

Formosan Agromyzidae (Diptera)*

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Abstract: Fifty-four species of Agromyzidae are recorded from Formosa, 11 of which are described as new and keys are given to known Formosan species. Nearly half of a total of 73 species in the 13 genera now known to be represented in Formosa belong to *Melanagromyza* and *Phytomyza*. Four genera, *Trilobomyza*, *Lemurimyza*, *Pseudoliriomyza* and *Ptochomyza* found in the Oriental region are unknown in Formosa.

Up to the present, only forty-four species of Agromyzidae have been recorded from Formosa by Malloch (1914), Spencer (1961, 1962, 1966) and Sasakawa (1963). It is certainly too little in comparison with some 140 species described from the Oriental and Australian regions. I had an opportunity to visit Formosa in April 1965 as a member of the 1965 Expedition under the Japan-U. S. Co-operative Science Program. Also, I have examined the additional material collected by other members

Generic distribution of Formosan Agromyzidae

Genera	Number of species			
	Formosa	Oriental region (total)	Australian region	Japan
<i>Agromyza</i>	7(5)*	17	3	15
<i>Japanagromyza</i>	5(1)	13	13	6
<i>Melanagromyza</i>	18(3)	36	46	20
<i>Ophiomyia</i>	5(2)	11	10	4
<i>Phytobia</i>	3(2)	8	10	1
<i>Cerodontha</i>	8(3)	14	12	18
<i>Calycomyza</i>	1	2	1	3
<i>Amauromyza</i>	1	1	2	3
<i>Trilobomyza</i>	—	1	1	—
<i>Nemorimyza</i>	—	—	—	1
<i>Liriomyza</i>	5(2)	7	11	23
<i>Lemurimyza</i>	—	1	—	—
<i>Pseudoliriomyza</i>	—	1	—	—
<i>Metopomyza</i>	—	—	—	2
<i>Praspedomyza</i>	3(3)	3	4	2
<i>Phytoliriomyza</i>	1	1	2	1
<i>Paraphytomyza</i>	—	—	—	6
<i>Pseudonapomyza</i>	2	8	7	—
<i>Napomyza</i>	—	—	—	2
<i>Phytomyza</i>	14(5)	16	5	48
<i>Ptochomyza</i>	—	1	—	—
Total	73(26)	141	127	155

*() : number of species endemic to Formosa.

and a small series in the Entomological Laboratory, National Taiwan University. Eleven species are herein described as new, and eighteen known species are added as new to the fauna, making total now known in Formosa 73. And, the host plants and mining habits of three known species are established.

Thirteen of the seventeen Oriental genera are now represented in Formosa as shown in the left table.

The dominance of *Melanagromyza* is as well illustrated in the material from Formosa as in the Ethiopian and Australian

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regions (Spencer, 1959, 1963), and twelve of the eighteen species are known from the Oriental and three from the Australian region. It is interesting to find that the second largest genus appears to be *Phytomyza*, which occupies a dominant position in the Palaearctic region but is poorly represented in the Ethiopian, Australian and Neotropical regions. Among which eight are common Palaearctic-Japanese or Holarctic species, and four new species are found at the high altitude. It can certainly be expected that more cold-adapted new species do still await discovery. The number of species found in other Formosan genera except for *Phytobia* and *Pseudonapomyza* are almost equal in the proportion to those in the Oriental region.

All the types of the new species are deposited in the National Science Museum, Tokyo, unless otherwise indicated. The terminology and measurements are the same as described by me (Pacif. Insects 3 (2/3), 1961). The following abbreviations of bristles and collector's names have been used below: —

<i>acr</i> -acrostichal bristles	<i>pm</i> -peristomal setae
<i>dc</i> -dorso-central bristle (s)	<i>prs</i> -presutural bristle
<i>ia</i> -intra-alar bristle	<i>prsc</i> -prescutellar bristle
<i>ipa</i> -inner post-alar bristle	<i>sa</i> -supra-alar bristle
<i>mp</i> -mesopleural bristle	<i>ts</i> -tactile sensillae
<i>nsm</i> -marginal setae of ninth segment	<i>vi</i> -vibrissa
<i>opa</i> -outer post-alar bristle	<i>vte</i> -outer vertical bristle
<i>ori</i> -lower fronto-orbital bristle(s)	<i>vti</i> -inner vertical bristle
<i>ors</i> -upper fronto-orbital bristle(s)	
Y. H. - Y. Hirashima	T. Sh. - T. Shiraki
S. I. - S. Ito	C. M. Y. - Carl M. Yoshimoto
M. S. - M. Sasakawa	H. J. Z. - H.-J. Zhou
T. S. - T. Shirôzu	

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Subfamily AGROMYZINAE Fallén

Genus *Agromyza* Fallén

This genus is well represented in the Palaearctic region, but it is not a large genus, containing only fourteen species, in the Oriental region. Six species have been recorded from Formosa by Malloch (1914) and Spencer (1961).

The biology is known for only two species, *A. flavisquama* Malloch and *graminivora* Spencer, both of which are the grass-miners. Judging from the structures of the male terminalia of *comosa* Spencer and *obesa* Malloch, both species seem probably to be the grass-miners. The remainders also belong to the *albipennis*-group, which mines the leaf of grass, by recognition of the external characters of the adult (Sasakawa, 1961).

Key to Formosan species of *Agromyza*

1. Calypter with fringe of white, yellow or ochreous hairs 2
Calypter with fringe of dark brown hairs 5
2. Wing hyaline, veins pale to dark brown 3
Wing conspicuously whitish, veins colourless.....*vitrinervis* Malloch
3. Antenna entirely black; ultimate section of M_{3+4} one-half as long as penultimate 4
Antenna with segments partly brownish; ultimate section of M_{3+4} two-thirds length of penultimate..... *graminivora* Spencer
4. Large species, wing 2.8—3.2 mm long, hyaline; calypter with fringe yellow
..... *flavisquama* Mall.
Smaller, wing 2.5—2.9 mm long, tinged with yellow; calypter with fringe silvery-white
..... *plebeia* Mall.
5. Antenna brown; fore tibia with a dorsal bristle..... *comosa* Spenc.
Antenna black; fore tibia without dorsal bristle 6
6. Third antennal segment with long pubescence; wing 1.9—2.1 mm long.....*latipennis* Mall.
Third antennal segment normally pubescent; wing 2.5—3.0 mm long.....*obesa* Mall.

1. *Agromyza comosa* Spencer

(Fig. 1)

Agromyza comosa Spencer, 1962, Pacific Ins. 4: 662.

This species has been recorded from N. E. Burma. It closely resembles *A. latipennis* in having the long pile on the third antennal segment but is immediately recognizable by its larger size and presence of the fore-tibial bristle. Also, the male terminalia of *comosa* is characteristic in having the bifurcated, tubular endophallus and weakly expanded ejaculatory apodeme, 140 μ long.

Wing 2.4—2.6 mm long; ultimate section of M_{3+4} scarcely one-half as long as the penultimate. Fore leg with knee narrowly yellow; all tarsi yellowish brown; fore tibia with a dorsal bristle, middle tibia with three postero-dorsal bristles.

Specimens examined: 3♂♂, Chiao-chi, Ilan Hsien, 16 Apr. 1965 (M. S.).

Distribution: Formosa, Burma. New to Formosa.

2. *Agromyza flavisquama* Malloch

Agromyza flavisquama Malloch, 1914, Ann. hist.-nat. Mus. Hung. 12: 318 (♀, Chip-Chip).

Females bred from the leaf-mines on *Panicum repens* Lamk. are clearly referable to this species, having whitish yellow hairs of fringe on the calypter and a pair of long prescutellar bristles. The mining habit is now established.

The mine is greenish white in color, stigmatonome with a short linear mine at first, 45 mm²; small or large grains of the frass are scattered irregularly. Two to four larvae are seen in a single mine. The full-grown larva escapes the mine and pupates on the surface of leaf.

Specimens examined: 1♀, Kuantzuling, 250 m, Tainan Hsien, 7 Apr. 1965, 7♀♀, Chuchi, 120 m, Chiai Hsien, 17 Apr. & 7 May 1965, on *Panicum* (M. S.).

Distribution: Formosa.

The dorso-central bristles are variable in number; Spencer (1961) stated that the holotype specimen has a pair of presutural bristles (1+4 *dc*), but only one specimen examined has a pair of short ones. Also, the number of the lower fronto-orbital bristles varies from two to four.

3. *Agromyza graminivora* Spencer

Agromyza graminivora Spencer, 1960, Trans. R. ent. Soc. Lond. **112**: 16; 1961, *ibid.* **113**: 61 (♀, Taihoku).

This is a distinctive species with the ochreous fringe on the calypter, wing length 2.2—2.6 mm and ultimate section of M_{3+4} two-thirds length of the penultimate. A female specimen examined agrees with the original description and redescription by Spencer. This species has been known as a millet leaf-miner in West Africa.

Specimen examined: 1♀, Chiaoichi, Taipei Hsien, 16 Apr. 1965 (M. S.).

Distribution: Africa, Formosa, Indonesia.

4. *Agromyza latipennis* Malloch

(Fig. 2)

Agromyza latipennis Malloch, 1914, Ann. hist.-nat. Mus. Hung. **12**: 321 (♂, ♀, Takao).

On account of the distinctly pilose third antennal segment and arista, smaller wing which measures 1.9—2.1 mm, dark fringe on the calypter, etc., the specimens examined should be identified with *latipennis*. In the present specimens the orbital hairs are minute but arranged in a row of four to eight hairs and the acrostichals are arranged in six rows, differing from the original description.

Male terminalia: Epandrium with surstylus bearing eleven or twelve stout spines; hypandrium of normal form, one-half length of phallapodeme, with apodeme short, praegonite with four sensory setulae; phallus well-developed, basally with a pair of spinulose, membranous processes, endophallus internally with a row of spinulae and hairs on both sides: ejaculatory apodeme 120μ long.

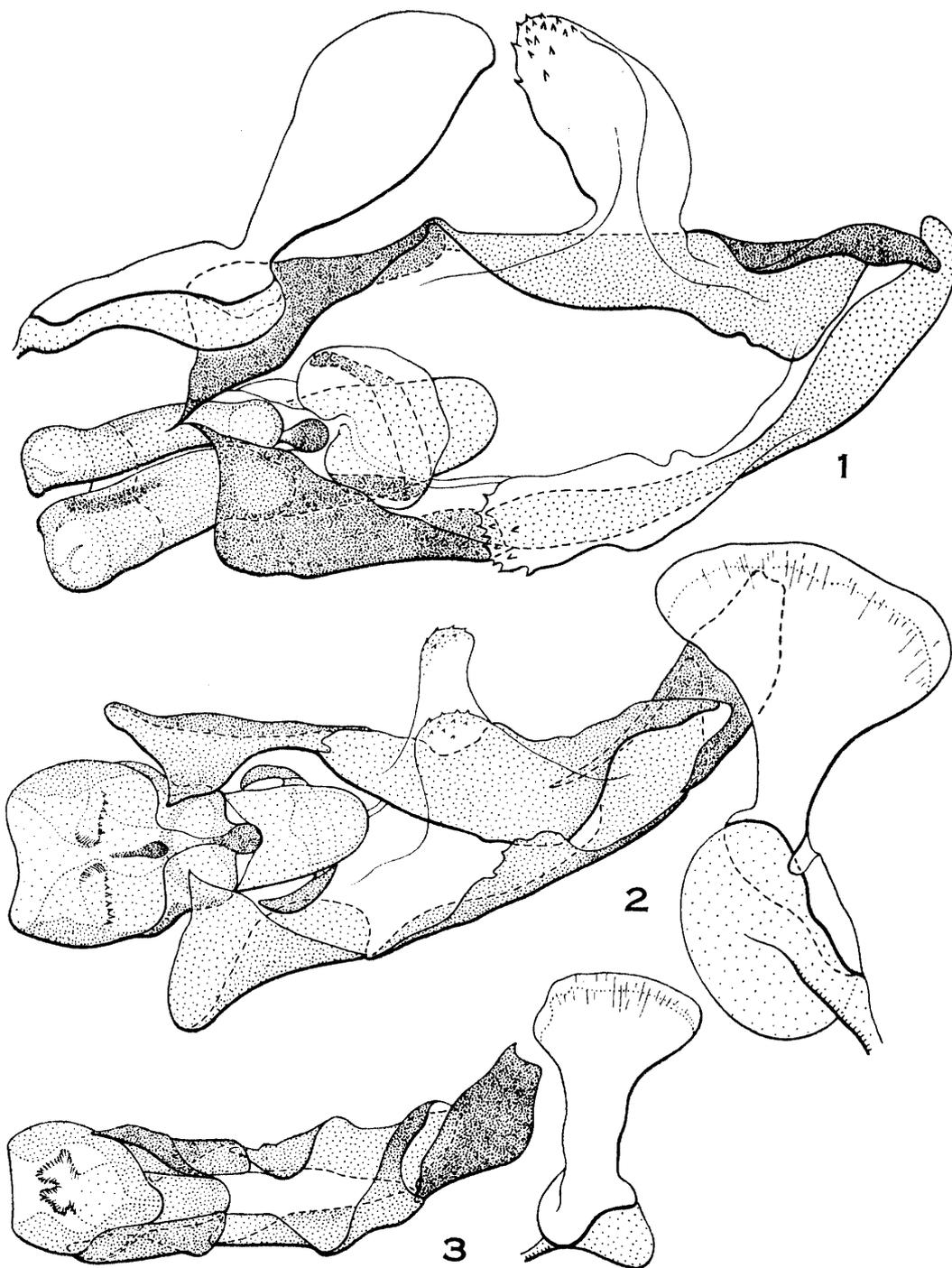
Specimens examined: 1♂, Kantzuchai, Chiai Hsien, 11 Apr. 1965; 1♂, Chuchi, Chiai Hsien, 12 Apr. 1965; 1♀, Taipei, 15 Apr. 1965 (M. S.).

Distribution: Formosa.

5. *Agromyza obesa* Malloch

(Fig. 3)

Agromyza obesa Malloch, 1914, Ann. hist.-nat. Mus. Hung. **12**: 322 (♀, Sokotsu).



Figs. 1—3. Phallus and ejaculatory apodeme of *Agromyza comosa* Spencer (1), *A. latipennis* Malloch (2) and *A. obesa* Malloch (3).

This is a shining black species and characterised by the distinctly pubescent arista, narrow gena and dark brown fringe of hairs on the calypter. It is closest to *latipennis* in structures and coloration, but differs from the latter in having the shorter pile on the third antennal segment and by the larger size, 2.5—3.0 mm in the wing length.

Male terminalia: Surstylus with ten or eleven stout spines in two rows anteriorly and one stout spine on postero-ventral tip; hypandrium with apodeme short; endophallus with rows of seta-like spinulae before internal end; ejaculatory apodeme 130 μ long.

Specimen examined: 1♂, Ali Shan Mts., 21 Apr. 1917 (T. Sh.).

Distribution: Formosa.

Genus **Japanagromyza** Sasakawa

This genus was erected for four species occurring in Japan (Sasakawa, 1958), but has since been found throughout the world. Thirteen species occur in the Oriental region, of which four are now recorded in Formosa.

It is interesting to note that the genus would be divided into two distinct groups, depending on the character of the male terminalia. The phallus of *duchesneae*-group has distinctly projected ventral process and is distally forming a sclerotized fork, such as *trispina* (Thomson) (Sasakawa, 1961, figs. 17d, 20d), *triformis* Spencer (1962, fig. 1a), *incisa* Sasakawa (1963, fig. 4c) and *yanoi* (Sasakawa). In the second group, the ventral process is small, without distinct sclerites and the endophallus is long and membranous, such as *elaeagni* (Sasakawa, 1961, fig. 11d), *trifida* Spencer (1962, fig. 2), *cercariae* Sasakawa (1963, fig. 2b), *stylata* Sasakawa (1963, fig. 5c), *eucalypti* Spencer (1963, fig. 1A) and *viridula* (Coquillett) (Spencer, 1969, fig. 80).

The host-plants are known for *trispina* and *yanoi*. The larvae of these species mine the leaves, and are provided with quite different structure in the posterior spiracles, which are divided into two distinct types. In *trispina*, each spiracle is trifurcated and many minute spiracular bulbs are arranged along the margin of each arm (Sasakawa, 1961, fig. 20n). This structure is similar to that of the Japanese *elaeagni* and *quercus* (Sasakawa, 1961, figs. 18n, 21n), and the Oriental-Pacific *eucalypti* (Spencer, 1963, fig. 2). On the other hand, each posterior spiracle of *yanoi* has only three bulbs arranged in a single circle (Sasakawa, 1961, fig. 22n), as seen in the Oriental *loranthi* Spencer and *kalshoveni* (de Meijere, 1934: 255), and Japanese *duchesneae* (Sasakawa 1961, fig. 17n), but ten bulbs in the latter two species.

Key to Formosan species of *Japanagromyza*

1. Mesonotum with a pair of prescutellar bristles; halter with knob partly white to yellow 2
 Mesonotum without prescutellar bristle; halter entirely brown to black 3
2. Front broad; fore tibia with an external bristle *trispina* (Thomson)
 Front narrower than eye; fore tibia without external bristle *yanoi* (Sasakawa)
3. Third antennal segment minutely pilose; fore tibia with an external bristle
 *setigera* (Malloch)
 Third antennal segment with long pile; fore tibia without external bristle
 *yoshimotoi* Sasakawa

6. **Japanagromyza setigera** (Malloch)

Agromyza setigera Malloch, 1914, Ann. hist.-nat. Mus. Hung. **12**: 328 (♀♀, Tainan, Takao, Koshun, Kankau).

Japanagromyza setigera (Malloch): Spencer, 1961, Jour. Ent. Soc. S. Africa **24**: 326.

This species has black halter (slightly brownish on tip of the knob) and fore-tibial bristle, but no prescutellar bristle. Biology is unknown.

Specimens examined: 1♀, Chuchi, Chiai Hsien, 12 Apr. 1965; 1♀, Taipei, 15 Apr.

1965 (M. S.).

Distribution : Formosa.

7. *Japanagromyza trispina* (Thomson)

Agromyza trispina Thomson, 1869, *Eugenies Resa*. Dipt. : 609.

Japanagromyza trispina (Thomson) : Spencer, 1965, *Bull. Brit. Mus. (Nat. Hist.)*, Ent. **16** : 25.

Agromyza variihalterata Malloch, 1914, *Ann. hist.-nat. Mus. Hung.* **12** : 329 (♂, Koshun).

Agromyza koshunensis Malloch, 1914, *ibid.* **12** : 321 (♂, Koshun).

This species occurs widely throughout the Oriental region to Japan, and the larva makes a whitish ophistigmatonome in the leaves of *Glycine* and *Pueraria* spp.

The stalk of halter is brown but the knob is irregularly white at apex. The structures of the male and female terminalia were described and illustrated by Sasakawa (1961).

Specimen examined : 1♂, Fenchihu, 1,370 m, Chiai Hsien, 10 Apr. 1965 (M. S.).

Distribution : China, Formosa, Vietnam, Malaya, Indonesia, Ceylon, Nepal, Japan, New Ireland.

8. *Japanagromyza yanoi* (Sasakawa)

(Fig. 4)

Melanagromyza yanoi Sasakawa, 1955, *Trans. Shikoku ent. Soc.* **4** : 87.

Japanagromyza yanoi (Sasakawa), 1961, *Pacific Ins.* **3** : 338.

Japanagromyza angustifrons Spencer, 1961, *Trans. R. ent. Soc. Lond.* **113** : 64 (♂, Maruyama).

This is a large black species, with wing length up to 2.8 mm in the male and 3.0 mm in the female. It is immediately distinguishable from *J. trispina* by the pale yellowish brown tarsi of all legs, narrower front which is two-thirds as wide as either eye and having all fronto-orbitals directed upwards. The orbital hairs are usually two in number and situated below the level of lower fronto-orbital. An additional seta before the anterior dorso-central bristle is sometimes absent. The long cerci are broadened ventrally as illustrated by Spencer (1962) and minutely pointed at posterior apices. The side-pieces of hypandrium are narrow and provided with very short apodeme. The median process of phallus is spinose-lanciform and the endophallus is also spinose on the membrane. The ejaculatory apodeme is 315 μ long and 115 μ broad.

The larva of this species makes a broad, upper surface ophionome in the leaf of *Mallo'us* in Japan.

Specimens examined : 2♂♂, Chiaochi, Taipei Hsien, 16 Apr. 1965 (M. S.).

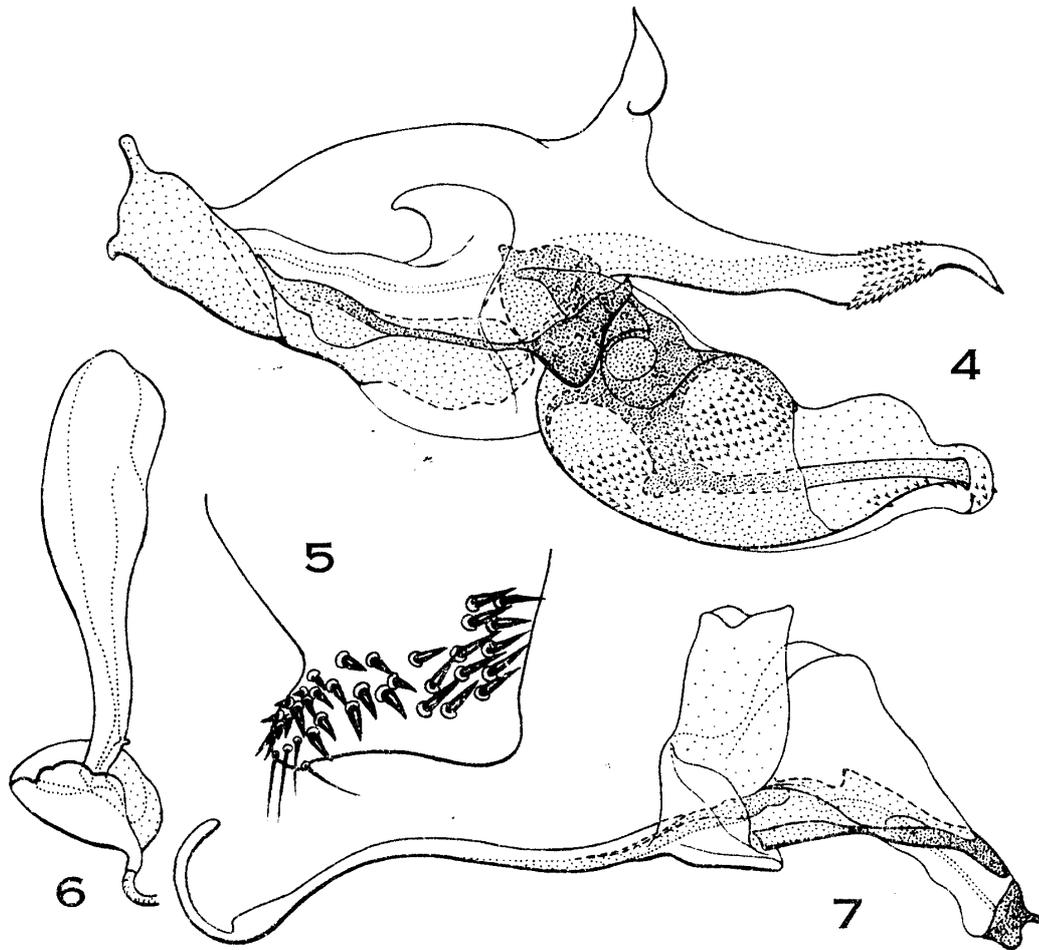
Distribution : Japan, Formosa.

9. *Japanagromyza yoshimotoi* Sasakawa

(Figs. 5—7)

Japanagromyza yoshimotoi Sasakawa, 1963, *Pacific Ins.* **5** : 30.

This species agrees closely with *J. setigera* in the coloration of halteres and absence of the prescutellar bristle which is developed in most of the known species of this genus, but can be easily distinguished by its long pile on the third antennal



Figs. 4—7. 4, Phallus of *Japanagromyza yanoi* (Sasakawa); 5—7: *J. yoshimotoi* Sasakawa, 5, surstylus; 6, ejaculatory apodeme; 7, phallus.

segment.

The male terminalia indicate distinctly the characters belong to *Japanagromyza* as follows: Surstylus strongly incurved and projected posteriorly, bearing about thirty heavy spines in two irregular rows and several setae on posteroventral tip; cercus slender, about two-thirds as high as epandrium; hypandrium with sidepieces narrow, apodeme short, praegonite small, with about fifteen sensillae, postgonite spinulose ventrally; phallus weakly sclerotized, endophallus long and largely membranous; ejaculatory apodeme clavate, 240 μ long.

Specimen examined: 1♂, Kuantzuling, 250 m, Tainan Hsien, 7 Apr. 1965 (M. S.).

Distribution: Philippines, Formosa. New to Formosa.

10. *Japanagromyza* sp.

A single female specimen was bred from the larva mining the leaf of bamboo at Chiaochi, Ilan Hsien on 9 April, 1965. In general appearance this species is intermediate between *J. triformis* Spencer from New Guinea and *trientis* Spencer from Thailand, with both of which it agrees in having the entirely yellow halter and extremely narrow gena. The cross-vein r-m is situated only slightly before middle of the discal cell as in *triformis*, the orbital hairs are relatively long and arranged in a distinct row as in *trientis*, and the arista is distinctly shorter than vertical height of the eye. It seems to be preferable to await the male specimen before

describing the species as new.

Genus *Melanagromyza* Hendel

This is the dominant genus in the Ethiopian, Oriental and Australian regions, and Madagascar. Spencer (1961—62) listed thirteen species from Formosa with discussion on many Malloch's types, and Sasakawa (1963) recorded two additional species. A total of eighteen species is now recorded for Formosa.

The biology is known for only nine species; most of them are the internal stem-borers, for example, *M. dolichostigma*, *phaseoli* and *sojæ* on the Leguminosae, and *M. lasiops* and *metallica* on the Compositae. An epidermal leaf-miner, *M. theae* (Green), occurring widely in the Oriental and Australian regions, is quite different from the true stem-borers in the structures of the male terminalia, especially of the basi- and endo-phallus, and the mandible and cephalopharyngeal sclerites of the larva. Also, the phallus of an Australian non-epidermal leaf-miner, *M. wikstroemiae* Kleinschmidt, illustrated by Spencer (1963) show the similarity in general appearance to that of *theae*. As pointed out by Spencer (1966), it seems to be better for the species to establish the generic or subgeneric status, without treating them merely as species-group.

Key to Formosan species of *Melanagromyza*

1. Calypter with fringe of white to ochreous hairs 2
Calypter with fringe dark, brown to black 10
2. Mesonotum predominantly black 3
Mesonotum distinctly greenish or coppery 6
3. Orbital hairs proclinate *declinata* Sasakawa
Orbital hairs reclinate 4
4. Abdomen entirely shining black *alternata* Spencer
Abdomen shining green or coppery 5
5. Gena conspicuously rounded; abdomen green *sojæ* (Zehntner)
Gena narrower; abdomen greenish, bluish, reddish or purple *dolichostigma* de Meijere
6. Ocellar triangle very large, extending anteriorly to margin of lunule *obtusa* (Malloch)
Ocellar triangle small 7
7. Arista minutely pubescent, appearing bare *specifica* Spencer
Arista distinctly pubescent 8
8. Fore tibia with a dorsal bristle; arista plumose *lasiops* (Mall.)
Fore tibia without dorsal bristle 9
9. Eye in female virtually bare *metallica* (Thomson)
Eye in female distinctly pilose *piliseta* (Mall.)
10. Parafrontalia distinctly projecting above eye in profile 11
Parafrontalia not projecting 15
11. Mesonotum entirely matt, grayish-black 12
Mesonotum shining black 13
12. Eye in male with a patch of long hairs; orbital hairs normal; abdomen shining bluish- or reddish-black *oculata* Sasakawa
Eye in male bare; orbital hairs very long; abdomen subshiny black *sauteri* (Mall.)
13. Arista plumose; gena narrow, one-twelfth height of eye *subfusca* (Mall.)

- Arista normally pubescent or bare; gena broader14
14. Third antennal segment with conspicuously long pile..... *provecta* (de Meij.)
Third antennal segment normally pilose.....*nigrisquama* (Mall.)
15. Ocellar triangle brilliantly shining, greatly elongated *phaseoli* (Tryon)
Ocellar triangle less shining, shorter16
16. Middle tibia with at most one posterodorsal bristle17
Middle tibia with two bristles..... *ricini* de Meij.
17. Third antennal segment with conspicuously long pile..... *conspicua* Spencer
Third antennal segment minutely pilose..... *theae* (Green)

11. *Melanagromyza conspicua* Spencer

Melanagromyza conspicua Spencer, 1961, Trans. R. ent. Soc. Lond. **113**: 71.

Small black species, with long pile on third antennal segment and only one mid-tibial bristle. The terminalia of this species are distinctive, in the male the distal lobes of phallus are covered with numerous heavy spines, and in the female the spermathecae are transparent and minute.

The wing length (σ : 1.6-2.1, ♀ : 1.8-2.4 mm) of this species shows similarity to *M. theae*, but *conspicua* differs distinctly from the latter by having the broad gena and long pile on the third antennal segment. In all of the Formosan series, the cross-vein r-m is distinctly beyond middle of the discal cell. But it is not a significant difference.

Specimens examined: 1 ♀ , Yehliu, Taipei Hsien, 30 Mar. 1965 (C. M. Y.); 1 ♀ , Taipei, 31 Mar. 1965 (M. S.); 25 $\sigma\sigma$, 15 $\text{♀}\text{♀}$, Ssujungchi, Pingtung Hsien, 3-4 Apr. 1965 (M. S.); 1 ♀ , Mt. Yangming Shan, Taipei, 29 Mar. 1965 (Y. H.); 2 $\sigma\sigma$, Chuchi, Chiai Hsien, 12 Apr. 1965 (M. S.); 1 ♀ , Chiaochi, Ilan Hsien, 16 Apr. 1965 (M. S.).

Distribution: Ceylon, Singapore, Philippines, Formosa, Ryukyus, New Guinea, New Britain, New Hebrides, Australia. New to Formosa.

12. *Melanagromyza declinata* Sasakawa

(Figs. 8-10)

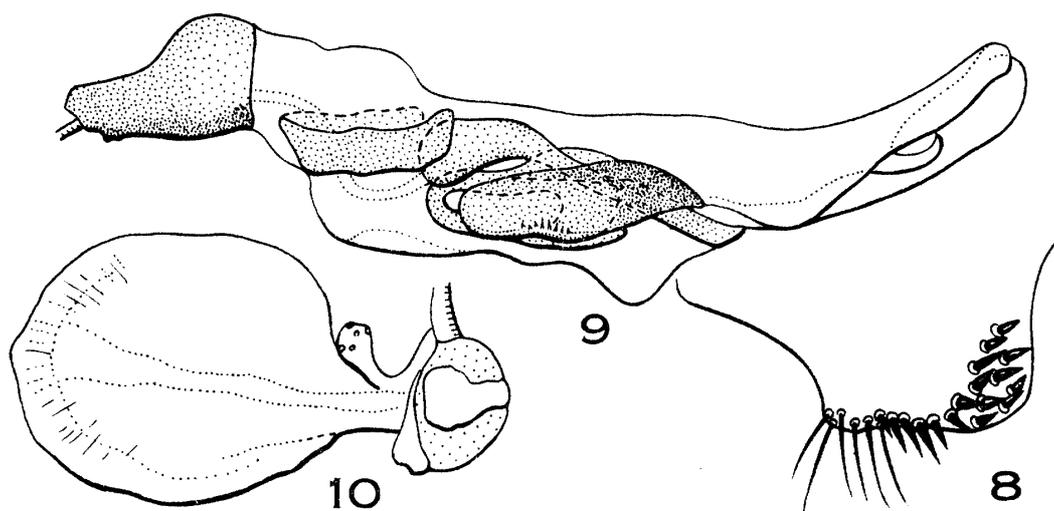
Melanagromyza declinata Sasakawa, 1963, Pacific Ins. **5**: 32 (♀ , Taipei).

Melanagromyza bowralensis Spencer, 1963, Rec. Aust. Mus. **25**: 314. **syn. nov.**

This species is highly specific in having the whitish fringe on the calypter, the dense rows of proclinate orbital hairs and a small patch of short hairs on the dorsoanterior part of eye.

In the type specimen, the lower fronto-orbitals are four pairs, and the mesonotum and abdomen are black, without coppery reflection. But in the present series, the former is usually three (only one female has four) and the latter is variable in colour, that is, the mesonotum is weakly pollinose, faintly with coppery reflection, and the abdomen is brilliantly coppery or coppery-red through all tergites, or strongly greenish on only posterior two tergites. Wing length 2.2-2.8 mm in female.

The male was not previously known. It agrees exactly with the female, except for a patch of hairs on eye larger, whitish pile on the third antennal segment longer and the gena broader (1/8-1/6 height of eye). Wing length 2.0-2.5 mm. The



Figs. 8—10. *Melanagromyza declinata* Sasakawa. 8, surstylus; 9, phallus; 10, ejaculatory apodeme.

abdominal tergites are predominantly black, with faint metallic or greenish tinge, or distinctly coppery-red. The male terminalia are characteristic as shown in Figs. 8-10.

M. bowralensis Spencer, from Australia, is clearly identical with *declinata* in the view of distinct characters cited above although it has a wing length of 3.1 mm, and the synonymy is established herewith.

Specimens examined: 2♀♀, Kantzuchai, Chiai Hsien, 11 Apr. 1965 (M. S.); 2♂♂, 2♀♀, Chiaochi, Taipei Hsien, 16 Apr. 1965 (M. S.); 1♂, 1♀, Pinglin, Taipei Hsien, 23 Jun. 1965 (S. I.); 1♂, Wufeng, Chaiyi Hsien, 7 July 1965 (S. I.).

Distribution: Formosa, Australia.

13. *Melanagromyza dolichostigma* de Meijere

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

This species is immediately recognizable from *M. sojae* by the narrower front and gena, distinctly pubescent arista and shiny mesonotum with tendency to purplish or bluish. The larva is a stem-miner of *Glycine* and *Phaseolus* spp.

Specimen examined: 1♂, Chuchi, Chiai Hsien, 12 Apr. 1965 (M. S.).

Distribution: Java, Formosa, Japan.

14. *Melanagromyza lasiops* (Malloch)

Agromyza lasiops Malloch, 1914, Ann. hist.-nat. Mus. Hung. 12: 324 (♂♀, Kosempo, Tainan).

Melanagromyza lasiops (Malloch): Hennig, 1941, Ent. Beiheft. 8: 174.

This is a large, greenish black species, characterised by the narrow gena, plumose arista, hairy eye in the male, weakly sclerotized ninth sternite of the female and by having a fore-tibial bristle. The abdomen is strongly shining, with variable sheen of green, greenish-blue, -coppery and red. Wing length 2.7-3.2 mm.

Specimens examined: 2♀♀, Fenchihu, Chiai Hsien, 10 Apr. 1965 (M. S.).

Distribution: Formosa, Vietnam.

15. *Melanagromyza metallica* (Thomson)

Agromyza metallica Thomson, 1869, Eugenes Resa. Dipt.: 609.

Melanagromyza metallica (Thomson): Spencer, 1959, Trans. R. ent. Soc. Lond. **111**: 278; Sasakawa, 1963, Pacific Ins. **5**: 36 (Taipei).

This is a shining greenish species; eye in the male with a distinct patch of short hairs dorsoanteriorly; wing length of male 1.8-2.3 mm and of female 1.7-2.7 mm. The endophallus is covered with many sensory pores. The larva is known as a stem-miner of Compositae.

Specimens examined: 1♂, 1♀, Mt. Yangming Shan, Taipei, 29 Mar. 1965 (M. S.); 2♂♂, 1♀, Yehliu, 30 Mar. 1965 (C.M.Y.): 1♂, Sschungchi, Pingtung Hsien, 3 Apr. 1965 (M. S.); 4♂♂, 8♀♀, Kuantzuling, Tainan Hsien, 6-7 Apr. 1965 (M. S.); 4♂♂, 2♀♀, Kuantzuling, Tainan Hsien, 6 Apr. 1965 (Y. H.); 1♂, 6♀♀, Fenchihu, Chiai Hsien, 10 Apr. 1965 (M. S.); 1♂, 3♀♀, Taipei, 15 Apr. 1965 (M. S.); 2♀♀, Kantzuchai, Chiai Hsien, 11 Apr. 1965 (M. S.); 15♂♂, 7♀♀, Chuchi, Chiai Hsien, 12-13 Apr. 1965 (M. S.).

Distribution: Africa, Thailand, Vietnam, Indonesia, Philippines, Formosa, Ryukyus, Micronesia, Melanesia, Australia.

16. *Melanagromyza oculata* Sasakawa

Melanagromyza oculata Sasakawa, 1963, Pacific Ins. **5**: 812.

This species was originally described on the basis of a single male specimen from New Britain. On account of the hairy patch on the eye this species appears to be similar to *M. declinata* but it is distinct from the latter in having the brownish black hairs of fringe on the calypter, only two lower fronto-orbitals and minute pile on the third antennal segment. Abdomen is shiny bluish or reddish and wing length 2.0-2.5 mm.

Specimen examined: 1♂, Kantzuchai, Chiai Hsien, 11 Apr. 1965 (M. S.).

Distribution: New Britain, Formosa. New to Formosa.

17. *Melanagromyza phaseoli* (Tryon)

Oscinis phaseoli Tryon, 1895, Trans. nat. Hist. Soc. Qd. **1**: 4.

Melanagromyza phaseoli (Tryon): Spencer, 1959, Trans. R. ent. Soc. Lond. **111**: 283.

Agromyza destructor Malloch, 1916, Proc. ent. Soc. Wash. **18**: 93.

This small, shining-black species is readily distinguishable from all of the others with dark fringe on the calypter by having the brilliantly shining, greatly elongated ocellar triangle.

This is one of the serious pests on cultivated leguminous crops, *Phaseolus*, *Soja*, etc., in the Oriental and Australian regions.

Specimen examined: 1♀, Chuchi, Chiai Hsien, 12 Apr. 1965 (M. S.).

Distribution: Africa, Egypt, India, Ceylon, Malaya, Formosa, Philippines, Java, Ryukyus, Micronesia, Australia.

18. *Melanagromyza provecta* (de Meijere)

Agromyza provecta de Meijere, 1910, Tijdschr. Ent. **53**: 161.

Melanagromyza provecta (de Meijere) : Spencer, 1961, Trans. R. ent. Soc. Lond. **113** : 76 (♀, Paroe).

This shiny black species is immediately recognizable from the Formosan *M. nigrisquama* (Malloch) by its long pile on the third antennal segment. Other essential characters of this species are as follows: parafrontalia distinctly projecting above eye in profile, arista almost bare, gena one-fifth to one-fourth height of eye; cross-vein r-m situated on posterior one-third to two-fifths of discal cell; middle tibia with one posterodorsal bristle; wing length 2.3-2.6 mm.

Specimens examined: 1♀, Chiaochi, Ilan Hsien, 16 Apr. 1965 (M. S.); 1♀, Arisan, 4 May 1917 (T. Sh.).

Distribution: Java, Formosa.

19. *Melanagromyza ricini* de Meijere

Melanagromyza ricini de Meijere, 1922, Bijdr. Dierk. **22** : 20; Spencer, 1961, Trans. R. ent. Soc. Lond. **113** : 77 (♀, Tainan, Toa Tsui Kutsu).

This species superficially similar to *M. conspicua* but is separable by the larger size and by having two mid-tibial bristles.

Specimens examined: 2♂♂, Mt. Yangming Shan, Taipei, 30 Mar. 1965 (Y. H.); 1♀, Yehliu, Taipei Hsien, 30 Mar. 1965 (C. M. Y.); 3♂♂, Chuchi, Chiai Hsien, 12 Apr. 1965 (M. S.).

Distribution: Indonesia, Formosa, Philippines, Burma, Ryukyus.

20. *Melanagromyza sojæ* (Zehntner)

Agromyza sojæ Zehntner, 1900, Ind. Natur. **11** : 113

Melanagromyza sojæ (Zehntner) : de Meijere, 1922, Bijdr. Dierknnde **22** : 18.

Agromyza producta Malloch, 1914, Ann. hist.-nat. Mus. Hung. **12** : 325 (♂♀, Pilam, Tainan).

Agromyza prolifica Malloch, 1914, ibid. **12** : 326 (♂♀, Chip-Chip, Tainan, Takao).

This species is characteristic in the coloration: mesonotum shining black, without metallic reflection but abdomen greenish. The larva has the same mining habit as *dolichostigma*.

Specimens examined; 2♀♀, Taipei, 15 Apr. 1965 (M. S.).

Distribution: Egypt, India, Formosa, Indonesia, Japan, Melanesia, Micronesia, Fiji, Australia.

21. *Melanagromyza specifica* Spencer

Melanagromyza specifica Spencer, 1963, Rec. Aust. Mus. **25** : 320.

This species had been recorded from Australia. It agrees closely with *M. metallica* in having the greenish lusture and a patch of minute hairs on the eye, but is recognizable by its minutely pubescent arista and not having the sensory pores on the endophallus. Female has also smaller patch of hairs on the eye. Wing length 2.0 (♂)-2.1(♀) mm.

Specimens examined: 1♂, 1♀, Banshoryo, 19 Oct. 1916 (T. Sh.).

Distribution: Australia, Formosa. New to Formosa.

22. *Melanagromyza theae* (Green)

Agromyza theae Green, 1896, Indian Mus. Not. **3** : 28.

Agromyza atomella Malloch, 1914, Ann. hist.-nat. Mus. Hung. **12**: 331 (♂♀, Pilam, Tainan, Takao, Anping).

Melanagromyza styricicola Sasakawa, 1954, Trans. Shikoku ent. Soc. **4**: 42.

This is a common, widespread species throughout the Pacific from India to Australia. Spencer (1966) synonymized the above-listed two species. It has been considered that *theae* is monophagous, epidermal leaf-miner, on *Camellia theae*, while *atomella* and *styricicola* are polyphagy, attacking about thirty families of plants.

Specimens examined: 1♂, Mt. Yangming Shan, Taipei, 3 Apr. 1965, bred from leaf-mine on *Hydrangea chinensis* Max.; 3♀♀, Ssunchungchi, Pingtung Hsien, 3-16 Apr. 1965, bred from leaf-mines on *Colocasia Antiguorum* Schott. (Araceae-new host record); 1♀, Yehliu, Taipei Hsien, 30 Mar. 1965 (C. M. Y.); 2♂♂, 4♀♀, Kuantzuling, 250 m, Tainan Hsien, 6 Apr. 1965 (M. S.); 1♂, 2♀♀, Taipei, Apr. 1968 (H. J. Z.); 1♂, 4♀♀, Taipei, 2 July 1968 (H. J. Z.).

Distribution: India, Ceylon, Philippines, Java, Flores, Formosa, Japan, Guam, Australia.

Genus *Ophiomyia* Braschnikov

This is the smallest genus in the Oriental region. Only two species have hitherto been known from Formosa. Five species are now recorded, of which two are described as new and one is Palaearctic. The mining habits are known for only two species.

Key to Formosan species of *Ophiomyia*

1. Facial keel broad and fusiform 2
 Facial keel narrow and linear 4
2. Acrostichals extending only to level of anterior dorso-central bristle..... *anguliceps* (Malloch)
 Acrostichals extending to level of posterior dorso-central in four to six rows 3
3. Male with distinct vibrissal fasciculus..... *kwansonis* Sasakawa
 Male with simple vibrissa *spinicauda* n. sp.
4. Male with vibrissal fasciculus; wing length 1.5 mm *setituberosa* n. sp.
 Male without vibrissal fasciculus; wing length 1.9-2.4 mm..... *centrosematis* (de Meijere)

23. *Ophiomyia anguliceps* (Malloch)

Agromyza anguliceps Malloch, 1914, Ann. hist.-nat. Mus. hung. **12**: 327 (♀, Tainan).

Spencer (1961) stated that the difference between *anguliceps* and *lantanae* (Froggatt) is very slight as a result of examination of the female type, and suggested the possibility of the synonymy of these two species.

24. *Ophiomyia centrosematis* (de Meijere)

Melanagromyza centrosematis de Meijere, 1940, Tijdschr. Ent. **83**: 128; Spencer, 1961, Trans. R. ent. Soc. Lond. **113**: 69 (♂♀, Tainan).

This species was transferred to the genus *Ophiomyia* by having the characteristic features of the male terminalia and typical form of the larval spiracles by Spencer (1966). The larva is known as the stem-feeder on *Centrosema*, *Glycine*, *Vicia*, *Pisium* and *Tephrosia*.

The male terminalia was illustrated by Spencer. The surstylus is distinctly projected, knob-like, bearing about sixty minute spines.

Specimens examined: 1♂, Mt. Yangming Shan, 450 m, 29 Mar. 1965 (M.S.); 2♂♂, Mt. Yangming Shan, 30 Mar. 1965 (Y. H. & M. S.); 1♂, Mt. Arisan, 21 Apr. 1917 (T. Sh.).

Distribution: Africa, Java, Malaya, Formosa, Australia.

25. *Ophiomyia kwansonis* Sasakawa

Ophiomyia kwansonis Sasakawa, 1961, Pacific Ins. 3: 355.

This species is known as a leaf-miner on *Hemerocallis* from Japan. I have found the species to be abundant on the cultivated *Hemerocallis* in Formosa. The larva forms a long linear mine, 45-52 cm long, and pupates in the mine at basal inner side of leaf.

Specimens examined: 16♂♂, 19♀♀, Fenchihu, Chiai Hsien, emerged on 11-15 Apr. 1965 (M. S.); 1♂, 1♀, Kantzuchai, Chiai Hsien, 11 Apr. 1965 (M. S.); 1♂, Chuchi, Chiai Hsien, 13 Apr. 1965 (M. S.).

Distribution: Japan, Formosa. New to Formosa.

26. *Ophiomyia setituberosa* Sasakawa, sp. nov.

(Figs. 11-13)

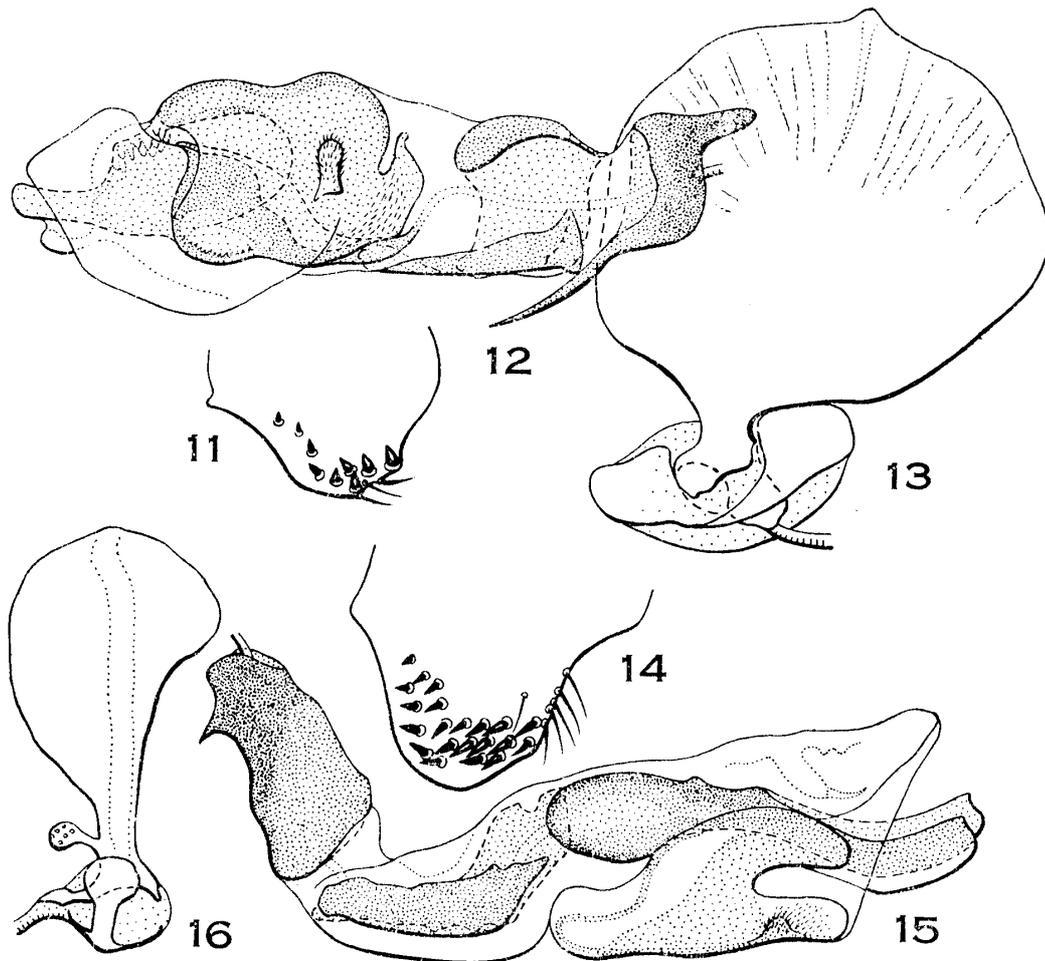
Male: Black; frontalia matt, parafrontalia weakly shining and tinged with brown ventrally, ocellar triangle subshiny, parafacialia, gena, lunule and dorsal part of facial keel tinged with brown; antenna and palpus black, first antennal segment blackish brown; mesonotum and abdomen subshining, the former pollinose. Wing hyaline, calypter brownish gray, with margin and fringe black; halter brownish black.

Front nearly twice as wide as eye, distinctly converging ventrally, parafrontalia one-sixth width of front, linearly or not projecting above eye in profile, bearing two up- and slightly outwardly directed *ors* and two *ori*, the first directed up- and inwards, second inwards, orbital hairs in a row; ocellar triangle large, with ventral tip almost reaching dorsal margin of lunule, which is semicircular in outline and with median furrow; eye bare; gena about one-fifth height of eye, distinctly projecting anteriorly, forming angle of 70°, with vibrissal fasciculus; facial keel narrow, not broadened ventrally but strongly carinate, with median furrow on dorsal half. Antenna with third segment small, rounded apically, with distinct pubescence, arista twice as long as whole length of antenna, swollen on basal one-fifth, microscopically pubescent.

Mesonotum with 0+2 *dc*, first behind level of *sa*, eight rows of *acr*, ending at level of first *dc*, only two pairs of central rows between *dc*, posterior pair directed outwards, *ipa* one-fourth length of *opa*. Wing 1.5 mm long, costal sections in proportion of 4:1:0.9, r-m distinctly beyond middle of discal cell, penultimate section of M_{1+2} as long as m-m and one-ninth length of ultimate section, ultimate section of M_{3+4} only slightly shorter than the penultimate. Leg: Middle tibia without posterodorsal bristle.

Terminalia: Surstylus with nine or ten spines, becoming larger posteriorly; sidepiece of hypandrium relatively narrow, apodeme short, praegonite with two sensory pores. Phallus as in Fig. 12, endophallus with a pair of setigerous processes on lateral sides, also a row of spinules and irregular rows of minute, blunt tubercles on inner side; ejaculatory apodeme large, 203μ in broadest width.

Female: Unknown.



Figs. 11—16. 11—13: *Ophiomyia setituberosa* n. sp. 11, surstylus; 12, phallus; 13, ejaculatory apodeme. 14—16: *Ophiomyia spinicauda* n. sp., 14, surstylus; 15, phallus; 16, ejaculatory apodeme.

Distribution: Formosa.

Holotype: ♂, Mt. Yangming Shan, Taipei, 29 Mar. 1965 (M. S.); male terminalia mounted on slide.

This is close to *O. centrosematis* in having the narrow facial keel. But, the minute size and the entirely different male terminalia confirm the distinctness of this species from the related species. The basiphallus is unusual in having two sclerites are not fused at base.

27. *Ophiomyia spinicauda* Sasakawa, sp. nov.

(Figs. 14-16)

Male: Entirely black; frontalia matt, parafrontalia shining, ocellar triangle less so; mesonotum very weakly shining, densely dusted; abdomen shining. Wing hyaline, calypter brownish gray, with margin and fringe dark brown; halter brown.

Front slightly wider than eye (10: 7), almost parallel-sided, parafrontalia about 1/5 width of front, not projecting above eye in profile, bearing 2 *ors* and 2 *ori*, first *ors* directed up- and slightly outwards, second up- and inwards, *ori* in- and up-wards, orbital hairs in a dense row; ocellar triangle with ventral tip almost reaching to level of second *ors*; lunule semicircular, with median furrow; gena about 1/6 height of eye, not projecting anteriorly, forming angle of 90°, without vibrissal fasciculus; facial keel broad, furrowed dorsally, fusiform below base of antennae, third antennal

segment shorter than broad, with short pile, arista almost bare.

Mesonotum with 0+2 *dc*, eight rows of *acr*, four rows of them ending just behind level of second *dc*; *ipa* about 1/5 length of *opa*. Wing: 2.3 mm long; costa with sections in proportion of 4.2:1:0.95; r-m on distal one-third of discal cell, ultimate section of M_{3+4} 3/4 length of penultimate. Leg: Mid tibia with a short posterodorsal bristle.

Terminalia: Surstylus strongly incurved, bearing 20-22 spines and several setae posteriorly; hypandrium with sidepiece relatively short but apodeme distinct. Phallus approximately one-third length of phallapodeme, basiphallus short, endophallus bifurcated distally, with a sharp spine on inner ventral membrane; ejaculatory apodeme 67 μ long, expanded asymmetrically.

Body 2.0 mm long.

Female: Similar to male, facial keel narrower but distinctly projected; third antennal segment smaller, rounded; wing 2.1 mm; ovipositor sheath shiny black.

Distribution: Formosa.

Holotype ♂, allotype ♀, Taipei, 15 Apr. 1965 (M. S.); male terminalia mounted on a slide.

This species resembles *O. kwansonis* Sasakawa and *anguliceps* (Malloch), but can be readily distinguished by the lack of the male vibrissal fasciculus. The male terminalia are entirely distinct.

Subfamily PHYTOMYZINAE Fallén

Genus *Phytobia* Lioy

This genus is well represented in the Oriental and Pacific regions but only three species was recorded from Formosa. The larvae of the genus are known as the cambium-miners in the twigs of young trees, and the ninth segment of ovipositor is extremely long as found in most borers of the other genera.

The thorax of the known Oriental species except for *P. diversata* Spencer from Formosa is black, densely or slightly dusted with gray. In the Neotropical region there are a number of partially yellow species, although the yellow scutellum is a character of the genus *Liriomyza*. These species are certainly placed in this genus by the distinctive features, such as the coloration of head, chaetotaxies on the mesonotum and mid legs, and the venation.

P. magna (Sasakawa) is one of the large species in the Oriental region, and *P. gigas* Spencer, from Burma, with the wing length of 6.5 mm is the largest in the family.

Key to Formosan species of *Phytobia*

1. Scutellum and mesonotum partially yellow..... *diversata* Spencer
Scutellum concolourous with mesonotum, gray-dusted black 2
2. Large species, wing length 4.2-4.3 mm; mid tibia with two posterodorsal bristles
..... *magna* (Sasakawa)
Smaller species, wing length 2.8-3mm; mid tibia with one bristle..... *nigrita* (Malloch)

28. *Phytobia nigrita* (Malloch)

(Fig. 17)

Agromyza nigrita Malloch, 1914, Ann. hist.-nat. Mus. Hung. 12: 320 (♀, Pilan)

Phytobia nigrita (Malloch) : Spencer, 1961, Trans. R. ent. Soc. Lond. **113** : 82.

Male: Head black, tinged with brown; antenna brown. Mesonotum black, densely pollinose; abdomen shining. Wing hyaline, calypter yellow, with margin and fringe dark brown. Legs brownish black.

Front one and a half times width of eye, parafrontalia not projecting above eye in profile, bearing two *ors* and two *ori*; orbital hairs minute, in a rather dense row; gena one-eleventh height of eye; third antennal segment rounded at apex, arista microscopically pubescent.

Mesonotum with 1+3 *dc*, eight irregular rows of *acr*, *ipa* equal to *ia* in length. Wing: 2.8 mm long, costal sections in proportion of 3: 1: 0.8, r-m slightly beyond middle of discal cell, ultimate section of M_{3+4} equal to the penultimate. Middle tibia with one posterodorsal bristle.

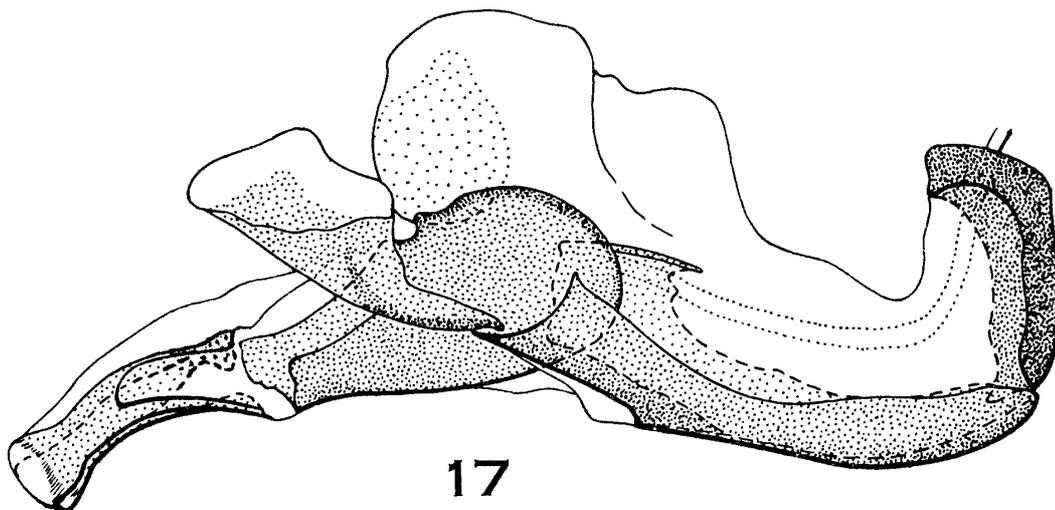


Fig. 17. Phallus of *Phytobia nigrita* (Malloch).

Terminalia: Surstylus with about twenty-five setae; processus longus very weakly sclerotized. Hypandrium rather broadly united at base, with sidepiece nearly one-half length of phallapodeme, praegonite with two long and seven short setae, postgonite with a seta at base of hook. Phallus as figured, 400 μ long, distiphallus bifid terminally. Ejaculatory apodeme 207 μ long.

Specimen examined: 1♂, Kusua, Taiwan, July 4, 1918 (T. Sh.).

Distribution: Formosa, Indonesia, Philippines.

Genus *Cerodontha* Rondani

The concept of the genus *Cerodontha* by Nowakowski (1962) has been accepted by the recent workers. It consists of four well-defined subgenera, *Cerodontha* s. str., *Dizygomyza*, *Poemyza* and *Icteromyza*. Two Nowakowski's subgenera, *Butomomyza* and *Crastemyza*, were treated as the species groups within *Dizygomyza* by Spencer (1969).

The larvae of this genus feed exclusively on Monocotyledoneae.

Cerodontha (*Cerodontha*) *denticornis* (Panzer) is characteristic in having a conspicuous spine on the third antennal segment and only two apical scutellar bristles. It is widespread in the Palaearctic region and occurs also in Africa.

The large and broad lunule, widely separated bases of the antennae and the enlarged third antennal segment in the male make the subgenus *Dizygomyza* easy to recognize. The structures of the male terminalia are similar each other within

this subgenus, and different from that of *Poemyza* by the presence of strong spines on the surstyli and having the endophallus usually with a membranous part between the basal tube and a pair of distal tubules. The biology of two Oriental species, *C. omissa* Spencer from Formosa and *vietnamensis* Sasakawa from Vietnam, is unknown.

The subgenus *Icteromyza* is very close to *Dizygomyza* in most of the characters, but may be separated by the usually yellow frontalia and elongate ocellar triangle. *Cerodontha (Icteromyza) nigricoxa* (Malloch) is endemic, but *piliseta* (Becker) and *duplicata* (Spencer) are widespread in the Pacific and the former has also been recorded in Africa and Southern Europe.

The subgenus *Poemyza* has generally a characteristic lunule which is distinctly high and narrow in two Formosan species recorded below and also in other known Oriental species, *C. javana* (de Meijere) from Java, *oryzivora* Spencer from Malaya, *negrosensis* Sasakawa from Philippines and *spinipennis* Sasakawa from Malaya.

Key to Formosan species of *Cerodontha*

1. Third antennal segment with a distinct spine at dorsoapical corner (subgenus *Cerodontha*)
..... *denticornis* (Panzer)
Third antennal segment without spine..... 2
2. Lunule broad, almost semicircular in outline..... 3
Lunule greatly higher than semicircular and narrow (subgenus *Poemyza*)..... 7
3. Front yellow to brown; ocellar triangle extended to margin of lunule
(subgenus *Icteromyza*) 4
Front brownish black; ocellar triangle small (subgenus *Dizygomyza*) *omissa* Spencer
4. Femora entirely yellow..... 5
Femora black, only yellow at distal ends 6
5. Eye conspicuously hairy.....*hirsuta* n. sp.
Eye bare.....*piliseta* (Becker)
6. Parafrontalia yellow; ultimate section of M_{3+4} shorter than penultimate
.....*nigricoxa* (Malloch)
Parafrontalia dark brown; ultimate section of M_{3+4} longer than penultimate
.....*duplicata* (Spencer)
7. Parafrontalia yellow; eye distinctly hairy; $0+3\ dc$*hirta* n. sp.
Parafrontalia black; eye bare; $1+3\ dc$*cornigera* (de Meijere)

29. *Cerodontha (Icteromyza) duplicata* (Spencer), comb. nov.

Phytobia (Icteromyza) duplicata Spencer, 1961, Trans. R. ent. Soc. Lond. **113**: 84.

Phytobia (Icteromyza) floresensis Spencer, 1961, *ibid.* **113**: 84. **syn. nov.**

Main characters of this species are as follows: head yellow but front rarely brown, parafrontalia dark brown ventrad to level of upper *ori* between line of fronto-orbitals and orbit, darkened dorsally, two reclinate *ors* and two incurved *ori*; antennae with first segment yellow to yellowish brown, second brown, third black, arista distinctly pubescent; palpus yellow, sometimes slightly tinged with brown. Thorax and abdomen shiny black, the former weakly dusted, with $1+3\ dc$ and four irregular rows of *acr*. Wings 1.7-2.0 mm long in ♂, 1.9-2.2 mm in ♀. Legs with femora black but broadly yellow at distal ends. Male terminalia typical in structures with other species of this subgenus, differing from that of *geniculata* (Fallén) in the following points: epandrium with a tooth and about ten setae at each inner posteroventral angle; surstylus well-sclerotized, trapezoid in lateral view, about

one-half as wide as dorsal length of epandrium, with eight to ten setae along dorsal margin; distiphallus as long as phallopodeme; ejaculatory apodeme 60-73 μ wide.

C. duplicata and *floresensis* were recorded from Indonesia. I have examined the male terminalia of both Formosan specimens which are provided with yellow and brown front, respectively. The differences described by Spencer are not significant in comparison with those terminalia and also in the length of wings as mentioned above. The brown form seems to be merely a colour variation. Thus, I synonymise *floresensis* with *duplicata* herewith.

Spencer (1966) synonymised *I. hardyi* Sasakawa, from New Guinea, with *floresensis* Spencer. But, the distiphallus of *hardyi* is much more similar to that of *duplicata* than *floresensis* illustrated by Spencer (1961). As described above, the differences between them in the structures of epandrium and surstyli are significant. I therefore consider *hardyi* must be resurrected.

Specimens examined: 5♂♂, 2♀♀, Kuantzuling, Tainan Hsien, 7 Apr. 1965 (M. S.); 1♂, 1♀, Fenchihu, Chiai Hsien, 10 Apr. 1965 (M. S.); 2♀♀, Taipei, 15 Apr. 1965 (M. S.).

Distribution: Nepal, Indonesia, Philippines, Formosa, New Britain. New to Formosa.

30. *Cerodontha (Icteromyza) hirsuta* Sasakawa, sp. nov.

Male: Head yellow, front orangish or slightly brown-tinged, parafrofrontalia slightly brownish between line of *or* and orbit, both *vt* on brown ground, ocellar triangle centrally and occiput black, lunule silverly pruinose on dorsal half; antenna yellow, second segment brown-tinged basally, the third yellowish brown on outer side but yellow on ventral part of inner side, arista brown; palpus yellow. Thorax black, densely dusted with gray; abdominal tergites brownish black, sternites brown. Wing hyaline, with veins pale brown but whitish at base, calypter yellowish white, with fringe of whitish hairs, halter whitish yellow. Legs pale yellowish brown except for whitish yellow apices of coxae and distal four-fifths of femora of all legs.

Front only slightly wider than eye, almost parallel-sided; parafrofrontalia with two reclinate *ors* and two inclinate *ori*; orbital hairs minute, in a row; ocellar bristle as long as first *ors*; lunule relatively large, higher than semicircular, reaching dorsally to level of first *ori*; eye distinctly hairy; gena one-eighth as high as height of eye; antennae approximated at base, third segment with dorsal margin straight, rounded at apex, arista nearly twice as long as whole length of antenna, distinctly pubescent.

Mesonotum with 1+3 *dc*, three irregular rows of *acr* between anterior two *dc* but only two rows behind level of second *dc*, *ipa* about one-fourth length of *opa*, *ia* twice as long as *ipa*. Wing with costal sections in proportion of 2.4: 1: 0.6, r-m only a little before middle of discal cell, ultimate section of M_{3+4} slightly longer than penultimate (1.2: 1).

Length: Body and wing 1.4 mm.

Distribution: Formosa.

Holotype ♂, Ssuechungchi, Pingtung Hsien, 3 Apr. 1965 (M. S.).

This species may be easily distinguished from *C. piliseta* (Becker) by the smaller size, the densely gray-dusted mesonotum and by having the hairy eye. It is close to the European *calosoma* Hendel in having the hairy eye and high lunule, but in the related species, the wing is up to 3.9 mm long in the female, the ultimate section of M_{3+4} is shorter than the penultimate, and the abdominal tergites are yellow

along the lateral and caudal margins.

31. *Cerodontha* (*Poemyza*) *cornigera* (de Meijere), comb. nov.

(Figs. 18, 19)

Dizygomyza (*Poemyza*) *cornigera* de Meijere, 1934, Tijdschr. Ent. 77: 264.

Phytobia (*Poemyza*) *cornigera* (de Meijere) : Sasakawa, 1963, Pacific Ins. 5: 42.

This is a large black species, with wing length of 2.5-2.7 mm and known as a leaf-miner on a species of the Cyperaceae. I have examined a single male specimen bred from a leaf-mine on *Carex chinensis* Retz.

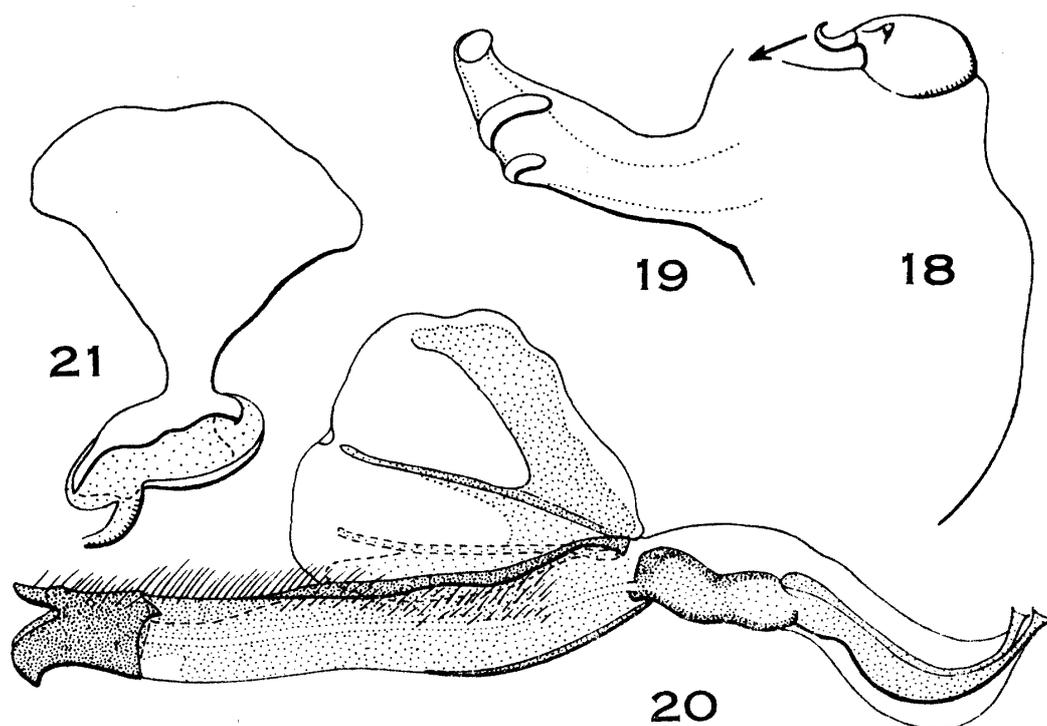
The distinctive features of this species are: lunule brownish ventrally, mesonotum with 1+3 *dc*, fore leg with knee yellow, middle knee narrowly yellowish brown and hind femur entirely black, all tarsi yellowish brown, middle tibia with a distinct posterodorsal bristle. The distiphallus of male terminalia of the Formosan specimen is longer than that of the Malayan one, that is, it is as long as the basiphallus in length and is bifided on distal two-thirds. The ejaculatory apodeme is 188 μ long and 175 μ in greatest width.

Specimen examined: 1♂, Taipei, 4 Apr. 1965, on *Carex* (M. S.).

Distribution: Java, Malaya, Formosa. New to Formosa.

Puparium: Dark brown, 2.6-3.0 mm long, flattened on both dorsal and ventral sides. Mandibles each with two teeth, dorsal one smaller than ventral; labial sclerite nearly two-thirds length of dorsal process of paraclypeal phragma. Anterior spiracle with eleven to thirteen bulbs; posterior spiracle as figured.

Mine: Whitish in colour, ophonome of the upper surface type, 22-24 cm long and 2 mm in the greatest width, running toward the tip of leaf at first, then turning backward and finally stretching through whole width of leaf in touch with parallel ones; microscopic grains of frass arranged irregularly but five or six very large grains per mine distinctly visible; pupation takes place in the mine.



Figs. 18-21. 18-19: Posterior spiracle of puparium of *Cerodontha cornigera* (de Meijere). 20-21: *Cerodontha hirta* Sasakawa, n. sp. 20, phallus; 21, ejaculatory apodeme.

32. *Cerodontha (Poemyza) hirta* Sasakawa, sp. nov.

(Figs. 20, 21)

Male: Head black, excepting bright yellow parafrontalia between vertex (*vti* growing at edge of yellow area but *vte* on brown) and base of second *ori*, orbital margin linearly brown, frontalia narrowly yellow just laterad of dorsal angles of ocellar triangle (rarely yellow on dorsal half); parafacialia, gena and anterior area of postgena brown-tinged; antenna and palpus black. Thorax shiny black, very weakly gray-dusted, dorsal margin of mesopleura narrowly yellow. Wing hyaline, very slightly brown-tinged, veins pale brown, basally yellowish; calypter yellowish, with margin and fringe brown; halter yellow. Legs black, all knees distinctly yellow, tarsi brown. Abdomen shiny brown, posterior margins of third to fifth tergites sometimes linearly yellowish.

Head: Front two and a half times as wide as either eye, converging ventrally; parafrontalia nearly one-third width of front, almost parallel-sided, slightly projecting above eye in profile, two *ors* directed upwards, two *ori* short and directed inwards, all fronto-orbitals growing mesad from centre of parafrontalia and second *ors* nearest to inner margin of parafrontalia, distance between two *ors* almost twice as long as either distance between ventral fronto-orbitals, orbital hairs in irregular rows between second *ors* and second *ori*; lunule high, nearly reaching to level of second *ors*; eye densely with whitish, short pubescence; gena very narrow, about one-eleventh height of eye; antennae approximate, third segment small, arista about twice as long as whole length of antenna, pubescent.

Mesonotum with 0+3 *dc*, first *dc* about one-half length of the second; four irregular rows of *acr*, extending to third *dc*; *ipa* subequal to basal scuteller bristle which is one-third length of the apical. Wing 2.5-2.7 mm long, costal sections in proportion of 3.6 : 1.0 : 0.6, r-m before middle of discal cell, ultimate section of M_{3+4} slightly longer than penultimate.

Sixth tergite almost twice as long as the fifth, fifth sternite as long as sixth tergite but excavated on posterior one-fifth. Terminalia: Epandrium with minute dorsoapical process, surstylus directed in- and upwards, bearing about twenty-five setae; cercus about one-half as high as epandrium; processus longus slightly longer than epandrium, curved distally and hamate on tip, dorsal lobes united with each other. Hypandrium with sidepieces broadly united at anterior base. Phallus basally hairy on ventral side, ventral process fan-shaped and with a pair of V-shaped sclerites, endophallus bifurcated distally; ejaculatory apodeme 200 μ long and 220 μ broad.

Female: Similar to male, abdomen darker, sixth tergite one and a half times as long as the fifth; ovipositor sheath glossy black; wing 2.9 mm long.

Distribution: Formosa.

Holotype ♂, Mts. Arisan, 2,000 m, Chiai Hsien, 27 Mar. 1967 (T. S.); allotype ♀, Vicinity of Taataka-anbu, ca. 2,700 m, Chiai Hsien, 3 Apr. 1967 (T. S.). Paratypes 6♂♂, topotypical; 1♂, Tonpogoe, 2,500 m (T. S.).

Host-plant: Unknown.

This new species differs from *C. cornigera* by its yellow parafrontalia, and hairy eye and distiphallus. It is also closely related to *C. javana* (de Meijere) comb. nov., in the coloration of head, but differs in having the larger size and yellow knees of all legs.

Genus *Calycomyza* Hendel

This genus is characterized by the yellow front and notopleura, and black scutellum. The epandrium is provided with many spines on each caudoventral corner and the surstyli are also spinose. The mesonotal chaetotaxy is not a certain

character, although most of the known species have not presutural dorsocentral bristle.

Only two species are known from the Oriental region, one is Holarctic and the other *humeralis* is cosmopolitan. Both species are the leaf-miners on the Compositae.

33. *Calycomyza artemisiae* (Kaltenbach)

Agromyza artemisiae Kaltenbach, 1856, Verh. Naturh. Ver. preuss. Rheinl. Westphal. **13**: 236.

Dizygomyza (Calycomyza) artemisiae (Kaltenbach); Hendel, 1931, in Lindner: Die Flieg. palaearkt. Reg. **59**: 66.

Phytobia (Calycomyza) artemisiae (Kaltenbach): Frick, 1952, Univ. Calif. Publ. Ent. **8**: 394.

Calycomyza artemisiae (Kaltenbach): Nowakowski, 1962, Ann. Zool. **20**: 97.

This has been known as a leaf-miner on *Artemisia* spp. It closely resembles *C. humeralis* (v. Roser), but is immediately recognizable by its entirely yellow parafrenalia and dark brown fringe on the calypter. The differences between them in the larval external characters are also distinct (Sasakawa, 1961).

Specimen examined: 1♂, Mt. Yangming Shan, Taipei, 19 Apr. 1965 (M. S.).

Host-plant: *Patrinia villosa* Juss.

Distribution: Europe, China, Formosa, Japan, N. America. New to Formosa.

Genus *Amauromyza* Hendel

This genus may be easily distinguished by the over-all black coloration, including the halteres, the large, strongly sclerotized ejaculatory bulb and the disc-like spermathecae. The endophallus is usually covered with spines or spinules, but in a single Oriental species, *aliena*, it is smooth.

The biology and the larval characters of *A. aliena* (Malloch) are resolved herewith.

34. *Amauromyza aliena* (Malloch), comb. nov.

(Figs. 22-28)

Agromyza aliena Malloch, 1914, Ann. hist.-nat. Mus. Hung. **12**: 328 (♀, Sokotsu).

Dizygomyza aliena (Malloch): Hennig, 1941, Ent. Beiheft. **8**: 173.

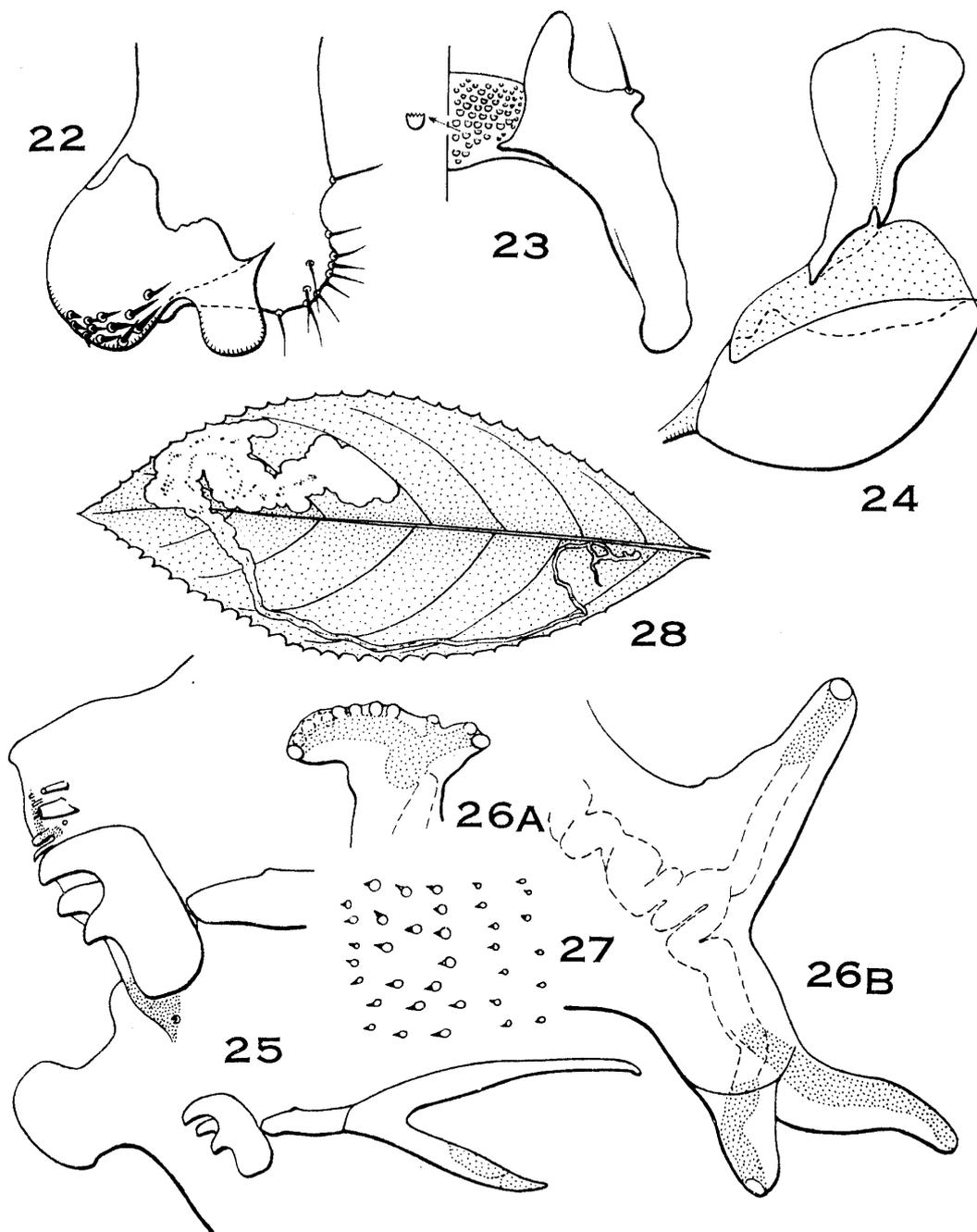
Phytobia (Amauromyza) aliena (Malloch): Spencer, 1961, Trans. R. ent. Soc. Lond. **113**: 85.

This species was described by only the females. A series of males and females bred from the larvae mining in the leaves of *Callicarpa formosana* is clearly referable to this species.

The male is smaller, with the wing length of 1.7-2.0 mm (♀: 1.95-2.5 mm). The mesonotum is densely dusted with brownish gray and the abdominal tergites are linearly brownish yellow along the posterior margins. The front is narrower and only a little wider than the eye. The gena is one-ninth as high as height of eye.

Terminalia: ♂—Epandrium with about twelve setae on posteroventral corner; surstylus strongly incurved, two-lobed, anterior one with about twelve spines along ventral margin and posterior one well sclerotized; processus longi connected with membrane covered with scale-like spines; hypandrium about one-half as long as phallopodeme; phallic hood with claw-like posterior tip; phallus figured by Spencer (1962); ejaculatory apodeme 66-72μ long. ♀—Ovipositor sheath shiny black, pubescent on basal half, with apodeme slightly shorter than sheath, pouched on anterior one-third to two-fifths; egg

guide 100-110 μ long, trapezoidal in lateral side, bearing five to seven minute spines on mesal side; ninth tergite inverted Y-shaped, 140 μ long, sternite V-shaped, 113 μ long, bearing five pairs of *nsm*; cercus 40 μ long, with four short *ts*; spermathecae black, disk-like, 78-81 μ in diameter; ventral receptacle 68 μ long, without tail.



Figs. 22—28. *Amauromyza aliena* (Malloch). 22, surstylus; 23, processus longus; 24, ejaculatory apodeme; 25, head and cephalopharyngeal sclerite of larva; 26A, anterior spiracle; 26B, posterior spiracle; 27, spinal pattern on lateral side of the third abdominal segment.

Larva: Full-grown larva yellow, 3.2-3.6 mm long. Head with two distinct protuberances, dorsal one just before prothoracic segment smaller than ventral one which is projected just ventrad of mandibles. Right mandible with two teeth, the left with only terminal one; posterior half of dorsal process and ventral process of paraclypeal phragma brown. Anterior spiracle somewhat bilobate,

with eleven or twelve bulbs; posterior spiracle trifurcate, ventrolateral one shortest, spiracular bulbs situated on each tip of branches. Cuticular processes brown, those of anterior rows larger than of posterior rows but almost same on seventh and eighth abdominal segments; spinal pattern: on lateral side, 1T=5.0, 2T=0.2, 3T=1-2.2, 1A=2-3.2, 2&7A=3-4.2, 3-6A=4.2, 8A=5.0, on ventral, 1-3T=0, 1-2A=3.0, 3-4&8A=2.0, 5-7A=1.0, absent on dorsal side.

Puparium: Dark brown but blackish on ventral side, 1.8-2.1mm long.

Specimens examined: 12♂♂, 15♀♀, Peitou, Taipei, 15-20 Apr. 1965, reared by myself; 3♀♀, Mt. Yangming Shan, Taipei, 29 Mar. 1965 (M. S.); 7♂♂, 9♀♀, Peitou, 31 Mar. 1965 (M. S.); 1♂, 6♀♀, Chiao-chi, Taipei Hsien, 16 Apr. 1965 (M. S.).

Host-plant: *Callicarpa formosana* Rolfe.

Distribution: Formosa, Thailand.

The leaf-mine is whitish green in colour, usually ophistigmatonome, upper surface type, with first linear part 2-6 cm in length and blotch part 22-31 mm². The minute grains of frass in the ophionome are arranged along sides of the mine but changed into short threads of grains alternately along sides, in the stigmatonome they are scattered irregularly. One to four mines occur on a single leaf. The mature larva escapes through a semicircular slit made on the upper surface of the leaf.

Genus *Liriomyza* Mik

This is one of the larger genus in the Palaearctic region and the largest one in the Neotropical region, but is not dominant in the Oriental and Ethiopian regions. Of the three known species in Formosa, one is cosmopolitan and one is Oriental. Five species are recorded for Formosa at present, of which one is described below as new, and three are known as the leaf-miners.

The scutellum of the most species in this genus is largely yellow. It may be separated by the wing venation from some yellow aberrant species of *Phytobia* in the Neotropical region. The terminalia of *Liriomyza* are distinctive, particularly the epandrium is provided with a spine on each inner caudoventral corner, and the cruciform tergite and narrowly U-shaped sternite of the ninth segment of ovipositor.

Key to Formosan species of *Liriomyza*

1. Mesonotum with yellow semicircular area adjoining scutellum *subpusilla* (Malloch)
- Mesonotum without such yellow prescutellar area 2
2. Scutellum largely yellow; third antennal segment rounded 3
- Scutellum entirely black; third antennal segment with pointed angle dorsoapically
 *cepae* (Hering)
3. Parafrontalia entirely yellow 4
- Parafrontalia normally brownish to black..... *brassicae* (Riley)
4. Head with both vertical bristles arising from yellow area..... *yasumatsui* n. sp.
- Inner vertical bristle growing on yellow area but the outer on black..... *compositella* Spencer

35. *Liriomyza brassicae* (Riley)

Oscinis brassicae Riley, 1884, Rep. U. S. Dept. Agr. 1884: 332.

Liriomyza brassicae (Riley): Hendel, 1936, in Lindner: Die Flieg. palaearkt. Reg. 59: 215 (as syn. of *cruciferarum* Hering, 1927).

This is a cosmopolitan leaf-miner on many species of the Cruciferae and Capparidaceae and frequently a serious pest on cruciferous crops.

The parafrontalia is either black or almost entirely yellow, but both vertical bristles are always growing on black area. The mesonotum is shining black.

Spencer (1963) synonymized *L. hawaiiensis* Frick with *brassicae* on the basis of a variable coloration of the orbits, but I (1964) confirmed the distinctness of *hawaiiensis* by the significant differences between both species in the structures of male terminalia.

Specimens examined: 1♀, Ali Shan Mts., Chiai Hsien, 8 Apr. 1965 (M. S.); 1♀, Pinglin, Taipei Hsien, 23 Jun. 1965 (S. I.).

36. *Liriomyza cepae* (Hering)

Agromyza cepae Hering, 1927, Tierw. Deutschl. **6**: 50.

Phytobia (Cephalomyza) cepae Hering: Frick, 1952, Univ. Calif. Publ. Ent. **8**: 391.

Liriomyza cepae Hering: Nowakowski, 1962, Ann. Zool. **20**: 96.

This species is unusual in having the scutellum black, only the first upper fronto-orbital bristle reclinate and the third antennal segment distinctly pointed on dorsal tip.

Although Nowakowski transferred this species to *Liriomyza* by his comparative study of the male terminalia, I also recognized its justification in the structures of the female terminalia (1961, Fig. 46 h-j).

This is a common pest of the cultivated leek in Formosa.

Specimens examined: 12♂♂, 8♀♀, Taipei, Nov. 1967, on *Allium odorum* L. (H. J. Z.).

Distribution: Europe, Japan, Formosa. New to Formosa.

37. *Liriomyza compositella* Spencer

Agromyza pusilla Malloch (*nec* Meigen, 1830), 1914, Ann. hist.-nat. Mus. Hung. **12**: 314.

Liriomyza compositella Spencer, 1961, Trans. R. ent. Soc. Lond. **113**: 87 (Taiwan).

The differences between *L. pusilla* and *compositella* were noted by Spencer. *Compositella* has been known as leaf-miners on *Solidago*, *Tithonia* and *Gynura*. I could breed the larvae which are clearly referable to this species mining on *Epaltes* sp. and *Bidens biternata* Merr. et Sherff. The leaf-mine is whitish-yellow ophiome with two or three coils at first, and the frass is arranged in long threads at side of channel.

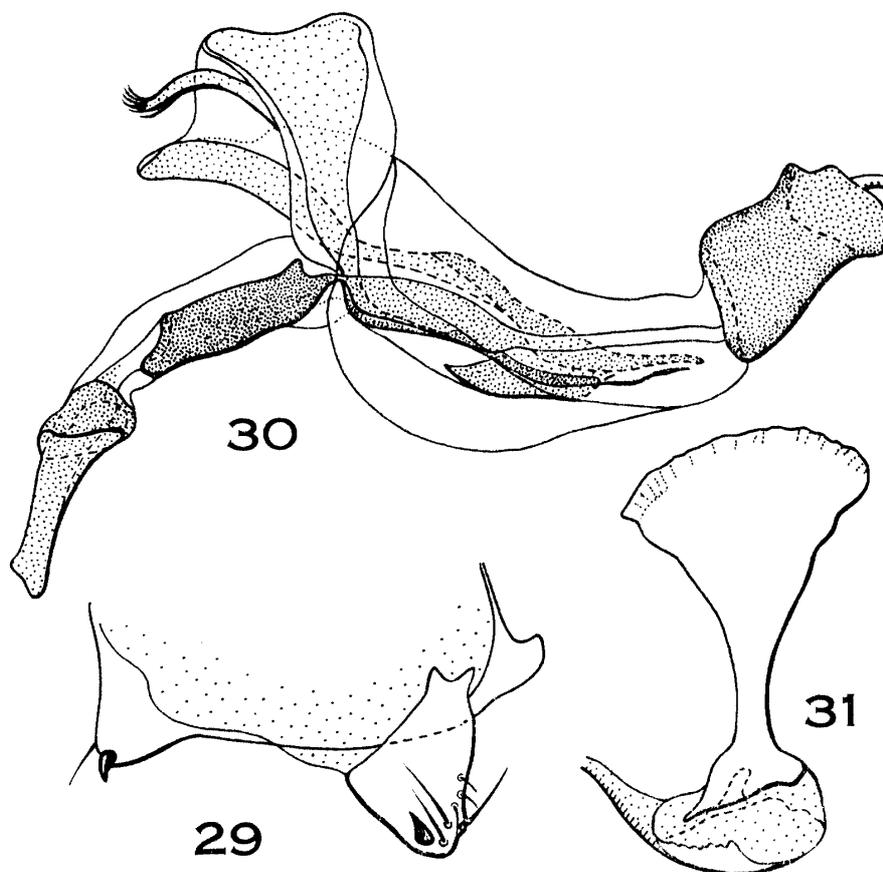
Specimens examined: 13♂♂, 6♀♀, Taipei, 7-16 Apr. 1965, on *Epaltes* (M. S.); 4♂♂, 6♀♀, Taipei, 15-19 Apr. 1965, on *Bidens* (M. S.); 2♀♀, Mt. Yangming Shan, 29 Mar. 1965 (M. S.); 8♂♂, 7♀♀, Ssunchungchi, Pingtung Hsien, 3-4 Apr. 1965 (M. S.); 1♀, Ali Shan Mts., Chiai Hsien, 8 Apr. 1965 (M. S.); 1♂, 1♀, Fenchihu, Chiai Hsien, 10 Apr. 1965 (M. S.); 3♂♂, 2♀♀, Chuchi, Chiai Hsien, 12-13 Apr. 1965 (M. S.); 4♀♀, Chiaoichi, Taipei Hsien, 16 Apr. 1965 (M. S.).

Distribution: Formosa, India, Ceylon.

38. *Liriomyza yasumatsui* Sasakawa, sp. nov.

(Figs. 29-31)

Male: Head with front, face, gena, postgena, antenna and palpus yellow, but frontalia and palpus slightly brown-tinged, arista brown; both *vt* on yellow ground of vertical angle; postorbit entirely yellow, only brown-tinged dorsally in short distance from posterodorsal angle of eye. Mesonotum shining black, weakly gray-pollinose, with small yellow spot at posterior corner; humerus with pale brown spot at centre; pleura yellow excepting brown triangle on sterno- and hypopleuron. Wing hyaline, calypter with margin and fringe pale brown, halter yellow. Legs yellow, tibiae and tarsi brown-tinged. Abdomen brown, second to fifth tergites with yellow posterior and lateral margins, broadened posteriorly, sixth tergite yellow, with a small brown median spot anteriorly; epandrium brown, cercus yellow.



Figs. 29-31. *Liriomyza yasumatsui* Sasakawa, n. sp. 29, epandrium and surstylus; 30, phallus; 31, ejaculatory apodeme.

Front almost one and a half times as wide as eye, parafrontalia linearly projecting above eye in profile, bearing two reclinate *ors*, two inclinate *ori* and three minute orbital hairs; eye bare; gena about one-fourth height of eye, *vi* distinctly longer than four *pm*; third antennal segment rounded, with distinct pile, arista minutely pubescent.

Mesonotum with 1+3 *dc*, decreasing anteriorly in length, an additional seta before first *dc* which is only slightly longer than that, distance between second and third *dc* one-half that between third and fourth; three or four rows of *acr* before second *dc*, central two rows of them extending just behind level of third *dc*, one or two setulae in *ia* row. Wing 1.2 mm long, costal sections in proportion of 20:7:6, r-m far beyond middle of discal cell, ultimate section of M_{3+4} about three and a half times as long as the penultimate.

Terminalia: Epandrium with ventroposterior angle distinctly projected, bearing a spine, surstylus conical, with a spine and three long setae; cerci long, each three-fifths as high as epandrium. Hypandrium with sidepieces slender, about two-thirds length of phallopodeme. Endophallus separated into two sclerotized tubes; ejaculatory apodeme 115μ long.

Length: Body 1.2 mm.

Distribution: Formosa.

Holotype ♂, Kantzuchai, Chiai Hsien, 11 Apr. 1965 (M. S.); terminalia mounted on a slide.

This species is clearly distinct from *L. brassicae* (Riley) and *compositella* Spencer by the pale coloration of vertical angles, but shows a close similarity with *L. palauensis* Spencer, known from Palau Is. and Philippines, and *Liriomyza* sp. (1) from Formosa (Spencer, 1961). It differs from the former related species in the venation, that is, the cross-vein r-m is situated at basal third of the discal cell and the ultimate section of M_{3+4} is twice as long as the penultimate, and moreover the postorbits are black ventrad from the bases of outer vertical bristles. In the latter *Liriomyza* sp. (1), the mesopleuron is largely yellow, with a small dark area on the ventral margin. The endophallus of *yasumatsui* is characteristic.

Genus *Praspedomyza* Hendel

This genus is characterized by the pronounced parafrontalia which are abruptly raised above plane of the frontalia.

Three species, including one new species described below, are known in Formosa, and can be separated as follows:

1. Front orangish- to reddish-yellow 2
Front dark brown..... *brunnifrons* (Malloch)
2. Palpus yellow; mesonotum with 1+3 *dc*..... *frontella* (Malloch)
Palpus brownish-black; mesonotum with 0+3 *dc*..... *viticola* n. sp.

Malloch (1914) described above two species belong to the genus *Agromyza* but both were transferred to the subgenus *Praspedomyza* of *Phytobia* by Spencer (1961). *P. brunnifrons* is larger (♀: 2.7 mm in the wing length) than *frontella* (♀: 1.9 mm), and both species have the distinct presutural dorsocentral bristle, yellow palpi and yellow to brownish-yellow fringe on the calypteres.

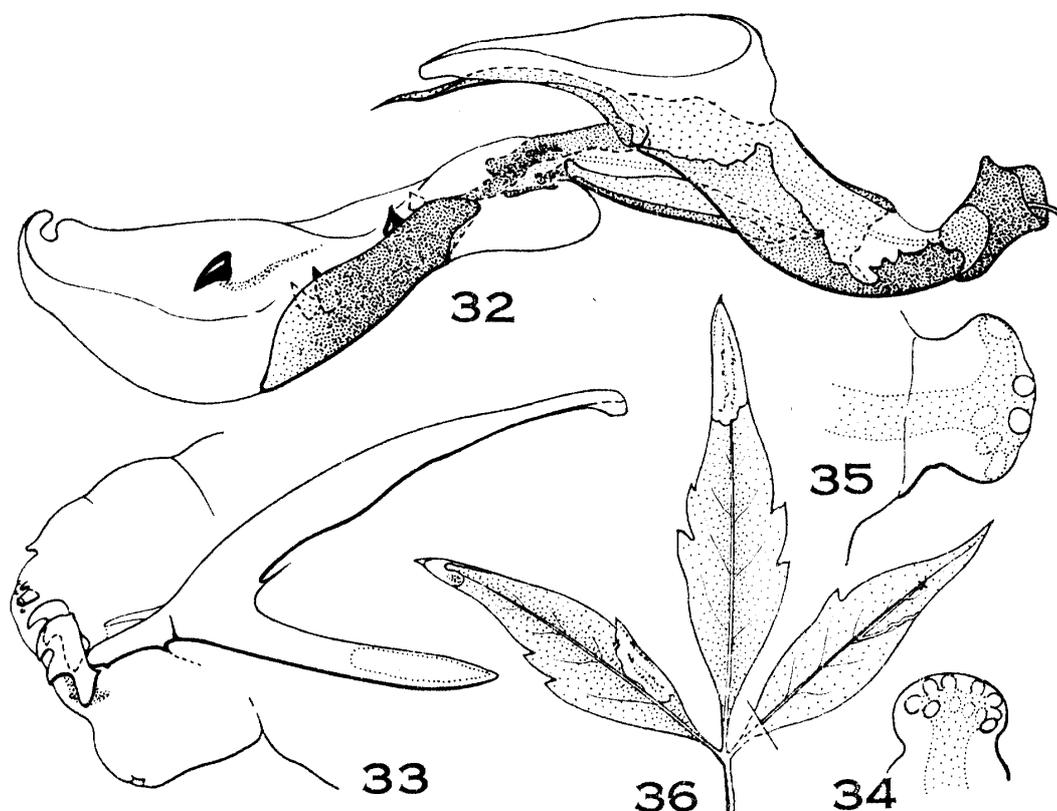
39. *Praspedomyza viticola* Sasakawa, sp. nov.

(Figs. 32-36)

Mele: Head yellow but frontalia orange to reddish and very slightly brown-tinged on dorsal part, parafrontalia brown dorsad from level of second *ors*, ocellar triangle and occiput black, lunule orange, face and peristome brown; antenna and palpus brownish black. Thorax black, densely dusted with brownish gray; abdomen dark brown to brownish black, faintly shining. Wing hyaline, veins pale brown, calypter with margin brown and fringe dark brown; halter yellow. Legs black.

Front about one and a half times as wide as eye, almost parallel-sided; parafrontalia about one-fourth width of front but narrowing ventrally, slightly projecting above eye in profile, bearing two reclinate *ors* and two inclinate *ori*; orbital hairs minute, in a sparse row, dorsal ones between two *ors* reclinate or erect but ventral ones incurved; apex of ocellar triangle almost reaching level of first *ors*; lunule semicircular, about one-third as high as length of front; gena about one-fourth height of

eye. Antennae approximated at bases; third segment small, rounded; arista short, less than twice as long as whole length of antennae, swollen one basal one-third, with microscopic pubescence.



Figs. 32—36. *Praspedomyza viticola* Sasakawa, n. sp. 32, phallus; 33, head and cephalopharyngeal sclerite of larva; 34, anterior spiracle; 35, posterior spiracle; 36, leaf-mines on *Vitex negundo*.

Mesonotum with 0+3 *dc*, presutural *dc* equal to *acr* in length, four irregular rows of *acr*. Wing: 1.4-1.5 mm in length, costal sections in proportion of 2.8:0.8:0.6, r-m at middle of discal cell, ultimate section of M_{3+4} about one and three-fourths times as long as penultimate.

Terminalia: Surstylus small, bearing seventeen to twenty setae; processus longus with two bristles on both posterior tips. Hypandrium circular, with sidepieces approximately one-third length of phallapodeme; praegonite with one long seta and two minute setae, postgonite with a tooth before knob. Endophallus with three pairs of black and stout spines on ventral membranous part. Ejaculatory apodeme 269 μ long, one-half as long as phallapodeme, with a knob-like process at base.

Length of body: 1.3-1.4 mm.

Female: Posterior margins of abdominal tergites linearly yellowish; ovipositor sheath shiny black, pubescent on basal half; front narrowing ventrally; length of body 1.35-1.65 mm, of wing 1.4-1.6 mm.

Larva: Full-grown larva yellow, 2.3-2.5 mm in length. Head with minute dorsal and large ventral protuberances. Mandibles each with two teeth; paraclypeal phragma of normal shape. Anterior spiracle papillate, with eight to twelve bulbs in two rows; posterior spiracle slightly larger than anterior, with five or six bulbs. Cuticular processes pale brown, almost equal in size, excepting smaller ones on posterior row of anterior band of each segment; spinal pattern on lateral side, 1T=7.0, 2T=2.1, 3T=3.2, 1-6A=4.2, 7A=3.4, 8A=4.5.0, on ventral, 1T&8A=0, 2T-7A=1-2.0, on dorsal 1-2T&8A=0, 3T&1-3A=2.0, 4-7A=1.0.

Puparium: Brown, 1.4-1.7 mm in length, 0.65-0.8 mm in greatest width.

Host-plant: *Vitex negundo* L.

Distribution: Formosa.

Holotype ♂, Ssuehchungchi, Pingtung Hsien, 4 Apr. 1965 (M. S.); allotype ♀, 19 Apr. 1965; paratopotypes 2♂♂, 4♀♀, 4-19 Apr. 1965; all bred from larvae; 2 paratypes in coll. of Kyoto Pref. Univ.

This new species can be distinguished by the smaller size, darker palpus and fringe on the calypteres, and not having the presutural dorsocentral bristle. There is the very definite characters in the structures of the distiphallus and the posterior spiracles of larva.

The leaf-mine is pale green in colour but brown later on and ophistigmatonome: the first linear part is of the lower surface type, running mid-vein of leaf and then moving to the margin of leaf along lateral vein, 1.4-1.6 mm in length, the second linear before the stigmatonome of the upper surface type and 0.6-1.3 cm in length, and the last blister is of the full-depth type and about 30 mm². The grains of frass in the linear part are arranged in short threads along one side of the mine but larger isolated grains are arranged in two irregular rows in the blister. One or two mines occur on a leaflet. The mature larva escapes through a semicircular slit made on the lower surface of the leaf.

Genus *Phytoliriomyza* Hendel

This genus is represented by only a single species in Formosa, and it has the proclinate orbital hairs and dark scutellum, differing from the genus *Liriomyza*.

40. *Phytoliriomyza perpusilla* (Meigen)

Agromyza perpusilla Meigen, 1830, Syst. Besch. bekann. eur. zweifl. Insekt. **6**: 181.

Agromyza formosensis Malloch, 1914, Ann. hist.-nat. Mus. Hung. **12**: 315 (♂♀, Taihoku).

Phytoliriomyza perpusilla (Meigen): Hendel, 1936, in Lindner: Die Flieg. palaearkt. Reg. **59**: 203.

This is a small yellow-brown species, with the wing length of 1.3-1.7 mm in male and 1.6-2.3 mm in female. It can be recognized by the minutely pilose third antennal segment, sparsely hairy eye, long ultimate section of M₃₊₄ (nearly twice as long as the penultimate), and long phallus of the male terminalia, from the known world species of this genus. It is variable in colour of the thorax and abdomen, ranging from gray to yellow. The synonymy of *formosensis* is taken from Spencer (1961).

The larvae of this species are the stem-miners of the Compositae.

Specimens examined: 1♂, Jenai, Nantou Hsien, 1 July 1965 (S. I.); 1♀, Tonpogoe, 2,500 m, Chiai Hsien, 29 Mar. 1967 (T. S.); 4♂♂, 3♀♀, Taipei, 10 June 1968 (H. J. Z.).

Distribution: Europe, Africa, Formosa, North America.

Genus *Pseudonapomyza* Hendel

This genus is rather well represented in the Oriental region, but only two of the eight known Oriental species occur in Formosa. They can be separated as follows:

1. Third antennal segment normal, rounded at apex *atrata* (Malloch)

Third antennal segment with pointed angle at anterodorsal corner.....*spicata* (Malloch)

41. *Pseudonapomyza spicata* (Malloch)

Phytomyza spicata Malloch, 1914, Ann. hist.-nat. Mus, Hung. **12**: 334 (♀, Tainan).

Pseudonapomyza spicata (Malloch) : Hennig, 1941, Entom. Beiheft. **8**: 173.

This is a very small black species, with wing length of 1.25-1.55 mm. It is specific in having the sharply pointed angle at the dorsoapical corner of the third antennal segment and strongly shining mesonotum. The male terminalia and puparium illustrated and discussed by Spencer (1961).

The larvae mine the leaves of different species of the Gramineae.

Specimens examined: 4♂♂, 3♀♀, Ssuchungchi, Pingtung Hsien, 4 Apr. 1965 (M. S.); 1♀, Chuchi, Chiai Hsien, 13 Apr. 1965 (M. S.).

Distribution: Formosa, Micronesia, Hawaii, Polynesia, Australia.

Genus *Phytomyza* Fallén

This is the largest genus in the Palaearctic and Nearctic regions. The only records to date of this genus in Formosa are of *P. horticola* Goureau (as *atricornis* Meigen by Hennig, 1941) and *formosae* Spencer (for *affinis* Fallén of Malloch, 1914). Two further species had hitherto been known from the Oriental-Pacific region, *P. orientalis* Spencer, 1962, from New Guinea and *P. plantaginis* R.-D. (Sasakawa, 1964) from Hawaii. The latter species on *Plantago* is widespread in the Pacific and *P. vitalvae* Kalt. firstly recorded here is semicosmopolitan. Therefore, the occurrence of both species in Formosa is not surprising. Now fourteen species are recorded for Formosa, five of which are new. The mining habit of larva is known for eight species of them.

This genus closely resembles *Napomyza*, consisting of the stem-boring species, in the direction of orbital hairs and the wing venation. The cross-vein m-m is absent in most of the known world species of *Phytomyza*, but some species have hitherto been placed in *Napomyza* by the presence of this cross-vein were recently transferred to *Phytomyza* (Griffiths, 1968; Spencer, 1969). *Napomyza yasumatsui* Sasakawa was now transferred to *Phytomyza*, and two such species, *P. tomentella* n. sp. and *valida* n. sp. were treated similarly.

Key to Formosan species of *Phytomyza*

1. Cross-vein m-m lacking..... 2
 Cross-vein m-m present12
2. Front yellow 3
 Front brownish black..... *perangusta* n. sp.
3. Scutellum with yellow median stripe or only spot on caudal apex..... *vitalvae* Kalt.
 Scutellum entirely black 4
4. Mesonotum with yellow lateral stripes from humeri to notopleura 5
 Mesonotum black laterally 6
5. Vertical angles brownish yellow; third antennal segment distinctly pilose..... *eupatorii* Hendel
 Vertical angles dark brown; third antennal segment minutely pilose..... *helianthi* Sasakawa
6. Femora yellow; wing length 4 mm *takasagoensis* n. sp.

- Femora black excepting yellow knee; smaller species 7
7. First *ors* subequal to the second in length..... 8
 First *ors* distinctly shorter than the second.....*homogyneae* Hendel
8. Eyes densely covered with short hairs..... *nigra* Mg.
 Eyes bare or sparsely with minute hairs 9
9. Third antennal segment with conspicuously long pile. *quadriseta* n. sp.
 Third antennal segment normally pubescent10
10. Fore coxae yellow; third antennal segment enlarged, quadrate..... *plantaginis* R. -D.
 Fore coxae black; third antennal segment small, rounded.....11
11. Mesonotum with 2-4 rows of *acr*; second costal section three times length of fourth
 *formosae* Spencer
 Mesonotum usually without *acr*, rarely with a few isolated ones; second costal section
 twice length of fourth.....*horticola* Goureau
12. Front yellow; mesonotum with yellow lateral stripes..... *yasumatsui* (Sasakawa)
 Front brownish black13
13. Mesonotum shining; m-m distad beyond level of r-m *tomentella* n. sp.
 Mesonotum matt, grayish; m-m on level of r-m..... *valida* n. sp.

42. *Phytomyza eupatorii* Hendel

Phytomyza eupatorii Hendel, 1927, Zool. Anzeig. **69**: 258.

This species has hitherto not been known to occur outside Europe and Japan. The Formosan specimens have the narrower yellow dorsal margin on the mesopleura (less than one-third height of mesopleuron), but they can be recognized by the other main external characters given by Hendel and the distinct features of the male and female terminalia by Sasakawa (1961).

The larva forms a linear mine with heliconome at first in the upper tissue of the leaf.

Specimens examined: 1♂, 3♀♀, Mt. Yangming Shan, Taipei, 1 May 1965, bred from leaf-mines on *Eupatorium tashiroi* Hay (M. S.); 1♂, Fenchihu, Chiai Hsien, 10 Apr. 1965 (M. S.); 1♀, Taipei, 15 Apr. 1965 (M. S.).

Distribution: Europe, Japan, Formosa. New to Formosa.

43. *Phytomyza helianthi* Sasakawa

Phytomyza helianthi Sasakawa, 1955, Sci. Rep. Saikyo Univ., Agr. **7**: 30.

The specimen examined agrees exactly with the holotype from Japan, where it was bred from leaf-mines on *Helianthus*.

This species is characterized by the narrowly yellow dorsal margin of mesopleura (about one-fourth height of mesopleuron) and narrow second section of the costa (nearly three times as long as the fourth). The front is yellow but the vertical angles are brown; the first upper fronto-orbital bristle is one-half to two-thirds length of the second; the lateral sides of mesonotum and only fore knee are yellow; the acrostichals are arranged in four irregular rows.

Specimen examined: 1♀, Taipei, 15 Apr. 1965 (M. S.).

Distribution: Japan, Formosa. New to Formosa.

44. *Phytomyza homogyneae* Hendel

Phytomyza homogyneae Hendel, 1927, Zool. Anzeig. **69**: 261.

The distinguishing features of this species are the distinctly pilose arista and brown parafrontalia. The second costal section is variable in length, being three and a half times to nearly four times as long as the fourth.

The larva mines linearly in the leaves of *Aster* and *Homogyneae* in Japan.

Specimen examined: 1♂, Jenai, Nantou Hsien, 29 June 1965 (S. I.).

Distribution: Europe, Japan, Formosa. New to Formosa.

45. *Phytomyza horticola* Goureau

Phytomyza horticola Goureau, 1851, Ann. Soc. ent. France **9**: 148.

Phytomyza subaffinis Malloch, 1914, Ann. hist.-nat. Mus. Hung. **12**: 335 (♂♀, Chip-Chip, Taihoku, Tainan)

This species is very widely distributed throughout the Old World, and is one of the polyphagous leaf-miners. Griffiths (1967) clarified the species-group have usually been known as *Phytomyza atricornis* Meigen. The normally absence of the acrostichals makes this species readily distinguishable from *P. formosae* and *plantaginis*.

I have found that the larvae mine the leaves of *Arisaema ringens* Schott., *Bidens biternata* Merr. et Sherff., *Chrysanthemum cornarium* var. *spatiosum* Bail., *Emilia sonchifolia* DC., *Gnaphalium affine* D. Don., *G. purpureum* L., *Hyptis capitata* Jacq., *Solanum indicum* L. and wild egg-plant in Formosa, and also examined many specimens preserved in the Laboratory of Entomology, National Taiwan University.

46. *Phytomyza nigra* Meigen

Phytomyza nigra Meigen, 1830, Syst. Besch. bekann. eur. Zweifl. Insekt. **6**: 191.

Having compared only a specimen from Formosa with authentic European specimens (2♀♀) and a lot of Japanese specimens of *nigra*, I have come to the conclusion that the present specimen should be identified with *nigra*. In general appearance this species is very similar to *horticola*, but it differs from the latter in having the densely short hairs on the eyes and two rows of the acrostichals. Other main characters were described by Sasakawa (1961).

Many kinds of host plants belonging to the Gramineae have been recorded from Europe and Japan. The larva forms a linear mine and the pupation takes place in the leaf.

Specimen examined: 1♀, Jenai, Nantou Hsien, 1 July 1965 (S. I.).

Distribution: Europe, Siberia, Kamchatka, Japan, Formosa, N. America. New to Formosa.

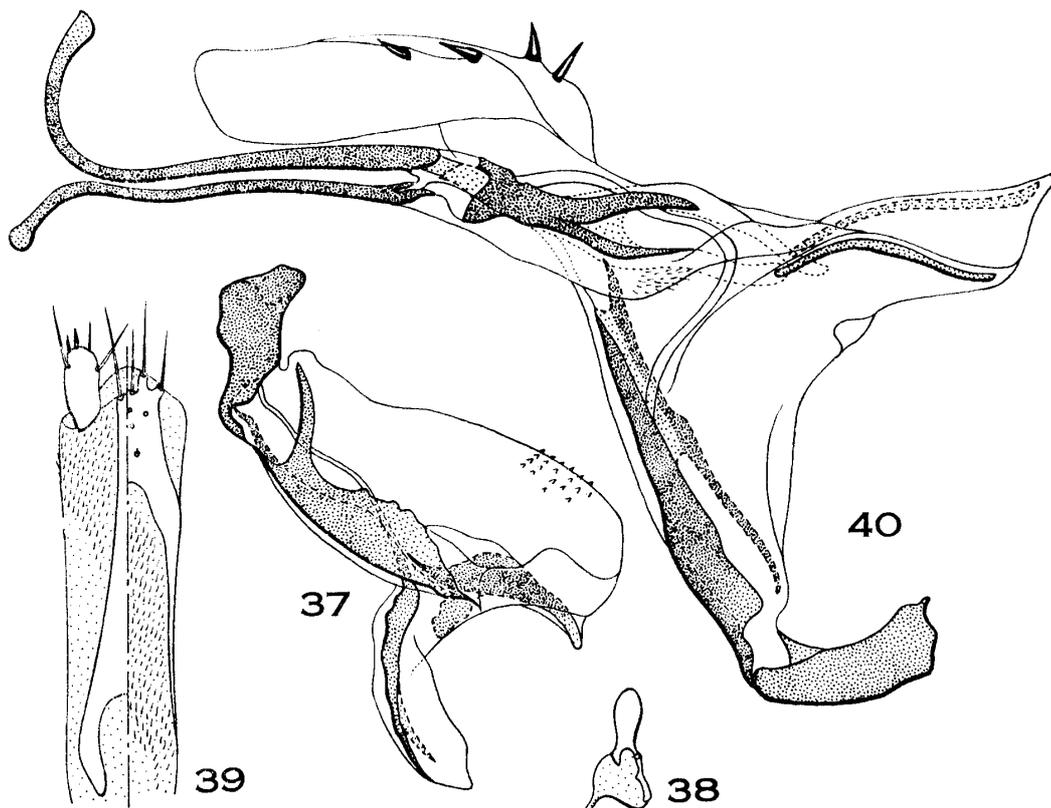
47. *Phytomyza perangusta* Sasakawa, sp. nov.

(Figs. 37-39)

Male: Head brownish black but dorsal half of front, face and gena brown, dorsal inner margin of parafrontalia yellowish to pale brown; antennae and palpus black. Thorax black, mesonotum shining, dusted with brownish-grey, humerus and notopleura slightly tinged with brown, mesopleura

linearly yellow along dorsal margin. Wing hyaline, faintly tinged with brown; calypter smoky brown, with black fringe; halter yellow. Legs black, only fore knee narrowly yellowish brown to pale brown. Abdomen dark brown, second to fourth tergites paler along posterior margins.

Front two and a half times width of eye, almost parallel-sided; parafrontalia nearly one-fourth width of front, narrowing ventrally, not or linearly projecting above eye in profile, bearing two *ors* and one *ori*, first *ors* distinctly shorter than second, rarely absent; orbital hairs two to four; lunule semi-circular; eye densely with whitish short hairs; gena about one-fourth height of eye; *pm* short, three to six; third antennal segment orbicular, with minute pile; arista short, less than twice as long as whole length of antenna, microscopically pubescent.



Figs. 37—40. 37—39: *Phytomyza perangusta* Sasakawa, n. sp., 37, phallus; 38, ejaculatory apodeme; 39, halves of ninth tergite and sternite. 40: Phallus of *Phytomyza quadriseta* Sasakawa, n. sp.

Mesonotum with 1+3 *dc*, first *dc* before level of *prs*, four irregular rows of *acr* extending midway between third and fourth *dc*, usually two setulae in *ia*-rows behind suture, *ipa* one-fourth to one-third length of *opa*. Mesopleura usually without dorsally directed setula. Wing 1.9-2.6 mm, costal sections in proportion of 3:1:1.

Sixth tergite as long as fifth; fifth sternite twice as long as fourth, incised on caudal one-half. Terminalia: Epanthrium with surstyli small, densely setigerous; hypandrium with sidepiece distinctly broadened before posterior end, more than two times as wide as anterior width, without apodeme. Phallus well-developed, bearing about six rows of membranous spinules on distal part of membrane; endophallus bifurcate, claw-shaped. Ejaculatory apodeme minute, not expanded distally, 52 μ long.

Length of Body 1.4-2.1 mm.

Female: Similar to male, but paler posterior margins of tergites usually indistinct excepting sixth; wing 1.9-2.9 mm, second costal section longer, being 3.3-3.8 times as long as third. Ovipositor sheath one and a half times as long as sixth tergite, pollinose; spermathecae not chitinized, ventral receptacle

and egg guide of normal forms; ninth tergite broadened basally, sternite with three pairs of *nsm*; cercus with two *ts*.

Length of Body 1.4-2.3 mm.

Distribution: Formosa.

Holotype ♂, allotype ♀, Ali Shan Mts., 2,270 m, Chiaï Hsien, 8 Apr. 1965 (M. S.). Paratypes 26♂♂, 18♀♀, topotypical: 1♀, same locality as holotype, 27 Mar. 1967 (T. S.).

This species is somewhat intermediate between the Palaearctic *P. ranunculivora* Hering and *novitzkyi* Hering, both of which agree in having the shining mesonotum. There is, however, the definite differences between them in the presence or absence of hairs on the eye and the colouration of wings. Also, it differs distinctly from *P. tropica* Spencer from Indonesia by the darker colour, shorter first upper fronto-orbital and denser rows of the acrostichals.

48. *Phytomyza plantaginis* Robineau-Desvoidy

Phytomyza plantaginis Robineau-Desvoidy, 1851, Rev. Mag. Zool. 3: 404.

This is a moderate species with the wing length of 2.3 mm, having the front, the first and second antennal segments and the distal parts of fore coxae yellow, and mostly two rows of the acrostichals on the ash-gray mesonotum.

The larva makes a linear mine in the leaf of *Plantago*.

This species is extremely similar to *P. formosae* Spencer in the coloration, but can be readily distinguished by the sparser rows of acrostichals and the smaller size. This species also resembles *P. orientalis* Spencer known from New Guinea in the arrangement of acrostichals, but shows the definite differences in the coloration of thorax and chaetotaxy of the fronto-orbitals. *Plantaginis* lacks the acrostichals entirely is separable from *horticola* by the distinctly projected parafrontalia, enlarged third antennal segment and yellow fore coxa.

Specimen examined: 1♀, Ali Shan Mts., Chiaï Hsien, 8 Apr. 1965 (M. S.).

Distribution: Europe, Japan, Formosa, Hawaii, Australia, N. America. New to Formosa.

49. *Phytomyza quadriseta* Sasakawa, sp. nov.

(Fig. 40)

Male: Head yellow, parafrontalia pale brown between line of *or* and orbits, *ors* and first *ori* at edge of brown, vertical angle black, both *vt* on black, ocellar triangle and occiput black, postgena brownish laterally, face brown except for yellow carina and lateral side; antenna brownish black, first segment brownish yellow, arista brown; palpus brown. Thorax black, mesonotum shining, slightly dusted with brownish-gray, dorsal one-fourth of mesopleura yellow; abdomen brownish black. Wing hyaline, veins pale brown but yellow at base, calypter with margin and fringe pale brown. Legs brownish black, fore knee narrowly yellow, middle knee slightly brownish.

Front one and a half times as wide as eye, converging ventrally; parafrontalia one-fifth width of front, narrowing ventrally from base of second *ors*, not projecting above eye in profile, bearing four *or*, first *ors* slightly shorter than second, second *ori* short and weak, a row of four or five orbital hairs not extending below second *ori*; lunule lower than semicircular; gena one-sixth height of eye; third antennal segment as long as wide, rounded apically, with white long pile which is distinctly

longer than basal thickness of arista; arista one and a half times as long as whole length of antenna, swollen on basal one-fourth, pubescent.

Mesonotum with 1+3 *dc*, first *dc* before *prs*, two sparse rows of *acr*, four to six setulae in *ia*-row behind suture; mesopleura with one dorsally directed setula. Wing 2.4 mm long, costal sections in proportion of 3.6 : 1 : 1.

Terminalia: Surstylus very narrow, setigerous along inner margin; sidepiece of hypandrium narrow but distinctly broadened at posterior one-third; phallus very long, almost equal to phallapodeme in length, with small patch of setulae on dorsal membrane and two pairs of sharp spines on posteroventral membranous process; ejaculatory apodeme 160 μ long, strongly expanded distally, 170 μ in greatest width.

Length of body 2.2 mm.

Female unknown.

Distribution: Formosa.

Holotype ♂, Meifeng, 2, 127 m, Jenai, Nantou Hsien, 29 June 1965 (S. I.); terminalia mounted on slide.

The distinctive characters of this species are the distinctly pilose third antennal segment and brownish parafrontalia; it resembles the European *P. ciliata* Hendel but is readily distinguishable by having the shining mesonotum and non-projecting parafrontalia.

50. *Phytomyza takasagoensis* Sasakawa, sp. nov.

Female: Head yellow, front tinged with brown, occiput and dorsal three-fourths of postgenae brownish black, extending to dorsal half of postorbit and vertical angles, *vti* arising at edge of brown area; antenna and palpus yellow except for brownish black third antennal segment and arista. Thorax black; mesonotum strongly shining, slightly pollinose, with a pair of tiny yellow spots on posterolateral corners before scutellum; propleura ventrally and dorsal one-fifth of mesopleura yellow, propleural bristle growing on brown spot. Wing hyaline, very slightly tinged with brownish gray; costa and radial veins pale brown but basally yellow; calypter yellow, with margin and fringe brown; halter yellow. Legs brownish black, mid and hind coxae paler, all femora and basal one-third of fore tibia yellow. Abdomen shiny, blackish brown, third to sixth tergites narrowly with yellow caudal margins; ovipositor sheath black.

Front slightly wider than width of eye, slightly converging ventrally; parafrontalia about one-fourth width of front, narrowing ventrally, not projecting above eye margin in profile, bearing two strong reclinate *ors* and two incurved *ori*; orbital hairs in a row; lunule small, semicircular; gena about one-fifth height of eye; third antennal segment small, arista microscopically pubescent; palpus almost as broad as middle height of gena.

Mesonotum with 1+3 *dc*, first *dc* before level of *prs*, four irregular rows of *acr* extending just before level of fourth *dc*, *ipa* about one-third length of *opa*; mesopleura without dorsally directed setula. Wing: 4.0 mm long, costal sections in proportion of 4.2 : 1 : 1. Ovipositor sheath entirely pubescent on dorsal side.

Length of body: 3.8 mm.

Distribution: Formosa.

Holotype ♀, Ali Shan. Mts., Chiai Hsien, 8 Apr. 1965 (M. S.).

This new species is distinctive in the size and coloration of the femora. It is closely related to the Palearctic *P. dorsata* Hendel in having the strongly shining mesonotum and yellow femora, but differs from the latter by the darker lateral

sides of mesonotum, abdomen and distal segments of legs. Also it differs from *P. clematidicola* Spencer known from Australia by the shiny mesonotum, dark coxae, four rows of the acrostichals and larger size. Bionomics is unknown.

51. *Phytomyza tomentella* Sasakawa, n. sp.

(Figs. 41-43)

Male: Head including antenna and palpus black; frontalia, face and gena slightly tinged with brown, parafrontalia strongly shining. Thorax and abdomen black, mesonotum shining, slightly brownish-gray dusted, notopleural suture yellow, abdomen more densely dusted. Wing hyaline but costal and marginal cells faintly tinged with brown, calypter brownish gray, with fringe brown, halter yellow. Legs entirely black.

Front nearly twice as wide as eye, slightly converging ventrally; parafrontalia a little narrower than one-third width of front, projecting linearly above eye in profile, with two strong reclinate *ors*, one incurved *ori* and a row of orbital hairs; gena about one-fourth height of eye; three *pm*, two or three setulae near by *vi*. Third antennal segment large, somewhat quadrate, with minute pile; arista distinctly pubescent.

Mesonotum with 1+3 *dc*, two regular rows of *acr* ending at level of third *dc*, two or three setulae in *ia*-row. Wing: 2.0-2.2 mm long, costal sections in proportion of 2.3 : 1 : 1.2, m-m distad beyond level of r-m, ultimate section of M_{3+4} seven to eight times as long as penultimate.

Fifth sternite deeply incised posteriorly, membranous part almost reaching anterior margin. Terminalia: Surstylus setose along ventral margin; hypandrial sidepiece rather broad, about two-thirds length of phallus; phallus as figured, similar to that of *yasumatsui* in general appearance, but a pair of endophallus slender and long, densely setulose on ventral membrane, ejaculatory duct distinctly broadened distally, apodeme 300 μ long, 258 μ wide.

Length of body 1.7-1.9 mm.

Female: Similar to male, sixth abdominal tergite entirely black. Length of wing 2.3 mm, body 2.2-2.3 mm.

Terminalia: Ovipositor sheath dusted, setigerous on distal half, with apodeme slightly longer than one-half length of sheath, pouched on anterior one-sixth. Egg-guide subtriangular, 52 μ long, only sclerotized marginally, setulose before ventral tip. Ninth tergite narrow, 140 μ long, sternite as long as tergite, well-sclerotized, bearing three pairs of *nsm*; cercus with four long *ts*. Spermathecae semiorbicular, 35 \times 66 μ ; ventral receptacle of normal form.

Distribution: Formosa.

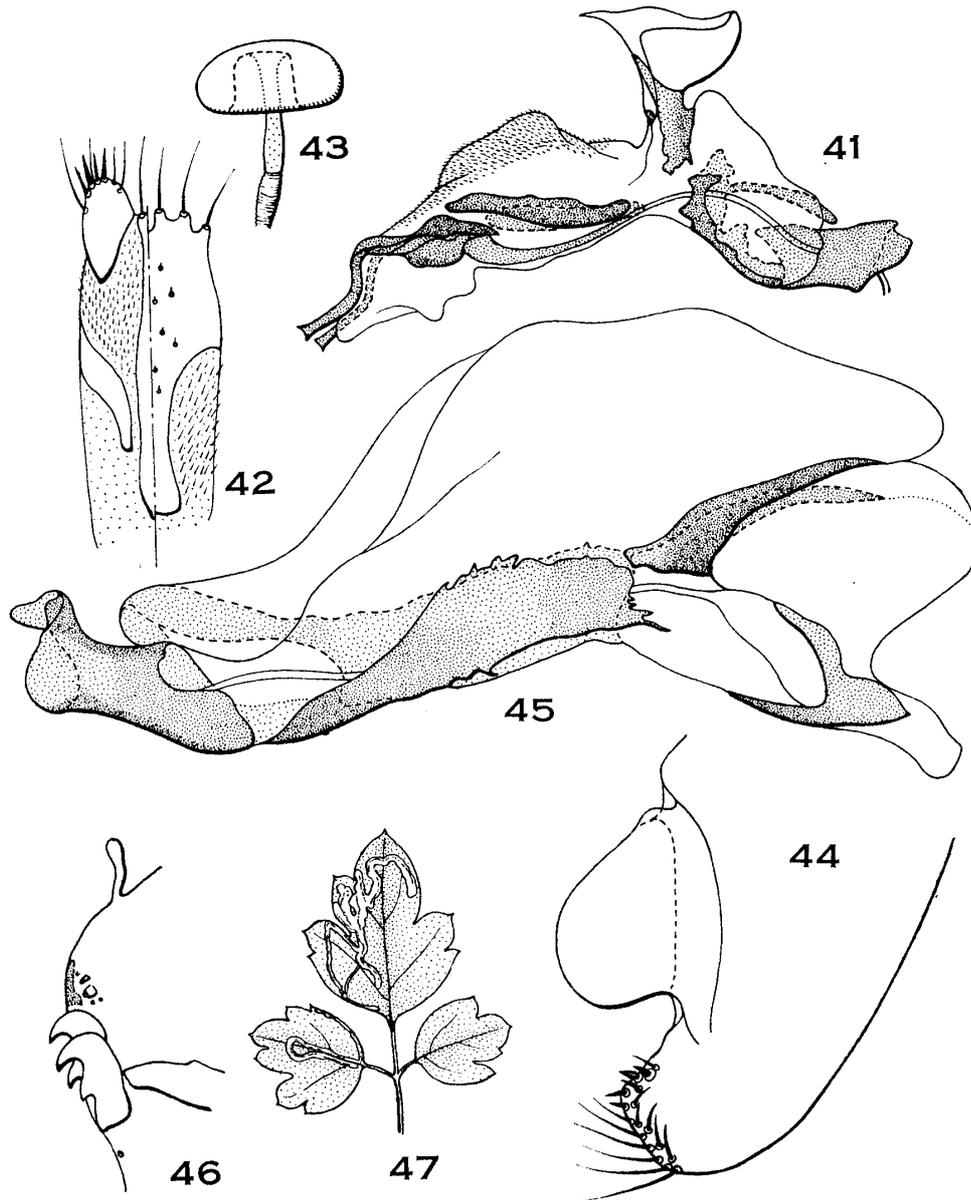
Holotype ♂, allotopotype ♀, Ali Shan Mts., Chiai Hsien, 8 Apr. 1965 (M. S.); paratopotype 2♀♀, 8-9 Apr. 1965; ♂ & ♀ terminalia of paratype mounted on a slide.

This is a distinctive species with the shining black mesonotum. It is very closely related to the European *P. glechomae* (Kaltenbach), but can be readily distinguished by its smaller size, narrower gena, more shining mesonotum and by not having yellow posterior margin on the sixth tergite.

52. *Phytomyza valida* Sasakawa, sp. nov.

(Figs. 44-45)

Male: Head black, frontalia brown along lateral margins of ocellar triangle, parafrontalia and gena brown-tinged; antenna and palpus black. Thorax black, mesonotum and scutellum densely gray-dusted, lateral sides of notum and pleura slightly tinged with brown; mesopleura with yellow dorsal



Figs. 41—47. 41—43: *Phytomyza tomentella* Sasakawa, n. sp., 41, phallus; 42, halves of ninth tergite and sternite; 43, spermatheca. 44—45: *Phytomyza valida* Sasakawa, n. sp., 44, surstylus; 45, phallus. 46—47: *Phytomyza vitalbae* Kaltenbach, 46, head of larva; 47, leaf-mines on *Clematis taiwanensis*.

margin, broadening towards posterior corner. Wing hyaline, veins yellowish at bases, calypter yellow, with margin and fringe brown; halter yellow. Legs black. Abdomen dark brown, second to fourth tergites with yellow caudal margins; cercus yellowish.

Front about twice as wide as eye, distinctly converging ventrally; parafrofrontalia one-fourth width of front, linearly projecting above eye in profile, bearing two *ors* and two *ori* (distinguishable by their pits), orbital hairs five, in a row; lunule semicircular; gena one-fifth height of eye; third antennal segment longer than broad, microscopically pubescent, arista as long as height of eye, swollen at basal quarter, minutely pubescent.

Mesonotum with 1+3 *dc*, first *dc* before level of *prs*, third *dc* on level of *sa*, two rows of *acr*, ending before level of third *dc*, one or two *ia*-setulae behind suture, *ipa* less than one-half length of *opa*; mesopleura without dorsally directed setula. Wing 2.2 mm long, costal sections in proportion of 3.3:1:1, m-m almost on level of r-m, ultimate section of M_{3+4} about ten times as long as

penultimate.

Sixth tergite as long as fifth; fifth sternite twice as long as fourth, incised on posterior half. Terminalia: Epandrium with a pair of anterior lobes before surstyli which are provided with several short spine-like setae and many bristles. Hypandrium broad, U-shaped; praegonite with two short setae. Phallus as figured, median process strong, claw-like, endophallus with lateral and ventral sclerites Y-shaped in form respectively.

Length of body 1.8 mm.

Distribution: Formosa.

Holotype ♂, Arisan, 2,000 m, Chiai Hsien, 27 Mar. 1967 (T. S.); terminalia mounted on slide.

This new species resembles *P. tomentella* n. sp. in the general coloration, but can be easily distinguished by its matted mesonotum and level of both cross-veins. There are distinct differences between two new species in the structures of male terminalia.

53. *Phytomyza vitalbae* Kaltenbach

(Figs. 46, 47)

Phytomyza vitalbae Kaltenbach, 1874, Pflanz. Feinde, p. 4.

This species has been recorded as a leaf-miner on *Clematis*.

The main characteristics of the species are: front yellow, first *ors* minute or lacking; antenna black excepting brownish yellow first segment; mesonotum densely gray-dusted, with two sparse rows of *acr*; scutellum brownish, with narrowly or broadly yellow median longitudinal stripe, rarely only with small yellow spot on caudal tip; mesopleura yellow above level of *mp*; fore femur yellow to brownish yellow, with dark brown dorsal spots at base and before knee, middle and hind femora yellowish brown to brown but paler on ventral sides and knees. Body length, ♂ 1.5-1.7 mm, ♀ 1.7-1.9 mm; wing length, ♂ 2.0-2.3 mm, ♀ 2.2-2.45 mm.

Specimens examined: 13♂♂, 12♀♀, Mt. Yangming Shan, Taipei, emerged 7-15 Apr. 1965 (M. S.).

Host-plant: *Clematis taiwanensis* Hay.

The mine is whitish ophiomyzine of the upper surface type, but starting from the lower side of leaf; the frass is arranged usually in long thread along one side of the tunnel. The pupation takes place on the ground.

Distribution: Europe, S. Africa, Formosa, Australia. New to Formosa.

De Meijere described the larva and puparium of this species.

In the Formosan examples the puparium is pale brown (not pale yellow) and 1.7-1.9 mm long (not 1.5). The larvae are 2.3-2.5 mm in length and the spinal pattern is as follows: 1T=4.0, 2T=0, 3T=1.2, 1A=3.3, 2A=4.3, 3A=4.4, 4A=5.4, 5-6A=6.5, 7A=5.3, 8A=4.0 on the lateral side, 1-2T & 8A=0, 3T=0.3, 1A=2.1, 2A=4.1, 3A=4.2, 4-5A=5.2, 6A=5.1, 7A=1.0 on ventral side, but entirely absent on the dorsal side.

54. *Phytomyza yasumatsui* (Sasakawa), comb. nov.

Napomyza yasumatsui Sasakawa, 1955, Kontyû 23: 16.

This species is highly specific in having the yellow lateral stripes of mesonotum and dorsal one-third of the mesopleura, two rows of the acrostichals, and has been known as a leaf-miner of *Clematis* and *Anemone* spp. from Japan.

This species closely resembles the Palaearctic species, *P. buhriana* Hering on *Ranunculus*, but is immediately recognizable by the larger wings, measuring 2.39 (2.0-2.8) mm in male and 2.56 (2.3-2.8) mm in female, sparser peristomal setae (usually three), having a setula before intra-alar bristle and the cross-vein r-m situated distinctly beyond middle of the discal cell (rarely on same level of m-m).

Specimens examined: 1♀, Taipei, 31 Mar. 1965 (M. S.); 22♂♂, 16♀♀, Ali Shan Mts., Chiai Hsien, 8-9 Apr. 1965 (M. S.); 1♀, Taipei, 15 Apr. 1965 (M. S.); 1♂, Jenai, Nantou Hsien, 19 Jun. 1965 (S. I.).

Distribution: Japan, Formosa. New to Formosa.

要旨: 台湾産ハモグリバエ科54種(11新種を含む)について分類学的検討を行ない, あわせて既知種を含む検索表を属ごとに作成した。

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