* at edge of yellow; scutellum with brown triangles lateroproximally, *bs* growing on yellow part; dorsal 1/3 of mesopleura, dorsal margin of sternopleura yellow. Wings hyaline; veins pale brown, basally yellow; calypteres yellowish, with margins and fringe pale brown. Legs black, all femora distally yellow as long as own width, proximal ends of all tibiae yellow narrowly, tarsi tinged with brown. Abdomen brown to dark brown, gray pruinose, anterior 5 tergites with broadly yellow lateral and narrowly yellow caudal margins; cerci brownish yellow.

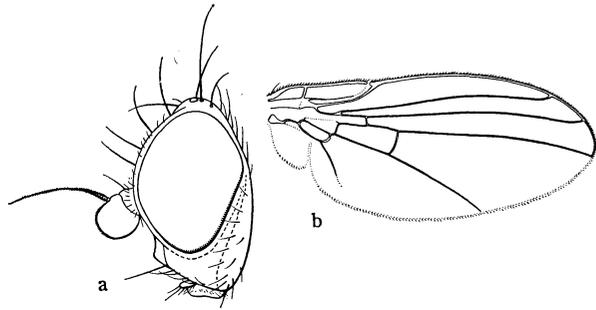


Fig. 83. *Liriomyza praeusta* Sasakawa, n. sp.

Head: Front about $2 \times$ as wide as eye, broader than long, distinctly convergent ventrally; parafrontalia nearly $1/4$ width of front, narrowing ventrally. Ocellar triangle of normal size, with a pair of setulae plus *oc*. Lunule flat, semicircular, about $1/3$ as high as length between its dorsal tip and anterior ocellus. Fronto-orbitals 4 pairs; 1. *ors* directed up- and slightly outwards, 2. *ors* upwards; *ori* directed in- and slightly upwards; *oh* in a row. In profile parafrontalia and parafacialia slightly extending beyond eye-margin; eye about $1.3 \times$ as high as wide, almost bare; gena about $1/4$ eye height. Face as high as wide, with carina low and broad; antennal grooves shallow. Parafacialia scarcely $1/2$ as wide as diameter of antennal segment 1. Antennae with bases approximated; segment 3 subspherical, as long as wide, minutely pilose; arista $2 \times$ as long as whole length of antenna, swollen on basal $1/4$, microscopically pubescent. **Thorax:** Mesonotum with 1+3 *dc*, 1. *dc* before level of *prs*, 3. *dc* before level of *sa*, distance between 3 and 4. *dc* $1.5 \times$ as long as that between 2 and 3. *dc*; 4 rows of *acr*, becoming sparser behind level of 3. *dc*, ending just before level of 4. *dc*; 3 rows of 12-13 *ia*-setulae behind suture; *ipa* about $2/3$ length of *opa*; humeri each with 6 setulae plus *h*. Mesopleura with 2 dorsally directed setulae; sternopleura with a setula before *sp*. **Wing:** Costa with sections 2-4 in proportion of 53 : 13 : 10; r-m located at middle of discal cell; m-m shorter than penultimate section of M_{1+2} and perpendicular to that; ultimate section of M_{1+2} about $6 \times$ length of penultimate; ultimate section of M_{3+4} about $2 \times$ penultimate. **Abdomen:** Tergites moderately

setigerous, *mar* long; tergite 6 almost as long as 5. *Length*: Body 2 mm; wing 2.5. *Female*: Unknown.

DISTRIBUTION: Japan (Hokkaido).

Holotype ♂, Ashoro, Hokkaido, 16 June 1954, Sasakawa.

The present new species distinctly differs from *L. pulchella* by the main character given in the foregoing key. It is very closely related to the Holarctic species, *L. flaveola* Fallén in the coloration of the vertex, mesopleura and femora. But, in the related species, there are only 3 setulae in each intra-alar row behind the transverse suture; metapleural callus is yellow, while in *praeusta* brown; the femora are yellow on distal 1/3, while in *praeusta* yellow only on distal 1/4. Bionomics unknown.

***Liriomyza pulchella* Sasakawa, n. sp.** Fig. 84.

This species is extremely similar to *praeusta* in color and appearance, but separable from the allied species by the following points:

Head with dorsal halves of postorbits and vertical angles black, both *vt* arising from black area; scutellum laterally with large black triangles, *bs* arising from black part; distal 1/6 of femora yellow; abdomen black, tergites except for 5 with yellow caudal margins; ovipositor sheath black.

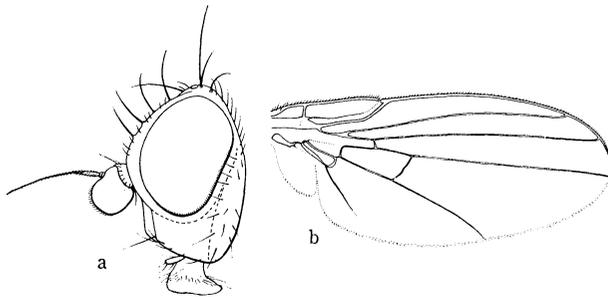


Fig. 84. *Liriomyza pulchella* Sasakawa, n. sp.

Front 1.5× as wide as eye, as broad as long, almost parallel-sided; parafrontalia about 1/5 width of front, parallel-sided, *ori* 2 or 3; genae 1/3 eye height; parafacialia 2/3 as wide as diameter of antennal segment 1. Mesonotum with 1. *dc* situated slightly before level of *prs*, 3. *dc* on level of *sa*; 3-5 *ia*-setulae; *ipa* as long as 3. *dc* and slightly shorter than *opa*; humerus

with 3-5 setulae plus *h*. Mesopleura with 4 dorsally directed setulae. Costa with sections 2-4 in proportion of 65 : 14 : 14; m-m at angle of 80° to penultimate section of M_{1+2} . Ovipositor sheath about 2 × as long as 5, pubescent on basal 1/2. *Length*: Body 2.67 mm; wing 3. Male unknown.

DISTRIBUTION: Japan (Hokkaido).

Holotype ♀, Experimental Forest of Kyoto Univ., Nukabira, Hokkaido, 14 June 1954, Sasakawa.

This species also distinctly differs from *L. pedestris* Hendel known from Europe by its projected parafacialia, shorter ultimate section of M_{3+4} and dark face. Bionomics unknown.

***Liriomyza securicornis* Sasakawa, n. sp.** Fig. 85.

Readily distinguished from *anaphalidis* and similarly colored species by the following

characters:

Male: Thorax with black pleura, mesopleura with yellow dorsal margin which is about 1/5 of its height, dorsal margin of sternopleura narrowly yellow; brown lateral triangles of scutellum extending posteriorly midway between bases of *bs* and *as*. Legs with coxae brown except for yellow distal ends, trochanters and femora yellow, the latter brownish on proximal 1/4–1/3, tibiae and tarsi brown but paler on fore-legs. Abdomen more densely dusted than on mesonotum, tergites with yellow caudal and lateral margins.

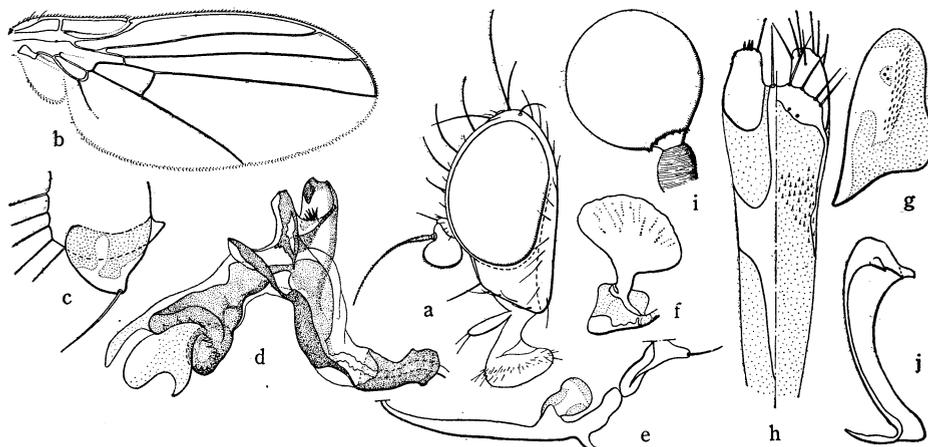


Fig. 85. *Liriomyza securicornis* Sasakawa, n. sp.

Front $2 \times$ as wide as eye; in profile parafrontalia more narrowly extending beyond upper eye-margin; genae about 1/4 eye height; antennal segment 3 slightly broadened distally in hatchet-form, more or less angulated dorsoapically. Mesonotum with 1. *dc* slightly before level of *prs*; 4 rows of *acr* extending posteriorly level of 3. *dc*, 2–3 pairs of them ending before level of 4. *dc*; 6–8 *ia*-setulae; humeri each with 5–6 setulae plus *h*. Mesopleura with 2 dorsally directed setulae; sternopleura usually with a setula before *sp*. Costa with 3 sections in proportion of 38 : 11 : 8; r-m situated slightly before or at middle of discal cell; ultimate section of M_{1+2} is $7-8 \times$ length of penultimate; ultimate section of M_{3+4} about $2 (1.7-2.3) \times$ penultimate. Surstyli small, sclerotized only at distal margin, each with a long seta; cerci about 2/3 height of epandrium. Basiphallus rather long; para- and hypophallus with distinct ventral processes, accompanying with a spinulate process between them; endophallus very long, with dorsal lobes spinose internally. Ejaculatory apodeme about 170μ in length and width, bulb somewhat rhombic. *Length*: Body 1.5 mm; wing 1.67.

Female: Tergites 4–5 without yellow caudal margin but 6 broadly yellow. Ovipositor sheath shining black, about $1.5 \times$ as long as tergite 6, pubescent on proximal 1/2; apodeme 3/4 length of sheath, pouched on anterior 2/3. Egg guides suboval, about 80μ long, bearing 3 sensillae and numerous setulae. Tergite 9 is 180μ long; sternite 100μ long, with 4 pairs of *nsm* and 2 pairs of sensillae; cerci each with 3 *ts* which are 1/6 length of cercus. Spermathecae orbicular, minutely sinuate at proximal end, 72×72 to $80 \times 80 \mu$, necks 4μ long, ducts transparent, 160μ long, 12μ in diameter. Ventral receptacle with

body $100\ \mu$ long, with a pair of processes at distal end. *Length*: Body 1.5-2 mm; wing 1.5-2.67.

DISTRIBUTION: Japan (Hokkaido).

Holotype ♂, Kamishihoro, Hokkaido, 13 June 1954; allotype ♀, Ashoro, 16 June 1954, Sasakawa; 4 paratypes, same data as holotype.

This new species is unique among Japanese species of this genus in the hatchet-shaped antennal segment 3. The Holarctic *L. angulicornis* (Malloch) and the Palearctic *triglochinae* Hendel have the same antennae, but their yellow prescutellar area is larger, quadrate in shape, differing from the present species. Bionomics unknown.

Liriomyza sonchi Hendel, 1931, IN Lindner: Die Flieg. palaearkt. Reg. 59: 247. Fig. 86.

This species is paler than *bryoniae*, dark area of postgena not reaching postorbis; mesopleura with pale brown spot on ventromedian part; femora entirely yellow; best distinguished by the terminalia in which the ventral process of distiphallus broadly membranous, without fasciculus; ovipositor sheath pubescent all over surface, apodeme pouched on anterior 1/4, egg guides $55\ \mu$ long, with 2 sensillae, cerci each with 5 *ts*, spermathecae orbicular, $64 \times 64\ \mu$; necks only 1/8 of capsule; ducts $200\ \mu$ long, brown-tinged and broadened on distal 2/3, $16\ \mu$ in diameter.

Many, including puparia, Sapporo, 17 June 1947, on *Sonchus*, Nishijima; 2 July 1956, T. Kumata; Jyōzankei, Hokkaido, 10 July 1954, on *Taraxacum*, Sasakawa; Kibune, Kyoto, 10 June 1953, on *Lactuca*, Sasakawa; Matsuyama, Ehime Pref., 25 Nov. 1950, on *Lactuca*, Yano.

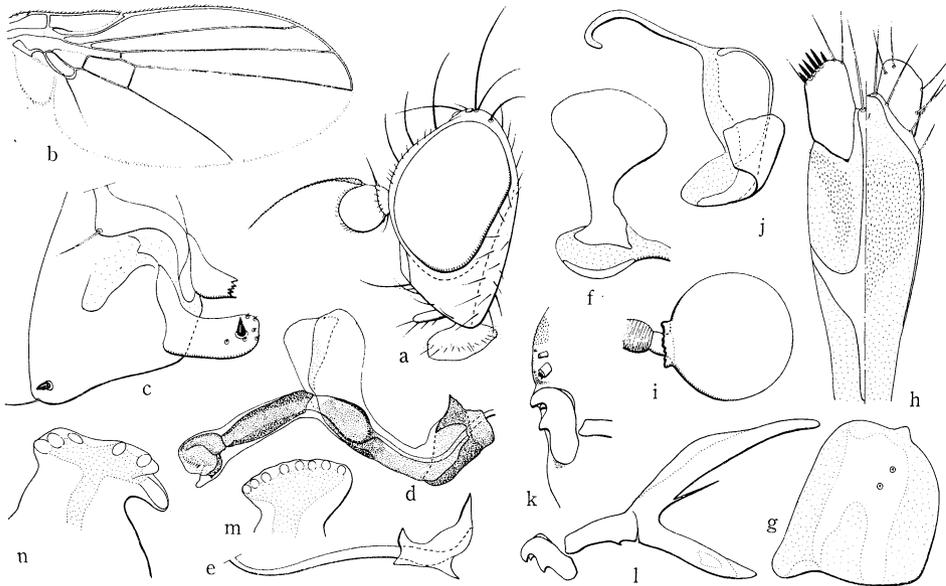


Fig. 86. *Liriomyza sonchi* Hendel.

DISTRIBUTION: Europe, Japan.

HOSTS: *Sonchus arvensis* var. *uliginosus* Trautv., *Lactuca debilis* Maxim., *Taraxacum platycarpum* Dahlst.

Liriomyza takakoe Sasakawa, 1954, Saikyo Univ., Sci. Rep., Agr. 6: 116. Fig. 87.

Terminalia: Epandrium with a pair of spines on caudoventral angles and a pair of strong spines just above that; surstyli suboval, each bearing 5-9 setae. Distiphallus shorter than sidepieces of hypandrium, paraphallus distally with spinose process, endophallus with distal tubes spinulose on laterodistal part and 2 sharp spines at inner side of opening. Ejaculatory apodeme 130-140 μ long, 120-160 μ wide.

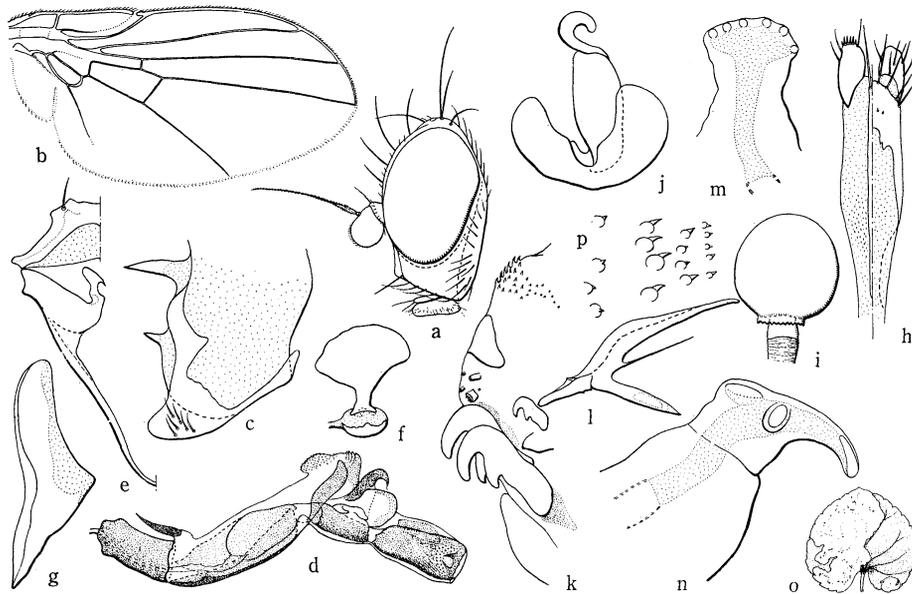


Fig. 87. *Liriomyza takakoe* Sasakawa.

Ovipositor sheath $2/3$ length of tergite 6, pubescent on proximal $4/5$; apodeme as long as sheath, pouched on anterior $1/3$. Egg guides relatively elongated, 120-160 μ long. Tergite 9 narrow, stripe-like, 140-160 μ long, sternite with 4 pairs of *nsm*; cerci each with 4 long and 2 minute *ts*. Spermathecae orbicular, 30×35 to $32 \times 40 \mu$, necks about 10 μ long, ducts 180-220 μ long, brown-tinged and broadened on distal $2/3$, about 15 μ in diameter.

Additional many, including larvae, Kibune, Kyoto, 4-6 June 1956, on *Viola*, Sasakawa.

DISTRIBUTION: Japan.

HOST: *Viola nipponica* Maxim.

Liriomyza trifolii (Burgess), 1880, U. S. Dept. Agr., Ann. Rep. 1879: 200. Fig. 88.

Male terminalia with following modifications: epandrium with 2 spines on each pos-

teroverventral angle; distal lobes of endophallus with a row of spines. Ejaculatory apodeme 160 μ long and wide.

Ovipositor sheath slightly longer than tergite 6, pubescent on proximal 1/2; apodeme as long as sheath, pouched on anterior 1/2. Egg guides suboval, 85 μ long, each with 2 setulae and 3 sensillae. Tergite 9 is 160 μ long, sternite 100 μ long, bearing 4 pairs of *nsm*; cerci each with 6 short *ts*. Spermathecae orbicular, with serrated proximal margin, 50 \times 45 μ ; necks somewhat constricted at middle, 16 μ long, ducts 240 μ long, brown-tinted and broadened on distal 3/4, 12 μ in diameter.

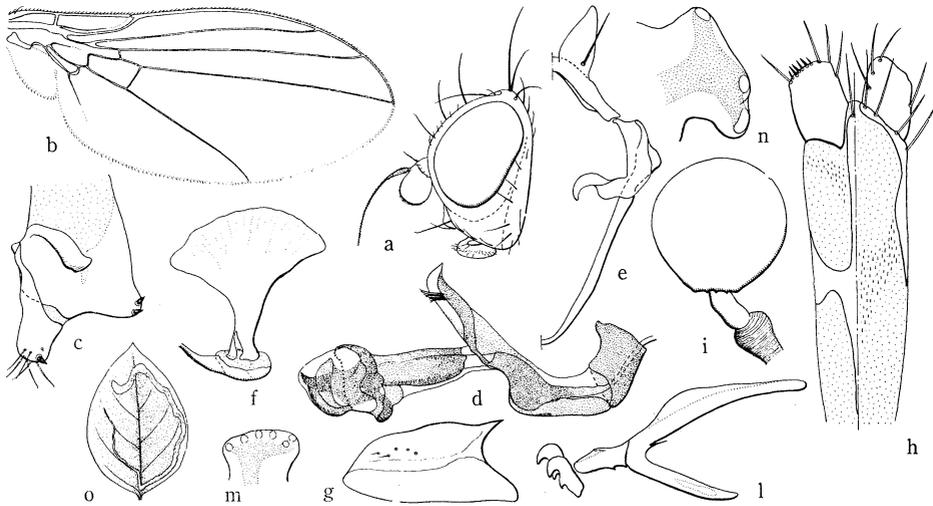


Fig. 88. *Liriomyza trifolii* (Burgess).

Many were reared from larvae, in *Glycine*, Sapporo, 7 & 27 July 1949, Shioya beach, Hokkaido, 20 Aug. 1949, on *Lathyrus*, Nishijima; Jyōzankei, 10 June 1954, Sasakawa; Morioka, Iwate Pref., 28 May 1953, on *Trifolium*, Sasakawa.

DISTRIBUTION: Europe, N. Africa, E. Asia, Japan, N. America.

HOSTS: *Glycine max* Merrill, *Lathyrus maritimus* Bigel., *Trifolium repens* L.

10. Genus *Metopomyza* Enderlein, 1936

KEY TO ADULTS

Mesonotum entirely black; 0+3 *dc* **flavotata**
 Mesonotum with yellow lateral stripes; 1+3 *dc* **laeta**

Metopomyza flavotata (Haliday), 1833, Ent. Mag. 1: 173. Fig. 89.

A shining black species with medially yellow scutellum.

Terminalia: Epandrium dorsally 1/3 as long as tergite 6, bearing 2 rows of spines,

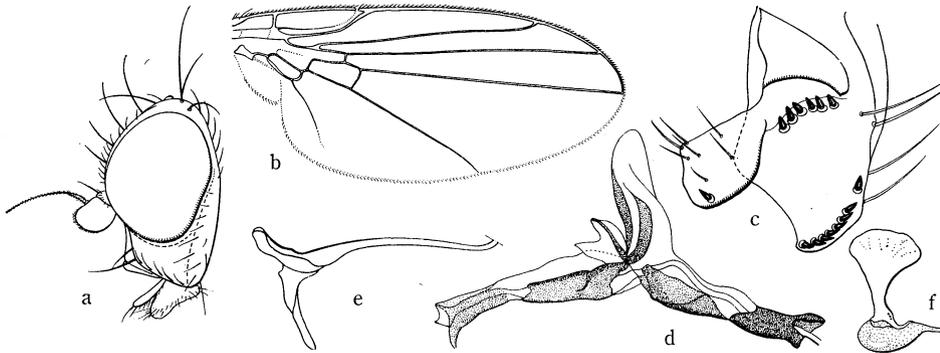


Fig. 89. *Metopomyza flavonotata* Haliday.

of which dorsal row with 6–9 spines located on ventral 1/3 and ventral row with 9–10 spines along ventral margin; surstyli subcylindrical, each with a spine and about 7 setae; cerci about 1/3 as high as epandrium. Hypandrium with sidepieces slender, about 1/2 length of phallapodeme. Processus longus conical, curving ventrally. Distiphallus as long as sidepieces of hypandrium. Ejaculatory apodeme about 100 μ long and 80 μ broad, stem with a few sensillae, bulb with a small chitinous plate.

DISTRIBUTION: Europe, Japan.

HOST: *Holcus* sp.

Metopomyza laeta Sasakawa, 1955, Japan Jour. Appl. Zool. 20 : 116.

Fig. 90.

A species with brownish black head, yellow lateral stripes on mesonotum, yellow knees, pale brown squamal fringe and brown abdomen; *acr* in 4 rows.

Terminalia: Similar to *flavonotata*, but quite different as follows: epandrium more narrowing ventrally than dorsally, 11–13 spines arranged in 2 rows along each ventral margin, 17–19 spines in 2 rows dorsad of that; surstyli conical, each with 2 spines basal-

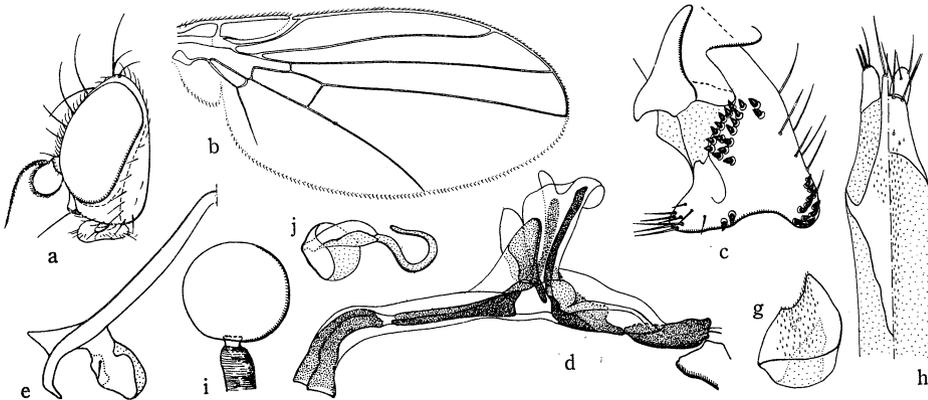


Fig. 90. *Metopomyza laeta* Sasakawa.

ly and 9-11 setae apically; endophallus longer; ejaculatory apodeme 140μ long, 108μ broad.

Ovipositor sheath as long as tergite 6, pubescent all over surface; apodeme conical, longer than sheath, pouched on anterior 1/3. Egg guides subtriangular, about 50μ long, distally covered with setulae, mesally with 3 sensillae. Tergite 9 cruciform, weakly sclerotized proximally, 175μ long; sternite rather broad distally, 60μ long, bearing 2 pairs of *nsm* and 3 pairs of sensillae; cerci each with 2-3 *ts*. Spermathecae orbicular, $40 \times 50 \mu$; necks narrow and 8μ long; ducts 260μ long, brown and broadened on distal 1/2, 12μ in diameter; ventral receptacle with body 60μ long, tail about $1.5 \times$ as long as body.

DISTRIBUTION: Japan.

11. Genus *Phytoliriomyza* Hendel, 1931

Phytoliriomyza perpusilla (Meigen), 1830, Syst. Besch. bekann. eur. Zweifl. Insekt. 6: 181. Fig. 91.

A minute whitish yellow species with brown mesonotum and scutellum; wings gray-brownish hyaline, knobs of halteres darker. Mesonotum with 1+3 *dc*, 2 sparse rows of *acr*, without *ia*; costa with 3 sections in proportion of 30 (25-36) : 8 : 6; ultimate section of M_{3+4} 2.3-2.5 \times as long as penultimate.

Epandrium about 1/3 as long as tergite 6, broadened ventrally, with 5 spines along each ventral margin; surstyli subcylindrical, projected anteroventrally, each bearing 4 spines at tip; cerci almost as high as epandrium. Processus longus with dorsal lobes bearing a pair of setae. Hypandrium with sidepieces slender, a little longer than 1/2 length of phallopodeme, bearing a pair of elongate processes near posteroventral ends. Distiphallus shorter than hypandrium; paraphallus subequal in length to endophallus, bearing a pair of

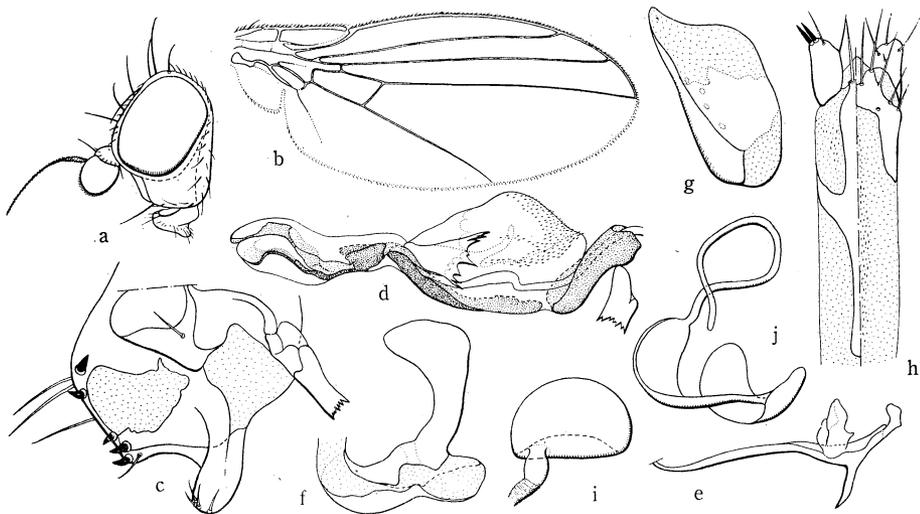


Fig. 91. *Phytoliriomyza perpusilla* (Meigen).

serrulate processes and a spine-like process. Praegonites with 1-2 sensory setae; ventral processes of postgonites about 1/3 length of sidepieces of hypandrium, bearing 3 sensillae at tip. Ejaculatory apodeme 55 μ long, 30 μ broad; bulb large; duct about 12 μ in diameter.

Ovipositor sheath shiny, dark brown, slightly shorter than tergite 6, pubescent on ventral 1/2; apodeme almost as long as sheath, sclerotized only on dorsomesal part, pouched on anterior 1/3. Egg guides subovate, about 75 μ long, with 4 sensillae. Tergite 9 cruciform, 180 μ long, sternite about 80 μ long, bearing 5 pairs of *nsm* and a pair of sensillae; cerci relatively short, each with 2 *ts*. Spermathecae semispheroidal, 44 \times 64 to 48 \times 76 μ ; necks about 1/3 as high as capsule; ducts 360 μ long, broadened and browned on distal 1/5, about 12 μ in diameter; ventral receptacle with body 70 μ long, tail almost colorless.

Many, Kamishihoro, Hokkaido, 13 June 1954, Akan, Hokkaido, 17 June 1954, Sasakawa; Koniya, Amami-Oshima, Amami Is., 22 Apr. 1956, Sasakawa.

DISTRIBUTION: Europe, N. Africa, Japan, N. America.

The larvae mine the stems of *Crepis*, *Lapsana* and *Sonchus* in Europe.

12. Genus *Phytagromyza* Hendel, 1920

KEY TO ADULTS

1. Wing tip situated between apices of R_{4+5} and M_{1+2} 2
Wing tip at apex of M_{1+2} 4
2. Mesonotum entirely black..... 3
Mesonotum with yellow lateral stripes. Legs yellow **magna**
3. Legs entirely black **nigricauda**
Legs with all knees broadly, and tibiae and tarsi yellow **tarsata**
4. Cross-vein m-m present..... **metaplecicola**
Cross-vein m-m absent..... 5
5. Antennal segment 3 suborbicular; lunule semicircular; occiput with white pubescence **fraxinivora**
Antennal segment 3 suboval; lunule higher than semicircular; occiput without white pubescence **populi**

Phytagromyza fraxinivora Sasakawa, n. sp. Fig. 92.

ADULT. *Male*: Head yellow; ocellar triangle subshiny, centrally dark brown; occiput and dorsal halves of postgenae dark brown, its dark area usually not extending to postorbites, rarely reaching to dorsal halves of postorbites; both *vt* growing on yellow part but rarely on pale brown area; antennae yellow, segment 3 sometimes darker, arista brown; proboscis and palpi yellow. Mesonotum brownish black, densely dusted with gray, dorsally often separated into 5 vittae by yellow areas, median one extending posteriorly just behind level of 3. *dc*, linearly separated from 1st lateral stripes which are narrowed posteriorly and ending just behind level of 4. *dc*, 2nd lateral stripes short, extending between bases of *sa* and *pa*, laterally with yellow stripes, *prs* and *pa* at edge of yellow part, *ipa* sometimes on black part; scutellum mostly yellow on dorsal side, rarely narrowly and long-

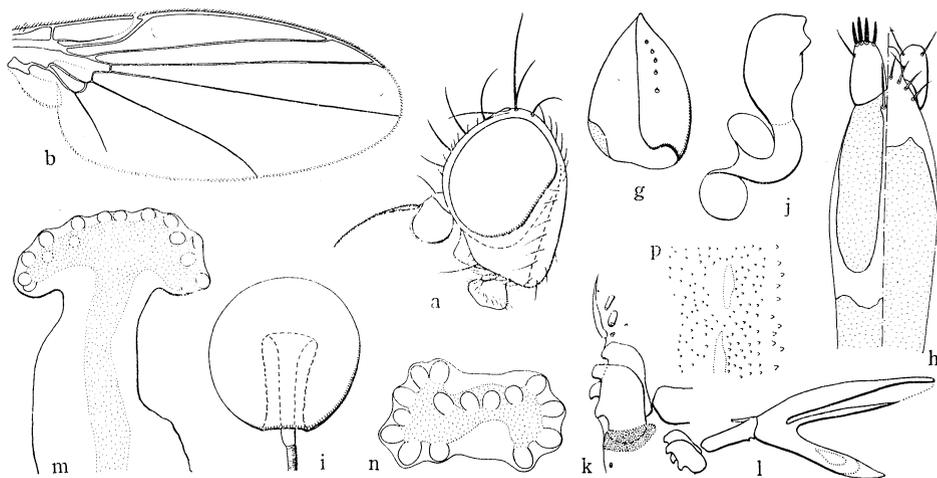


Fig. 92. *Phytagromyza fraxinivora* Sasakawa, n. sp.

itudinally yellowish, with lateroproximal brown spot, *bs* usually growing on yellow part; humeri yellow, rarely with brown spot; pleurae yellow, mesopleura with pale brown spot on ventromedian part, rarely broadly pale brown on ventral 2/3; brown triangles of sterno- and hypopleura broadly separated from each other. Wings hyaline; veins pale brown; calypter yellowish white, with margin and fringe pale brown; halteres yellow. Legs yellow, rarely coxae proximally and femora excepting distal ends distinctly darkened, tibiae and tarsi slightly brown-tinged. Abdomen brown, subshiny, tergites yellow on caudal 1/2, also broadly yellow on lateral sides; epandrium yellowish brown, cerci yellow.

Head: Front $2 \times$ as wide as eye, broader than long, sides slightly converging ventrally; parafrontalia $1/5$ width of front, almost parallel-sided. Ocellar triangle ventrally extending almost to level of 1. *ors*, bearing a pair of setulae plus *oc*. Lunule semicircular, $1/3$ as high as distance between its dorsal tip and anterior ocellus. Fronto-orbitals 4 pairs; *ors* directed up- and outwards; *ori* inwards; *oh* sparsely in a row. In profile parafrontalia and parafacialia extending beyond above eye-margin; eyes $1.3 \times$ as high as broad, very sparsely hairy; genae $1/4$ – $1/3$ eye height; *vi* long, 3–5 *pm* in a row. Occiput bearing 4 rows of white pubescence. Face weakly concave, as high as wide; antennal grooves deep. Parafacialia $2/3$ as wide as diameter of antennal segment 1. Antennae approximated at bases; segment 3 almost as broad as long, with white pile; arista $1.5 \times$ as long as whole length of antenna, swollen on proximal $1/3$. **Thorax:** Mesonotum with 1+3 *dc*, anterior 2 approximately $1/3$ length of 4. *dc*, 1. *dc* situated at level of *prs*, 3. *dc* far before level of *sa*; 4 rows of *acr*, becoming sparser posteriorly, ending at level of 4. *dc*; *ia* absent, 2–3 setulae just behind transverse suture; *sa* long; *ipa* nearly $1/3$ length of *opa*; humeri each with 3–7 setulae plus *h*. Mesopleura without or with 1 dorsally directed setula; sternopleura without setula before *sp*. **Wing:** Costa with 3 sections in proportion of 40 : 11 : 13. **Abdomen:** Tergites very sparsely covered with setae, *mar* long; tergite 6 distinctly longer than 5. **Length:** Body 1.5 mm; wing 1.67.

Female: Similar to ♂, but sternite 5–6 each $2.5 \times$ as broad as long. **Terminalia:**

Ovipositor sheath glossy, brownish black, as long as tergite 6, pubescent on basal $1/3-1/2$; apodeme conical, weakly sclerotized, slightly longer than sheath, pouched on anterior $1/3$. Egg guides well sclerotized, suboval, about 50μ long, with about 6 sensillae, with mesal process pointed distally. Segment 9 is 200μ long, tergite trifurcate, 100μ long, sternite sclerotized only at posterior end, laterally uniting with tergite, bearing 4 pairs of short setae; cerci each with 4 *ts*. Spermathecae suborbicular, $76 \times 80 \mu$, necks 50μ long, ducts narrow, about 4μ in diameter. Ventral receptacle with body 50μ long. *Length*: Body 1.5–1.8 mm; wing 2–2.25.

PUPARIUM. Brown, 2 mm long, 1 mm broad, suboval, dorsal and ventral sides somewhat flattened; segmental constriction rather distinct. Larval exuviae: head with long but narrow longitudinal sclerites; mandibles each with 2 teeth; dorsal process of paraclypeal phragma with distinct ventral arm, ventral process $2/3$ length of dorsal; adductor apodeme distinct. Anterior spiracles approximated at base, furcate, 120μ in height, each with 16–18 bulbs; posterior spiracles conical, smaller than anterior spiracles, each separated by its own diameter, projected posterolaterally, each with 13–16 bulbs. Cuticular processes of posterior rows along anterior margin of each segment largest, pattern on lateral side of abdominal segment 3 as 5–6·4–5, decreasing dorsally and ventrally, absent on ventromedian part of all segments and dorsomedian part of posterior 4 segments. Posterior end with a pair of papillae just ventrad of spiracles.

DISTRIBUTION: Japan (Hokkaido, Honshu, Kyushu).

Holotype ♂, allotype ♀, Sapporo, Hokkaido, 12 Aug. 1956, T. Kumata, on *Fraxinus*. Paratypes: ♀, Kibune, Kyoto, 5 July 1954, Sasakawa, on *Fraxinus*; 2, Mt. Hiko, Fukuoka Pref., May 1956, H. Kuroko, on *Fraxinus*.

Most closely related to *populi*, not only in the wing venation, but by the chaetotaxy of the mesonotum. *P. fraxinivora* may be separated from related species by the subcircular antennal segment 3, lower lunule and the possession of white occipital pubescence. The larvae of *fraxinivora* differ from those of *populi* in having larger size and more bulbs of both spiracles.

BIONOMICS. *Hosts*: *Fraxinus longicuspis* Sieb. & Zucc. and *mandshurica* Rupr. *Mine*: Whitish green in color and ophonome.

Phytagromyza magna Sasakawa, n. sp. Fig. 93.

ADULT. Female: Head yellow, whitish pruinose; ocellar triangle centrally quadrately blackish brown, subshining; occiput blackish brown, dark area extending to dorsal $1/4$ of postorbits and just before bases of both *vt*, but *vti* growing at edge of yellow area; antennae and palpi yellow, arista slightly brownish. Mesonotum and scutellum black, densely dusted with gray-white, with yellow lateral stripes and spots at both ends of scutoscutellar suture, *prs* and *opa* growing at edge of yellow part; pleura yellow, but mesopleura with slightly brown triangle at cephaloventral corner, sternopleura and hypopleura ventrally with brown triangles which are widely separated from each other; pleurotergites brownish black. Wings hyaline, with yellow-brown tinge, darker in cell R_1 ; veins pale yellow-brown; calypteres yellowish white, with yellow margins and fringe of brown hairs; halteres yellow. Legs yellow, posterior 4 tibiae with brown tinge, tarsi brownish yellow. Abdomen dark brown, gray-dusted, tergites 2–3 and 6 with yellow posterior margins; ovipositor sheath

shiny, brownish black.

Head: Front $2.5 \times$ as broad as eye, distinctly broader than long, sides slightly converging ventrally; parafrontalia $1/6$ width of front, gradually narrowing ventrally. Ocellar triangle ventrally not reaching level of 1. *ors*; *oc* parallel. Lunule flat, lower than semicircular, $1/3$ as high as basal width or distance between its dorsal tip and anterior ocellus. Fronto-orbitals 5 pairs; *ori* 3, only 1. *ors* directed upwards, lower 4 in- and slightly upwards; *oh* long, in a row. In profile parafrontalia and parafacialia distinctly extending beyond upper eye-margin; eyes a little higher than broad, almost bare; genae about $1/3$ eye height. Face vertical, slightly higher than broad; carina sharp; antennal grooves rather deep; *pm* only 3. Parafacialia ventrally a little wider than diameter of antennal segment 1. Antennae very slightly separated from each other at base; segment 3 large, as long as broad, with white long pile; arista about $1.5 \times$ as long as whole length of antenna, swollen on basal $1/4$, pubescent. *Thorax*: Mesonotum with $1+3$ *dc*, 1. *dc* slightly before level of *prs*, 3. *dc* behind level of *sa*, distance between 2 adjacent *dc* shortening posteriorly; about 10 setulae of *acr* sparsely arranged in 2 irregular rows between 1. and 4. *dc*; *ipa* $1/2$ length of *opa*; *ia* absent; humeri each with about 10 setulae plus *h*. Mesopleura without dorsally directed setula; sternopleura with a setula before *sp*. *Wing*: Costa with sections 2-4 in proportion of $90 : 20 : 24$. *Abdomen*: Tergites moderately covered with setae, *mar* long; tergite 6 slightly longer than 5; sternite 6 is $3 \times$ as broad as long, centrally densely setigerous. *Terminalia*: Ovipositor sheath slightly longer than tergite 6, pubescent on proximal $1/3$; apodeme strongly chitinized, long conical, $1.5 \times$ as long as tergite 6, pouched on anterior $2/3$. Segment 9 membranous, dorsolaterally weakly sclerotized, tergite about 450μ long, sternite only sclerotized at

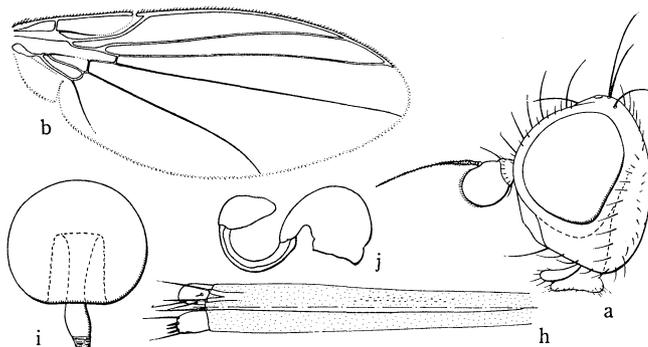


Fig. 93. *Phytagromyza magna* Sasakawa, n. sp.

bases of 2 pairs of *nsm*; cerci with 3 *ts* which are $1/3$ length of cercus. Spermathecae orbicular, with truncate proximal end, $60 \times 68 \mu$, necks 60μ long, ducts 8μ in diameter. Ventral receptacle of normal form, 80μ long. *Length*: Body 4.33 mm; wing 4.5.

DISTRIBUTION: Japan (Hokkaido).

Holotype ♀, Ashoro, Hokkaido, 16 June 1954, Sasakawa; 1 paratype, same data.

P. magna, *nigricauda*, and *tarsata* belong to the group with the wing tip between R_{4+5} and M_{1+2} . However, *magna* is highly specific in size, coloration of mesonotum and legs, height of genae, and number of rows of acrostichals. This new species is very close to the Palearctic species, *P. pyrrhocera* Hering, in having yellow head and legs, but can be separated by the character mentioned above. In *pyrrhocera* the wing length is only 1.8 mm, the genae are $1/8$ of eye height, the acrostichals are arranged in 4-5 irregular rows, about

10 intra-alars are arranged in 3 rows, and the cross-vein m-m is present. Bionomics unknown.

***Phytagromyza metaplepicola* Sasakawa, n. sp.** Fig. 94.

ADULT. Male: Head yellow; ocellar triangle faintly brownish; occiput and dorsal halves of postgenae brown; dorsal halves of postorbites yellow or pale brown; both *vt* arising from yellow part; antennae yellow, segment 3 brownish excepting basal margin, arista brown; proboscis and palpi yellow. Thorax yellow; mesonotum subshiny, very slightly pruinose, with 5 black-brown vittae, median vitta united anteriorly with lateral vittae at level of transverse suture, posteriorly extending anterior 1/3 of distance between 3. and 4. *dc*, 2 lateral vittae united anteriorly but separated posteriorly from each other along row of *ia*, ending at level of *pa*; scutellum with small brown lateral triangles, *bs* on yellow part; humerus with pale brown spot; mesopleura with pale brown spot on ventromedian part; dark brown triangles of sterno- and hypopleura broadly separated from each other. Wings hyaline; veins pale brown, basally yellow; calypteres yellowish, with margins and fringe brown; halteres yellow. Legs yellow, tibiae and tarsi with a slight brown tinge. Abdomen subshiny, brown except for yellow tergite 6, tergites with yellow lateral and caudal margins, tergites 3-5 yellowish centrally and longitudinally; epandrium brown, cerci yellow.

Head: Front as wide as either eye, about 2/3 of its length, parallel-sided; parafrontalia 1/4 width of front. Ocellar triangle with ventral tip extending to level of 1. *ors*, anterior angle between ocelli about 40°, bearing 3 setulae plus *oc*. Lunule flat, semicircular, about 1/3 as high as length between its dorsal tip and anterior ocellus. Fronto-orbitals 4 pairs; *ors* directed upwards; *ori* directed in- and slightly upwards; *oh* minute, in a row.

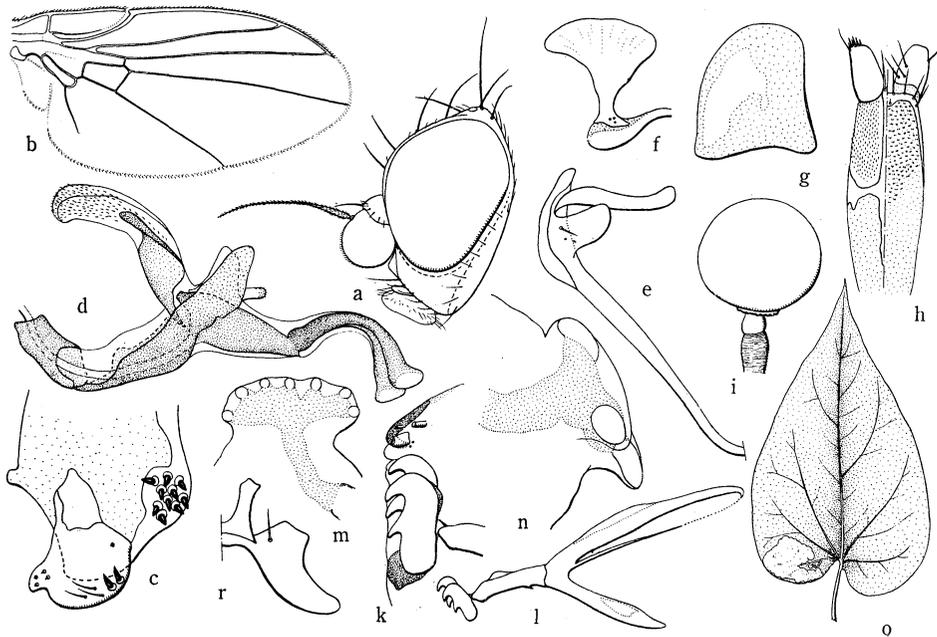


Fig. 94. *Phytagromyza metaplepicola* Sasakawa, n. sp.

In profile parafrontalia linearly extending beyond eye-margin; eyes $1.3 \times$ as high as wide, almost bare; genae about $1/5$ eye height; *vi* longer than $4-5 \mu m$. Face slightly concave, a little higher than wide; carina narrow; antennal grooves rather deep; parafacialia linear. Antennae approximated at bases; segment 3 relatively large, subspherical, with minute pile; arista $1.5 \times$ as long as antenna, swollen on basal $1/4$, pubescent microscopically. *Thorax*: Mesonotum with $1+3$ *dc*, 1. *dc* situated on level of *prs*, 3. *dc* on or slightly before level of *sa*, distance between 3. and 4. *dc* $1.5-2 \times$ as long as that between 2. and 3. *dc*; 4 rows of *acr* posteriorly extending just behind level of 4. *dc*; *ia* subequal in length to 1. *dc*, accompanying 2 rows of about 8 setulae behind suture; *ipa* $2/3$ length of *opa*; humeri each with about 9 setulae plus *h*. Mesopleura with 5 dorsally directed setulae; sternopleura with 2 setulae before *sp*. *Wing*: Costa with sections 2-4 in proportion of $32 : 11 : 11$; r-m far distad beyond middle of discal cell; ultimate section of M_{1+2} about $23 \times$ as long as length of penultimate; ultimate section of M_{2+4} about $3.5 \times$ as long as penultimate. *Abdomen*: Tergites moderately setigerous, *mar* long; tergite 6 as long as 5; sternite 5 about $1.5 \times$ as wide as long, incised on caudal $1/3$. *Terminalia*: Epandrium broadened ventrally, bearing 9 or 10 spines on each inner posteroventral angle; surstyli short, subcylindrical, slightly projected at distal end, each with 2 or 3 spines, 3 setae and several sensillae; processus longus with a pair of setae. Hypandrium with sidepieces almost $2/3$ length of phallapodeme. Paraphallus broad, about $1/2$ length of hypandrium, ventral processes setulose on membranous part. Ejaculatory apodeme 140μ long, 160μ wide. *Length*: Body 1.5 mm; wing 2.

Female: Similar to ♂, but parafrontalia $1/5$ width of front; arista $2 \times$ as long as whole length of antenna; sternite 5 is $3 \times$ as wide as long. *Terminalia*: Ovipositor sheath shiny, black, slightly shorter than tergite 6, pubescent on basal $2/3$; apodeme conical, shorter than sheath, pouched on anterior $1/4$. Egg guides subquadric, 65μ long, weakly chitinized mesally. Tergite 9 about 145μ long; sternite with 4 pairs of *nsm*; cerci each with 4 long and 2 short *ts*. Spermathecae orbicular, with notches proximally, $44 \times 52 \mu$; necks 10μ long; ducts 220μ long, brown-tinged and broadened on distal $4/5$. *Length*: Body 2 mm; wing 2.25.

LARVA. Full-grown larva yellow, 3-3.3 mm in body length. Head with brown longitudinal sclerite; mandibles each with 2 teeth, dorsal process of paraclypeal phragma with distinct ventral arm, ventral process $2/3$ length of dorsal. Anterior spiracles brown, broadly separated from each other, each knob-like, 70μ long, with 7-8 bulbs; posterior spiracles pale brown, 80μ long, each with 3 bulbs, in angle A of 120° and angle B of 60° . Cuticular processes yellow, those on anterior 1 or 2 rows along anterior margin of each segment larger than others; spinal pattern: on dorsal, $1T=8-9.0$, $2T-1A$, $7-8A=0$, $2-6A=1-2.0$; on lateral, $1T=8-9.0$, $2T=4.1$ (only on dorsal $1/2$), $3T$, $7A=4.2$, $1-2A=2-3.4-5$, $3-5A=3-5.5-6$, $6A=5.2$, $8A=3.0$; on ventral side, $1T=4.0$, $2T-3A$, $8A=0$, $4-7A=2.0$. Posterior end with a pair of tubercles midway between posterior spiracles and anus.

PUPARIUM. Yellowish brown, about 3 mm in length, subcylindric; segmental constriction distinct.

DISTRIBUTION: Japan (Hokkaido).

Holotype ♂, allotype ♀, Kamiotoineppu, Hokkaido, 23 Aug. 1958, Sasakawa, on *Metaplexis*; 2 paratopotypes, same data.

This species may be easily distinguished from *P. fraxinivora* and *populi* by the presence of the cross-vein m-m. This species is somewhat similar to the European species, *P. heringi* (Hendel), but differs in having the brown occiput, 5 blackish brown vittae on the mesonotum, and narrower front and genae.

BIONOMICS. *Hosts:* *Metaplexis japonica* Makino, *Tylophora dickinsii* Makino. *Mine:* Whitish green, ophistigmatonome, of upper surface type; the first linear part 1–1.5 cm in length, the blotch part 3–4 cm² in area. The grains of frass are greenish and irregularly scattered. *Tenancy:* Usually more than 1 mine found on a single leaf. *Pupation:* The full-grown larva abandons the mine to transform and pupation takes place in the ground.

Phytagomyza nigricauda Sasakawa, n. sp. Fig. 95.

ADULT. Female: Head black, parafrontalia and genae blackish brown, the former and ocellar triangle subshining; antennae excepting dark brown arista and palpi black; proboscis pale brown. Thorax black, subshiny, with dense gray pollen, lateral stripes of mesonotum slightly brownish; mesopleural sutures and bases of wings pale brown. Wings hyaline, veins pale brown; calypteres pale brown, with blackish margins and fringe; halteres yellow. Legs black. Abdomen shiny, brownish black, slightly gray-dusted, tergite 6 without dusting, with yellow caudal margin; ovipositor sheath glossy black.

Head: Front almost as wide as eye, as broad as long, its sides strongly converging ventrally; parafrontalia about 1/4 width of front, slightly narrowing ventrally. Ocellar triangle with ventral tip reaching level of 1. *ors*, bearing a pair of setulae plus *oc*. Lunule 1/3 as high as distance between its dorsal tip and anterior ocellus. Fronto-orbitals 4 pairs; *ors* 2, directed up- and slightly outwards; *ori* in- and slightly upwards; *oh* minute, sparsely in a row. In profile parafrontalia linearly extending beyond above eye-margin, eye nearly 1.5 × as high as wide, with minute hairs; gena about 1/8 eye height. Face concave, narrower than high; carina narrow; antennal groove deep; parafacialia linear; *vi* differs from 6 short *pm*. Antennae approximated at bases; segment 3 subspherical, as long as broad, minutely pilose; arista 2 × as long as whole length of antenna, swollen on basal 1/4, pubescent. **Thorax:** Mesonotum with 0+3 *dc*, 3. *dc* almost on level of *sa*, distance between 3. and 4. *dc* subequal to that between 2. and 3; 4 rows of *acr*, extending posteriorly to level of 4. *dc*; *ia* long; about 2 rows of setulae between rows of *dc* and *sa*; *ipa* about 1/2 length of *opa*; humerus with 6 setulae plus *h*. Mesopleura with 5–7 dorsally directed setulae; sternopleura with 2 setulae before *sp*. **Wing:** Costa with sections 2–4 in proportion of 34 : 15 : 14. **Abdomen:** Tergites sparsely covered with setae, *mar* long; tergite 6 longer than 5. Ovipositor sheath as long as tergite 6. **Length:** Body 1.8 mm; wing about 2.

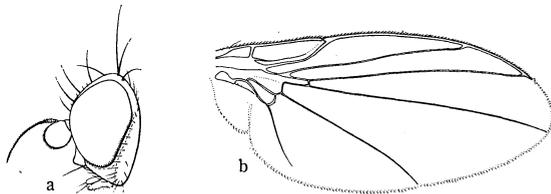


Fig. 95. *Phytagomyza nigricauda* Sasakawa, n. sp.

DISTRIBUTION: Japan (Hokkaido).

Holotype ♀, Shibecha, Forest Exp. Stat. Kyoto Univ., Hokkaido, 19 June 1954, Sasakawa.

This new species may be distinguished from the other 2 species belonging to the same

group by its entirely black legs. *P. nigricauda* is somewhat similar to the European species, *P. loniceræ* (Robineau-Desvoidy) and *Anderi* Rydén. In the first related species the genae are yellow, the mesonotum is provided with 0+4 *dc*, and the cross-vein m-m is present, differing from the present new species. In the second related species the abdominal segments 1-4 are yellow, and the orbital hairs are long, those between 2 *ors* are directed anteriorly.

Phytagromyza populi (Kaltenbach), 1864, Naturh. Ver. preuss. Rheinl. Westphal., Verh. 21 : 336. Fig. 96.

This species can readily be separated from *fraxinivora* by the following points: mesonotum with 3 black stripes, orbital hairs arranged in 2 rows; genae 1/2 eye height; antennal segment 3 suboval, arista shorter; costal ratio as 30 : 7 : 14.

Epiandrium almost 1/2 as long as tergite 6; surstyli lobe-like; cerci small, 1/5 epiandrium height. Hypandrium with sidepieces moderately broad, only 1/3 length of phallapodeme. Phallapodeme distinctly bifurcated at posterior end, extending over basiphallus. Basiphallus extremely short; distiphallus shorter than 1/2 length of phallapodeme, endophallus membranous distally, laterally with broad lobes. Ejaculatory apodeme about 100 μ long, 40 μ broad.

Ovipositor sheath about 1/2 length of tergite 6; apodeme subequal to tergites 5-6 taken together, strongly chitinized, pouched on anterior 4/5. Egg guides subtriangular, distally weakly sclerotized, about 50 μ long, with 2 sensillae mesally. Tergite 9 is 100 μ long, sternite with 3 pairs of *nsm*, pleural sclerites well-developed; cercus with 4 long *ts*. Ven-

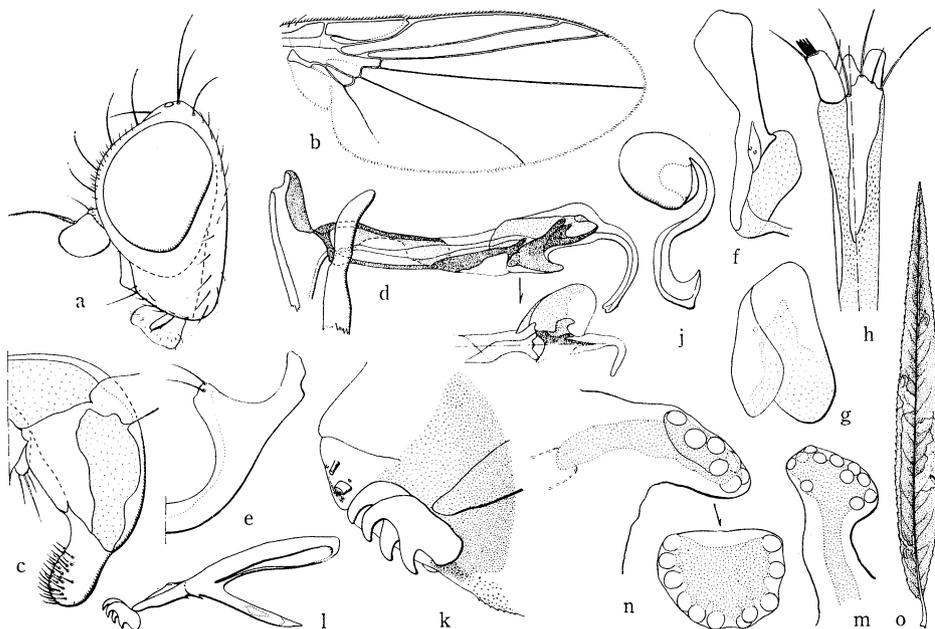


Fig. 96. *Phytagromyza populi* (Kaltenbach).

tral receptacle $280\ \mu$ long.

Spinal pattern of larva: on dorsal side, only $1T=8.0$; on lateral, $1-2T=0$, $3T=5.5$ but absent on lateroventral half, $1-2$ and $8A=10.9$, $3-7A=14.11$, processes of posterior 2-4 rows along anterior margin of each segment larger; $V=0$.

Many were reared from larvae mining leaves of *Salix*, Horikawa, Kyoto, 20 Feb.-23 Mar. 1959, Sasakawa; Morioka, Iwate Pref., 9 July 1957, Kumata.

DISTRIBUTION: Europe, Japan.

BIONOMICS. *Hosts*: *Salix babylonica* L., *Populus nigra* L. *Mine*: Greenish white, ophonome, mostly of the lower surface type (84% of the mined leaves examined) and only 16% changing into the upper surface type from the lower; mostly 65 (55-70) mm in length, 2-2.5 mm in width near end; pupal blister irregular oval in form, about 4 by 3 mm in area; M; black grains of frass deposited irregularly at right or left side in the central part of the mine. *Tenancy*: 1-22 larvae on a single leaf of *Salix* (39.7% of leaves with mines examined has single larva, 26% has 2, 10.6% has 3, 7.6% has 4, 1.5% has 5, 6.9% has 6, 2.3% has 7, 1.5% has 8, 0.8% has 9, 1.5% has 15, 0.8% has 18, and 0.8% has 22 larvae).

Phytagromyza tarsata Sasakawa, n. sp. Fig. 97.

ADULT. *Female*: Head dark brown; ocellar triangle shiny black; parafrontalia subshining; lateral parts of parafrontalia between bases of *or* and orbits, antennal grooves and peristome blackish brown; occiput and postgenae black; antennae and palpi blackish brown, antennal segment 1 and arista somewhat paler; proboscis pale brown. Thorax and abdomen shiny black, with brown-grayish dusting; mesopleural sutures and bases of wings pale brown; ovipositor sheath black, glossy distally. Wings hyaline; veins pale brown; calypteres brownish white, with brown margins and fringe of dark brown hairs; halteres yellow. Legs with coxae and femora proximally dark brown, trochanters, distal 1/4 of fore-femora and 1/5 of mid- and hind-femora, tibiae and tarsi brownish yellow, but central parts of tibiae and tarsal segment 5 darkened.

Head: Front almost $2\times$ as wide as eye, broader than long, its lateral sides slightly converging ventrally; parafrontalia about 1/4 width of front. Ocellar triangle with ventral tip extending level of 1. *ors*, bearing a pair of setulae plus *oc*. Lunule small, flat, about 1/3 as high as distance between its dorsal tip and anterior ocellus. Fronto-orbitals 4 pairs; *ors* 2, directed up- and slightly outwards; *ori* inwards; *oh* minute, in a row. In profile parafrontalia extending beyond upper eye-margin; eyes $1.3\times$ as high as broad, almost bare; genae nearly 1/5 eye height; $5\ pm$

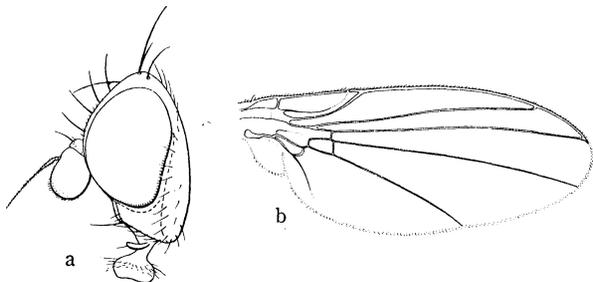


Fig. 97. *Phytagromyza tarsata* Sasakawa, n. sp.

short. Face vertical, as high as broad; carina sharply keeled; antennal grooves rather shallow. Parafacialia narrow, not linear. Antennae relatively large, approximated at bases; segment 3 longer than broad, with white distinct pubescence; arista subequal to whole length

of antenna, swollen on basal 1/3, microscopically pubescent. *Thorax*: Mesonotum with 1 + 3 *dc*, equally spaced from each other, 1. *dc* situated before level of *prs*, 3. *dc* behind level of *sa*; 6 irregular rows of *acr*, extending posteriorly level of 4. *dc*; *ia* absent, about 8 setulae in 2 rows between *dc*- and *sa*-row; *ipa* subequal to *acr* in length, *opa* long; humeri each with about 10 setulae plus *h*. Mesopleura and sternopleura without dorsally directed setula. *Wing*: Wing tip more or less near termination of R_{4+5} than M_{1+2} ; costa with sections 2-4 in proportion of 58 : 17 : 16; r-m and m-m approximating each other, far before termination of R_1 ; ultimate section of M_{3+4} about 6 × as long as penultimate. *Abdomen*: Tergites moderately setigerous, *mar* long; tergite 6 as long as 5th. Ovipositor sheath slightly shorter than tergite 6, with whitish pubescence on proximal 4/5. *Length*: Body 2 mm; wing 2.67.

DISTRIBUTION: Japan (Honshu).

Holotype ♀, Oohara, Kyoto, 5 May 1955, Sasakawa.

The present new species is most distinctive in the coloration of the legs, differing from *nigricauda* and *flavocingulata* Strobl from Europe. Bionomics unknown.

13. Genus *Napomyza* Westwood, 1840

KEY TO ADULTS

- | | |
|---|-----------------------------|
| 1. Cross-vein m-m basad or on level of r-m | 2 |
| Cross-vein m-m distad beyond level of r-m | 3 |
| 2 (1). Antennal segment 3 with long pile | hirticornis |
| Antennal segment 3 minutely pilose | lateralis |
| 3 (1). R_{4+5} terminating nearest wing tip | crawfurdiae |
| M_{1+2} terminating at or nearest wing tip | 4 |
| 4 (3). Mesonotum with 2 rows of <i>acr</i> | 5 |
| Mesonotum with 4-6 rows of <i>acr</i> | 7 |
| 5 (4). Mesonotum entirely black | lateralis |
| Mesonotum with yellow lateral stripes | 6 |
| 6 (5). Femora black | yasumatsui |
| Femora yellowish brown | yasumatsui anemoneae |
| 7 (4). Mesonotum with 4 rows of <i>acr</i> | 8 |
| Mesonotum with 6 rows of <i>acr</i> | deflecta |
| 8 (7). Costal section 3 slightly longer than 4; gena 1/6 eye height | akebiae |
| Costal section 3 shorter than 4; gena 1/4 eye height | xylostei |

Napomyza akebiae Sasakawa, 1954, Kontyû 20: 55. Fig. 98.

DISTRIBUTION: Japan.

HOST: *Akebia quinata* Decne.

Napomyza crawfurdiae Sasakawa, 1954, Kontyû 20: 57. Fig. 99.

A distinct species with dark brown head and brown-yellow abdomen, differing from the European *Gentiana*-miners, *N. gentianella* Hende! and *gentii* Hende!.

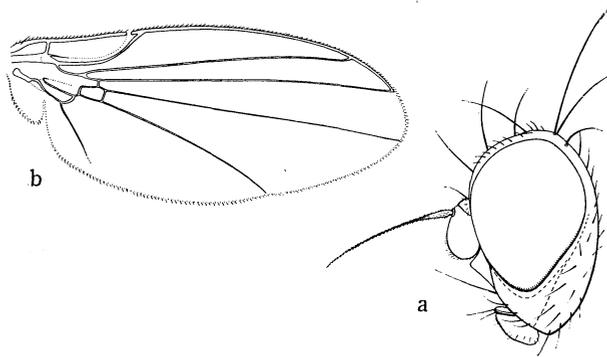


Fig. 98. *Napomyza akebiae* Sasakawa.

Male terminalia similar to *xylostei*, but surstylus with only 45 setae, endophallus less sclerotized, postgonites about 1/3 length of phallapodeme, each with a long spine at tip, ejaculatory apodeme rounded distally.

Spinal pattern of larva : on dorsal, 2T & 8A=0, 3T-1A=3.0, 2-6A=4-5 (large, broadly arranged) · 1-2 (minute), 7A=3.2 ; on lateral, 2T=2.2, 3T=4.3, 1A=0+4-5.4, 2-5A=4 (minute)+2 (large) · 4 (minute), 6A=3+1.3, 7A=4+0.4, 8A=4.0 ; on ventral side, T=0, 1A=0.4, 2-4A=4+2.4, 5-6A=4+2.3, 7A=4+1.4, 8A=2+1.0.

DISTRIBUTION: Japan.

HOST: *Crawfurdia japonica* Sieb. & Zucc.

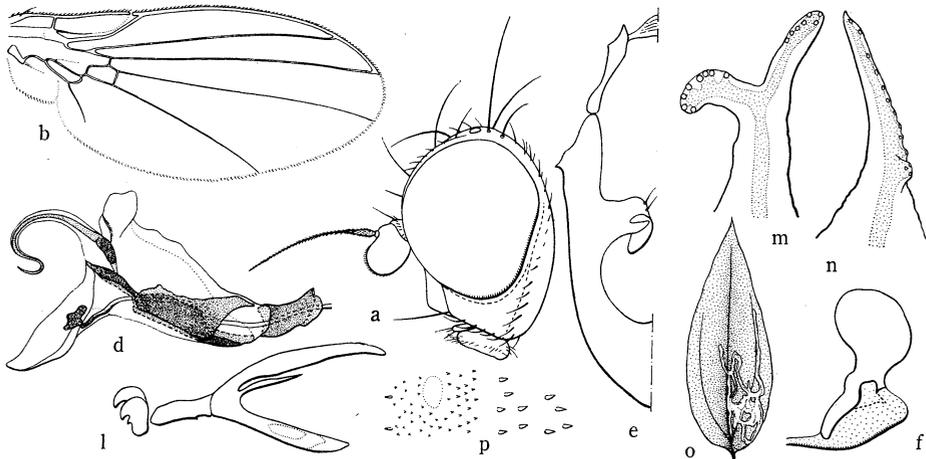


Fig. 99. *Napomyza crawfurdiae* Sasakawa.

Napomyza deflecta (Hendel), 1920, Archiv Naturg. A 84: 150.

Fig. 100.

Ovipositor sheath longer than tergite 6, densely setigerous, pubescent on proximal 1/2; apodeme strongly chitinized, nearly 1.5 × as long as sheath, pouched on anterior 1/2.

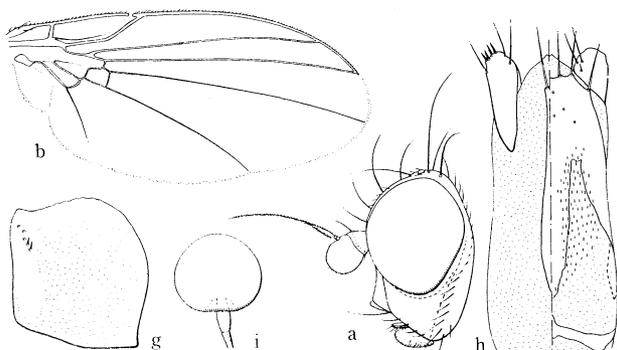


Fig. 100. *Napomyza deflecta* (Hendel).

Egg guides subquadrate, more or less pointed ventrodistally, weakly chitinized marginally, $100\ \mu$ long, each with 2 sensory setae and 3 pores. Tergite 9 narrow, stripe-shaped, $240\ \mu$ long; sternite W-shaped, slightly longer than tergite, bearing 3 pairs of *nsm*; cerci each with 4 *ts* which are $1/4$ of cercus length. Spermathecae suborbicular, with truncate proximal margin, 60×68 to $68 \times 80\ \mu$; ducts $300\ \mu$ long, $10\ \mu$ in diameter; ventral

receptacle about $200\ \mu$ long.

DISTRIBUTION: Europe, Japan.

Napomyza hirticornis (Hendel), 1932, IN Lindner: Die Flieg. palaearkt. Reg. 59: 315.—
Sasakawa, 1955, Kontyû, 23: 34. Fig. 101.

Ovipositor sheath longer than tergite 6, pubescent on proximal $1/2$ and setigerous on distal $1/2$; apodeme strongly chitinized, $2/3$ length of sheath, pouched on anterior $1/2$. Egg guides subquadrate, somewhat produced ventrodistally, $60\ \mu$ long, each with 4 sensillae. Tergite 9 cruciform, $160\ \mu$ long; sternite W-shaped, $100\ \mu$ long, with 3 pairs of *nsm*; cerci each with 4 *ts* which are about $1/3$ of cercus length. Spermathecae orbicular, with truncate proximal end, 54×60 to $60 \times 60\ \mu$; necks about $40\ \mu$ long, $8\ \mu$ wide; ducts 360 – $380\ \mu$ long, $8\ \mu$ in diameter, slightly brown-tinged on proximal $1/4$; ventral receptacle about $200\ \mu$ long. Uterus spinulose on dorso-mesal part.

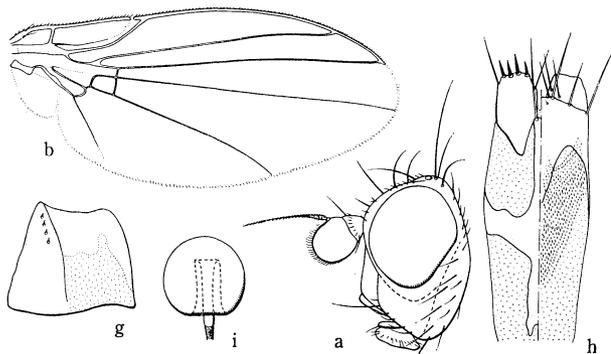


Fig. 101. *Napomyza hirticornis* (Hendel).

DISTRIBUTION: Europe, Japan.

Napomyza lateralis (Fallén), 1823, Dipt. Suec., Phyt. 2: 3. Fig. 102.

Terminalia: Epandrium $1/4$ as long as tergite 6; surstyli subconical, slightly longer than cerci, bearing numerous setae at apices. Hypandrium with sidepieces slender, with indistinct apodeme, $3/5$ length of phallapodeme. Processus longus short. Phallapodeme projected ventrally at posterior end. Distiphallus surrounded by large membrane; ventral processes with several spines apically; endophallus equal in length to paraphallus. Ejacu-

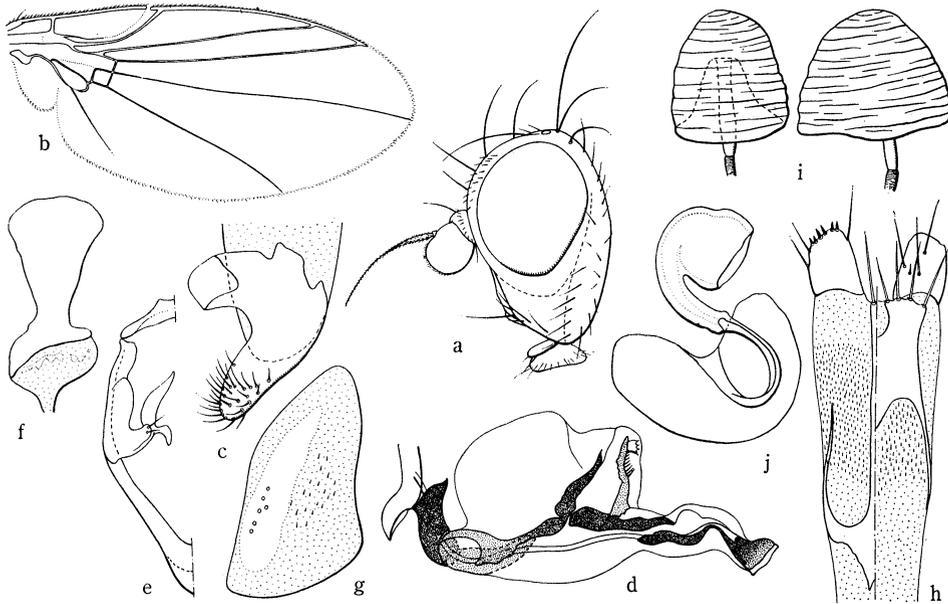


Fig. 102. *Napomyza lateralis* (Fallén).

latory apodeme with blade plectrum-shaped $150\ \mu$ long, $100\ \mu$ wide; bulb with teeth laterally.

Ovipositor sheath as long as tergite 6, setigerous on distal $1/2$, without pubescence dorsally; apodeme slightly shorter than sheath, pouched on anterior $2/3$. Egg guides subtriangular, $120\ \mu$ long, mesally with about 6 sensillae and may setulae. Tergite 9 trifurcate, $220\ \mu$ long; sternite somewhat U-shaped, $180\ \mu$ long, bearing 4 pairs of *nsm* and about 15 sensillae; cerci with 6 *ts* which are only $1/5$ of cercus length. Spermathecae semispherical, minutely striated, 52×72 to $72 \times 80\ \mu$, deeply excavated proximally; necks $60\ \mu$ long; ducts $600\ \mu$ long, $6\ \mu$ in diameter; ventral receptacle with large stipules, about $150\ \mu$ long.

DISTRIBUTION: Europe, Japan, N. Africa, N. America.

As already pointed out in a previous paper (1955), the majority of the Japanese species exhibit a considerable variation in the position of the fronto-orbital bristles, the costal proportional sections, and the position of the cross-vein *m m*.

The larvae usually mine the pith of stems or the receptacles of many plants in the family Compositae, Verbenaceae, Umbelliferae, Urticaceae, etc.

Napomya xylostei (Kaltenbach), 1862, Naturh. Ver. preuss. Rheinl. u. Westphal., Verh. 1: 93.—Sasakawa, 1954, Kontyû 20: 12. Fig. 103.

Terminalia: Epandrium about $1/2$ length of tergite 6, surstyli each with 12–15 short spines and many setae; cerci $1/2$ height of epandrium. Hypandrium with sidepieces rather broad, about $1/2$ length of phallapodeme. Distiphallus with para- and hypophallus ex-

tremely long; ventral processes with a tendon; endophallus somewhat trifurcated. Praegonites each with 2 setae; postgonites 1/2 length of phallic hood, with a seta ventrally and 3 sensillae dorsally. Ejaculatory apodeme only slightly expanded distally, 60 μ long, 30 μ wide.

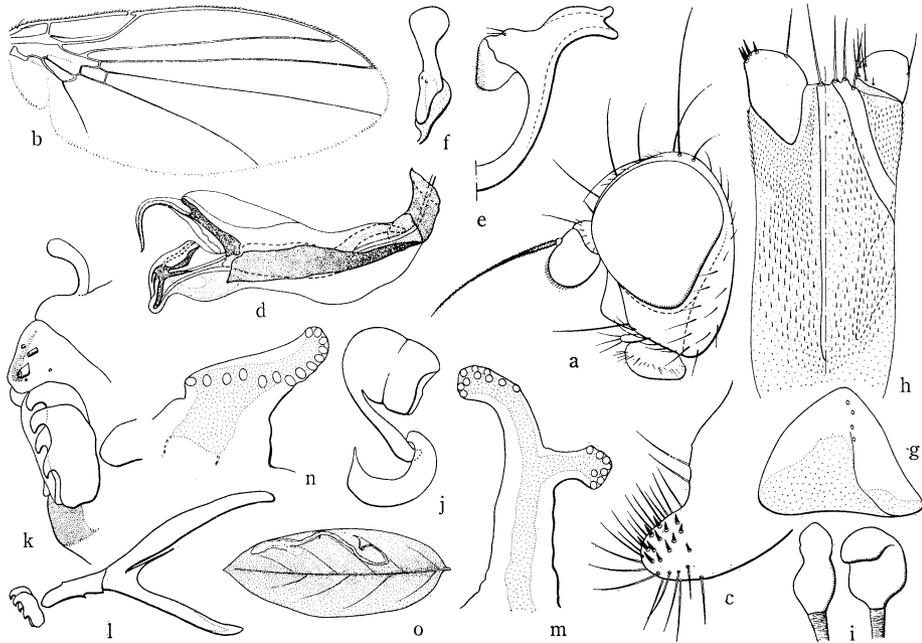


Fig. 103. *Napomyza xylostei* (Kaltenbach).

Ovipositor sheath longer than tergite 6; apodeme pouched on anterior 1/2. Egg guides triangular, chitinized marginally, 60 μ long, with 3 sensillae mesally. Tergite 9 narrow stripe-like, 220 μ long; sternite V-shaped, with 3 pairs of *ns*m; cerci each with 4 short *ts*. Spermathecae minute, curved apically or slightly constricted mesally, 24 \times 20 μ , without distinct necks; ducts 360-400 μ long, 3 μ in diameter; ventral receptacle with stipules uniting with body, 80 μ long, tail 100 μ long.

LARVA. Full grown larva milky white, 3-3.5 mm in body length; head with a frontal process, 40 μ long; mandibles each with 2 teeth; anterior spiracles brown, apically bifurcated, 150 μ high, proximal short horn with 7-9 bulbs, distal horn with 9-12 bulbs; posterior spiracles brown, 60 μ high, each with 10-15 bulbs; cuticular process pale yellow-brown, posterior large processes of anterior rows of each segment with truncate apical ends, others conical; spinal pattern: on dorsal, 1A=3.0, 2-5A=4.0, 6-7A=2.0, T & 8A=0; on lateral, 1T=4.0, 2T=0.2, 3T-1A=4.2-3, 2A=2-3+2.3-4, 3-4 & 6A=3-4+2.3-4, 5A=3-4+2.3-4, 7A=3.3, 8A=3.0; on ventral side entirely absent.

DISTRIBUTION: Europe, Japan.

HOSTS: *Lonicera gracilipes* var. *genuina* Makino, var. *glabra* Miq., var. *glandulosa* Maxim., *L. japonica* Thunb., *Akebia quinata* Decne.

Napomyza yasumatsui Sasakawa, 1955, *Kontyû* 23: 16. Fig. 104.

The characteristic feature of this species is the yellow lateral stripes of mesonotum and dorsal 1/3 of mesopleura.

Ovipositor sheath almost as long as tergite 6, pubescent on proximal 1/2; apodeme 2/3 length of sheath, pouched on anterior 1/3-1/2. Egg guides subtriangular, proximally membranous, $64\ \mu$ long, with several sensillae and many setulae mesally. Tergite 9 narrow, about $160\ \mu$ long; sternite W-shaped, about $200\ \mu$ long, bearing 3 pairs of *nsm*; cerci each with 4 *ts* which are about 1/4 of cercus length. Spermathecae semispherical, 36×52 to $36 \times 60\ \mu$; necks $50\ \mu$ long and $12\ \mu$ in diameter; ducts $320-400\ \mu$ long, distally with a slight brown tinge; ventral receptacle of normal form. Ejaculatory apodeme $80\ \mu$ long, $100\ \mu$ wide.

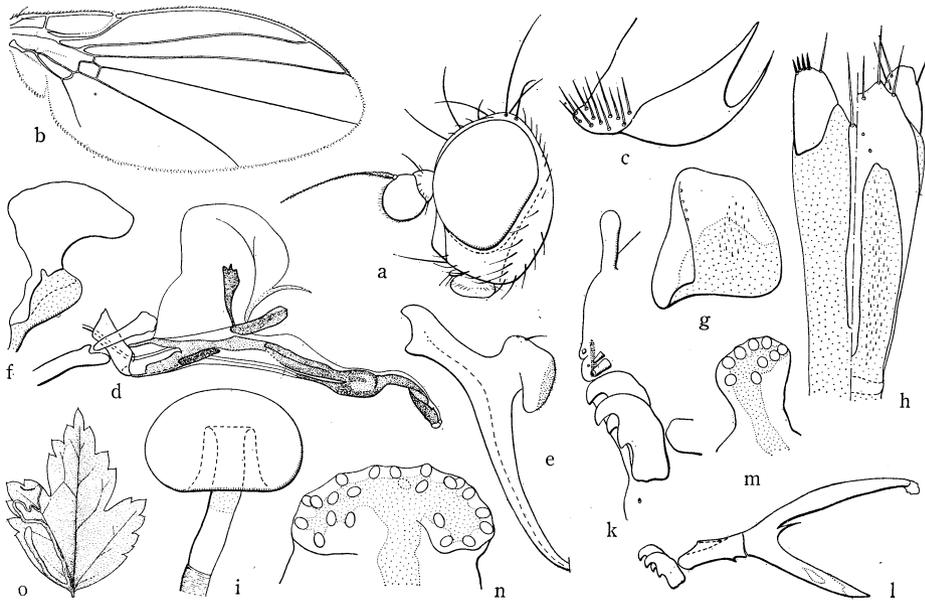


Fig. 104. *Napomyza yasumatsui* Sasakawa.

LARVA. Head with a frontal process; anterior spiracles knob-like, $56\ \mu$ high, with 7-14 bulbs; posterior spiracles subcylindric, $140\ \mu$ high, each with 20-24 bulbs; cuticular processes yellowish, spinal pattern: on dorsal, 1T=3.0, 2T=3.3, 3T-1A=6.3, 2-6A=6-7.3-4, 7A=4.3; on lateral, 1T=7-8.0, 2T=5.3, 3T-1A=7.4-5, 2-5A=8-10.5, 6A=9.4, 7A=5.3, 8A=3.0; on ventral side, 1T=4.0, 2T-8A=0.

Additional numerous, including immature stages, Kibune, Kyoto, 4 May 1955, 20 June 1955, on *Clematis apiifolia*; Kibune, 1 June 1955, on *Anemone*; Kibune, 2 June 1956, on *Clematis paniculata*, Sasakawa; Mominoki, Mt. Sara, Ehime Pref., 2 June 1954, on *Clematis*, Yano; Mt. Hiko, Fukuoka Pref., 19 May 1956, on *C. apiifolia*, Sasakawa.

DISTRIBUTION: Japan.

HOSTS: *Anemone japonica* Sieb. & Zucc., *Clematis* spp.

subsp. *anemoneae* Sasakawa, 1956, Saikyo Univ., Sci. Rep. Agr. 8: 130.

This subspecies is immediately recognizable by the yellowish brown femora and the visceronome in the leaves of *Anemone flaccida* Fr. Schm. and *stolonifera* Max.

14. Genus *Phytomyza* Fallén, 1810

This is the largest genus, which is characterized by having the orbital hairs proclinate, and M_{1+2} weakest, and in absence of the cross-vein m-m. Hendel (1936) defined 205 Palaearctic species, and about 150 new species have been described since that time. Only 43 species are known at present from Japan, of which 6 are Holarctic and 12 are Palaearctic in distribution. *Phytomyza atricornis*, *nigra* and *ranunculi* give sometimes serious damage to the cultivated plants.

The subdivision for the genus has not been attempted although there may be quite well marked groups. I have defined certain groups on the Japanese species taking mainly the structure of the male and female terminalia into consideration.

The Japanese species of *Phytomyza* were divided into 2 sections by the difference of coloration of the front. The first section has the whitish yellow front and was grouped into 11 groups. The first group contains only *dryoptericola* being named for it and is characteristic in the mostly yellow coloration. The second group is the *paniculatae*-group and the third is the *ranunculi*. The species of the second has the distinct wing-like processes on the ventroproximal part of the endophallus, the horn-like posterior spiracles of the larva, and the larvae pupate in the mines. The third is recognized in having the very long and spiral endophallus, and the long necks of spermathecae. The fourth may be called the *abeliae*-group in which the distiphallus bears 2 claw-like ventral processes similarly to that of the *gentianae*-subgroup, but the color of the antennae and the shape of the spermathecae are characteristic. The fifth *aconiti* and the sixth *albiceps*-groups may be distinguished by the yellow mesonotal margins, and the black antennae and scutellum from the foregoing groups. In the species of the *albiceps*-group the endophallus is distinctly shorter than para- or hypophallus which is provided with many spines and the spermathecae are semiorbicular or a little higher than semiorbicular. In the species of the seventh *atricornis*-group, the antennae, mesonotal margins, scutellum, and femora are dark, both upper fronto-orbital bristles are equal in length, the acrostichals are absent or arranged in 2 rows, the distiphallus with ventral process are much well-developed, and the spermathecae are semiorbicular to orbicular. The spermathecae of *atricornis*, *nigra* and *plantaginis*, which pupate in their mines, are unusual. The *thalictricola*-group differs from the seventh only in having the dense row of the acrostichals and the large spermathecae. The ninth, *araliae* and the tenth, *facialis*-group are similar to the *thalictricola*- and *atricornis*-group, but may be readily distinguished by the shorter first upper fronto-orbitals. These are not only separated by the arrangement of the acrostichals, as in the similar groups, but also by the male genital characters; in *araliae*-group, the endophallus are composed of a pair of chitinous tubules and longer than paraphallus, while in the *facialis*, the endophallus are single, short and membranous. The last *japonica*-group is intermediate between the *araliae* and *facialis* group in the structure of the male genitalia.

The second section has the dark front, and is divided into 3 groups, i. e., *jucunda*, *minuscula* and *tordylii*-group mainly by the chaetotaxy, the structure of the male and female

genitalia. In the first group, the ventral process of the distiphallus is remarkably developed, the spermathecae are small, and the larva pupates in the mine. The second group contains *minuscule*, *esakii*, *actaeae nigrociliata* and *tamui*, of which *minuscule* is more generalized in having the large processus longus with a pair of setae and the cruciform ninth tergite of female. These characters are in common with the most generalized groups of other genera. The last *tordylii*-group is characterized by the male genitalia; the surstyli are separated from the epandrium, the para- and hypophallus are long and spinous, and the endophallus is membranous.

KEY TO ADULTS

1. Front whitish to orangish yellow..... 2
- Front brown to brownish black 34
- 2 (1). Scutellum entirely or at least dorsomesally yellow 3
- Scutellum entirely black 9
- 3 (2). Antennal segment 3 yellow..... **dryoptericola**
- Antennal segment 3 black 4
- 4 (3). Upper fronto-orbital bristle 1 strong, equal to 2..... 5
- First *ors* shorter than 2nd or lacking..... 7
- 5 (4). Mesopleura yellow in dorsal 1/2..... **hydrangeae**
- Mesopleura yellow only in dorsal 1/4 to 1/3 6
- 6 (5). Palpi blackish brown..... **flavofemoralis**
- Palpi yellowish brown to brown..... **paniculatae**
- 7 (4). Mesonotum with 3 black stripes separated by yellow lines and a broad yellow area before scutellum **ranunculi albipes**
- Mesonotum black except for yellow lateral stripes..... 8
- 8 (7). Femora yellow; palpi brown..... **ranunculi flavoscutellata**
- Femora brown; palpi brownish black..... **ranunculi praecox**
- 9 (2). Antennae yellow..... **abeliae**
- Antennae black..... 10
- 10 (9). Mesonotum with yellow lateral stripes from humeri to *sa*-area 11
- Mesonotum slightly brown-tinged laterally 19
- 11 (10). First *ors* subequal to 2nd in length 12
- First *ors* distinctly shorter than 2nd or lacking..... 13
- 12 (11). Antennal segment 1 yellow; mesonotum with 1+3 *dc*..... **aconiti**
- Antennal segment 1 brown; mesonotum with 1+4 *dc* **carpescicola**
- 13 (11). Mesonotum yellow in dorsal 1/3-1/2..... 14
- Mesonotum yellow in less than 1/3..... **acanthopanicis**
- 14 (13). Vertical angles brownish yellow..... 15
- Vertical angles dark brown 17
- 15 (14). Antennal segment 3 distinctly pilose..... **eupatorii**
- Antennal segment 3 minutely pilose 16
- 16 (15). Front as broad as long; mesopleura yellow in dorsal 1/2..... **lappae**
- Front broader than long; mesopleura yellow in dorsal 1/3.....
- **senecionis ravasternopleuralis**
- 17 (14). Antennal segment 3 with very long pile **fimbriata**

	Antennal segment 3 minutely pilose	18
18 (17).	Mesopleura yellow in dorsal 1/3-1/2; mesonotum with 5-9 <i>ia</i> -setulae.....	albiceps
	Mesopleura yellow in dorsal 1/4; mesonotum with 2-4 <i>ia</i> -setulae.....	helianthi
19 (10).	First <i>ors</i> subequal to 2nd in length	20
	First <i>ors</i> shorter than 2nd or lacking	27
20 (19).	Mesonotum with 4 rows of <i>acr</i>	thalictricula
	Mesonotum without or with 2 rows of <i>acr</i>	21
21 (20).	Face yellow, antennal grooves slightly brown-tinged.....	23
	Face brown	22
22 (21).	Eyes densely with long hairs.....	nigra
	Eyes sparsely with minute hairs.....	cineracea
23 (21).	Fore coxae distally yellow; genae 1/2 eye height.....	24
	Fore coxae entirely black; genae 1/4-1/3 eye height.....	25
24 (23).	Antennal segment 2 yellow	nannodes
	Antennal segment 2 yellowish brown.....	plantaginis
25 (23).	Mesonotum with 3-4 pairs of <i>acr</i>	26
	Mesonotum without <i>acr</i>	atricornis
26 (25).	<i>Oc</i> long	disjuncta
	<i>Oc</i> short	murina
27 (19).	Mesonotum with 3-4 rows of <i>acr</i>	28
	Mesonotum with 2 rows of <i>acr</i>	33
28 (27).	Palpi normal.....	29
	Palpi dilated spoon-formed.....	bifida
29 (28).	Mesopleura yellow in dorsal 1/5; 2nd costal section 4 × as long as 4.....	araliae
	Mesopleura yellow in dorsal 1/7-1/6; 2nd costal section 3-3.5 × as long as 4..	30
30 (29).	Fronto-orbital bristles grown on yellow parafrontalia	31
	<i>Or</i> grown on brown area of parafrontalia	32
31 (30).	Palpi normal.....	angelicae kibunensis
	Palpi broadened apically.....	nishijimai
32 (30).	Antennal segment 3 with long pile	homogyneae
	Antennal segment 3 minutely pilose.....	japonica
33 (27).	Second costal section 4 × as long as 4	oenanthes
	Second costal section 3 × as long as 4.....	facialis
34 (1).	First <i>ors</i> subequal to 2nd in length	35
	First <i>ors</i> distinctly shorter than 2nd or lacking.....	39
35 (34).	Second costal section 3.3-4 × as long as 4.....	36
	Second costal section less than 3 × length of 4.....	38
36 (35).	Anterior abdominal tergites with broad yellow lateral margins.....	gentianae
	Tergites without yellow lateral margins.....	37
37 (36).	Mesonotum with 5-6 rows of <i>acr</i>	saxifragae
	Mesonotum with 4 rows of <i>acr</i>	deutziae
38 (35).	Mesonotum with 6 rows of <i>acr</i>	jucunda
	Mesonotum with 4 rows of <i>acr</i>	kisakai
39 (34).	Mesonotum with 3-5 rows of <i>acr</i>	40
	Mesonotum with 2 rows of <i>acr</i>	44
40 (39).	Mesonotum with intra-alar setulae.....	41

	Mesonotum without <i>ia</i>	minuscula
41 (40).	Second costal section 3–3.5 × as long as 4.....	42
	Second costal section 2.5 × length of 4.....	esakii
42 (41).	Antennal segment 3 with long pile.....	actaeae nigrociliata
	Antennal segment 3 minutely pilose	43
43 (42).	<i>Ori</i> 2 pairs	arnaudi
	<i>Ori</i> 1 pair	tamui
44 (39).	Mesonotum with 2–5 <i>ia</i> -setulae	tordylii
	Mesonotum usually without <i>ia</i> -setula	polycladae

KEY TO LARVAE

1.	Large species, 3–4 mm in length	2
	Small species, 2–2.5 mm in length.....	23
2 (1).	Head with frontal process.....	3
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5 (4).	Head with both dorsal and ventral bands of cuticular processes.....	6
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30 (29).	Posterior spiracles with 13-20 bulbs.....	acanthopanicis
	Posterior spiracles with 10-14 bulbs	minuscula

Phytomyza abeliae Sasakawa, n. sp. Fig. 105.

ADULT. Male: Head yellow; frontalia somewhat darker; ocellar triangle, occiput and dorsal 3/4 blackish brown, extending anteriorly dorsal halves of postorbital and vertical angles; antennal grooves mesally, anteclypeus and palpi slightly tinged with brown; antennae yellow, but segment 3 and arista yellowish to pale brown. Thorax black, densely dusted with gray; lateral stripes of mesonotum and pleurae more or less brown-tinged; mesopleural sutures and bases of wings yellow. Wings hyaline; veins pale brown, proximally yellow; calypteres yellow, with margins somewhat darker and fringe of brown hairs. Legs brown; coxae, femora and tibiae of fore legs yellowish brown, fore-knees yellow but mid- and hind-knees narrowly yellowish. Abdomen brown to dark brown, densely pollinose; tergite 6 with yellowish caudal margins; epandrium and cerci pale brown.

Head: Front 2 × as wide as eye, slightly wider than long, very slightly converging ventrally; parafrontalia about 1/5 width of front, narrowing ventrad. Ocellar triangle of normal size, bearing 1 or 2 pairs of setulae plus *oc*. Lunule flattened, lower than semicircular, about 1/2 as high as length between its dorsal margin and anterior ocellus, whitish pruinose. Fronto-orbitals 4 pairs; *ors* 2, equal in size, directed upwards; 2. *ori* minute,

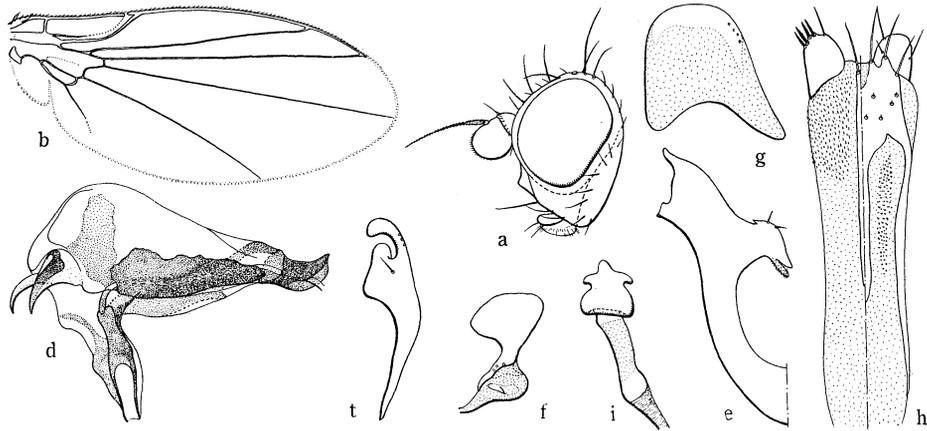


Fig. 105. *Phytomyza abeliae* Sasakawa, n. sp.

directed inwards; *oh* in a row. In profile parafrontalia and parafacialia linearly extending beyond eye-margin; eyes about $1.2 \times$ as high as wide, densely with minute white hairs; genae about $1/4$ eye height. Face slightly concave; carina very narrow and low; antennal grooves shallow. Parafacialia $1/3-1/2$ as wide as diameter of antennal segment 1; *vi* longer than $2-3 \mu m$. Antennae approximated at bases; segment 3 orbicular, with minute pile; arista $1.7 \times$ as long as whole length of antenna, swollen on basal $1/4$, minutely pubescent. *Thorax*: Mesonotum with $1+3 \text{ dc}$, 1. *dc* slightly before level of *prs*; *acr* in 3-4 irregular rows between 1. and 2. *dc*, 2 rows of which ending at level of 3. *dc*; 1-3 *ia*-setulae behind transverse suture; *ipa* $1/4-1/3$ length of *opa*; humeri each with 3-5 setulae plus *h*. Meso- and sternopleura each with 1 dorsally directed setula. *Wing*: Costa with sections 2-4 in proportion of 38 : 13 : 15. *Abdomen*: Tergites very sparsely covered with setae, *mar* long; tergite 6 almost as long as 5; sternite 5 as wide as long, with a shallow incision on caudal $1/5$. *Terminalia*: Epandrium normal; surstyli relatively long, united with epandrium, each with about 21 setae. Hypandrium with sidepieces broad, nearly $1/2$ length of phallopodeme. Processus longus narrow and short. Distiphallus well-developed; ventral process with a pair of spine-like processes; endophallus about $1/4$ length of phallopodeme, bifurcated distally. Postgonites with long terminal teeth. Ejaculatory apodeme about 60μ long and broad, bulb with a small chitinous plate. *Length*: Body 1.5 mm; wing 1.67.

Female: Similar to σ , but only tergite 6 with yellow caudal margin; sternite 5 is $3 \times$ as wide as long, slightly smaller than 6. *Terminalia*: Ovipositor sheath shining brownish-black, about $1.5 \times$ as long as tergite 6, pubescent on proximal $2/3$; apodeme shorter than sheath, pouched on anterior $1/5$. Egg guides quadrate, 40μ long, with 4 sensillae. Tergite 9 about 100μ long; sternite W-shaped, about 160μ long, bearing 3 pairs of *nsm* and 12 sensillae; cerci with long *ts*. Spermathecae semispherical, with finger-like processes apically, $20 \times 16 \mu$; necks about 30μ long, chitinized on both ends; ducts 6μ in diameter; ventral receptacle normal. *Length*: Body 1.67-1.75 mm; wing 2-2.25.

DISTRIBUTION: Japan (Kyushu).

Holotype ♂, allotype ♀, Mt. Hiko, Fukuoka, May 1956, H. Kuroko, on *Abelia*; 4 paratypes, same data.

This species is so highly characteristic in the coloration of antennal segment 3 and the legs and in the shape of the spermatheca that it is difficult to point out the Japanese allied species. The coloration somewhat resembles that of *P. dasyops* Hendel from Austria, but in *dasyops* the fringe on the calypter is paler, antennal segment 3 is wider than long, and the orbital hairs, the intra-alar setulae and the mesopleural setulae are more densely arranged.

BIONOMICS. *Host*: *Abelia serrata* Sieb. & Zucc. *Mine*: Greenish white ophiome, of the upper surface type. *Pupation*: Takes place in the ground.

***Phytomyza acanthopanicis* Sasakawa, n. sp.** Fig. 106.

ADULT. Male: Head yellow; frontalia and lunule somewhat orangish; ocellar triangle centrally dark brown, posteriorly yellowish brown; occiput and postgenae brownish black, reaching dorsal halves of postorbis and vertical angles as yellow-brown in color, *vii* growing at edge of brown area; face and anteclypeus more or less brown-tinged; antennae and palpi brownish black, but antennal segment 1 yellowish brown, 2 and arista dark brown. Thorax black; mesonotum densely gray pruinose, with yellow lateral stripes and yellowish spots before both ends of scuto-scutellar suture, *prs* on black and *opa* at edge of black area; humeri each with brown spot; pro- and mesopleura brown, pteropleura yellowish brown, dorsal 1/4-1/3 of mesopleura, mesopleural sutures and bases of wings yellow. Wings hyaline; veins brown, yellow proximally; calypteres yellow, with fringe of brown hairs. Legs blackish brown, but all knees yellow, tibiae and tarsi brown, those of fore-legs paler. Abdomen subshiny, dark brown, slightly pollinose, tergites with caudal margins narrowly yellow, broadest on sixth; epandrium with yellow caudal margin, cerci brown.

Head: Front 1.5-1.8 × as wide as eye, as broad as long, its sides converging ventrally; parafrontalia a little narrower than 1/4 width of front, sides converging ventrally.

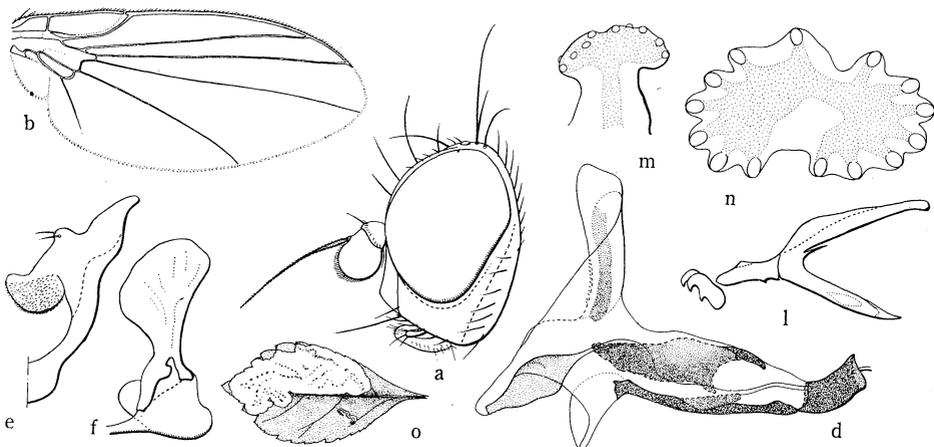


Fig. 106. *Phytomyza acanthopanicis* Sasakawa, n. sp.

Ocellar triangle with ventral tip extending slightly beyond level of 1. *ors*, bearing 8–12 setulae plus *oc*. Lunule flat, semicircular, nearly $1/2$ as high as length between its dorsal tip and anterior ocellus. Fronto-orbitals 4 pairs; 1. *ors* about $1/2$ length of 2, directed up and outwards, 2. *ors* upwards; *ori* directed in- and upwards; *oh* in a row. In profile parafacialia linearly extending beyond upper eye-margin; eyes $1.4 \times$ as high as wide, sparsely with minute hairs; genae $1/5$ – $1/4$ eye-height; 5–6 short *pm* in a row. Face almost vertical, lower than broad; carina narrow; antennal grooves rather deep; parafacialia linear. Antennae with bases approximated; segment 3 little shorter than broad, with relatively distinct pile, arista $2 \times$ as long as whole length of antenna, swollen on basal $1/4$, minutely pubescent. *Thorax*: Mesonotum with $1+3$ *dc*, equally spaced from each other, 1. *dc* before level of *prs*, 3. *dc* on level of *sa*; 4 irregular rows of *acr*, 1 or 2 pairs of which ending just behind level of 3. *dc*; 5–6 *ia*-setulae behind suture; *ipa* about $1/2$ length of *opa*; humeri each with 5–7 setulae plus *h*. Mesopleura with 2 or 3 dorsally directed setulae; sternopleura with 2–4 setulae before *sp*. *Wing*: Costa with sections 2–4 in proportion of $48(40-56) : 12 : 14$. *Abdomen*: Tergite sparsely covered with setae, *mar* long; tergite 6 as long as 5. *Terminalia*: Epandrium normal; surstyli short, incurved, each with about 23 setae. Hypandrium with a small apodeme. Hypophallus broad, as long as paraphallus. Ejaculatory apodeme 130μ long, 108μ wide. *Length*: Body 1.75 mm; wing 2.25.

Female: Similar to ♂, but ovipositor sheath shiny brownish black, slightly longer than tergite 6, pubescent on proximal $1/5$. *Length*: Body 1.5–2 mm; wing 2–3.

PUPARIUM. Black; oval, about 2 mm in length, 1.2 mm in width of abdominal segment 3; dorsal side arched, ventral side flattened; segmental constriction distinct. Anterior spiracles separated at base by own diameter, each knob-like, with about 10 bulbs; posterior spiracles apically two-lobed, each with 13–20 bulbs. Cuticular processes arranged as 6–8·4 in the lateral side of abdominal segment 3.

DISTRIBUTION: Japan (Hokkaido, Honshu).

Holotype ♂, Sapporo, Hokkaido, 6 July 1949; allotopotype ♀, 5 July 1949, Y. Nishijima, on *Acanthopanax*; 2 paratypes: Morioka City, Iwate Pref., 5 May 1953, Sasakawa; Sapporo, 9 June 1956, T. Kumata, on *Acanthopanax*.

There is no closely allied species in Japan. This species belongs to a distinctive European *sonchi*-group and is somewhat allied to the European *P. alpina* Groschke on *Senecio alpinus* in general appearance, but the coloration of the notopleura and the length of pile on the antennal segment 3 are distinctly different; in *alpina* the notopleura darkened ventrally and both notopleural bristles arise from the gray-dusted black part.

BIONOMICS. *Hosts*: *Acanthopanax sieboldianum* Makino and *A. sciadophylloides* Franch. et Sav. *Mine*: Whitish green in color, sometimes graduated pale black by the moist frass in the mine; the stigmatonome, swollen in a blister, of upper surface type; usually it extends towards the leaf-margin; the black grains of frass are arranged in short threads or scattered irregularly. It is common to find 1 mine on a leaf, but in a larger leaf more than 2. *Pupation*: The full-grown larva abandons the mine to transform through the slit made on the upper surface.

Phytomyza aconiti Hendel, 1920, Archiv. Naturg. A 84: 159. Fig 107.

The present species coincides with the original description, but some specimens have

the more yellow dorsal part of mesopleura, the darker squamal fringe, the longer 1. *ors* and no dorsally directed setula on the mesopleura.

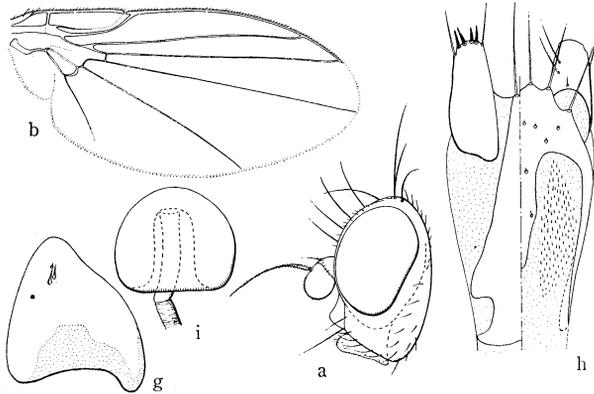


Fig. 107. *Phytomyza aconiti* Hendel.

Ovipositor sheath slightly longer than tergite 6, pubescent on proximal 1/2; apodeme shorter than sheath, pouched on anterior 1/3. Egg guides triangular, proximally membranous, 60 μ long, with 3 sensillae. Tergite 9 somewhat cuneiform, 200 μ long; sternite W-shaped, as long as tergite, bearing 3 pairs of *nsm*; cerci relatively long, each with 4 *ts* which are 1/5 of cercus length. Spermathecae orbicular, with truncate proximal end, 36 \times 44 μ ; necks 32 μ long; ducts 8 μ in diameter; ventral receptacle of normal form and size.

Many, bred from leaf-mines, Jyozankei, Hokkaido, 25 June 1954, Sasakawa.

DISTRIBUTION: Europe, Japan.

HOSTS: *Aconitum chinense* Sieb., *Delphinium ajacis* L.

***Phytomyza actaeae nigrociliata* Sasakawa, n. subsp. Fig. 108.**

ADULT. *Male*: Head brown; ocellar triangle, occiput and postgenae brownish black; lunule, face and genae brownish yellow; antennal grooves darker; antennae black, segment 1 brownish; palpi dark brown. Thorax brownish black, densely gray-dusted; mesonotum laterally brown-tinged; mesopleural sutures and bases of wings whitish. Wings hyaline, veins brownish yellow; calypteres white, with yellow margins and fringe of brown hairs. Legs blackish brown, but knees yellow-brown, tibiae and tarsi yellowish brown, mid- and hind tibiae somewhat darker. Abdomen brown to dark brown, becoming paler laterad on anterior 3 tergites, tergite 4-5 indistinctly with whitish caudal margins.

Head: Front 1.3-1.5 \times as wide as eye, as broad as long, almost parallel-sided. Ocellar triangle with ventral tip extending near level of 2. *ors*, bearing 2-4 setulae plus *oc*. Lunule flat, lower than semicircular, 1/2-3/4 length between its dorsal margin and anterior ocellus. Fronto-orbitals 4 pairs; *ors* directed up- and slightly outwards; *ori* directed inwards. In profile parafrontalia linearly extending beyond upper eye-margin; eyes almost bare; genae 1/7 eye height. Antennae slightly separated at bases; segment 3 relatively large, suborbicular, with white long pile; arista about 1.5 \times as long as whole length of antenna, swollen on basal 1/4, pubescent. *Thorax*: Mesonotum with 1+3 *dc*, 1. *dc* before level of *prs*; 4 rows of *acr* extending just behind level of 3. *dc*; 4-9 *ia*-setulae in 2 rows behind transverse suture; *ipa* 1/3-1/2 length of *opa*; humeri each with 4-7 setulae plus *h*. Mesopleura with usually 3 (2-4) dorsally directed setulae; sternopleura with 2-3 setulae before *sp*. *Wing*: Costa with sections 2-4 in proportion of 39 : 13 : 11. *Abdomen*: Tergite 6 slightly shorter than 5; sternite 5 about 2 \times as wide as long, incised on caudal

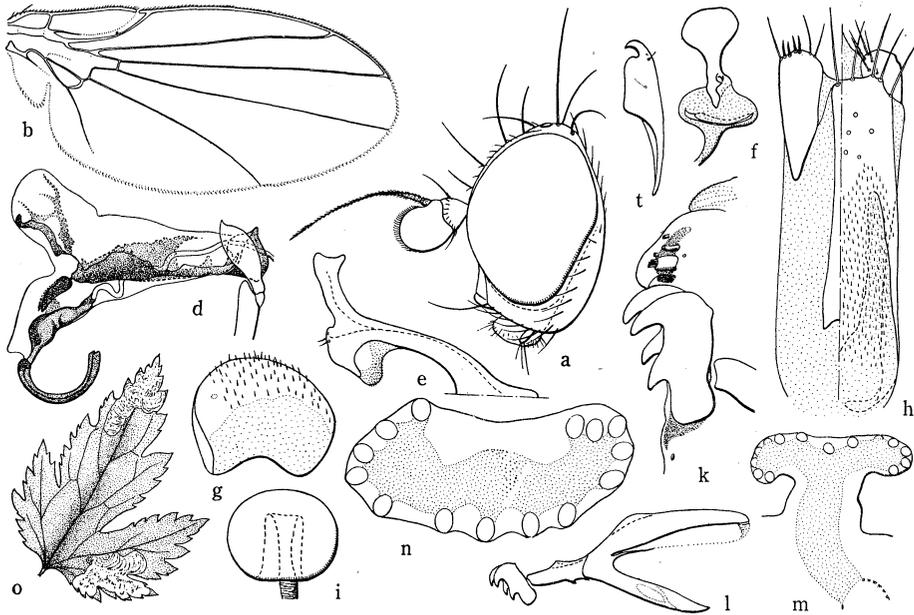


Fig. 108. *Phytomyza actaeae nigrociliata* Sasakawa, n. subsp.

1/2. *Terminalia*: Surstyli separated from epandrium by suture, each bearing about 25 setae. Hypandrium with distinct apodeme. Phallapodeme with distal processes broadened distally. Paraphallus about 2/3 length of hypandrium; ventral processes distinct. Ejaculatory apodeme 120 μ long, 100 μ wide; bulb with a transverse narrow sclerite; duct 1040 μ long and 12 μ in diameter. *Length*: Body 1.5–2 mm; wing 2.

Female: Similar to σ , but only tergite 6 with yellow caudal margin and as long as or slightly longer than 5; sternite 5 about 5 \times as wide as long. *Terminalia*: Ovipositor sheath brownish black, almost as long as tergite 6, pubescent on proximal 1/2; apodeme as long as sheath, pouched on anterior 1/2. Egg guides suboval, rounded posteriorly, 60 μ long, with numerous setulae and a sensilla mesally. Tergite 9 is 180 μ long; sternite W-shaped, 220 μ long, bearing 4 pairs of *nsm* and about 10 sensillae; cerci each with 4 *ts* which are 1/7 length of cercus. Spermathecae orbicular, with truncate proximal end, 44 \times 52 to 48 \times 60 μ ; ducts 520–600 μ long, 8 μ in diameter. *Length*: Body 2 mm; wing 2–2.5.

LARVA. Full-grown larva yellowish white, about 2.5 mm in length, 0.8 mm in width. Head without frontal process, but with 4 rows of almost colorless, minute cuticular processes. Mandibles each with 2 large teeth. Anterior spiracles approximated at bases, each 2-lobed, 60 μ long, with 13–14 bulbs; posterior spiracles cylindrical, separated from each other by diameter of one, each slightly expanded apically, 100 μ long and high, with 14–20 bulbs. Cuticular processes pale brown but those on dorsal and ventral sides colorless and minute, those of anterior rows of each segment larger than of posterior rows; spinal pattern: on dorsal side, 1T=7.0, 2T=3.0, 3T-1A=2-3.0, 2-7A=irregularly throughout all length of each segment; on lateral, 1-2T=0, 3T=2-3.3-4, 1-4A=5-6.3-4, 5-7A=6.4, 8A=4-5.0; on ventral, T=0, 1-2A=6.0, 3-7A=same as in dorsal side,

DISTRIBUTION: Japan (Hokkaido).

Holotype ♂, Motodomari, Rishiri I., Hokkaido, on *Actaea*, 1 Oct. 1958; allotopotype ♀, 22 Sept. 1958; 7 paratopotypes, 24 Aug.-9 Oct. 1958, Sasakawa.

This new subspecies differs from the European typical form in the following points: front more fuscous, face and genae more testaceous yellow, squamal fringe darker; genae narrower, 1. *dc* located before level of *prs*; larva with a band of cuticular processes dorsal of sensory organs on head. The remarkable structure of the egg guides suggests the relation to *murina* Hendel.

BIONOMICS. *Host:* *Actaea spicata* L. var. *nigra* Willd. *Mine:* Pale greenish in color, the ophiogenous stigmatonome, heliconome at first, of upper surface type; primary and secondary feeding lines are conspicuously visible; the black, large grains of frass are arranged in a string of beads or scattered as larger pellets. *Tenancy:* Usually more than 2 mines in a single leaf. *Pupation:* Takes place in the ground. *Remarks:* I have collected many larvae which were mining in the leaves of *Actaea* in Mt. Hiko, Kyushu in 1956.

***Phytomyza albiceps* Meigen, 1830, Syst. Besch. bekann. eur. zweifl. Insekt. 6: 194. Fig. 109.**

Terminalia: Distiphallus subequal to phallapodeme in length, para- and hypophallus narrow rod-like, 400 μ long, bearing 8 long spines on ventral membrane, endophallus distally forked. Ejaculatory apodeme with stem broad, blade 100 μ long and 85 μ wide.

Ovipositor sheath slightly longer than tergite 6, pubescent on proximal 1/2; apodeme weakly sclerotized, almost as long as sheath, pouched on anterior 1/5. Egg guides subquadrate but elongated ventroposteriorly, 50 μ long, with 6 sensillae mesally. Tergite 9 is

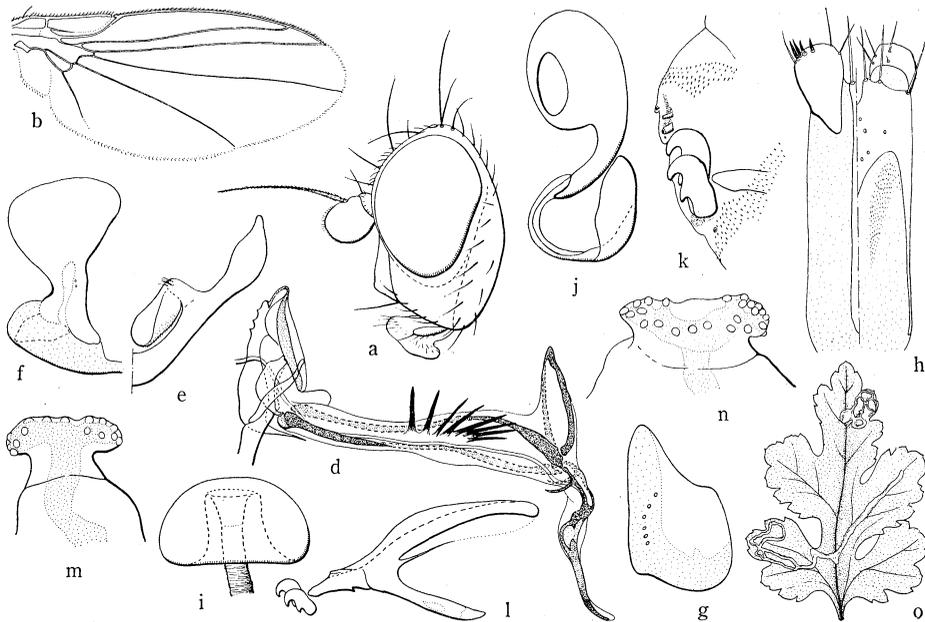


Fig. 109. *Phytomyza albiceps* Meigen.

160 μ long; sternite as long as tergite, bearing 3 pairs of *nsm* and about 15 sensillae; cerci with 4 *ts* which are 1/4 length of cercus. Spermathecae semiorbicular, 50 \times 72 μ ; ducts 220–240 μ long and 12 μ in diameter; ventral receptacle with body 80 μ long.

LARVA. Full-grown larva yellowish white, 4–4.3 mm in length. Head with 2 bands of cuticular processes, dorsal band in 6–8 rows dorsad of sensory organs, ventral one in 5–7 rows extending dorsolaterad from ventral ends of mandibles. Anterior spiracles pale brown, 60 μ long, each with 13–18 bulbs; posterior spiracles 110 μ long, each with 19–28 bulbs. Cuticular processes brownish yellow, those on anterior rows of each segment larger than on posterior; spinal pattern: on dorsal side, 3T=2.0, 1–8A=2.4.0; on lateral, 1T=6–7.0, 2T=3.2, 3T–1A=4.3, 2–6A=5–6.3–4, 7A=5–6.2, 8A=3–4.0, on ventral side, 1T=6–7.0, 2–3T=1.0, 1–2A=2.2–3, 3–6A=3.3, 7A=3.0, 8A=0.

DISTRIBUTION: Europe, E. Asia, Japan, N. America.

This is one of the commonest Holarctic species and also widespread throughout Japan and occasionally gives severe damage to cultivated chrysanthemum.

The phallus of *albiceps* is similar to that of *eupatorii* Hendel, *senecionis ravasternopleuralis* Sasakawa, *lappae* Robineau-Desvoidy and *helianthi* Sasakawa. These species all have the many and long spines, which are directed ventrally, on the membrane of the paraphallus and hypophallus. But in *albiceps* the spinal arrangement is conspicuously sparser than in the allied species.

HOSTS: *Artemisia absinthium* L., *A. vulgaris* L. var. *indica* Maxim. and var. *vulgatissima* Bess., *keiskeana* Miq., *Chrysanthemum morifolium* Ram. var. *sinense* Makino, *Rudbeckia laciniata* L.

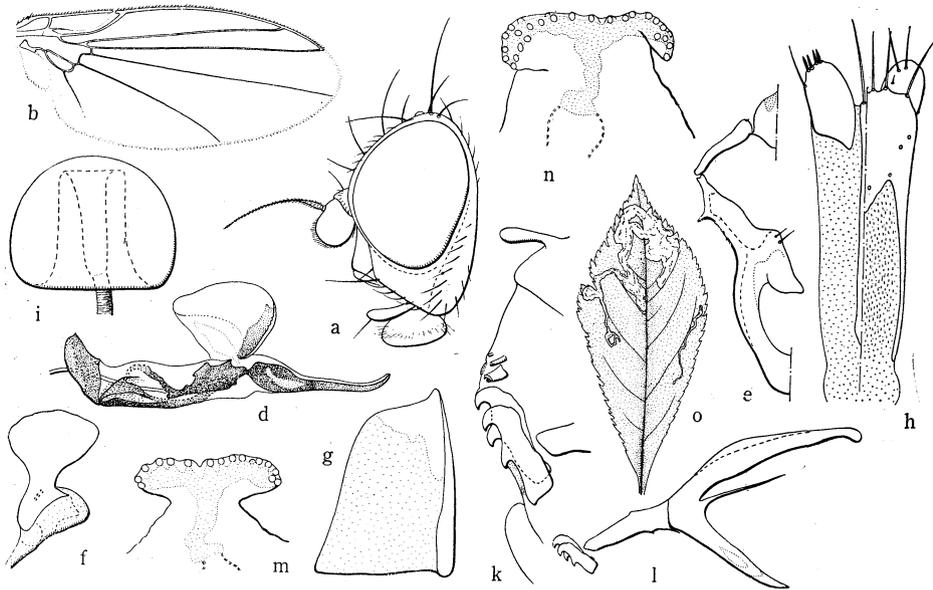


Fig. 110. *Phytomyza angelicae kibunensis* Sasakawa.

Phytomyza angelicae kibunensis Sasakawa, 1953, Saikyo Univ., Sci. Rep., Agr. 4: 13.

Fig. 110.

Terminalia: Distiphallus with spinulae proximally, hypophallus very narrow at proximal end, ventral process broadly membranous; endophallus distally composed of paired tubes. Ejaculatory apodeme with stem broad, blade $100\ \mu$ long, $82\ \mu$ wide.

Ovipositor sheath as long as or longer than tergite 6, pubescent on basal $1/4$; apodeme nearly $2\times$ as long as sheath, pouched on anterior $1/4$. Egg guides quadrate, a little pointed posteroventrally, $108\ \mu$ long, with 6 sensillae. Tergite 9 is $172\ \mu$ long; sternite $200\ \mu$ long, with 3 pairs of *nsm*; cerci each with 4 *ts* which are about $1/5$ length of cercus. Spermathecae subspherical, with truncate proximal end, $50\times 56\ \mu$, ducts $540\ \mu$ long, $10\ \mu$ in diameter.

Spinal pattern of larva: on dorsal side, $1-3T=0$, $1A=2\cdot0$, $2-6A=2-3\cdot1$; on lateral, $1T=6-8\cdot0$, $2T=3\cdot2$, $3T=4\cdot3$, $1A=4-5\cdot4-5$, $2A=6-8\cdot5-9$, $3-7A=8-10\cdot5-7$, $8A=6\cdot0$; on ventral, $1T$ & $8A=0$, $2T-7A$ =sparsely arranged throughout whole length.

DISTRIBUTION: Japan.

HOSTS: *Angelica kiusiana* Maxim. and *polyclada* Franch.

Phytomyza araliae Sasakawa, 1955, Saikyo Univ., Sci. Rep., Agr. 7: 26.

Fig. 111.

Terminalia: Surstyli united with epandrium, each with 16-17 setae; processus longus about $1/3$ length of hypandrium. Endophallus approximately $1/2$ length of phallapodeme. Ejaculatory apodeme $130\ \mu$ long, $88\ \mu$ wide; bulb with narrow sclerite.

Ovipositor sheath as long as tergite 6, pubescent on proximal $1/3-1/2$. Sternite 9 slightly longer than tergite, $200\ \mu$ long, with 3 pairs of *nsm* and about 10 sensillae; cerci each with 4 *ts* which are $1/3$ length of cercus. Spermathecae orbicular, with truncate proximal end, 50×56 to $44\times 64\ \mu$.

Spinal pattern of larva: on dorsal side, $1-2T=0$, $3T=1\cdot2$, $1-2A=2\cdot2$, $3-5A=3\cdot2$, $6-7A=6\cdot2$, $8A=5\cdot0$; on lateral, $1-2T=0$, $3T=2\cdot2$, $1-3A=4\cdot3$, $4-7A=5\cdot4$, $8A=5\cdot0$; on ventral, $2-3T=2\cdot3$, A =sparsely on median whole surface.

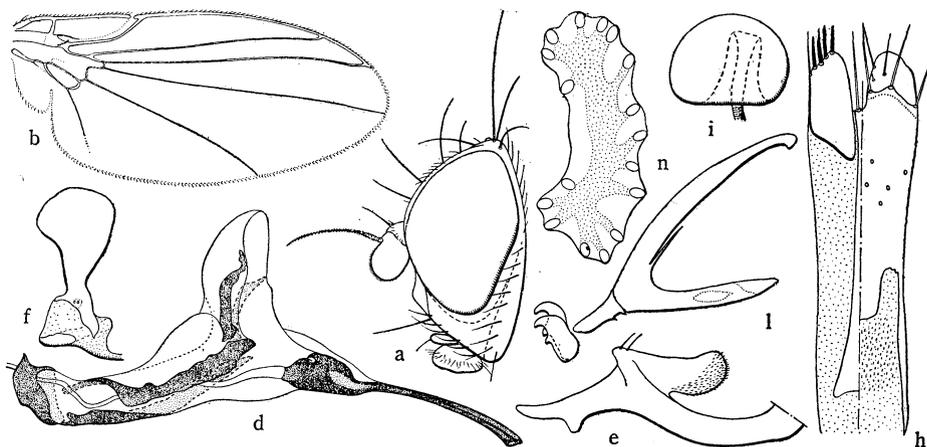


Fig. 111. *Phytomyza araliae* Sasakawa.

DISTRIBUTION: Japan.

This species is distinguished by the yellowish brown fore tibia and tarsus, and the long costal section 2 from all the related species of the *japonica* group. The phallus of *araliae* differs from those of *angelicae kibunensis* and *nishijimai* in having the endophallus longer than paraphallus.

HOST: *Aralia elata* Seem.

Phytomyza arnaudi Sasakawa, 1955, Akitu 4: 93. Fig. 112.

Terminalia: Para- and hypophallus narrow but very long, 4/5 length of phallapodeme, 520 μ in length, bearing numerous minute teeth ventrally; endophallus only 1/4 length of hypophallus. Ejaculatory apodeme 80 μ long, 50 μ wide, bulb rather large.

Ovipositor sheath slightly longer than tergite 6, pubescent on basal 1/3; apodeme as long as tergite 6, pouched on anterior 1/3. Egg guides subquadrate, 60 μ long, with about 7 sensillae. Tergite 9 is 160 μ long; sternite W-shaped, bearing 3 pairs of *nsm* and about 10 sensillae; cerci each with 4 *ts* which are 1/3 of cercus length. Spermathecae semiorbicular, 36 \times 50 to 44 \times 56 μ ; ducts 400 μ long, 8 μ in diameter.

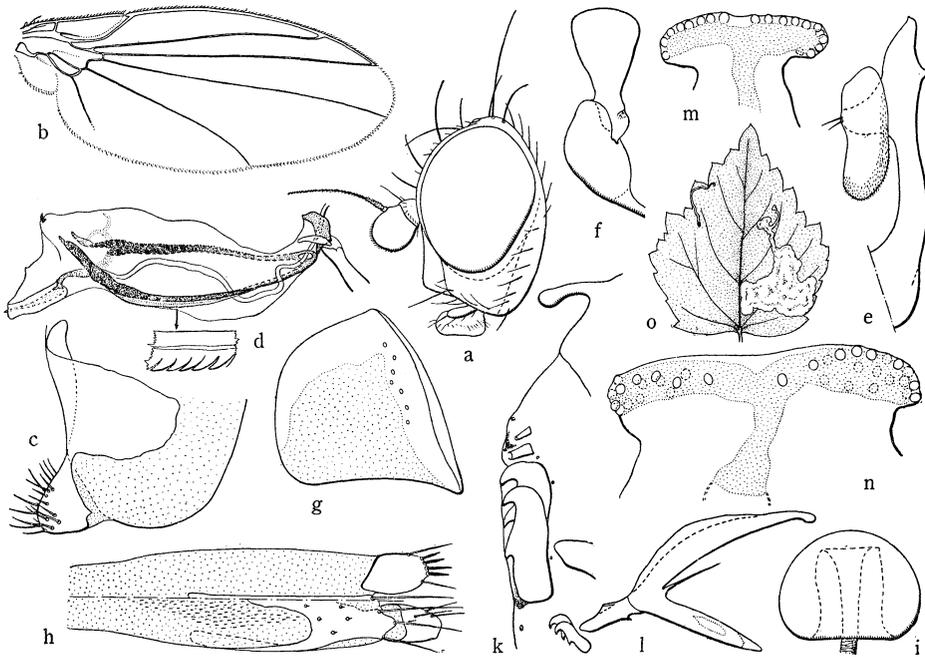


Fig. 112. *Phytomyza arnaudi* Sasakawa.

DISTRIBUTION: Japan.

The serrate para- and hypophallus is a conspicuous character, and will serve to distinguish *arnaudi* from other similar species in the color characters. The larva of *arnaudi* is very similar to that of *angelicae kibunensis*.

HOSTS: *Angelica miqueliana* Maxim, *Osmorhiza aristata* Makino & Yabe.

Phytomyza atricornis Meigen, 1838, Syst. Besch. bekann. eur. zweifl. Insekt. 7: 404.—Isitani, 1939, Kontyû 13: 82. Fig. 113.

Phytomyza nigricornis Macquart (1835): Matsumura, 1915, Dai Nippon Gaichu-zensho, p. 54.

Terminalia: Epandrium $2 \times$ as high as wide; surstyli conical, about $1/3$ height of epandrium, bearing 32-37 setae. Hypandrium with sidepieces rather broad; processus longus about $1/3$ length of sidepieces. Phallic hood strongly chitinized on lateral sides, about $1/4$ length of phallopodeme. Distiphallus about $1/2$ length of phallopodeme, but endophallus short. Praegonites with 2-3 setae; postgonites as long as phallic hood, distally with a large tooth and a minute tooth. Ejaculatory apodeme with stem broad, blade 60μ long and $30-50 \mu$ wide, bulb with a narrow sclerite.

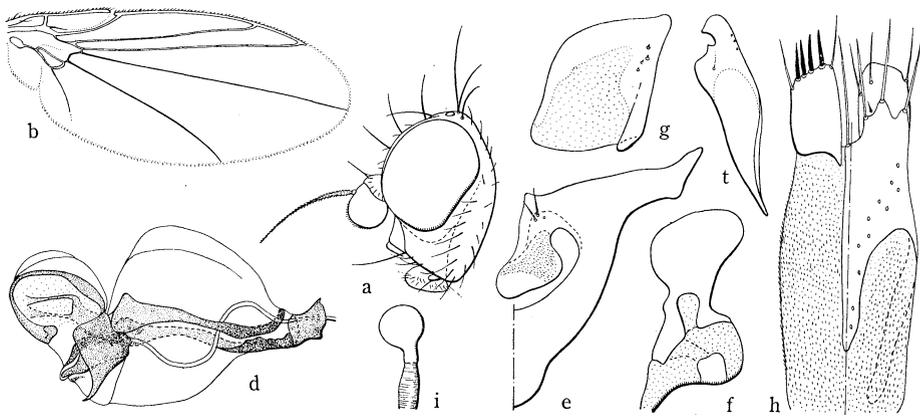


Fig. 113. *Phytomyza atricornis* Meigen.

Ovipositor sheath longer than tergite 6, pubescent on proximal $2/3$; apodeme almost as long as sheath, pouched on anterior $1/3$. Egg guides subquadrate, about 70μ long, with 4 sensillae. Tergite 9 is 115μ long; sternite somewhat W-shaped, 160μ long, bearing 3 pairs of *nsm* and about 20 sensillae; cerci each with 4 *ts* long, being $2/5$ length of cercus. Spermathecae minute, orbicular, $16 \times 16 \mu$, with short necks; ducts 260μ long, 6μ in diameter; ventral receptacle with body 60μ long.

DISTRIBUTION: Europe, Africa, Asia, Australia, America.

This species is the most wide spread and polyphagous in the family. The absence of the acrostichal bristle will readily separate this species from its relatives. The spermathecae and the structure of the larva of *atricornis* are very similar to those of *nigra* Meigen.

I have reared numerous specimens from larvae in the leaves of 60 hosts in 11 plant families; the following are here newly recorded: *Lactuca dentata* Makino and *laciniata* Makino, *Taraxacum platycarpus* Dahlst., *Hieracium japonicum* Franch. & Sav., *Cirsium japonicum* DC. and *kamtschaticum* Ledeb., *Senecio cruentus* DC., *Carpesium* sp., *Erigeron annuus* L., *Aster indicus* L., *Eupatorium japonicum* Thunb., *Lycopersicon esculentum* Mill., *Solanum tuberosum* L., *Hibiscus mutabilis* L., *Vicia sativa* L., *Cardamine leucantha* D. E. Schulz.

Phytomyza bifida Sasakawa, n. sp. Fig. 114.

ADULT. Male: Head yellow; ocellar triangle and occiput brownish black, brown of postgenae extending to dorsal halves of postorbits and orbits on level of 1. *ors* across vertical angles; *vti* growing at edge of yellow area; antennal grooves slightly brownish; antennae and palpi brownish black, but antennal segment 1 yellowish brown, segment 2 dark brown. Thorax black, densely dusted with gray; humeri and notopleura dark brown; dorsal margin of mesopleura, mesopleural sutures and bases of wings yellow. Wings hyaline; veins pale brown; calypteres yellow, with margins pale brown and fringe of dark brown hairs; halteres yellow. Legs black, fore knees narrowly yellow. Abdomen blackish brown, subshining; tergites 2-5 each with yellow caudal margin; epandrium brown, cerci yellow-brown.

Head: Front about $2 \times$ as wide as eye, broader than long, its lateral sides converging ventrally; parafrontalia about $1/4$ width of front, almost parallel-sided. Ocellar triangle with 2 pairs of setulae plus *oc*. Lunule semicircular, a little lower than length between its dorsal margin and anterior ocellus. Fronto-orbitals 4 pairs; 1. *ors* about $2/3$ length of 2, directed up and outwards, 2. *ors* upwards and located slightly before middle of front; *ori* inwards; *oh* in a row. In profile parafrontalia slightly extending beyond upper

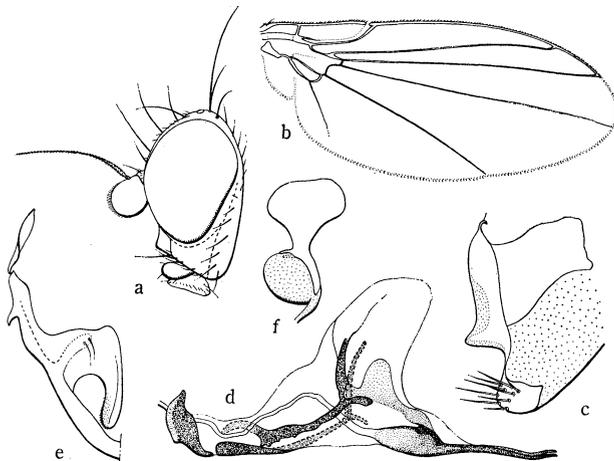


Fig. 114. *Phytomyza bifida* Sasakawa, n. sp.

eye-margin; eye $1.3-1.5 \times$ as high as wide, sparsely with minute hairs; gena about $1/5$ eye height. Face concave, somewhat higher than wide; carina narrow; antennal groove shallow. Parafacialia linear. Antennae with bases approximated; segment 3 subspherical, minutely pilose; arista $2 \times$ as long as whole length of antenna, swollen on basal $1/5$, minutely pubescent. Palpi broadened apically, about $1/2$ width of antennal segment 3, each with a few subapical setulae. **Thorax:** Mesonotum with $1+3$ *dc*, 1. *dc* before level of *prs*; 3-4 rows of *acr* before transverse suture, but 2 irregular rows of them extending posteriorly almost to level of 3. *dc*; 3-4 *ia*-setulae behind transverse suture; *ipa* about $1/2$ length of *opa*; humeri each with 4-5 setulae plus *h*. Mesopleura without dorsally directed setula; sternopleura with 1-2 setulae before *sp*. **Wing:** Costa with sections 2-4 in proportion of 43:11:13. **Abdomen:** Tergites with sparse setae, *mar* long; tergite 6 as long as 5; sternite 5 nearly $2 \times$ as wide as long, incised on caudal $1/3$. **Terminalia:** Epandrium with a pair of posteroventral processes just above surstyli; surstyli incurved, each bearing 14 setae. Hypandrium with sidepieces narrow; processus longus short and narrow; praegonites relatively large. Basiphallus normal; para- and hypophallus narrow, each slightly bifurcated at distal end and united with short, rod-like sclerite of ventral process; endophallus extremely narrowed distally. Ejaculatory apodeme 100μ long, 82μ wide. **Length:**

Body 1.75-2 mm; wing 2-2.25. Female unknown.

DISTRIBUTION: Japan (Hokkaido).

Holotype ♂, Ashoro, Hokkaido, 16 June 1954; 1 paratype, Jyozankei, Hokkaido, 10 June 1954, Sasakawa.

There are no close relatives in Japan, the palpi and the distiphallus being highly specific for *bifida*. This is somewhat allied to the European *P. digitalis* Hering in the shape of the palpi, but in *digitalis* all knees are yellow, the fringe on the calypter is ochreous yellow, the arista is broadened in the lancet-form, the intra-alar setula is absent and the costal section 2 is $2.3 \times$ as long as 4.

Phytomyza carpesicola Sasakawa, 1955, Kontyû 22: 59. Fig. 115.

DISTRIBUTION: Japan.

HOST: *Carpesium abrotanoides* L.

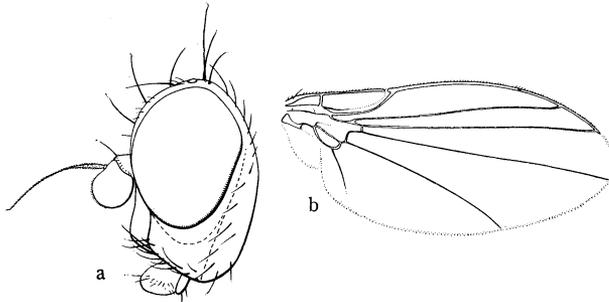


Fig. 115. *Phytomyza carpesicola* Sasakawa.

Phytomyza cineracea Hendel, 1920, Archiv Naturg. A 84: 166. Fig. 116.

Terminalia: Surstyli broad, united with epandrium, bearing 18 setae; sidepieces of hypandrium narrow. Distiphallus only $1/4$ length of phallapodeme; endophallus longer than paraphallus. Praegonites narrow; postgonites as long as sidepieces of hypandrium, with terminal teeth strongly curved. Ejaculatory apodeme 120μ long and broad; bulb small.

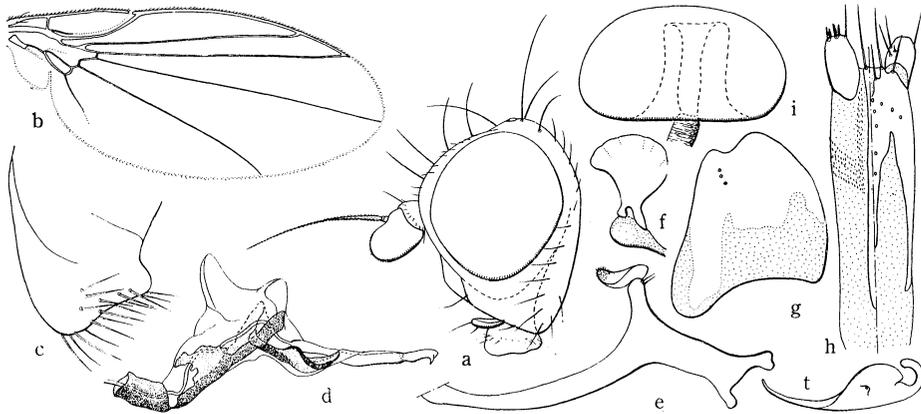
Ovipositor sheath pubescent on proximal $1/3$; apodeme slightly shorter than sheath, pouched on anterior $2/3$. Egg guides subquadrate, 80μ long, with 3 sensillae mesally. Tergite 9 is 245μ long; sternite W-shaped, bearing 3 pairs of *nsm* and about 15 sensillae; cerci each with 4 short *ts*. Spermathecae semiorbicular, $40 \times 72 \mu$; necks 30μ long; ducts pale brown, 460μ long and 10μ in diameter.

Several, Kotoni, Sapporo, 25-30 May 1951, Nishijima.

DISTRIBUTION: Europe, Japan.

This species was identified by comparison with the original and subsequent descriptions of Hendel, but the specimens which I have studied show the only significant variation in the thickness of the arista, that is swollen only on basal $1/3$.

In general structure this species is extremely similar to the species of the *atricornis* group, but the main points of difference between it and the allied species are the brown

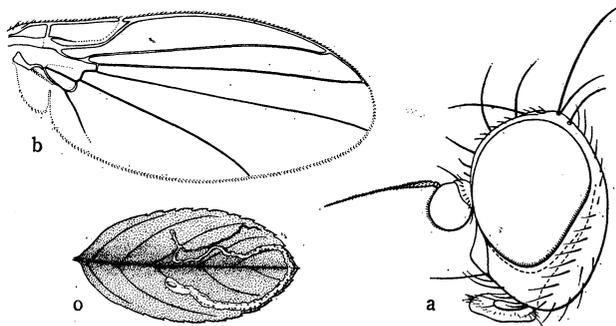
Fig. 116. *Phytomyza cineracea* Hendel.

orbits and dorsal halves of the parafacialia, the suboval antennal segment 3 and 2 rows of the orbital hairs. The larva of *cineracea* is not provided with the frontal process similarly to *nigra*, *atricornis* and *plantaginis*, but easily distinguished from them by the larger number of bulbs (25–35) of the posterior spiracles. The larva mines in the pith of *Ranunculus acer* in Europe.

Phytomyza deutziae Sasakawa, 1957, Akitu 6: 90. Fig. 117.

DISTRIBUTION: Japan.

HOST: *Deutzia crenata* Sieb. & Zucc.

Fig. 117. *Phytomyza deutziae* Sasakawa.

Phytomyza disjuncta Sasakawa, n. sp. Fig. 118.

ADULT. *Male*: Head pale yellow; frontalia somewhat orangish, ocellar triangle and occiput black, black of postgenae reaching dorsal curves of postorbits and extending anteriorly to parafrontalia on level of 1. *ors*; base of 2. *ors* and postorbits ventrally brownish; face yellow, carina and antennal grooves with a slight brown tinge; antennae and palpi

black, but segment 1 yellowish, segment 2 somewhat brownish. Thorax black, densely gray-dusted; mesopleural sutures yellow. Wings hyaline; veins pale brown; calypteres yellowish, with margins and fringe brown; halteres yellow. Legs black; knee of fore leg somewhat brownish. Abdomen subshiny, dark brown, each tergite with yellow caudal margin; epandrium and cerci brown.

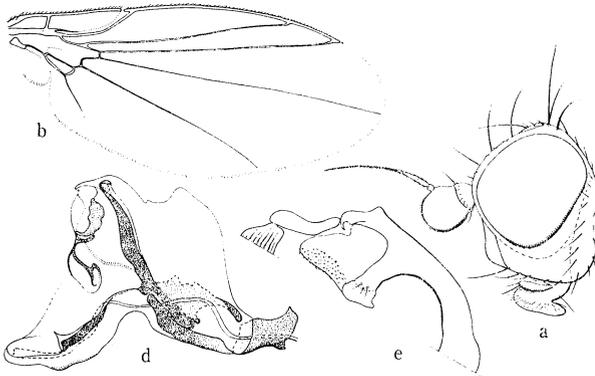


Fig. 118. *Phytomyza disjuncta* Sasakawa, n. sp.

Head: Front $2 \times$ as wide as eye, as broad as long, parallel-sided; parafrontalia $1/4$ width of front, slightly converging ventrally. Ocellar triangle large, with posterior side more than $1/3$ width of vertex; *oc* long, each parallel, with 5-6 setulae. Lunule flattened, semicircular, $1/2$ as high as length between its dorsal margin and anterior ocellus. Fronto-orbitals 4 pairs; 1. *ors* slightly longer than 2, directed up- and outwards, 2. *ors* slightly outwards; *ori* directed inwards; *oh* in a sparse

row. In profile parafrontalia extending beyond upper eye-margin, parafacialia very slightly so; eye almost as high as broad, with very sparse minute hairs; gena about $1/3$ eye height. Face almost vertical, as high as wide; carina distinct; antennal grooves shallow. Parafacialia about $1/3$ as wide as diameter of antennal segment 1. Antennae narrowly separated at bases; segment 3 as long as broad, with microscopic pile; arista nearly $2 \times$ as long as antenna, swollen on basal $1/3$, pubescent. *Thorax*: Mesonotum with 1+3 *dc*, 1. *dc* before level of *prs*; 3-4 pairs of *acr* between 1. and 2. *dc*; *ia*-setula absent behind suture; *ipa* $1/3$ length of *opa*; humerus with 4 setulae plus *h*. Mesopleura with 1-3 dorsally directed setulae; sternopleura with a setula before *sp*. *Wing*: Costa with sections 2-4 in proportion of 38 : 10 : 21. *Abdomen*: Each tergite sparsely covered with setae, *mar* long; tergite 6 as long as 5. *Terminalia*: Surstyli united with epandrium basally, bearing 23-25 setae; processus longus with dorsal lobe striated. Phallapodeme very short, only $1/2$ length of phallus. Para- and hypophallus well developed; endophallus poorly sclerotized. *Length*: Body 2 mm; wing 2.33. Female unknown.

DISTRIBUTION: Japan (Honshu).

Holotype ♂, 2 paratypes, Kibune, Kyoto, 16 May 1954 Sasakawa. Bionomics unknown.

***Phytomyza dryoptericola* Sasakawa, n. sp.** Fig. 119.

ADULT. Male: Head yellow, ocellar triangle centrally dark brown, ventral $3/4$ of occiput brown, postgenae slightly brown-tinged; antennae and palpi yellow; arista testaceous brown. Thorax yellow; mesonotum with 3 brown stripes which are united with each other, median one extending from pronotum between *dc*-rows to bases of 5. *dc* and lateral from level of 1. *dc* to that of 5, brown part on bases of *sa* reaching immediately above wing bases, *prs* and both *pa* growing on yellow area; humeri each with brownish spot; sternopleura faintly brownish, hypopleura with brown spot; dorsal pleurotergite brown.

Wings hyaline; veins yellowish brown, basally yellow; calypteres yellow, with fringe of pale yellow-brown hairs; halteres yellow. Legs yellow, tarsi of posterior 2 legs somewhat tinged with brown. Abdomen yellow, only tergites 3-5 brownish on anterior 1/3-2/3, tergite 6 slightly brownish on dorsomedian part.

Head: Front about $2\times$ as wide as eye, slightly narrower than long, sides converging ventrally; parafrontalia about 1/4 width of front, slightly narrowing ventrally. Ocellar triangle with 10 setulae plus *oc*. Lunule deeply excavated, semicircular, about 1/3 as high as length between its dorsal margin and anterior ocellus. Fronto-orbitals 5 pairs; *ors* directed up- and slightly outwards; 1.

ori directed up- and inwards, 2 and 3 inwards; *oh* rather long, in a row. In profile parafrontalia and parafacialia extending beyond eye-margin; eye about $1.3\times$ as high as wide, almost bare; gena about 1/4 eye height. Face concave, with narrow carina; antennal groove shallow. Parafacialia about 1/2 as wide as diameter of antennal segment 1. Antennae approximated at bases; segment 3 small, a little shorter than wide, microscopically pilose; arista about $2\times$ as long as whole length of antenna, swollen on basal 1/3, minutely pubescent. **Thorax:** Mesonotum with 2+3 *dc*, 1. *dc* about 1/2 length of 2, 2. *dc* situated before level of *prs*; 4 irregular rows of *acr* posteriorly extending almost to level of 5; 7-9 *ia*-setulae in 2 rows; *ipa* about 1/3 length of *opa*; humeri each with 4-5 setulae plus *h*. Mesopleura without dorsally directed setula; sternopleura with 2-3 setulae before *sp*. **Wing:** Costa with sections 2-4 in proportion of 30:9:12. **Abdomen:** Tergites rather densely setigerous, *mar* long; tergite 6 almost as long as 5. **Length:** Body 1.5 mm; wing 1.75.

PUPARIUM. Yellow; oval, about 2 mm long and 1 mm wide. Mandibles narrowly quadrate, each with 2 teeth; labial sclerite $2\times$ as long as mandible; dorsal process of paraclypeal phragma relatively broad, ventral process 5/6 length of dorsal (larval exuvia). Anterior spiracles brown, approximated at bases, about 80μ high, expanded apically, each with about 16 bulbs; posterior spiracles yellowish brown, separated by distance of 1/2 of its own diameter, lower than anterior, each with 12 bulbs in 2 rows. Cuticular processes on abdominal segment 3 arranged in 6-7-3, those of posterior rows almost colorless, minute, about 1/4 as large as those of anterior.

DISTRIBUTION: Japan (Kyushu).

Holotype ♂, Mt. Hiko, Fukuoka Pref., on *Dryopteris*, 31 July 1956, Sasakawa.

The present new species is quite specific in the coloration. It is closely related to European *P. phillyreae* Hering, but in the related species, the gena is 1/2 eye height, the mesonotum with 1+3 *dc* and with or without the *ia*-setula behind the suture, and costal section 2 about $2\times$ as long as 4. This is the only species which mines the leaf of Pteridophyta in Japan.

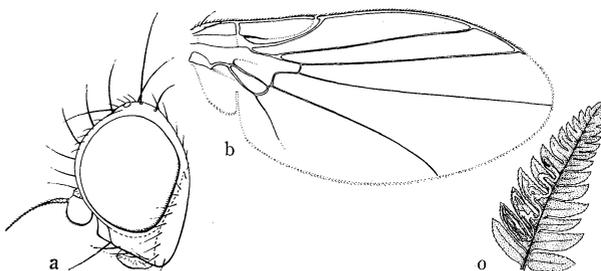


Fig. 119. *Phytomyza dryoptericola* Sasakawa, n. sp.

BIONOMICS. *Host*: *Dryopteris lacera* Thunb. *Mine*: Greenish white ophionome, of the upper surface type; 14 cm in length and 1 mm in greatest width; mostly it runs along margin of leaf. The black grains of frass are arranged in a very long line along one side of mine. *Tenancy*: 1-3 mines in a single leaf. *Pupation*: The mature larva makes a pupal blister (3.5 mm in length, 2 mm in width) at end of mine. *Remarks*: This species occurs in Honshu; many puparia were collected at Tochu, Kyoto Pref., 10 July 1955, in *Asplenium incisum* Thunb.

***Phytomyza esakii* Sasakawa, 1955, Kontyû 22: 61. Fig. 120.**

Terminalia: Surstyli about 1/3 height of epandrium, bearing about 16 setae. Distiphallus about 1/3 length of phallapodeme; ventral processes U-shaped, posteriorly brush-shaped; endophallus bifurcated. Ejaculatory apodeme $64\ \mu$ long and wide, bulb with small chitinous plate.

Ovipositor sheath almost as long as tergite 6, pubescent on proximal 2/3; apodeme slightly longer than sheath, pouched on anterior 1/3. Egg guides more or less pointed posteriorly, about $80\ \mu$ long and broad, with 6 sensillae. Tergite 9 is $140\ \mu$ long; sternite W-shaped, $240\ \mu$ long, bearing 6-7 *nsm* and about 16 sensillae; cerci each with 4 *ts* which are 1/5 length of cercus. Spermathecae semiorbicular, $24 \times 50\ \mu$; ducts $240\ \mu$ long and $6\ \mu$ in diameter.

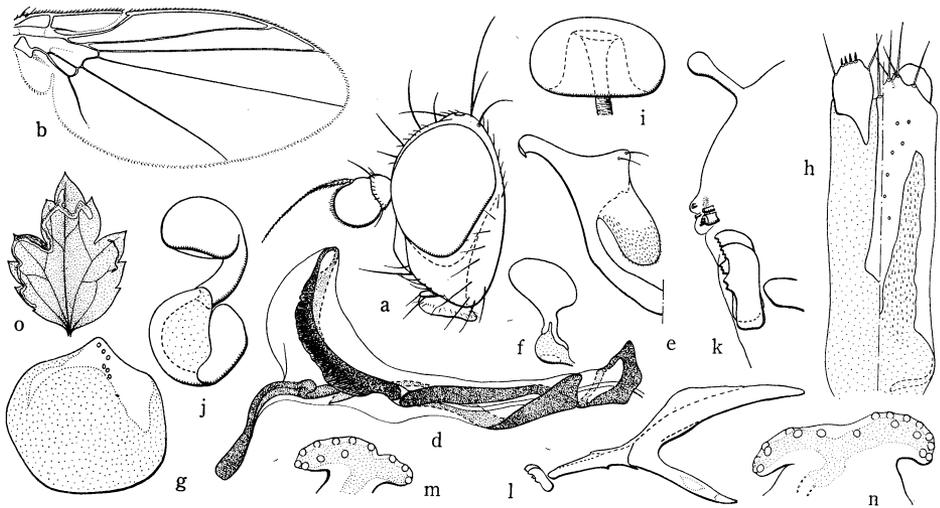


Fig. 120. *Phytomyza esakii* Sasakawa.

Spinal pattern of larva: on lateral side, $1T=5.0$, $2T=0$, $3T=0.2$, $1A=4.5.2-4$, $2-5A=8-10.4-6$, $6-7A=7-8.5$, $8A=7-8.0$; $D \& V=0$.

Many were reared from larvae in leaves of *Clematis*, Mt. Hira, Shiga Pref., 19 Mar. 1955, Sasakawa.

DISTRIBUTION: Japan.

HOSTS: *Clematis apiifolia* DC. and *stans* Sieb. & Zucc.

Phytomyza eupatorii Hendel, 1927, Zool. Anzeig. 69: 258. Fig. 121.

Terminalia: Surstyli slightly protruded, $1/8$ as long as height of epandrium, each with 25 setae; hypandrium with short apodeme, para- and hypophallus nearly $2/3$ length of phallapodeme, 320μ long, bearing 2 rows of 15 spines, endophallus weakly sclerotized; ejaculatory apodeme smaller, 56μ long, 36μ wide; ovipositor sheath pubescent on proximal $3/4$, egg guides 60μ long, each with 3 large sensillae; tergite 9 180μ long, sternite bare, 220μ long, bearing 4 pairs of *nsm* and 6 pairs of sensillae; spermathecae 40×54 to $44 \times 60 \mu$; ducts 270μ long and 8μ in diameter, differing from *albiceps* and its allies.

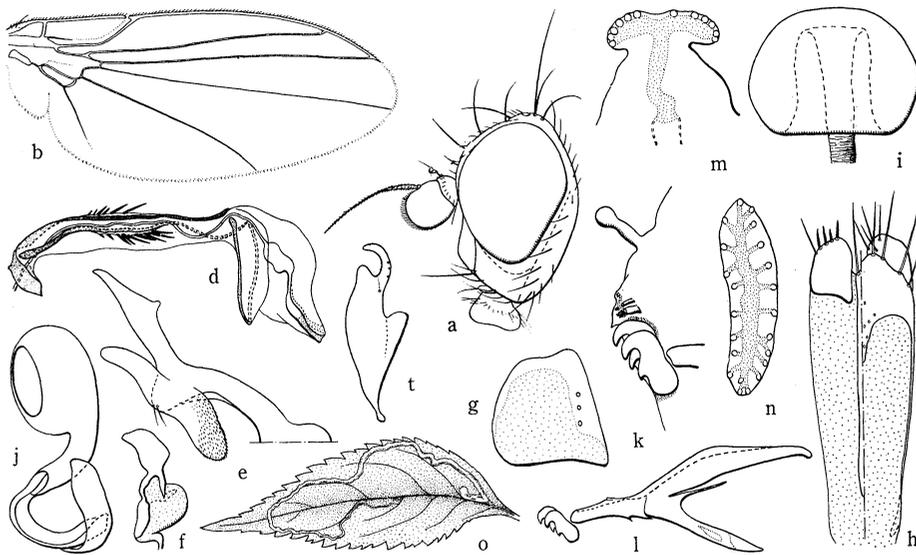


Fig. 121. *Phytomyza eupatorii* Hendel.

LARVA. Head with a frontal process and a narrow band of cuticular spinules just ventrad of that; maxillary palpi with long sensillae. Mandible with 2 teeth, dorsal tooth ventrally 5- or 6-denticulated and ventral tooth 3-denticulated. Anterior spiracles 2-lobed apically, about 80μ high and long, each with 11-20 bulbs; posterior spiracles cylindrical, not expanded apically, about 300μ long, 150μ high, each with 24-26 bulbs. Cuticular processes minute; spinal pattern: on dorsal side, 1-2T=0, 3T=1.0, 1-2A=1-2.0, 3-7A=3-5.0, 8A=0; on lateral, 1T=6.0, 2T=0.2, 3T=2.2, 1-2A=4-5.3-4, 3-5A=5-8.4-5, 6-7A=8-10.4-6, 8A=5.0; on ventral, 1T=a band of many rows just ventrad of mandibles, 2T-2A & 8A=0, 3-7A=2-3.0.

Many, including immature stages, on *Eupatorium*, Mt. Hira, Shiga Pref., 7-27 Apr. 1955, Sasakawa; Mt. Hiko, Fukuoka Pref., 26 June 1956, Sasakawa; Sapporo, 11-16 July 1956, T. Kumata.

DISTRIBUTION: Europe, Japan.

HOSTS: *Eupatorium japonicum* Thunb. and *sachalinense* Makino.

Phytomyza facialis Kaltenbach, 1874, Pflanz. Feinde, 274. Fig. 122.

Terminalia: Surstyli united with epandrium, each with about 30 setae. Hypandrium with short apodeme. Basiphallus very short; para- and hypophallus with 10 dorsally directed spines near distal end; ventral process broadly membranous, with U-shaped sclerite irregularly and minutely serrulated at proximal part; endophallus weakly sclerotized, dilated trumpet-formedly, quite differing from phallus of the *albiceps* group. Ejaculatory apodeme $80\ \mu$ long and wide; bulb with a few small chitinous plates.

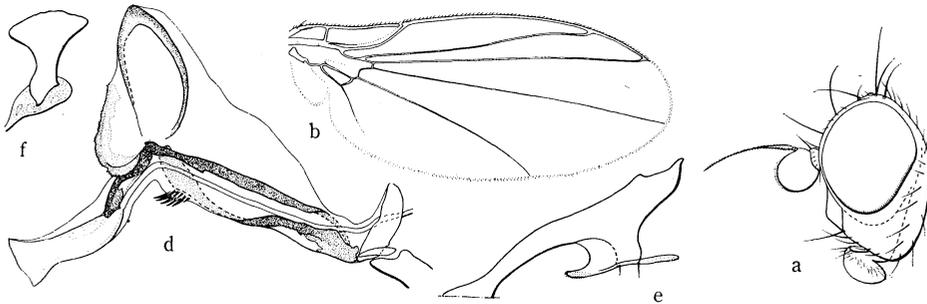


Fig. 122. *Phytomyza facialis* Kaltenbach.

Several, Ashoro & Akan, Hokkaido, 16-17 June 1954, Sasakawa.

DISTRIBUTION: Europe, Japan.

HOST: *Bupleurum falcatum* L.

Phytomyza fimbriata Sasakawa, 1955, Saikyo Univ., Sci. Rep., Agr. 7: 27. Fig. 123.

DISTRIBUTION: Japan.

HOST: *Impatiens noli-tangere* L.

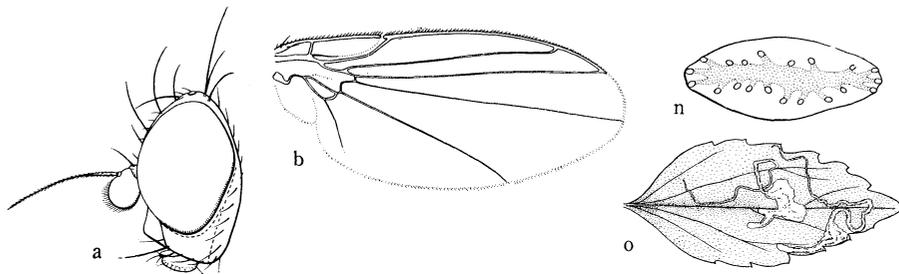


Fig. 123. *Phytomyza fimbriata* Sasakawa.

Phytomyza flavofemoralis Sasakawa, 1955, *l. c.*, 29. Fig. 124.

Scutellum sometimes obscurely yellowish on mesal part; femora rarely with darker

stripes at places.

Terminalia: Surstyli small, united with epandrium, each with 27–30 setae; para- and hypophallus well-developed; ventral process extremely projected, setulose apically. Ovipositor sheath longer than tergite 6, pubescent on basal 1/2; apodeme slightly shorter than sheath, pouched on anterior 1/3. Egg guides subquadrate, $72\ \mu$ long, each with 2 sensory setae and 1 sensilla. Tergite 9 is $160\ \mu$ long; sternite W-shaped, bearing 3 pairs of *nsm* and about 8 sensillae; cerci each with 4 short *ts* which are about 1/5 length of cercus. Spermathecae orbicular, with truncate proximal end, 50×60 to $55 \times 65\ \mu$.

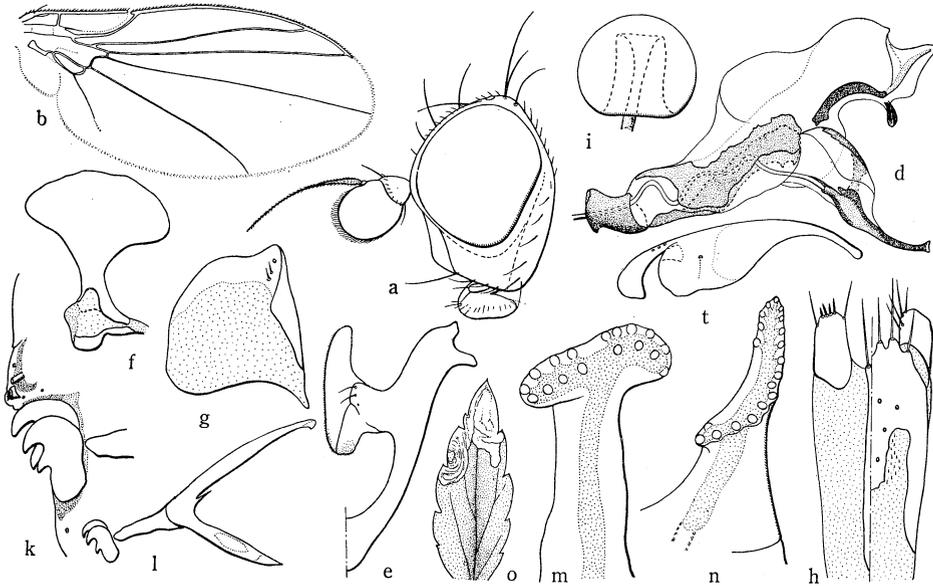


Fig. 124. *Phytomyza flavofemoralis* Sasakawa.

LARVA. Full-grown larva yellowish white, about 3 mm in body length. Head without frontal process and band of cuticular process; mandible with 2 teeth. Anterior spiracles approximated at bases, each $160\ \mu$ high, with 15–18 bulbs; posterior spiracles slightly longer than anterior, apically brown, each with 13–19 bulbs. Cuticular processes pale brown, those of antermost row on prothoracic segment and postermost row along anterior margin of each abdominal segment especially larger than others; spinal pattern: on dorsal side, $1T-2A \& 6-8A=0$, $3A=4.0$, $4A=5.0$, $6A=2.0$; on lateral, $1T=3.0$, $2-3T=3.2-3$, $1-2A=4-5.3$, $3-7A=5-6.3-4$, $8A=5.0$; on ventral, $T, 1-4 \& 7-8A=0$, $5-6A=0.1$.

Many, including larvae, Ohara, Kyoto, on *Anemone*, 1 May 1956, Sasakawa; Okayama, Honshu, on *Ranunculus*, 21 Mar. 1954, K. Koizumi.

DISTRIBUTION: Japan.

HOSTS: *Anemone yezoensis* Koidz., *Ranunculus glaber* Makino.

Phytomyza gentianae Hendel, 1920, Archiv Naturg. A 84: 163. Fig. 125.

In all external characters the Japanese specimens agree with *gentianae*, but I describe

the following significant terminalia characters :

Surstyli united with epandrium, strongly incurved, each with 19 short setae which are directed upwards; sidepieces of hypandrium broad. Para- and hypophallus short, less than 1/2 of hypandrium; endophallus forked, narrowing distally. Ejaculatory apodeme minute, plectrum-shaped, 50 μ long, 24 μ wide.

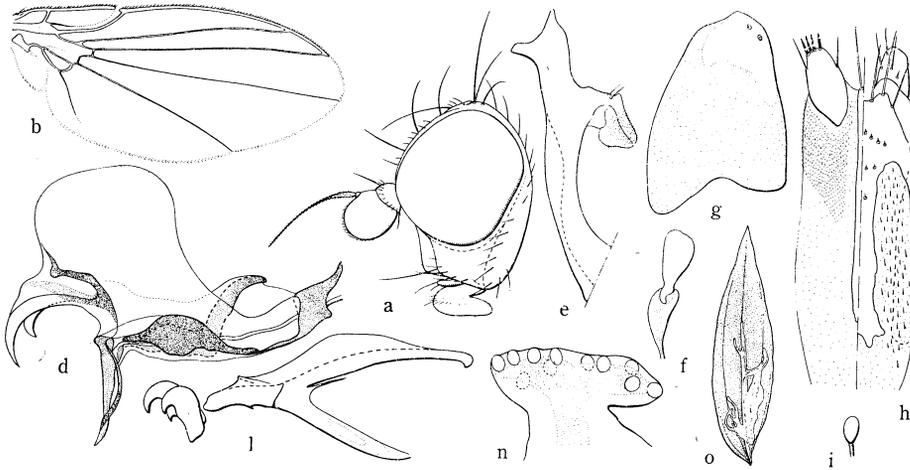


Fig. 125. *Phytomyza gentianae* Hendel.

Ovipositor sheath slightly longer than tergite 6, pubescent on proximal 3/4; apodeme shorter than sheath, pouched on anterior 1/2; egg guides subtriangular, 60 μ long, with 3-4 sensillae. Tergite 9 is 160 μ long; sternite W-shaped, bearing 2 pairs of *nsm* and 15-17 sensillae; cerci each with 4 *ts* which are 1/4 length of cercus. Spermathecae pale brown, oval, 10 \times 5 μ ; ducts 160 μ long, 3 μ in diameter.

Spinal pattern of larva: on dorsal side, T=0, 1A=2.9, 2A=6.9, 3A=6.6, 4A=4.6, 5A=3.2, 6A=4.0, 7-8A=0; on lateral, 2-3T=4-5.3-4, 1-5A=7-9.4-5, 6-7A=6-8.3-4, 8A=6-7.0; on ventral, 2T=1.0, 1-4A=2.4-0, 5-8A=0.

Many, bred from leaf-mines on *Gentiana*, Mt. Hira, Shiga Pref., 8-15 Oct. 1954, Sasakawa.

DISTRIBUTION: Europe, Japan.

The structure of the σ phallus suggests relations to *P. abeliae* Sasakawa, n. sp., but the related species quite differs in having the head yellow. The spermathecae of *gentianae* are quite small and sternite 9 is covered with rather long setulae on the membranous part, differing from any other species known from Japan.

HOSTS: *Gentiana makinoi* Kusnez. and *sikokiana* Maxim.

Phytomyza helianthi Sasakawa, 1955, Saikyo Univ., Sci. Rep., Agr. 7: 30.

Fig. 126.

Surstyli united with epandrium basally, each with 17-20 setae; para- and hypophallus

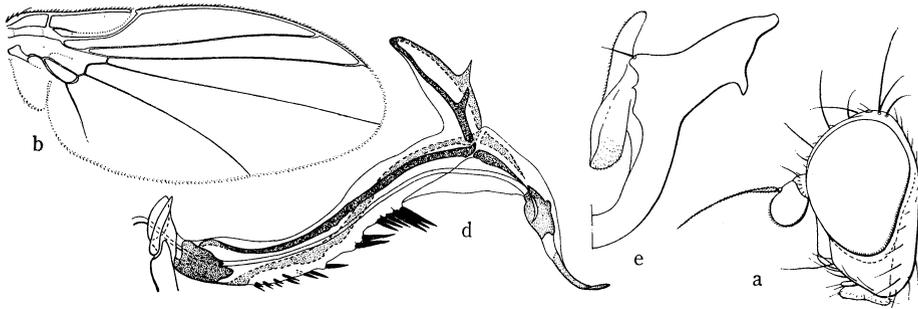


Fig. 126. *Phytomyza helianthi* Sasakawa.

longer than hypandrium, dorsally bearing about 20 long spines in 2 rows; U-shaped sclerite of ventral process branched basally; endophallus consisting of paired dorsally projected pieces and bifurcated distal pieces.

DISTRIBUTION: Japan.

HOST: *Helianthus tuberosus* L.

Phytomyza homogyneae Hendel, 1927, Zool. Anzeig. 69: 261. Fig. 127.

The specimens examined are identical with the original description except for the relative length of the costal sections, as 52 : 13 : 15 in the Japanese specimens.

Terminalia: Surstyli separated from epandrium, each bearing 38 setae in 6 rows. Hypandrium with sidepieces very narrow, about 3/5 length of phallapodeme. Para- and hypophallus long and broad, 2/3 length of hypandrium, each with a long spine at distal end, differing from the known Japanese species which are more spinous on the distiphallus. Ejaculatory apodeme 120 μ long, 80 μ wide; bulb with a small sclerite.

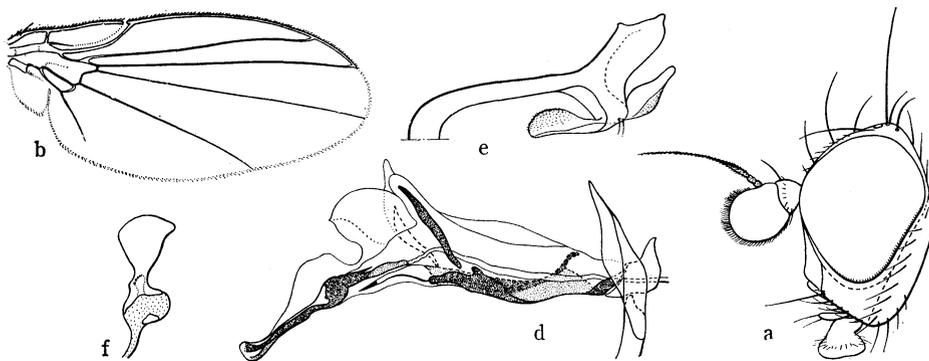


Fig. 127. *Phytomyza homogyneae* Hendel.

Many, including immature stages, Towada, Aomori Pref., 23 Apr. 1953, Sasakawa; Jyo-zankei, Nukabira, Ashoro, Shibechea, Hokkaido, 10-19 June 1954, Sasakawa.

DISTRIBUTION: Europe, Japan.

HOSTS: *Aster trinervius* var. *adustus* Maxim., *Homogyne* sp.

Phytomyza hydrangeae Sasakawa, 1956, *Ins. Matsumurana* **19**: 106. Fig. 128.

DISTRIBUTION: Japan.

This is a distinctive species in that the dorsal 1/2 of mesopleuron is yellow and the femora are black, with yellow knees, differing from *flavofemoralis* Sasakawa and *paniculatae* Sasakawa.

HOST: *Hydrangea paniculata* Sieb.

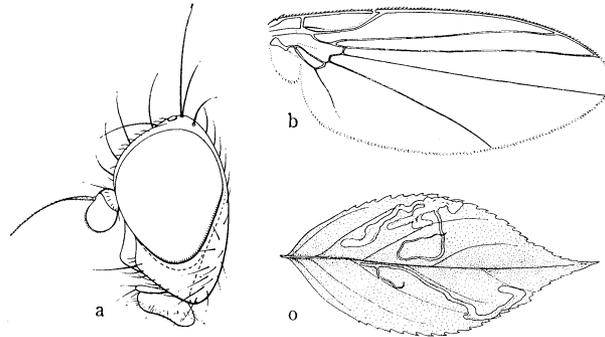


Fig. 128. *Phytomyza hydrangeae* Sasakawa.

Phytomyza japonica Sasakawa, 1953, *Saikyo Univ., Sci. Rep., Agr.* **4**: 15. Fig. 129.

Terminalia: Epandrium with numerous setulae on inner anteroventral membranous part; surstyli small, separated from it by suture, each bearing 18 setae. Hypandrium with sidepieces rather broad, especially at anterior end. Phallapodeme with posterior processes about 1/5 of its own length. Basiphallus short; para- and hypophallus narrow, longer than sidepieces of hypandrium, 300 μ long; ventral process U-shaped; endophallus short, weakly chitinized at end of each piece. Ejaculatory apodeme minute, 80 μ long, 40 μ wide; bulb almost as large as blade.

Ovipositor sheath about 1.5 \times as long as tergite 6, pubescent on proximal 2/3; apodeme 3/4 length of sheath, pouched on anterior 1/2. Egg guides subtriangular, 60 μ long, mesally with 5-6 sensillae. Tergite 9 is 140 μ long; sternite W-shaped, bearing 3 pairs of *nsm* and 10 sensillae; cerci each with 4 *ts*, which are about 1/4 length of cercus. Spermathecae orbicular, somewhat constricted above truncate proximal end, 64 \times 56 to 72 \times 72 μ ; ducts 320 μ long, 8 μ in diameter.

Spinal pattern of larva: on dorsal side, 1-2T=0, 3T=3.0. 1A=4.0, 2A=5.1, 3A=5.2, 4-6A=6.3, 7A=5.0, 8A=7.0; on lateral, 1T=8.0, 2-3T=3-4.2-3, 1 & 6-7A=5-6.3-4, 2-5A=7-9.4-5, 8A=5.0; on ventral, T=0, 1-6A=sparsely 8-9.6-7, 7A=7.5, 8A=7.0.

Additional numerous, including immature stages, on *Aster*, Horikawa, Kyoto, 26 Oct. 1955; Kagoshima City, 1 Mar. 1956; on *Hieracium*, Kibune, Kyoto, 21 Nov. 1955; on *Bellis*, Shimogamo, Kyoto, 29 Oct.-3 Nov. 1953, 5-9 Apr. 1954, Sasakawa,

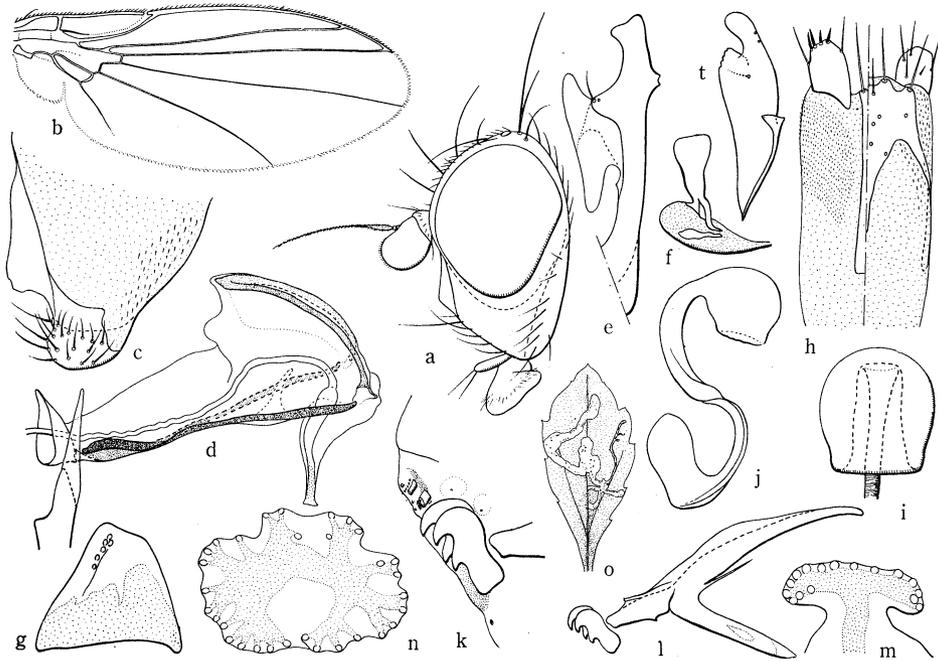


Fig. 129. *Phytomyza japonica* Sasakawa.

DISTRIBUTION: Japan.

This species differs from *homogyneae* Hendel, in having minute pile on antennal segment 3, broader parafacialia and long, rod-like paraphallus and hypophallus. The globular spermatheca which bears the shallow basal constriction of *japonica* is similar to that of *jucunda* Frost & Sasakawa, but is larger and the spermathecal ratio is 0.21, while in *jucunda* 0.67. The peculiar row of minute spines dorsad bases of the antennae and many bulbs of the large posterior spiracles will serve to distinguish the larva of this species.

HOSTS: *Aster indicus* L., *Bellis perennis* L., *Hieracium japonicum* Franch. & Sav.

***Phytomyza jucunda* Frost and Sasakawa, 1954, Mushi 27: 49. Fig. 130.**

Terminalia: Epandrium covered densely with setae on ventrocaudal part; surstyli as long as cerci, separated from epandrium by suture, bearing 12–15 setae; processus longus narrow. Hypandrium broadened anteriorly, about 2/5 length of phallapodeme. Para- and hypophallus broad, each shorter than 1/3 length of phallapodeme; sclerites of ventral processes with serrated margins. Ejaculatory apodeme 180–260 μ long, 160–200 μ broad, bulb with a narrow sclerite.

Ovipositor sheath almost as long as tergite 6, pubescent except for distal margin; apodeme slightly longer than sheath, strongly chitinized, pouched on anterior 3/4. Egg guides subtriangular, 60 μ long, each with 3 sensillae. Tergite 9 is 180 μ long; sternite W-shaped, with 3 pairs of *nsm* and 6 sensillae; cerci rather short, with 4 long *ts*. Spermathecae globular, somewhat constricted just above proximal margin, 40 \times 36 to 40 \times 40 μ ; ducts

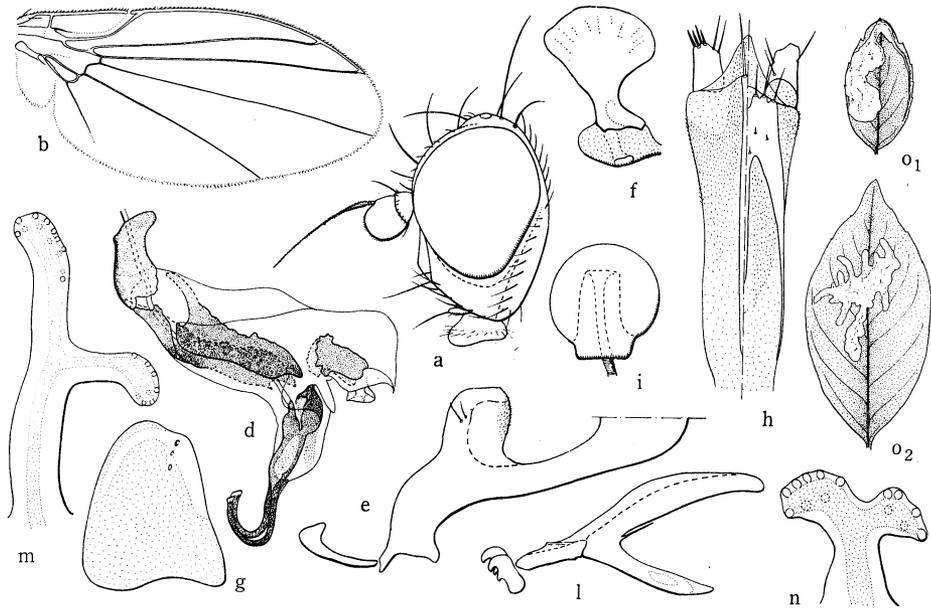


Fig. 130. *Phytomyza jucunda* Frost and Sasakawa.

extremely long, 560–640 μ long, 6 μ in diameter.

LARVA. Cuticular processes pale yellow-brown, posterior processes of anterior rows of each segment larger than anterior, ventral processes on thoracic segments sharply pointed; spinal pattern: on dorsal side, T, 1 & 8A=0, 2 & 5–7A=4–5, 3–4A=6–7, sparsely at middle of segments; on lateral, 1T=6.0, 2T=0.1, 3T=3.3, 1–4A=4–5.3, 5–7A=6–7.4–5, 8A=7.0; on ventral, 1T=4.0, 2T=3.0, briefly at middle of segments.

Many, including immature stages, on *Ilex*, Shimogamo, Kyoto, 17 Nov. 1955, Sasakawa; Toyama, Toyama Pref., 20 Jan. 1956, S. Takagi; Sapporo, 18–25 Jan. 1956, T. Kumata.

DISTRIBUTION: Japan.

HOSTS: *Ilex crenata* Thunb. (Fig. 130, O₁), *macropoda* Mq. and *radicans* Ohwi, *Illium religiosum* Sieb. & Zucc. (O₂).

Phytomyza kisakai Sasakawa, 1954, Saikyo Univ., Sci. Rep., Agr. 6: 110. Fig. 131.

Cuticular processes of larva yellowish brown, only well-developed on sides, 1T=5–6.0, 2–3T=2–3.2, 1–2A=4.3, 3–5A=4–5.3, 6–7A=4.3, 8A=4.0.

DISTRIBUTION: Japan.

HOST: *Styrax japonica* Sieb. & Zucc.

Phytomyza lappae Robineau-Desvoidy, 1851, Rev. Mag. Zool. 3: 399. Fig. 132.

Terminalia: Surstyli a little projected inwardly, each with 18–20 setae. Hypandrium with sidepieces relatively broad, nearly 3/5 length of phallapodeme. Processus longus nar-

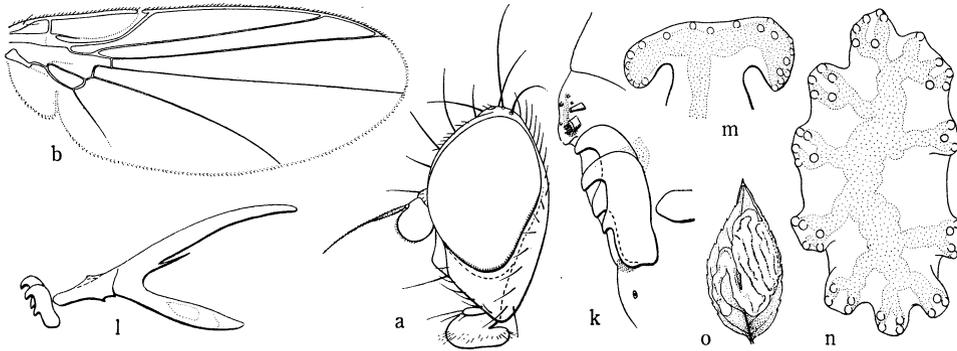


Fig. 131. *Phytomyza kisakai* Sasakawa.

row, rod-like, about 1/3 length of hypandrium. Para- and hypophallus as long as hypandrium, about 400 μ long, each provided with a group of strong spines on proximal part; endophallus shorter than U-shaped ventral process, broadly membranous. Ejaculatory apodeme about 100 μ long, 60 μ wide, bulb rather large.

Ovipositor sheath pubescent on proximal 1/2; apodeme as long as sheath, pouched on anterior 1/2. Egg guides subtriangular, loosely serrated laterally, each with 5 sensillae. Tergite 9 is 180 μ long; sternite W-shaped, 240 μ long, bearing 3 pairs of *nsm* and 6 sensillae; cerci each with 4 *ts* which are about 1/5 length of cercus. Spermathecae semi-

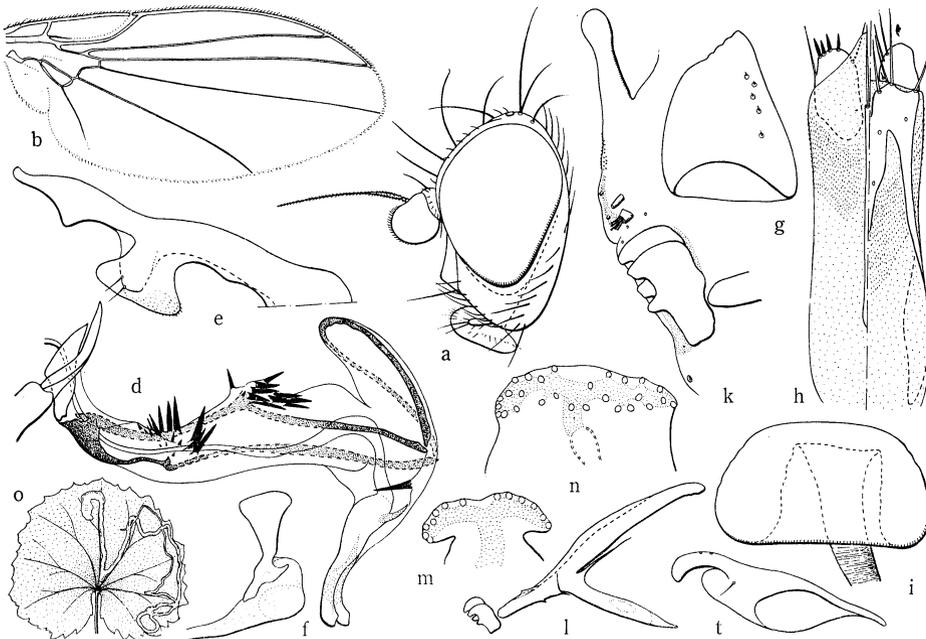


Fig. 132. *Phytomyza lappae* Robineau-Desvoidy.

spherical, 32×64 to $45 \times 72 \mu$; ducts $320-360 \mu$ long, about 17μ in diameter.

Larva similar to *eupatorii*, but teeth of mandibles straight, anterior spiracles with 12-13 bulbs, posterior spiracles with 22-29 bulbs, cuticular processes almost equal in size, spinal pattern: on lateral side, $1T=7-8.0$, $2T=0$, $3T=0.2$, $1A=3.2$, $2-6A=4.5-3.4$, $7A=6.2$, $8A=4.5-0$, $D \& V=0$.

Many were reared from larvae in leaves of *Adenocaulon*, Kibune, Kyoto, 4-6 June 1954, Mt. Hiko, Fukuoka Pref., 7 May 1956, Sasakawa; in *Arctium*, Oohara, Kyoto, 24 May 1955; in *Petasites*, Matsuyama, Ehime Pref., T. Yano.

DISTRIBUTION: Europe, E. Asia, Japan.

HOSTS: *Arctium lappa* L., *Adenocaulon adhaerescens* Maxim., *Petasites japonicus* Miq., *Ligularia tussilaginea* Makino.

Phytomyza minuscula Goureau, 1851, Soc. Ent. France, Ann. 9: 153. Fig. 133.

Although I have not compared directly with the types, the Japanese specimens agree in general with both Goureau's and Hendel's descriptions, except for the relative length of the costa. All the Japanese specimens have a much shorter second costal section (relative length of section 2 to that of 4 as 2.5-3:1). Frick (1959) recorded also its considerable variation in the North American specimens (as 2-3.4:1).

Terminalia: Surstyli narrow, cylindrical, bearing 14-15 setae. Processus longus suboval, nearly $1/2$ length of hypandrium, with a pair of setae. Distiphallus about $1/3$ length of phallapodeme; ventral process strongly chitinized; endophallus setulose distally. Postgonites a little shorter than hypandrium, with long terminal teeth. Ejaculatory apodeme 110μ long, 140μ wide; bulb with large sclerite.

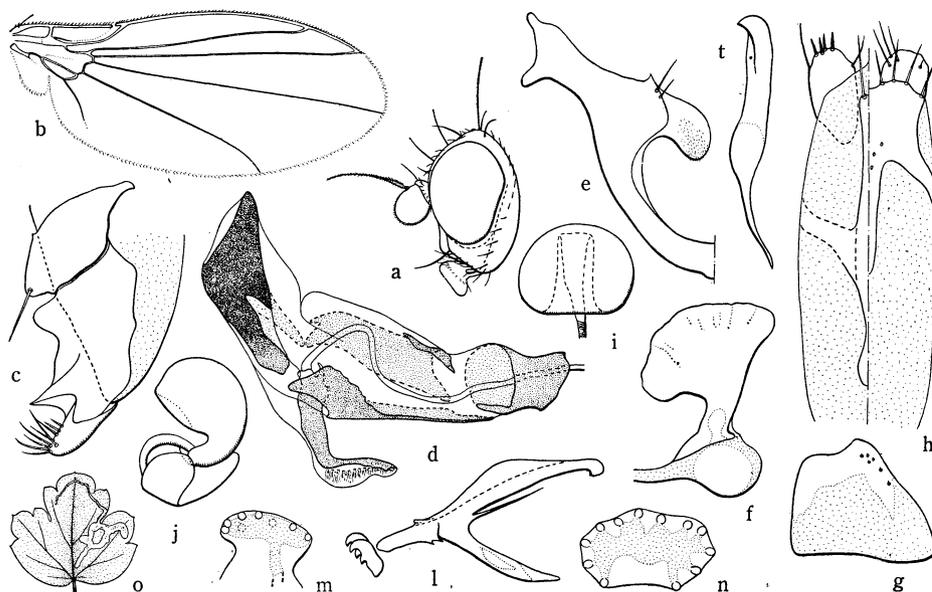


Fig. 133. *Phytomyza minuscula* Goureau.

Ovipositor sheath as long as or $1.5 \times$ length of tergite 6, pubescent all over surface; apodeme as long as sheath, pouched on anterior $1/5$. Egg guides subquadrate, 60μ long, each with 6 sensillae. Tergite 9 cruciform, about 160μ long; sternite W-shaped, laterally united with tergite, with 4 pairs of *nsm* and about 6 sensillae; cerci each with 4 short *ts*. Spermathecae orbicular with truncate proximal end, 50×60 to $56 \times 64 \mu$; necks brown, 50μ long; ducts $320\text{--}340 \mu$ long, about 7μ in diameter.

Many, including larvae, puparia, on *Thalictrum*, Sapporo, 16 May 1950, Nishijima; Ashoro, 16 June 1954, Shibeche, Hokkaido, 21 June 1954, Sasakawa; Yoshino, Nara Pref., 10 June 1953, Sasakawa.

DISTRIBUTION: Europe, Japan, N. America.

This species is specific in the shiny mesonotum, the absence of *ia*-setula, the large processus longus and ventral process of distiphallus and the cruciform tergite 9, highly differing from any other species of the group.

HOSTS: *Aquilegia flabellata* Sieb. & Zucc., *Thalictrum aquilegifolium* L., *thunbergii* DC. and var. *majus* Nakai, and *tuberiferum* Maxim.

Phytomyza murina Hendel, 1935, IN Lindner: Die Flieg. Palaearkt. Reg. 59: 434. Fig. 134.

Terminalia: Surstyli rather strongly projected, as long as height of cercus, each bearing 20–23 setae; cerci $1/4$ height of epandrium. Paraphallus narrow but bifurcated distally, about $1/3$ length of phallapodeme; ventral process apically with a pair of spines; endophallus with numerous minute spines on lateral sides of distal membranous part. Postgonites with extremely long terminal teeth. Ejaculatory apodeme 100μ long and 75μ wide; bulb large.

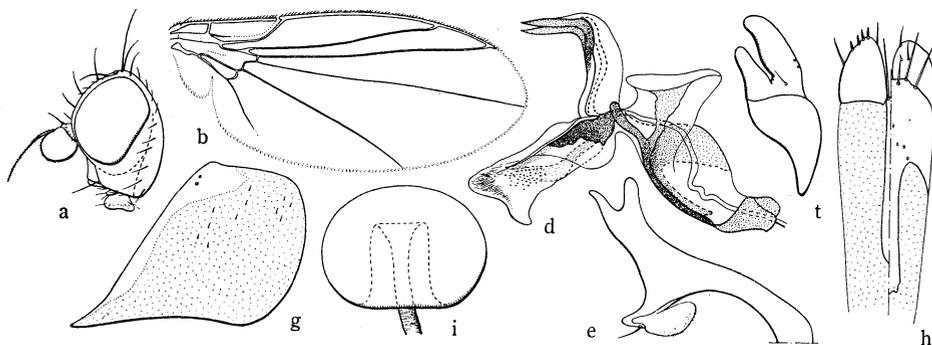


Fig. 134. *Phytomyza murina* Hendel.

Ovipositor sheath $3 \times$ as long as tergite 6, pubescent on proximal $3/4$; apodeme slightly shorter than tergite 6, pouched on anterior $1/3$. Egg guides subquadrate, 60μ long, broadly membranous, mesally with many setulae. Tergite 9 is 120μ long; sternite 180μ long, with 3 pairs of *nsm* and several sensillae; cerci with 4 minute *ts*. Spermathecae orbicular, with truncate proximal end, 44×52 to $48 \times 60 \mu$; ducts slightly brown-tinged, 200μ long, 7μ in diameter.

Many, Shibeche, Hokkaido, 19–22 June 1954, Sasakawa.

DISTRIBUTION: Europe, Japan.

The specimens from Japan have the dorsal mesopleural setula. However, no other significant differences from the types were found in the color and structural characters.

The pale brown spermathecal ducts are only characteristic for *murina* and *cineracea* Hendel. *P. cineracea* can be separated from this species by its darker face and longer antennal segment 3.

Phytomyza nannodes Hendel, 1935, IN Lindner: Die Flieg. palaearkt. Reg. 59: 435. Fig. 135.

This species was described from 4 males and females from East Siberia, China and Japan (Misaki, Kiu-Shiu, VII). Although I have not seen the type, the yellow second antennal segment suggests that my species are of the same species as Hendel's.

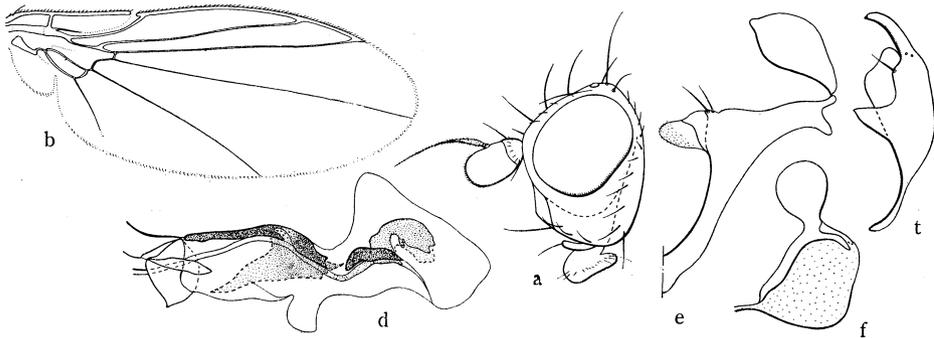


Fig. 135. *Phytomyza nannodes* Hendel.

The male terminalia of this species differ from that of *plantaginis* in the presence of 8 minute spines on the paraphallus and in the absence of a group of hairs at end of the endophallus.

Several, Kibune, Kyoto, 16 May 1954, Sasakawa.

DISTRIBUTION: E. Asia.

Phytomyza nigra Meigen, 1830, Syst. Besch. bekannt. eur. zweifl. Insekt. 6: 191. Fig. 136.

ADULT. Head yellowish brown to pale brown; occiput and postgenae brownish black; face brown; antennae and palpi brownish black. Thorax black, densely grayish pollinose; abdomen subshiny, brown to blackish brown, anterior 5 tergites with yellow caudal margins linearly. Wings hyaline; veins pale yellowish-brown; calypteres yellow, with margins and fringe brown. Legs black, with yellow knees.

Front 1.7-2 × as wide as eye, as broad as or slightly narrower than long; ocellar triangle with 1-2 pairs of setulae plus *oc*; lunule a little higher than semicircular; *or* 4. In profile parafrontalia slightly extending beyond upper eye-margin; eyes slightly higher than wide, densely with whitish minute hairs; genae 1/3-1/4 eye height. Mesonotum with 1+3 *dc*, 1. *dc* before level of *prs*; 2 rows of *acr* extending before level of 3. *dc*; 1-2 *ia* se-

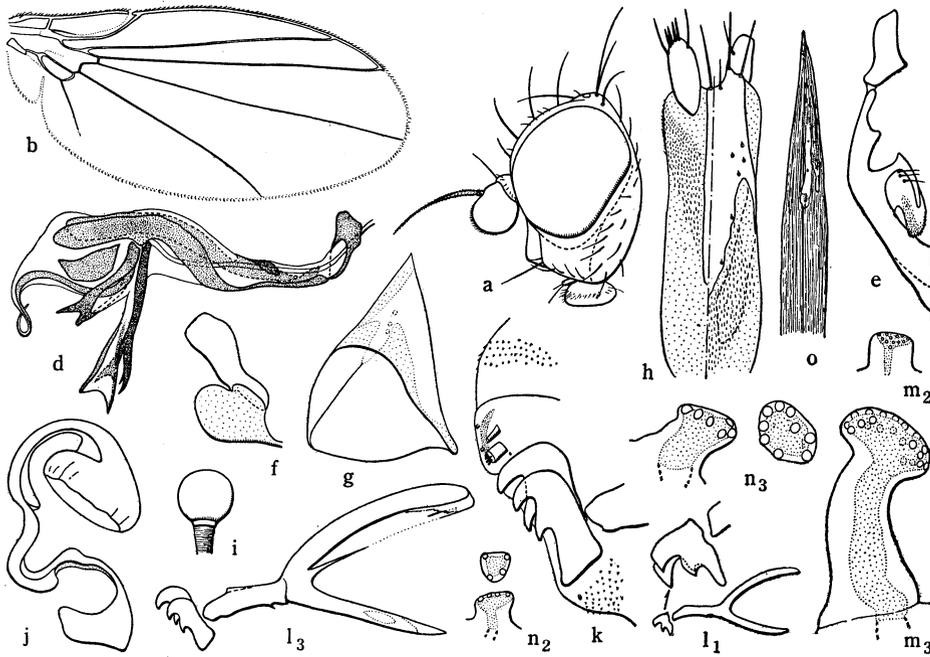


Fig. 136. *Phytomyza nigra* Meigen.

tulae behind suture; *ipa* about $1/3$ length of *opa*; humeri each with 5–6 setulae plus *h*. Mesopleura without or with a dorsally directed setula; sternopleura usually with 2 setulae before *sp*; costal ratio as 51 : 14 : 20.

Surstyli separated from epandrium by suture, about $1/5$ height of epandrium, each with 18–21 setae. Hyandrium medium-sized, with minute apodeme; processus longus boot-shaped. Para- and hypophallus long, curved dorsally, the former $2/3$ length of phallopodeme, with a pair of ventral processes, one of which U-shaped, another one bifurcated distally; endophallus narrow, coiled once at distal end. Ejaculatory apodeme spatula-shaped, 30μ long, 18μ wide.

Ovipositor sheath pubescent on proximal $2/3$; apodeme slightly shorter than sheath, pouched on anterior $1/5$. Egg guides triangular, sharply pointed posteriorly, about 80μ long, each with 3 sensillae. Tergite 9 is 160μ long; sternite W-shaped, about 200μ long, bearing 6–7 *nsm* and about 12 sensillae; cerci each with 4 *ts* which are about $1/3$ length of cercus. Spermathecae minute, orbicular, 20×20 to $20 \times 26 \mu$; necks ring-like, about 2μ long; ducts 300 – 320μ long, 6μ in diameter. Ventral receptacle as figured, with tail 115μ long.

LARVA. Milky white; larval characters in all stadia are summarized in chart and figured.

DISTRIBUTION: Europe, N. Asia, Japan, N. America.

This Holarctic species is unusual in having the densely hairy eyes, a pair of ventral processes on the distiphallus, the apically pointed egg guides, and the ring-like necks of the

LARVAL CHARACTERS OF *PHYTOMYZA NIGRA*

Character \ Instar	1st	2nd	3rd
Body length (mm)	0.99 (0.66-1.18)	1.63 (1.07-2.14)	3.26 (2.68-3.84)
Body width	0.23 (0.14-0.30)	0.40 (0.26-0.53)	0.82 (0.56-1.10)
Mandible	triangular (fig. 136, l ₁)	quadrate	quadrate (l ₃)
Labial sclerite: dorsal process of paraclypeal phragma	1 : 1.8	1 : 2.1	1 : 2.4
Anterior spiracle height (μ)	—	12	80
number of bulbs	—	12 (9-13)(fig. 136, m ₂)	20 (16-25)(m ₃)
Posterior spiracle height (μ)	—	12	40
number of bulbs	—	3-4 (fig. 136, n ₂)	9 (6-13) (n ₃)
Spinal pattern on 3rd abdominal segment	—	3-4-2	6-7-3-4

spermathecae.

This is one of the important economic species in cultivated fields of wheat and barley in Japan. In 1898, Sasaki first reported its morphology and biology in the male of *Chlorops* sp. (Komugi-no-habae). Ecological notes on this species were reported by me (1953-54).

HOSTS: *Triticum aestivum* L., *Hordeum vulgare* L. var. *hexastichon* Aschers., *Secale cereale* L., *Alopeurus aequalis* Sobol., *A. pratensis* L., *Anthoxanthum japonicum* Hack., *A. odoratum* L., *Brachypodium miserum* Koidz., *Dactylis glomerata* L., and *Festuca ovina* L. var. *vulgaris* Koch.

Phytomyza nishijimai Sasakawa, 1955, Saikyo Univ., Sci. Rep., Agr. 7: 31. Fig. 137.

DISTRIBUTION: Japan.

HOST: *Cornus kousa* Buerg.

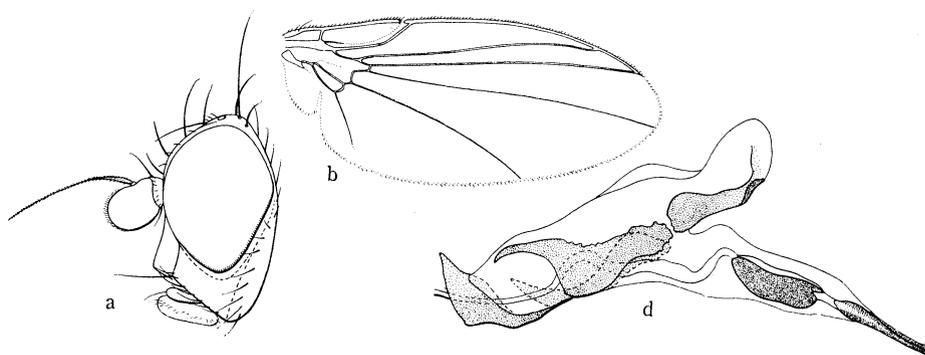


Fig. 137. *Phytomyza nishijimai* Sasakawa.

Phytomyza oenanthes Sasakawa, 1955, *l. c.*, 33. Fig. 138.

Male terminalia differ from that of *facialis* in following points: surstyli separated from

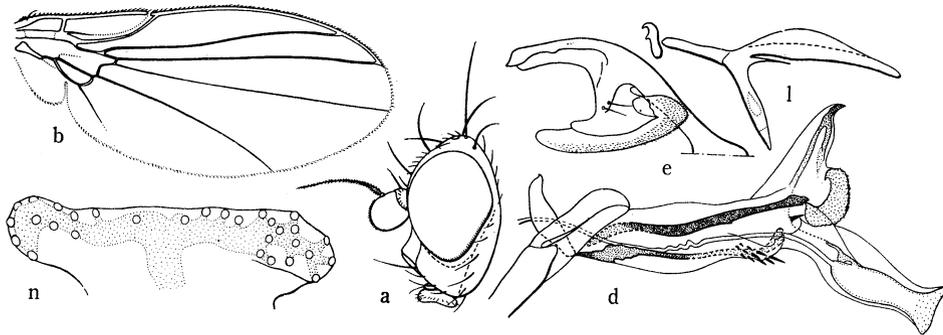


Fig. 138. *Phytomyza oenanthes* Sasakawa.

epandrium by suture, each bearing 23–25 setae; distal processes of phallapodeme broadly membranous; distiphallus with 13 spines on dorsodistal membrane.

P. oenanthes can be separated from the 2 known European species on the same host by the following points: from *oenanthis* Hering which is similar in having about 30 posterior spiracular bulbs, by its dark lateral stripes of the mesonotum, and from *phallandrii* Hering by its pale head color.

DISTRIBUTION: Japan.

HOST: *Oenanthe stolonifera* DC.

Phytomyza paniculatae Sasakawa, 1953, *op. cit.* 4: 18. Fig. 139.

ADULT. Head whitish yellow to brownish white; mesonotum brownish black, with brownish yellow lateral stripes and caudolateral spots before scutellum; *acr* normally in 2 rows, sometimes accompanying 1 or 2 sparse additional rows laterad of that, 1–3 *ia*-setulae; humeri each with pale brown spot, and 4–7 setulae plus *h*; scutellum and pleurae brown to dark brown, the former often yellowish dorsomesally; dorsal 1/4–1/3 of mesopleura, dorsal margin of sternopleura somewhat yellowish; abdomen subshiny, brown to dark brown, slightly pruinose.

Terminalia: Surstyli broadly united with epandrium at base, slightly incurved, bearing 25–28 setae; hypandrium with small apodeme. Distiphallus well-developed; ventral process with a membranous spine-like process and numerous minute setulae; endophallus ventrally with wing-like processes. Ejaculatory apodeme 100–120 μ long, about 100 μ wide.

Ovipositor sheath about 1.5 \times as long as tergite 6, pubescent on proximal 1/3; apodeme as long as sheath, pouched on anterior 1/2. Egg guides subquadrate, 70 μ long, each with 4 sensillae. Tergite 9 is 200 μ long; sternite W-shaped, bearing 3 pairs of *nsm* and 8–10 sensillae; cerci each with 4 *ts*. Spermathecae orbicular, 50 \times 50 to 56 \times 60 μ ; ducts 320–380 μ long, 6 μ in diameter.

LARVA. Head without frontal process and band of cuticular process; mandibles each with 2 teeth. Anterior spiracles approximated at bases, 100 μ high, each with 10–16 bulbs; posterior spiracle strongly projecting, with about 12 bulbs. Spinal pattern: on dorsal side, T, 1 & 5–8A=0, 2–4A=2.2–3; on lateral, 1T=6–7.0, 2–3T=3–4.2–3, 1–2A=4.3, 3–5A=

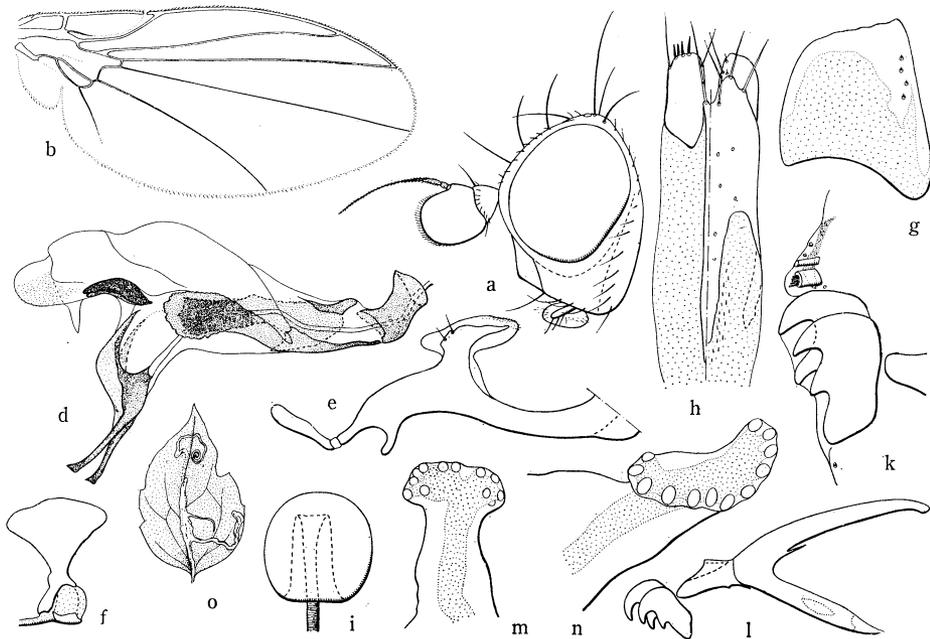


Fig. 139. *Phytomyza paniculatae* Sasakawa.

5-6·3-4, 6-7A=4-5·3-4, 8A=4·0; on ventral, T & 5-8A=0, 1-4A=1-2·0.

Many, including immature stages, on *Clematis*, Yase, Kyoto, 5-11 May 1953; Hatano, Kanagawa Pref., 17 Apr.-17 May 1955; Wakasugiyama, Fukuoka, 5-18 May 1956, Sasakawa; Matsuyama, Ehime Pref., 15 Jan. 1954, T. Yano.

DISTRIBUTION: Japan.

HOST: *Clematis paniculata* Thunb.

***Phytomyza plantaginis* Robineau-Desvoidy, 1851, Rev. Mag. Zool. 3: 404. Fig. 140.**

Terminalia: Surstyli united with epandrium, each bearing 10-12 short but strong setae; hypandrium with a small apodeme; processus longus 1/2 length of hypandrium. Endophallus as long as hypophallus, proximally with a pair of laterodorsal sclerites. Postgonites longer than sidepieces of hypandrium, with very long terminal teeth. Ejaculatory apodeme 80 μ long and wide, bulb larger than blade.

Ovipositor sheath nearly 1.5 \times as long as tergite 6, pubescent on proximal 1/2; apodeme strongly sclerotized, slightly longer than sheath, pouched on anterior 1/4. Egg guides subtriangular, 70 μ long, each with 5 sensillae. Tergite 9 is 160 μ long; sternite broadly sclerotized at posterior end, 200 μ long, bearing 3 pairs of *nsm* and about 8 sensillae. Spermathecae orbicular, truncated proximally, 4 to 6-striated shallowly, 50 \times 50 to 56 \times 52 μ ; ducts pale brown, 270-280 μ long, 6 μ in diameter.

Spinal pattern of larva: on dorsal side, T-1A & 8A=0, 2 & 5-7A=3-4·0, 3-4A=5·0; on lateral, 1T=7·0, 2T=3·2, 3T=3-4·3, 1A=4·4, 2-6A=6-7·4-5, 7A=6·2, 8A=3·0;

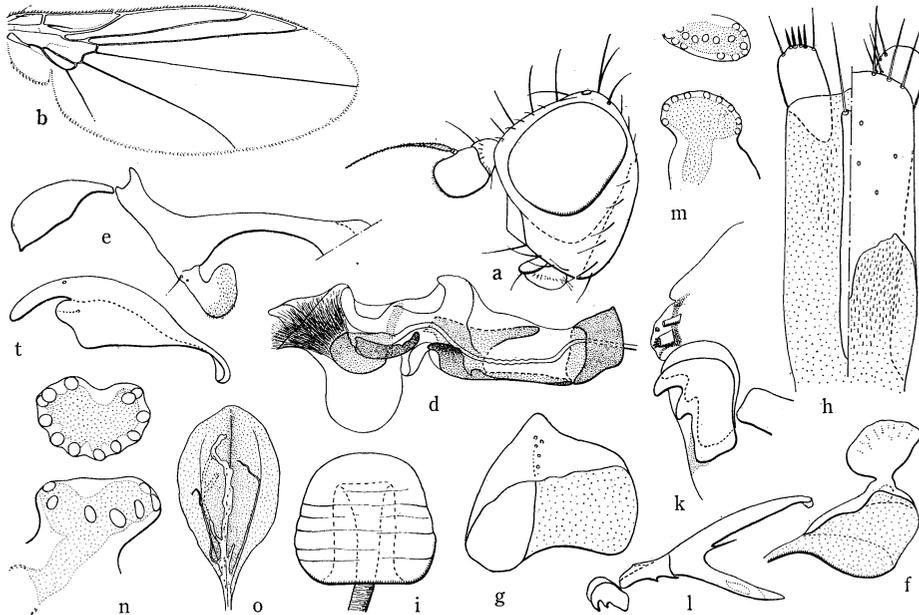


Fig. 140. *Phytomyza plantaginis* Robineau-Desvoidy.

on ventral, T-A=0; anterior spiracles with 10-16 bulbs; posterior spiracles about 60 μ long, each with 9-15 bulbs.

Many, including immature stages, on *Plantago*, Kamishihoro, Hokkaido, 13 June 1954; Otsu City, Shiga Pref., 23-26 Oct. 1952; Yagi, Kyoto Pref., 20-24 Oct. & 22-26 Dec. 1953; Matsuyama, Ehime Pref., 26 Nov.-1 Dec. 1953, Sasakawa.

DISTRIBUTION: Europe, Japan, N. America.

HOSTS: *Plantago major* L. var. *asiatica* Decne., *kamtschatica*, Link., *lanceolata* L. and *mohnikei* Miq.

Phytomyza polycladae Sasakawa, 1955, Akitu 4: 95. Fig. 141.

Surstyli separated from epandrium by suture, about 1/4 as long as height of epandrium, each bearing 15-18 setae. Basiphallus very short; para- and hypophallus curved dorsally, about 2/3 length of phallapodeme, each bearing many spines in 2-3 rows; ventral process with small U-shaped sclerite; a sharp spine dorsad of endophallus. Ejaculatory apodeme small.

LARVA. Full-grown larva yellowish white, about 2 mm in body length. Head without frontal process; mandibles large, each with 2 sickle-shaped teeth. Anterior spiracle small, brown, distally 2-lobed, 40 μ high, with 7-11 bulbs; posterior spiracle brown, 2-horned, about 220 μ long, with 15-19 bulbs. Cuticular processes pale brown, spinal pattern: on dorsal, 1T=12.0, 2-3T=0, 1-2A=1.1, 3-7A=2.2, 8A=0; on lateral, 1A=4.5.0, 2-3T=3.4.1-2, 1-4A=4.5.3-4, 5-7A=5.6.3-4, 8A=4.0; on ventral side, 7 rows just ventrad of mandibles, 1T=4.5.0, 2T=0, 3T=1.2.0, A=4-5 rows sparsely arranged posteriorly to

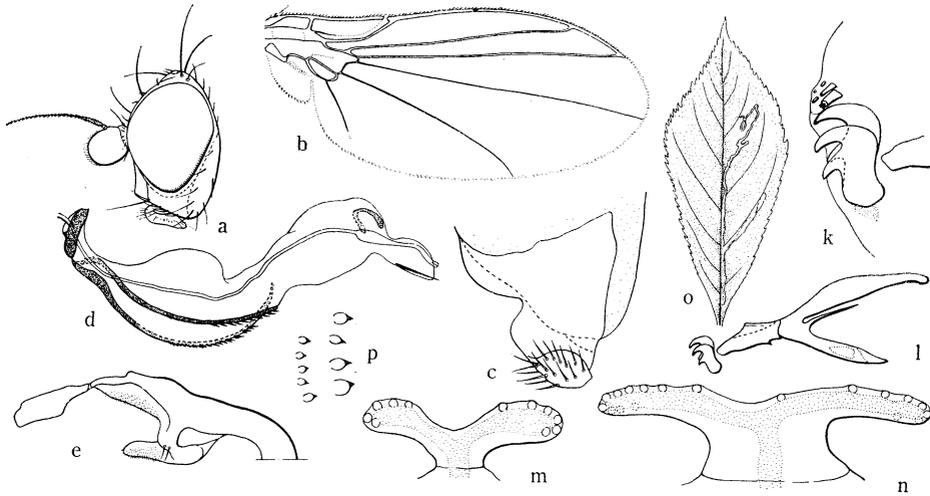


Fig. 141. *Phytomyza polycladae* Sasakawa.

midline.

Additional few, including larva, in *Sanicula*, Kibune, Kyoto, 3 June 1956, Sasakawa.

DISTRIBUTION: Japan.

HOSTS: *Angelica polyclada* Franch., *Sanicula elate* Ham. var. *chinensis* Makino.

Phytomyza ranunculi Schrank, 1803, Fauna Boica, Landshut 3: 140.

Terminalia: Surstyli narrowed distally, incurved, each with 25 setae. Distiphallus about 1/3 length of phallapodeme, with ventral process largely membranous; endophallus extremely long, about $2.3 \times$ length of phallapodeme, coiled 7-8 times. Postgonites as long as paraphallus, with terminal teeth strongly curved. Ejaculatory apodeme 100-120 μ long, 120-140 μ wide; bulb without chitinous plate.

Ovipositor sheath brownish yellow to black, subequal to $2 \times$ as long as tergite 6, pubescent on proximal 1/3-1/2; apodeme about 1/2 length of sheath, weakly sclerotized, pouches on anterior 1/4. Egg guides subquadrate, 75 μ long, each with 3 sensillae. Tergite 9 is 160 μ long; sternite 200 μ long, with 3 pairs of *nsm* and about 12 sensillae; cerci each with 2 long and 2 short *ts*. Spermathecae orbicular, with truncate proximal end, 60 \times 75 to 64 \times 80 μ ; necks about 80 μ long; ducts 8 μ in diameter. Ventral receptacle larger than normal, about 200 μ long.

subsp. *albipes* Meigen, 1830, Syst. Besch. bekannt. eur. zweifl. Insekt. 6: 195. Fig. 142.

Phytomyza ranunculi pentalinearis Kuroda, 1954, Kontyû, 21: 76. New Synonymy.

The original description and figures of Kuroda's subspecies evidently show that his subspecies is a synonym of var. *albipes*.

subsp. *flavoscutellata* Fallén, 1823, Dipt. Suec., Phytom. 2: 4.

Many, Kotoni, Hokkaido, 25 May 1951, Nishijima; Hatano, Kanagawa Pref., 12 Apr.

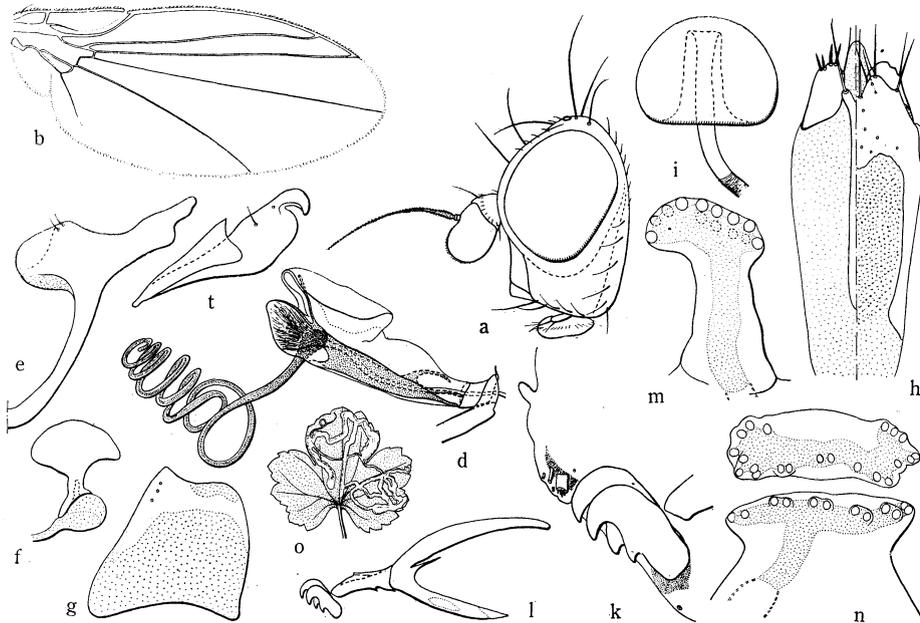


Fig. 142. *Phytomyza ranunculi albipes* Meigen.

1955, Sasakawa; Kasugai, Aichi Pref., 3 Dec. 1956, T. Okadome.

subsp. *praecox* Meigen, 1830, Syst. Besch. bekann. eur. zweifl. Insekt. 6: 194.

Many, Shimogamo, Kyoto, 25 Apr. 1951; Mt. Hiei, Kyoto, 20 Apr. 1955, Sasakawa.

Adults which emerged in early spring or autumn in Japan show darker coloration differing from *albipes*. I suppose that environmental factors, such as temperature, photoperiod, etc., during the larval and pupal stages effects the appearance of these types of color variation.

DISTRIBUTION: Europe, Asia, Japan, N. America.

HOSTS: *Ranunculus acris* var. *japonicus* Maxim., *glaber* Makino, *repens* L., *sceleratus* L., and cultivated species.

Phytomyza saxifragae Hering, 1924, Zeitschr. f. wiss. Ins. Biol. 19: 38.

Fig. 143.

Terminalia: Epandrium not narrowing ventrally; cerci each with ventral seta longer than its own height; surstyli broadly united with epandrium, each with 16–18 spines and about 8 setae at posterior angle; processus longus club-shaped, broadened posteriorly, about 1/3 length of hypandrium. Ejaculatory apodeme narrow, 50 μ long and 16 μ wide; bulb with a minute chitinous plate.

Ovipositor sheath almost as long as tergite 6, pubescent on proximal 1/2; apodeme subequal to sheath in length, pouched on anterior 1/3. Egg guides subquadrate, very weakly sclerotized distally, about 90 μ long, each with 4 sensillae. Tergite 9 is 160 μ long; sternite well-developed, with 3 pairs of *nsm* and 4 pairs of sensillae; cerci each with 4 *ts*

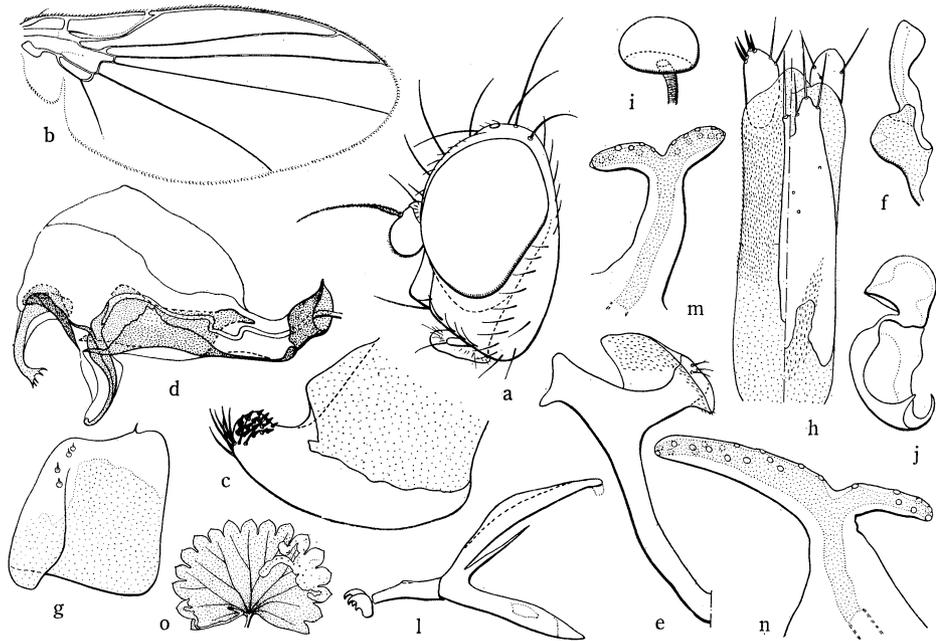


Fig. 143. *Phytomyza saxifragae* Hering.

which are $1/3$ of cercus length. Spermathecae semiorbicular, $20 \times 28 \mu$; ducts 320μ long, 4μ in diameter.

DISTRIBUTION: Europe, Japan.

HOSTS: *Saxifraga sachalinensis* Fr. Schm. (Hokkaido) and *fusca* Maxim. (Mt. Hakan, Toyama Pref.).

Phytomyza senecionis ravasternopleuralis Sasakawa, 1955, *Kontyû* 23: 19. Fig. 144.

Male terminalia differ from *lappae* in following points: surstylus with 27-30 setae; basiphallus setulose ventrally; para- and hypophallus each slightly shorter than hypandrium.

Ovipositor sheath as long as or $1.5 \times$ length of tergite 6, pubescent on proximal $1/2$; apodeme as long as sheath, pouched on anterior $1/3$. Egg guides 88μ long, each with several sensillae. Tergite 9 is 180μ long; sternite 200μ long, bearing 3 pairs of *nsm* and several sensillae; cerci each with 4 *ts* which are $1/4$ of cercus length. Spermathecae semi-orbicular, 48×72 to $56 \times 76 \mu$; ducts 320μ long and 12μ in diameter. Ventral receptacle with body 80μ and tail 100μ in length.

DISTRIBUTION: Japan.

HOST: *Senecio palmatus* Pall.

Phytomyza tamui Sasakawa, 1957, *Akitu* 6: 90. Fig. 145.

Ovipositor sheath almost $2 \times$ as long as tergite 5, pubescent on basal $1/2$; apodeme as long as sheath, pouched on anterior $1/3$. Egg guides triangular, 80μ long. Tergite 9

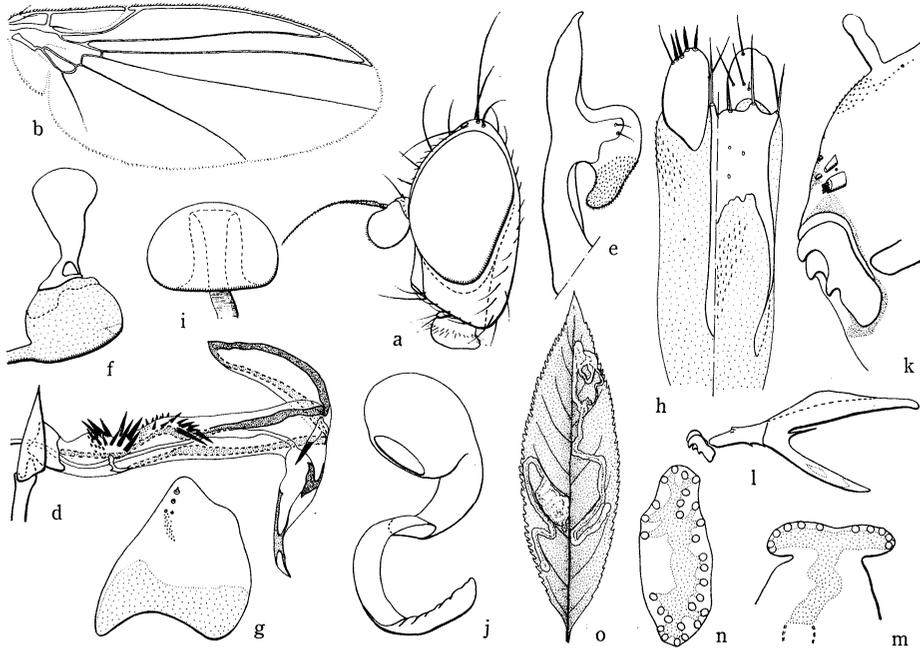


Fig. 144. *Phytomyza senecionis ravasternopleuralis* Sasakawa.

is 160 μ long; sternite W-shaped, 240 μ long, with 3 pairs of *nsm* and about 10 sensillae; cerci each with 4 *ts* which are 1/6 of cercus length. Spermathecae semiorbicular, 20 \times 36 to 24 \times 40 μ , with distinct necks, 20–30 μ in length, ducts 200 μ long and 6 μ in diameter.

DISTRIBUTION: Japan.

HOST: *Coptis quinquefolia* Miq.

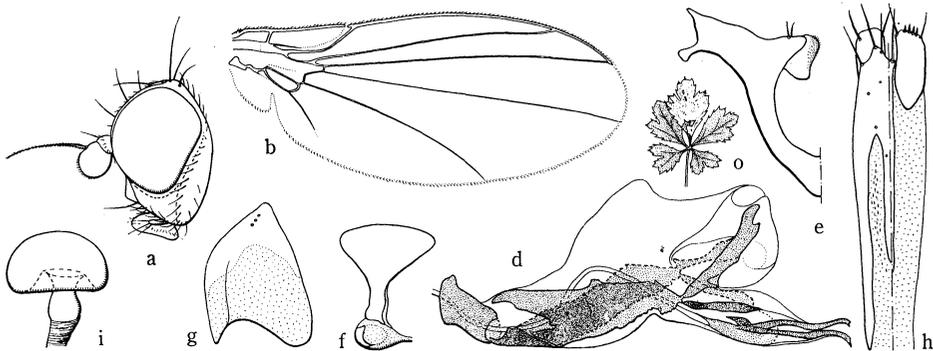


Fig. 145. *Phytomyza tamui* Sasakawa.

Phytomyza thalictricola Hendel, 1925, Konowia 4: 309.

Fig. 146.

Terminalia: Surstyli broadly united with epandrium, each bearing about 19 setae; hy-

pandrium $3/4$ length of phallapodeme. Distiphallus about $1/2$ length of phallapodeme; endophallus long, bifurcated distally, rugose near ends. Ejaculatory apodeme 200μ long and broad, bulb with a pair of small plates.

Ovipositor sheath as long as tergite 6, pubescent on anterior $1/2$; apodeme as long as sheath, pouched on anterior $1/3$. Egg guides 88μ long, each with 6-7 sensillae. Tergite 9 is 200μ long; sternite with 3 pairs of *nsm* and about 10 sensillae; numerous setulae on sternal membrane; cerci each with 5 *ts* short, being $1/6$ length of cercus. Spermathecae large, subcylindric, 76×80 to $96 \times 84 \mu$, ducts colorless but brown on proximal ends, 720μ long, 16μ in diameter but 8μ at middle.

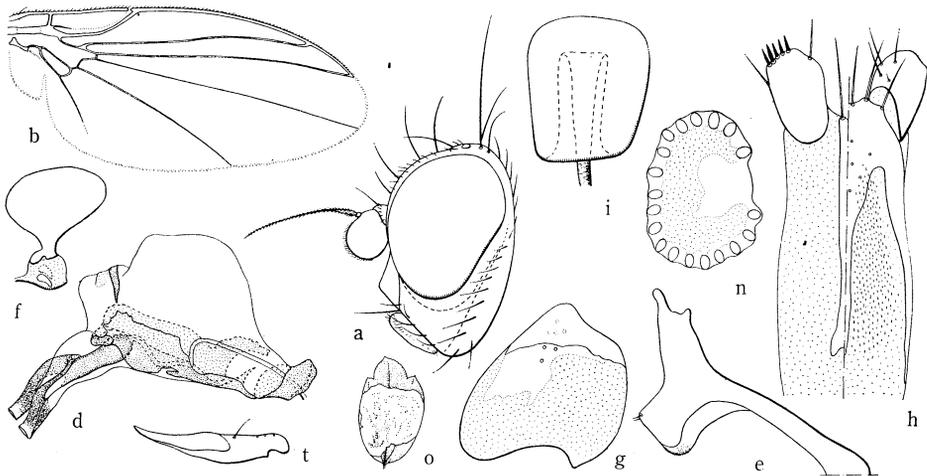


Fig. 146. *Phytomyza thalictricola* Hendel.

The larva of this species is highly specific in the arrangement of the cuticular processes which are densely scattered throughout whole surface of each segment excepting on dorsal side of pro- and mesothoracic segment, bases of posterior spiracles and anal lobes, 15-18 rows on thoracic and 25-30 rows on abdominal segment, and the Japanese specimens show considerable difference in number of spiracular bulbs as compared with de Meijere's description, anterior spiracles each with 10-12 bulbs; posterior spiracles 60μ high, with 15-19 bulbs.

Many were reared from larvae, in *Thalictum*, Kamikochi, Nagano Pref., 13 May 1952, Sasakawa; Kamuikotan, Hokkaido, 25 May 1948, Nishijima.

DISTRIBUTION: Europe, Japan.

HOSTS: *Thalictum aquilegifolium* L. and *thunbergii* DC. The type of mine of *thalicticola* quite differs from that of *minuscula* Goureaux. *P. thalicticola* occurs in areas of higher altitude than *minuscula* in Japan.

Phytomyza tordylia Hendel, 1927, Zool. Anz. 69: 269. Fig. 147.

Terminalia: Surstyli separated from epandrium, each bearing 23-26 setae; cerci each with a long ventral seta. Basiphallus extremely short, ring-like; distiphallus with slender

processes at distal end, paraphallus with 8 spines and hypophallus with 13 spines on ventral membranous part; endophallus membranous. Postgonites $4/5$ length of hypandrium, with terminal teeth strongly curved. Ejaculatory apodeme $80\ \mu$ long, $50\ \mu$ wide; bulb without sclerite.

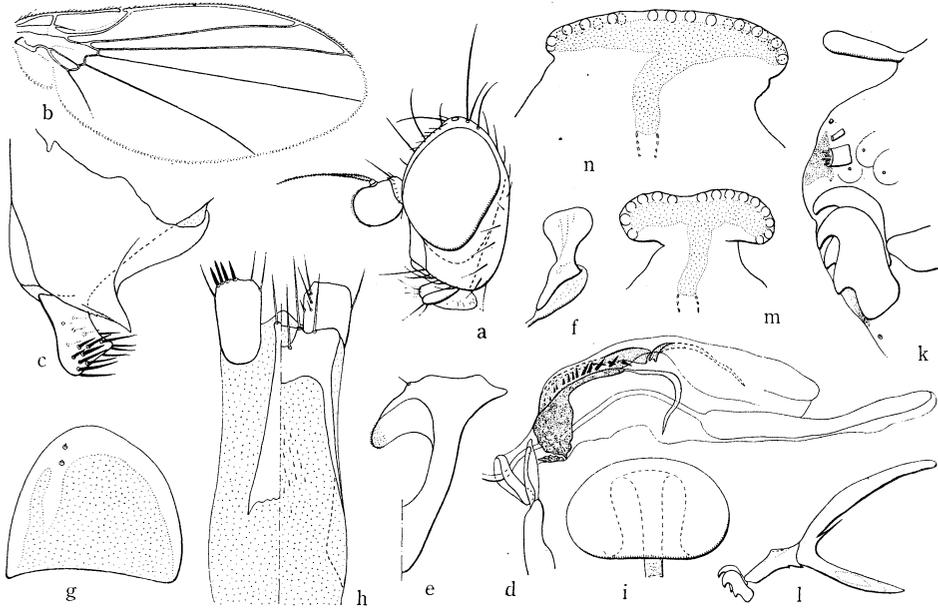


Fig. 147. *Phytomyza tordyllii* Hendel.

Ovipositor sheath slightly longer than tergite 6, pubescent on proximal $1/3$; apodeme $4/5$ length of sheath, pouched on anterior $1/3$. Egg guides somewhat semicircular, $50\ \mu$ long, each with 2 sensillae. Tergite 9 is $140\ \mu$ long; sternite $160\ \mu$ long, bearing 3 pairs of *nsm* and 4 sensillae; cerci each with 4 *ts* which are $1/4$ length of cercus. Spermathecae semiorbicular, smaller one 30×50 to $36 \times 56\ \mu$, larger one 36×60 to $44 \times 64\ \mu$; ducts $300\text{--}360\ \mu$ long, about $8\ \mu$ in diameter.

Full-grown larva yellowish white, 2.3–2.5 mm in body length. Head with a long frontal process; longitudinal sclerite broad ventrally; mandibles each with 2 teeth. Anterior spiracles each with 14–18 bulbs; posterior spiracles $80\ \mu$ high, each with 21–24 bulbs. Cuticular processes yellowish brown, spinal pattern: on dorsal side, $1T=11.0$, $2T=0.1$, $3T=2A$ & $6-7A=2.1$, $3-5A=2.2$, $8A=1.0$; on lateral, $1T=7.0$, $2T=3.2$, $3T=3.3$, $1-2A=4.3$, $3-6A=4.5$, $3-4$, $7A=4.2-3$, $8A=3-4.0$; on ventral, $1T=0.1$, $2-3T=1.1$, $1-3A=1.2$, $4-6A=2.2$, $7-8A=2.0$, short 2 rows at middle of abdominal segments 1–7.

Many were reared from larvae, Shimogamo, Kyoto, 11–16 May 1955, Sasakawa.

DISTRIBUTION: Europe, Japan.

HOST: *Torilis anthriscus* Gmel.

REMARKS ON ZOOGEOGRAPHY

The family Agromyzidae is almost world-wide in distribution. The distributional pattern shown by the known Japanese species in each genus is summarized in the following table. Among 145 known species, 77 species prove to be endemic to Japan. Most of the nonendemic Japanese species are Palaearctic.

Geographical distribution of Japanese Agromyzidae

Genera	Number of Species	Japan				Regions					
		Hokkaido	Honshu	Shikoku	Kyushu	Palaearctic	Nearctic	Ethiopian	Madagascan	Oriental	Australian
<i>Agromyza</i>	14 (6)*	6 (2)	12 (4)	7 (3)	9 (4)	8	4	1		1	
<i>Japanagromyza</i>	6 (5)	1 (1)	6 (5)	5 (4)	3 (2)					1	
<i>Melanagromyza</i>	13 (7)	3 (0)	11 (5)	6 (3)	3 (1)	3	2		1	3	
<i>Carinagromyza</i>	1 (1)		1 (1)	1 (1)	1 (1)						
<i>Ophiomyia</i>	3 (1)	2 (0)	2 (1)	2 (1)	1 (0)	2	1				
<i>Tylomyza</i>	1 (0)	1 (0)				1					
<i>Phytobia</i>	25 (10)	13 (5)	13 (5)	6 (3)	11 (3)	14	7	4			
<i>Cerodontha</i>	3 (0)	2 (0)	2 (0)		1 (0)	2	1	1		1	
<i>Liriomyza</i>	20 (13)	11 (6)	12 (6)	2 (1)	5 (3)	7	2	1		1	
<i>Metopomyza</i>	2 (1)	2 (1)				1					
<i>Phytoliriomyza</i>	1 (0)	1 (0)			1 (0)	1	1	1			
<i>Phytagromyza</i>	6 (5)	4 (4)	3 (2)		1 (1)	1					
<i>Napomyza</i>	7 (3)	3 (0)	4 (3)	2 (1)	2 (1)	4	1				
<i>Phytomyza</i>	43 (25)	29 (15)	30 (15)	13 (6)	17 (9)	17	6	1		2	1
Total	145 (77)	77 (34)	96 (47)	44 (23)	55 (25)	61	25	9	1	9	1

* (): number of species endemic to Japan.

The number of species found in each Japanese genus except for *Melanagromyza* and *Phytobia* are almost equal in the proportion to those in the Palaearctic region. *Melanagromyza* contains a few Oriental species in Japan but this genus is extremely well developed in the Oriental and Ethiopian regions. *Japanagromyza* may be principally Oriental, although there is only one species which is widely spread in Honshu. *Phytomyza* is the dominant genus in number of species in Japan as well as in Europe and *Phytobia* follows it. The higher percentages of the endemic Japanese forms are found in the following six genera: *Japanagromyza*, *Melanagromyza*, *Carinagromyza*, *Liriomyza*, *Phytagromyza* and *Phytomyza*.