

The Female Terminalia of the Agromyzidae, with Description of a New Genus (I)*

By

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Although the structure of male terminalia of the Agromyzidae has been used as an important character for the classification, the female terminalia largely neglected by most of the leading workers of this group. DE MEIJERE (1838) discussed firstly the segmentation of the female terminalia. After that time, a few authors described and illustrated on the female external or internal sexual organs, for examples, MIALI and TAYLOR (1907) for those of *Phytomyza ilicis* CURT. and VENTURI (1936) for *Agromyza mobilis* MEIG. HENDEL (1931) gave an account of the external structure in the first part of a monograph of the palaearctic species, and described the size of the ovipositor sheath and the presence or absence of its pubescence for various species. Moreover, he mentioned that the shape and size of the egg guide vary in different species. In the present paper the results of comparative study of the female sexual organs observed in 28 Japanese species of the subfamily Agromyzinae is reported.

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General characters

The last seventh segment is modified into a closed ovipositor sheath ("Basalglied" of HENDEL). It is shiny black, conical to trapezoidal in dorsal view, usually subequal to the sixth tergite in length, but very rarely elongated

almost in the same length as anterior six terga taken together, and is provided with several long setae near distal margin. The anterior part of its segment is telescoped into the preceding segment, forming the large chitinized apodeme on the dorsal border. The apodeme varies in shape and size from a narrow rectangle to a large and broad cone, its anterior inner surface serves as the place of attachment for strong retractor muscles of the ovipositor. The eighth segment is highly specialised, the dorsal and ventral surfaces are provided with the anteriorly directed denticles arranged in form of the file-teeth, which facilitate the operation of boring into the tissues of plant, and lateral surfaces are often pilose. A pair of egg guides or valvulae inferiores are borne immediately caudad of the eighth segment. Their shapes vary in different species, usually subtriangular, and more specialised in the Agromyzinae. They are provided with several sense organs on the inner or outer surfaces, and sometimes with spinules, setae, serrations and setigerous processes. The ninth segment is slender, the tergum and sternum are more or less sclerotized and take on a great variety of their forms, and those are fused with each other laterally or separated by the broad pleural membranes as so usual in the other segments. The tergum is usually larger and well-developed than the sternum, normally tapered towards the apex, and with a pair of setae at the end. The sternum is considerably modified, somewhat produced distally, and carries two to five pairs of setae along the distal margin. The tenth and eleventh segments are entirely membranous. The cercus consists of only one segment, and has usually four tactile

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sensillae and a set of long hairs. The tactile sensillae are of the trichoid type, variable in both number and size.

The internal reproductive system, occupying the posterior three-fourths of the abdomen, consists of paired ovaries and oviducts, the uterus, three sperm-storing organs, and two accessory glands. The ovaries are the polytrophic type, vary in their size according to the degree of maturity and each ovary contains usually ten to eighteen matured ovarioles. The ovaries from each side open into the short lateral oviducts. The oviducts unite to form a common median oviduct. The uterus is a very long tube formed by a thin-wall, when empty it is contracted and its wall is thrown in folds. The external opening of the genital chamber or vagina, ventrally just behind the egg guides, is the vulva, which serves as both a copulatory orifice and exit for the eggs. The spermathecae are two in number, each consists of the chitinous capsule which has a neck and long duct. They are usually situated in the fourth abdominal segment. The capsule is brown to black in color and somewhat an inverted double-walled bowl in shape. After fertilization it is filled with a concentrically coiled mass of spermatozoa. The neck, which arises from the inside of the bowl, is usually pale brown and bears sometimes minute cuticular spines. The duct is narrow and is lined with a chitinous intima, and it opens at the anterodorsal end of the uterus close together directly behind the mouth of the oviduct. The ratio of length to width of the capsule and that of length of the capsule divided by length of the neck or duct are much important for separating the species. The ventral seminal receptacle consists of two parts, a basal dilated body and a distal various shaped tail, and sometimes proximally with a pair of blades. It enters into the uterus just ventrad of the mouth of the oviduct. In fertilized females it is also filled with spermatozoa, arranged longitudinally with their heads toward its tip. The receptacle has also characteristic forms in various species of Agromyzidae. The accessory glands or colleterial glands are a pair of very long, narrow ducts with subvoid

dilation on either proximal or distal end and connected to the uterus immediately behind the spermathecal ducts.

Descriptions

Genus *Agromyza* Fallén

The genus is distinct from *Melanagromyza* and its allied genera in the structures of the female terminalia. The egg gudes are mostly smaller, triangular, with the setigerous processes mesally or ventrally and serrations lateroventrally. The spermathecae and the ventral receptacle are usually larger than those of other genera.

In Japan the following species are known:

1. *Agromyza albipennis* MEIGEN

Ovipositor sheath shiny, as long as sixth tergite, with pubescence on distal two-thirds; apodeme somewhat well developed, conical, twice as long as broad, pouched on apical half. Egg guides tantamount to those of *A. oryzae*. Ninth segment of moderate size, sternite narrower than tergite, proximally broadly less sclerotized, with three pairs of marginal setae. Cerci each with four tactile sensillae, which are about four-fifths length of cercus. Spermathecae suborbicular, with truncate proximal end. Ventral receptacle colourless, with body about five times as wide as tail, tail coiled semispherically five times. Accessory glands with ducts longer than spermathecal ducts, 740 microns long, 10 microns in diameter, dilated on distal one-sixth.

Materials examined: Sapporo, Kyoto, Matsuyama, on *Hordeum vulgare hexastichon* A., *Phalaris arundinacea picta* L. and *erucaeformis* L.

Remarks: The Japanese form differs from the European typical in many points of the external structures of the adult and the larva. It shall be erected to an independent species.

2. *Agromyza cinerascens* MACQUART

Agromyza cinerascens MACQUART, 1835, Hist. Nat. Insect., Dipt., 2: 610.

Ovipositor sheath one and two-thirds to twice as long as sixth tergite, with pubescence on distal one-third; apodeme strongly chitinized,

conical, pouched on distal half. Egg guides large, subtriangular, about three and a half times as long as broad, indistinctly and minutely 37-serrated ventrally, setigerous dorsoproximally. Ninth tergite small, tapered on apical half; ninth sternite longer than tergite, bearing three pairs of marginal setae. Cerci long, each with four tactile sensillae, which are a quarter as long as length of cerci. Spermathecae spheroidal, spinulate, with partite proximal ends, with ducts slender. Ventral receptacle long, proximal three-fifths brown, folded about seven times, tail broadened near distal end.

Materials examined: Seven females and two males, 12-16. IV. 1958, Kibune, Kyoto, collected by M. SASAKAWA.

This species is a widely distributed one, having been reported from Europe and N. Africa. This is the first record of the species from Japan. The larvae of this species mine the leaves of grasses, such as *Dactylis glomerata* and *Secale* sp. in Europe.

3. *Agromyza mobilis* MEIGEN

Agromyza mobilis MEIGEN, 1830, Syst. Besch. bekann. eur. zweifl. Insekt., 6 : 169.

Ovipositor sheath as long as sixth tergite, pubescent on distal two-thirds; apodeme relatively chitinized dorsally, pouched at end. Egg guides triangular, similar to those of *oryzae*. Ninth tergite distally membranous, sternite less sclerotized before distal end, bearing four marginal setae centrally and two pairs of short setae near lateral apices; cerci each with four tactile sensillae. Spermathecae elongated oval, much variable in size. Ventral receptacle similar to that of *yanonis*, but tail about quadruple as long as basal body.

Materials examined: Three females and five males, 2. VI. 1957, Mt. Tsurugisan, Tokushima & 12. IV. 1958, Kibune, Kyoto, collected by M. SASAKAWA.

This species is widely spread over Europe and N. America, and is new to the fauna of Japan. The larvae mine the leaves of grasses.

4. *Agromyza nigrescens japonica* TSUJITA

Ovipositor sheath one and a half times as

long as sixth tergite, with apodeme somewhat well developed, broad conical. Egg guides long, with about twenty teeth of serrations. Ninth tergite fused with sternite laterally, and sternite somewhat U-shaped, bearing three pairs of marginal setae and several sensory setulae. Cerci long, each with four short tactile sensillae. Spermathecae club-shaped, broadened apically and weakly chitinized at apex, with necks colourless, broad. Ventral receptacle with tail extremely long, basal half brown, coiled about eight times and apical half colourless, loosely coiled.

Materials examined: Osaka, Kyoto, on *Geranium nepalense* S.

5. *Agromyza oryzae* (MUNAKATA)

Ovipositor sheath shiny dorsad, slightly longer than sixth tergite, with pubescence on a posterodorsal quarter, but on posterior half laterally and on its entire length ventrally; apodeme strongly chitinized, one and a half times as long as broad, pouched on distal half to two-thirds. Egg guides triangular, each with numerous spinulae on laterodistal part, many sensillae on outer and inner side, inner prolonged processes covered with dense setae. Ninth tergite broad, overspreading laterally, sternite shield-shaped, about one half as wide as tergite, with two pairs of marginal setae distally and one or two pairs laterally, sometimes a short seta mesally. Cerci each with four to five long tactile sensillae, three setae on dorsal side, five setae and two setulae ventrally. Spermathecae relatively large, elliptical, with truncate proximal ends, necks weakly chitinized on both ends, ducts very long. Ventral receptacle with body broad, tail transversely folded about five times.

Materials examined: Sapporo, Akita, on *Oryza sativa* L.

6. *Agromyza phragmitidis* HENDEL

Ovipositor sheath shiny, pubescent on distal half; apodeme weakly chitinized excepting dorso-mesal part, pouched on distal one-third. Egg guides subtriangular, setulose posterolaterally, inner processes covered with sharp spines. Ninth tergite long and broad, deeply but narrowly incised before apex, sternite somewhat U-shaped,

provided with five pairs of marginal setae; cerci each with four long tactile sensillae. Spermathecae, swollen proximally, excavated distally as figured, with necks long, ducts broad. Ventral receptacle similar to that of *oryzae*, but tail longer.

Materials examined: Sapporo, Towada, on *Setaria viridis* B.

7. *Agromyza reptans* FALLÉN

Agromyza reptans FALLÉN, 1823, Dipt. Suec., Agromyzid., 2: 3.

Ovipositor sheath usually as long as basal width, almost as long as fifth tergite, pubescent on posterior two-thirds, with apodeme weakly chitinized excepting dorsomesal part, pouched on apical half. Egg guides medium-sized, simple, with elongated processes, without seta. Ninth tergite incised laterally, provided with a pair of long setae and two pairs of setulae at apex; ninth sternite somewhat V-shaped, with two pairs of marginal setae and several setulae. Cerci each bearing four short tactile sensillae. Spermathecae suboval, depressed apically, numerous but shallowly striated, with necks very narrow. Ventral receptacle short, without stipule.

Materials examined: Two females and three males, 20. V. 1956, Arashiyama, 16. IV. 1958, Kibune, Kyoto, reared by M. SASAKAWA, on *Bochmeria nipononivea* K.

This species is the type of the genus, very widely distributed throughout Europe, Asia Minor and western North America. This is the first record of the species from Japan. The larvae mine the leaves of species in the family Urticaceae.

8. *Agromyza rubi* BRISCHKE

Agromyza rubi BRISCHKE, 1881, Schrift. naturf. Ges. Danzig, 2: 250:

Ovipositor sheath dorsally broader than long, slightly longer than sixth tergite; apodeme similar to that of *reptans*. Egg guides medium-sized, subtriangular, with proximal transverse plate relatively long. Ninth segment small, sternite U-shaped, with four pairs of marginal setae and a pair of short setae. Cerci one half

length of ninth sternite, with four long tactile sensillae. Spermathecae very small, oval, with necks and ducts exceedingly short. Ventral receptacle equal in length to egg guide, curved, setulose proximally.

Materials examined: Five females and eight males, 16. & 29. IV. 1958, Kibune, Kyoto, collected by M. SASAKAWA.

A common holarctic species, but has not hitherto been recorded from Japan. The larvae of this species mine the leaves of *Filipendula*, *Potentilla*, *Rubus*, *Sanguisorba* spp. in Europe.

9. *Agromyza rufipes* MEIGEN

Agromyza rufipes MEIGEN, 1830, Syst. Besch. Bekann. eur. zweifl. Insekt., 6: 169.

Ovipositor sheath slightly longer than fifth tergite; apodeme similar to that of *reptans*, but pouched on apical one-third. Egg guides large, subtriangular, covered with setulae. Ninth tergite well sclerotized, but sternite less sclerotized apically in small trapezoid, bearing three pairs of marginal setae. Cerci each with three short tactile sensillae. Spermathecae relatively large, suboval, narrowed basally, cross-striated about fourteen times, with necks and ducts short. Ventral receptacle similar to that of *reptans*, but much longer, with body about five times as wide as tail, tail loosely folded.

Materials examined: Four females and five males, 16–19. V. 1954, Daihizan, Kyoto, reared by M. SASAKAWA, one female and one male, 23. IV. 1957, Mt. Hiko, Fukuoka, reared by H. KUROKO, on *Trigonotis brevipes* M.

This species occurs in Europe, and is new to the fauna of Japan.

10. *Agromyza spiraeae* KALTENBACH

Ovipositor sheath shorter than sixth tergite, pubescent on posterolateral half and ventral side; apodeme moderately well developed. Egg guides loosely and irregularly serrated. Ninth segment well developed, sternite bearing four pairs of marginal setae and many sensory setulae. Cerci each with four short tactile sensillae. Spermathecae very small, spherical, with necks short, ducts slender. Ventral receptacle similar to

that of *cinerascens*, but shorter, with tail coiled about five and a half times.

Materials examined: Ashoro, Kyoto, Matsuyama, on *Rosa multiflora* T.

11. *Agromyza* sp.

Ovipositor sheath dorsally two-thirds length of sixth tergite, setigerous only distally; apodeme more or less weakly chitinized except for dorso-mesal part, pouched on apical half. Egg guides subtriangular, indistinctly pointed distally, with many basiconic sensillae. Ninth sternite much developed than tergite, bearing three pairs of marginal setae. Cerci pubescent ventrally, each with four relative long tactile sensillae. Spermathecae subglobular, indistinctly but densely striated, very differing in size from each other, necks broad, with specific serrated band apically. Ventral receptacle short, with two folds.

Materials examined: Two females, 7. IV. 1955, Minoo, Osaka, reared by M. SASAKAWA,

on *Wistaria* sp.

12. *Agromyza yanonis* (MATSUMURA)

Ovipositor sheath as long as fifth tergite, apodeme well developed. Egg guides similar to those of *oryzae*, but provided with more sensillae laterally and mesally. Ninth tergite somewhat tripod-shaped, distally less sclerotized; sternite with two pairs of marginal setae on distal small plate and two short setae on lateral ends of membrane. Cerci short but broad, each bearing two to three long and one or two short tactile sensillae. Spermathecae large, subovoid, with necks and ducts long. Ventral receptacle colourless, coiled about four times, with proximal body two-thirds as long as distal tail, without stipule. Accessory glands with ducts longer than twice of spermathecal ducts.

Materials examined: Kyoto, Kochi, on *Hordium vulgare hexastichon* A., *Triticum aestivum* L.

Summary of lengths and widths of various parts of female terminalia
(Unit: μ)

Species	Characters	Egg guide		Ninth segment		Cercus	Tactile sensilla	Spermatheca		Neck		Duct		Ventral receptacle
		L.	L.	L.	W.			L.	W.	L.	W.	L.	W.	
<i>A. albipennis</i>		100	120	135	80	64	52	120×132	100×116	128	32	650	24	2840
<i>A. cinerascens</i>		220	132	160	72	80	20	144×144	124×104	20	12	600	10	2000
<i>A. mobilis</i>		108	105	140	84	72	32, 40	280×100	130×60	36	25	500	20	580
<i>A. nigrescens japonica</i>		208	108	160	92	84	16	120×72	100×76	48	32	848	19	3920
<i>A. oryzae</i>		128	180	120	112	64	48	172×120	152×88	70	16	1080	18	780
<i>A. phragmitidis</i>		120	200	168	120	56	48	100×108	80×116	88	36	786	24	1660
<i>A. reptans</i>		136	120	140	92	56	20	136×116	128×108	80	10	656	8	92
<i>A. rubi</i>		132	100	120	60	60	20, 40	84×60	84×48	10	8	252	8	132
<i>A. rufipes</i>		200	160	52	100	68	12	150×80	136×62	36	18	520	12	960
<i>A. spiraeae</i>		188	120	132	100	56	14	96×88	88×61	32	20	576	10	1520
<i>A. sp. on Wistaria</i>		120	72	112	100	52	26	110×88	75×64	20	16	1020	12	240
<i>A. yanonis</i>		120	140	152	84	60	20	168×112	128×72	56	40	608	16	760

L: length, W: width.

The most generalized genus *Agromyza* has two distinct sections in the presence or absence of the serrations on the egg guides. The first

section is represented by the *reptans* group and the second by the *rubi* group. Moreover, the former group is divided into four subgroups:

viz., *A. sp.*, *reptans* (including *A. reptans* and *rufipes*), *yanonis* (*A. yanonis*, *phragmitidis* and *mobilis*) and *oryzae* (*A. oryzae* and *albipennis*) subgroups, and also the latter into two: *rubi* and *cinerascens* (*A. cinerascens*, *spiraeae* and *nigrescens japonica*) subgroups.

In this genus, it is considered that *A. reptans* FALLÉN is the most primitive form, in having the simplest egg guides and the undeveloped ventral receptacle. The more primitive species, *A. rubi* BRISCHKE is provided with the setulae on the proximal body of the ventral receptacle and *A. sp.*, on *Wistaria*, with the dense setulae on the ventral sides of the cerci. The egg guides with serrations are in common with those of *Melanagromyza* and the allied genera. The spermathecae of *A. cinerascens* MACQUART quite differs from those of other members of *Agromyza* in having the spinules and the partite proximal end, although are of the same type as found in the related genera. The striated spermathecae, such as in *reptans*, *rufipes* and *phragmitidis*, are remarkably different from others. The long ventral receptacles of many species are also an independent specialization.

The above-mentioned groups and subgroups may be distinguishable as shown in the following key, with which is combined with a key to species.

Key to species of the genus *Agromyza*, with regard to the female terminalia

1. Egg guides without serration2
— Egg guides with serration.9
2. Egg guides without elongate processes.
Cerci ventrally covered with setulae.
.....*A. sp.* (on *Wistaria*)
— Egg guides with elongate processes. Cerci without setula3
3. Egg guides with processes shorter than its own length4
— Egg guides with processes as long as or longer than its own length5
4. Spermathecae suboval, densely and slightly striated. Ventral seminal receptacle very small *reptans* FALLÉN

- Spermathecae fusiform, broadened apically, about 14-striated distinctly. Ventral receptacle relatively long *rufipes* MEIGEN
- 5. Tactile sensillae of cercus short.
.....*yanonis* MATSUMURA
- Tactile sensillae $\frac{3}{5}$ to $\frac{4}{5}$ length of cercus.
.....6
- 6. Ninth sternite with three or four pairs of marginal setae. Spermathecae not depressed apically.7
- Ninth sternite with five pairs of long marginal setae. Spermathecae depressed apically.
.....*phragmitidis* HENDEL
- 7. Spermathecae with necks short, about a quarter length of capsule ...*mobilis* MEIGEN
- Spermathecae with necks very long8
- 8. Spermathecae suborbicular, with necks longer than capsule. Ventral receptacle about quadruple length of spermathecal ducts.
..... *albipennis* MEIGEN?
- Spermathecae oval, with necks about one half as long as capsule. Ventral receptacle shorter than spermathecal ducts.
.....*oryzae* MUNAKATA
- 9. Ventral receptacle very short, curved, setulose basally *rubi* BRISCHKE
- Ventral receptacle long, coiled10
- 10. Spermathecae less chitinized hemispherically, ducts greatly expanded at distal ends.
.....*nigrescens japonica* TSUJITA
- Spermathecae entirely chitinized, ducts slender11
- 11. Egg guides with loose serrations. Spermathecae with smooth proximal ends.
..... *spiraeae* KALTENBACH
- Egg guides with minute serrations, setulose lateroproximally. Spermathecae with partite proximal ends.....*cinerascens* MACQUART

Genus *Japanagromyza* gen. nov.

Genotype: *Agromyza duchesneae* SASAKAWA, 1954

ADULT. Body robust, 1.5 to 3 mm. in length. Black; mesonotum densely dusted with gray; fringe of calypteres brownish black; halteres with knobs apically yellow, but stems dark brown or black.

Front moderately large, as long as or narrower than long; ocellar triangle normal; frontal lunule small; ptilinal suture deep; face with a narrow carina. In profile parafrontalia usually not beyond above eye-margins; genae narrow. Fronto-orbital bristles four pairs, *ors* two, *ori* two (rarely three); orbital hairs dorsally directed; vibrissae long. Third antennal segment rounded. Proboscis short.

Mesonotum with 0+2 *dc*, 8 to 10 rows of *acr*, 1 *prsc*, 1 *prs*, 1 *ia*, 1 *sa*, 2 *pa*, 1 *h*; 1 *pp*, 2 *n*, 1 *mp*, 1 *sp*. Costa reaching M_{1+2} . Middle tibiae with two posterodorsal bristles.

Epandrium ventrally articulated to hypandrium; surstyli either extending downward or inward. Aedeagal hood moderately elongate, weakly sclerotized, either with minute spinules on posterodorsal end or entirely bare. Basiphallus broadly membranous. Pregonites separated from hypandrium. Hypandrial apodeme usually elongate. Ejaculatory apodeme large, blade slightly broadend, stem basally with a rounded projection. Ovipositor sheath with apodeme subrectangular, pouched at near anterior end. Egg guides with serrations almost all over lateral margins. Ninth tergite weakly developed, shorter than sternite; sternite bifurcated, somewhat U-shaped. Cerci each bearing four tactile sensillae. Spermathecae minute, spinulate. Ventral receptacle nearly colorless with exception of distal cotyledonous lobe, body relatively broad, suboval.

LARVA: Large, 3 to 4 mm in length; whitish to dark yellow. Mandibles each with two to six teeth; paraclypeal phragma with both dorsal and ventral processes well developed. Anterior spiracles minute, knoblike, with three to seven bulbs; posterior spiracles either with about ten large bulbs or numerous small bulbs situated spiky on trifurcate atria. Cuticular processes strongly developed. Posterior end with one or two pairs of papillae.

PUPARIUM: Large, 2 to 3 mm in length; shining dark brown. Suboval, in profile dorsal side arched, ventral somewhat flattened, segmentation distinct.

MINE: On leaf, ophistigmatonome, of upper

surface type.

In general appearance this genus is very similar to *Melanagromyza*, from which it differs by the presence of the prescutellar bristles, the coloration of the halteres, and the structures of male and female terminalia. Moreover, it comes near *Agromyza*, on account of the presence of a pair of prescutellar bristles, but it is easily distinguishable from the latter by three above-mentioned characters.

The following species found in Japan may be placed in this genus and they are divided into two groups, that is, *duchesneae*- and *elaegni*-group.

Key to species of the genus *Japanagromyza*, with regard to the female terminalia

1. Ventral seminal receptacle with chitinous cotyledonous lobe at end2
- Ventral receptacle without cotyledonous lobe, but more or less expanded at end.....3
2. Ventral receptacle with basal body large, duct of tail about two and a half times as long as apical lobe ... *duchesneae* SASAKAWA
- Ventral receptacle with body small, duct of tail about one and a half times as long as apical lobe.....*M. sp.* (on *Pueraria*)
3. Spermathecae orbicular; tail of ventral receptacle very short.....*elaegni* SASAKAWA
- Spermathecae suboval; tail of ventral receptacle longer than basal body.
.....*quercus* SASAKAWA

13. *Japanagromyza duchesneae* (SASAKAWA)

Agromyza duchesneae SASAKAWA, 1954, Sci. Rept. Saikyo Univ., Agr., 6:106.

Ovipositor sheath shorter than sixth tergite; apodeme subrectangular, almost twice as long as broad, pouched on apical one-sixth. Egg guides medium-sized, twice as long as broad, with fifty to fifty-five teeth of serrations and many rows of spinules dorsoproximally. Ninth segment medium-sized; tergite four-fifths length of sternite, sternite somewhat U-shaped, with two pairs of marginal setae, setulose ventromesally. Cerci relatively long, with four tactile

sensillae. Spermathecae minute, suboval, slightly constricted at near proximal one-third, spinulose, with necks short. Ventral receptacle colorless, relatively long, tail with chitinous, cotyledonous lobe at end. Accessory glands 880 microns long, 8 microns in diameter, dilated elliptically on proximal one-sixth.

Materials examined: Kyoto, on *Duchesnea indica* F.

14. *Japanagromyza* sp.

Resembles *J. duchesneae*, in having a cotyledonous lobe of ventral receptacle. Ninth tergite less than one-half length of sternite, without setulae. Ventral receptacle shorter than egg guides.

Materials examined: Kyoto, on *Pueraria hirsuta* M.

15. *Japanagromyza elaeagni* (SASAKAWA)

Melanagromyza elaeagni SASAKAWA, 1954, Trans. Shikoku Ent. Soc., 4: 38.

Ovipositor sheath shorter than sixth tergite, apodeme subrectangular, as in *duchesneae*, pouched on apical half. Egg guides relatively large, with about thirty large teeth of serrations, without spinules dorsally. Ninth segment medium-sized; tergite shorter than sternite, sternite bifurcated, with two pairs of marginal setae and six sensillae, setulose centrally and laterally. Cerci relatively long, each with four long tactile sensillae. Spermathecae minute, orbicular, spinulate, with ducts more or less broad. Ventral receptacle almost colourless, except for pale brown stipules, with body broad oval, tail short, slightly expanded apically.

Materials examined: Osaka, Matsuyama, on *Elaeagnus umbellata* T.

16. *Japanagromyza quercus* (SASAKAWA)

Agromyza quercus SASAKAWA, 1954, Trans. Shikoku Ent. Soc., 4: 35.

Ovipositor sheath shorter than sixth tergite, apodeme subrectangular, two and a half to three times as long as broad, pouched on apical one-eighth. Egg guides medium-sized, with about thirty large teeth of serrations. Ninth tergite much shorter than sternite; sternite U-shaped,

bearing two pairs of marginal setae and numerous setulae on mesal membranous part. Cerci short, each with four long tactile sensillae. Spermathecae minute, suboval, weakly chitinized, especially proximally, spinulose, with ducts narrow and short. Ventral receptacle relatively large, broadly membranous except for distal part of tail and basal blades, with body broader than tail. Accessory glands 480 microns long, without distal dilation.

Materials examined: Kyoto, Fukuoka, on *Quercus glauca* T.

Genus *Melanagromyza* Hendel

17. *Melanagromyza aeneiventris* (FALLÉN)

Agromyza aeneiventris FALLÉN, 1823, Dipt. Suec., Agromyzid., 2: 4.

The conspicuous characters of the present species are the proclinate orbital hairs and the black fringe of calypter.

Ovipositor sheath shiny, as long as or slightly longer than sixth tergite; apodeme strongly chitinized, elongate conical, two to two and a half times as long as wide, pouched on anterior three-fourths. Egg guides very long, about five times as long as wide, each with about sixty teeth of serrations, numerous sharp spines on dorsomesal membranous part, and six to seven sensillae dorsoproximally and five sensillae laterally. Ninth segment about five times as long as broad, tergite well sclerotized, but sternite slender, somewhat cuneiform, bearing two pairs of marginal setae and six sensillae at apex. Cerci relatively long, each bearing four tactile sensillae. Spermathecae suboval, partite proximally, necks and ducts relatively long. Ventral receptacle pale brown, sigmoid in lateral view. Accessory glands with ducts 740 microns long, about 7 microns in diameter, dilated fusiformly on distal quarter.

Materials examined: Two females and one male, 19. VI. 1954, Shibecha, Hokkaido, collected by M. SASAKAWA.

This species is the type of the genus, widely spread over Europe, Siberia, western North America and Argentina, and is new to the fauna

of Japan. The larvae mine in the pith of stems of *Urtica dioica* L. in Europe.

18. *Melanagromyza* sp.

Ovipositor sheath shorter than sixth tergite, densely setigerous on distal two-thirds, pubescent on anterolateral halves and all over ventral surface; apodeme similar to that of *aeneiventris*. Egg guides extremely long, slightly shorter than sixth tergite, about six times as long as wide, each with thirty to thirty-seven teeth of serrations and numerous sharp spines on posterodorsal membranous part. Ninth segment and cerci similar to those of *aeneiventris*, but ninth tergite somewhat longer, equal to egg guides in length, sternite with two pairs of marginal setae and several sensillae. Spermathecae suboval, partite proximally, necks long, ducts excessively long. Ventral receptacle similar to that of *aeneiventris*, but basal body broader than tail.

Materials examined: Two females, Arashiyama, Kyoto, 10. VI. 1956, collected by M. SASAKAWA.

Remarks: Characteristic features of this species are the dense, reclinate orbital hairs and the orangish white fringe of calypter, which is somewhat intermediate between the European *M. albocilia* HENDEL and *cunctans* (MEIGEN).

19. *Melanagromyza* sp.

Ovipositor sheath slightly longer than sixth tergite. Egg guides small, subtriangular, each with a sharp tooth at tip and setigerous large process. Ninth segment medium-sized, broadend distally, sternite U-shaped, with two or three pairs of marginal setae; cerci short, each with four long tactile sensillae. Spermathecae suboval, partite proximally, with necks very long, ducts relatively long and broad. Ventral receptacle of normal form, but situated on chitinous plate.

Material examined: Okayama, on *Glycine max* M., reared by K. KOIZUMI.

20. *Melanagromyza pulicaria* (MEIGEN)

Ovipositor sheath as long as or slightly longer than sixth tergite; apodeme triangular, chitinized only dorsomesally, pouched on apical one-third. Egg guides relatively long, with

about twelve large teeth of serrations, many sensillae and spinules dorsally. Ninth segment moderately well-developed, tergite normal, sternite very narrow, bearing two pairs of marginal setae. Cerci short, each with four tactile sensillae. Spermathecae suboval, partite proximally, with necks long and broad, ducts relatively long. Ventral receptacle similar to that of *aeneiventris*, but body subequal to tail in length.

Materials examined: Ashoro, Kyoto, on *Taraxacum officinale* L.

21. *Melanagromyza styricicola* SASAKAWA

Ovipositor sheath almost as long as sixth tergite; apodeme weakly chitinized, subrectangular, two and a half times as long as broad. Egg guides medium-sized, with about forty minute serrations. Ninth segment moderately well-developed, but sternite strongly constricted at middle, with two pairs of marginal setae at apex and a group of setulae mesobasally. Cerci short, each bearing four short tactile sensillae. Spermathecae minute, orbicular, with truncate proximal ends, necks and ducts of normal size. Ventral receptacle grown on small protuberance, with body narrow, about one half as long as tail, tail greatly broadening distally.

Materials examined: Kyoto, Okayama, Fukuoka, on *Styrax japonica* S.-Z., *Euonymus japonica* T. and *Ilex pedunculosa* M.

22. *Melanagromyza theae* (GREEN)

Ovipositor sheath slightly shorter than sixth tergite; apodeme similar to that of *styricicola*. Egg guides medium-sized, with thirty-five minute teeth of serrations on laterodistal one-third. Ninth segment moderately developed, distal half of sternite very narrow, with two pairs of marginal setae, dense setulae laterally. Cerci short, each with four tactile sensillae. Spermathecae minute, suboval, partite proximally, rarely three in number, with necks relatively long and broad. Ventral receptacle small, similar to that of *styricicola*, but with basal blades.

Materials examined: Kyoto, Shizuoka, on *Thea sinensis* L.

23. *Melanagromyza websteri* (MALLOCH)

Ovipositor sheath as long as sixth tergite ; apodeme similar to that of *aeneiventris*. Egg guides extremely long, about six and a half times as long as broad, with about twenty-two large teeth of serrations. Ninth tergite also long, but sternite conspicuously short, with two pairs of marginal setae and three pairs of sensillae. Cerci long, each with four long tactile sensillae. Spermathecae semispherical, partite proximally, necks broad, ducts very long. Ventral receptacle same form as in *aeneiventris*.

Material examined : Okayama, on *Wistaria* sp., reared by K. KOIZUMI.

24. *Melanagromyza yanoi* SASAKAWA

Ovipositor sheath as long as sixth tergite ; apodeme weakly chitinized, narrow rectangular, about five and a half times as long as broad. Egg guides small, subtriangular, with thirteen to fifteen teeth of small serrations and numerous setulae. Ninth tergite so much shorter than sternite, sternite with four pairs of long marginal setae and many setulae at apex. Cerci very long, each with four long tactile sensillae and many setulae on ventrolateral side. Spermathecae spheroidal, with truncate proximal ends, necks and ducts long and broad.

Summary of lengths and widths of various parts of female terminalia

(Unit : μ)

Characters	Egg guide L.	Ninth segment		Cercus L.	Tactile sensilla L.	Spermatheca L. \times W. Max. Min.		Neck L. W.		Duct L. W.		Ventral receptacle L.	
		Tergite	Sternite			W.	L.	W.	L.	W.			
<i>Japanagromyza duchesneae</i>	200	160	204	64	60	32, 24	44 \times 32	32 \times 28	10	8	312	12	320
<i>J. sp. on Pueraria</i>	200	80	192	60	60	40, 22	40 \times 24	32 \times 28	10	10	280	10	124
<i>J. elaeagni</i>	264	140	208	80	60	40, 32	28 \times 24	24 \times 24	12	8	132	12	132
<i>J. quercus</i>	200	108	192	72	48	36, 28	30 \times 22	28 \times 18	8	7	152	6	280
<i>Melanagromyza aeneiventris</i>	316	300	260	56	56	24	76 \times 44	72 \times 40	32	8	480	8	160
<i>M. sp. (Kyoto)</i>	360	360	280	52	60	20	80 \times 60	52 \times 40	40	10	1080	8	140
<i>M. sp. on Glycine</i>	152	180	180	72	52	32, 24	88 \times 66	72 \times 54	64	12	384	12	140
<i>M. pulicaria</i>	260	160	180	80	52	24, 16	64 \times 56	60 \times 56	36	20	352	8	132
<i>M. styricicola</i>	204	140	180	72	52	20	40 \times 36	36 \times 32	18	12	260	6	144
<i>M. theae</i>	240	140	180	72	52	24, 16	32 \times 28	28 \times 24	16	14	260	8	112
<i>M. websteri</i>	420	360	92	60	60	28, 20	76 \times 56	68 \times 40	24	20	704	12	180
<i>M. yanoi</i>	160	108	180	80	80	36, 28	68 \times 68	64 \times 60	40	20	480	12	140
<i>Carinagromyza heringi</i>	220	180	200	64	40	20, 16	20 \times 20	12 \times 20	12	6	360	5	108
<i>Ophiomyia maura</i>	292	180	220	80	48	24, 12	48 \times 48	40 \times 36	32	6	360	8	124
<i>O. sp. on Hemerocallis</i>	252	200	160	72	44	12	56 \times 56	56 \times 52	42	8	440	8	128
<i>Tylomyza madizina</i>	290	68	160	84	40	20	68 \times 76	68 \times 64	60	12	520	12	152

Material examined: Matsuyama, on *Mallotus japonicus* M.

The Japanese species of this genus are

divided into two groups, i. e., *aeneiventris* and *pulicaria*-group by the size of the egg guides. It is considered that the degree of length of the egg guides depends upon the egg-laying

habits of the female. All the species of *aeneiventris*-group, which are the stem-miners, have very long egg guides, and those of *pulicaria*-group are contrarily short because they are the leaf-mining species. Within the *pulicaria*-group, *Melanagromyza* sp. (the soy-bean top-miner) is considered to be the highly specialized, since the larvae mine the tip of stem of the soy-bean and the female terminalia more modified than those of closely related species; *M. yanoi* SASAKAWA is also specialized because the cerci with dense setulae such as in *Agromyza* sp. on *Wistaria*; other three species, *M. styricicola* SASAKAWA, *theae* GREEN and *pulicaria* MEIGEN, which are the epidermal miners, are rather closely related to each other having certain characters, such as the egg guides and ventral receptacle, in common with the generalized groups.

The Japanese species of these two groups may be distinguished by the characters of the female terminalia as follows.

Key to species of the genus *Melanagromyza*, with regard to the female terminalia

1. Egg guides short, two to three times as long as broad2
— Egg guides long, five to six times as long as broad6
2. Ninth sternite usually with two pairs of marginal setae. Cerci without dense setulae.....3
— Ninth sternite with four pairs of marginal setae. Cerci with many setulae on ventro-lateral sides..... *yanoi* SASAKAWA
3. Egg guides with setigerous, elongate processes. Ninth sternite sclerotized laterally, forming U-shaped plate.
.....*M. sp.* (on *Glycine*)
— Egg guides without elongate processes.
Ninth sternite sclerotized centrally.4
4. Egg guides with about twelve large teeth of serrations. Tail of ventral receptacle as wide as width of proximal body.
..... *pulicaria* MEIGEN
— Egg guides with thirty-five to forty minute

- teeth of serrations. Ventral receptacle broadened distally5
5. Spermathecae not partite proximally. Ninth sternite setulose proximally.
..... *styricicola* SASAKAWA
— Spermathecae partite proximally. Ninth sternite without setulae.....*theae* GREEN
 6. Ninth sternite about a quarter as long as tergite..... *websteri* MALLOCH
— Ninth sternite subequal in length to tergite.
.....7
 7. Egg guides with about thirty-five teeth of serrations, and numerous spines on distal halves *M. sp.* (Kyoto)
— Egg guides with about sixty teeth of serrations, and numerous spines mesally.
.....*aeneiventris* FALLE'N

Genus *Carinagromyza* Sasakawa

The type of the genus, *C. heringi* SASAKAWA, is clearly differentiated from *Melanagromyza aeneiventris* FALLE'N, the type of the genus *Melanagromyza*, in the external structure as well as in the female terminalia, chiefly in the feature of the spermathecae, which are smaller and provided with spiral, partite proximal ends.

25. *Carinagromyza heringi* SASAKAWA

Ovipositor sheath almost as long as sixth tergite, apodeme rectangular, scarcely twice as long as wide, pouched on anterior one-third. Egg guides medium-sized, about thrice as long as broad, with about twenty-two teeth of serrations, many rows of spinulae dorsoproximally, and many sensillae dorsally and ventrally. Ninth segment medium-sized; tergite well-developed but sternite incomplete, sclerotized only centrally and narrowly, with two pairs of marginal setae on lateral apices, and many setulae on latero-proximal membranes. Cerci short, each bearing four tactile sensillae. Spermathecae minute, strongly partite proximally, more or less spirally, with necks and ducts narrow and short. Ventral receptacle small, pale brown, except for colorless basal stipules, broadend distally.

Materials examined: Kyoto, Matsuyama, Kagoshima, on *Elaeagnus pungens* T.

Genus *Ophiomyia* Braschnikov

The female terminalia of this genus is rather closely related to that of the genus *Melanagromyza*. The ninth tergite is constricted at middle; the spermathecae are suborbicular, with long necks.

26. *Ophiomyia maura* (MEIGEN)

Ovipositor sheath almost as long as sixth tergite, apodeme conical but only sclerotized dorsomesally. Egg guides relatively large, three to three and a half times as long as broad, with six to seventeen blunt or sharp teeth of serrations, many rows of spinulae dorsoproximally and many sensillae dorsally and ventrally. Ninth segment medium-sized; sternite narrow, with two pairs of marginal setae and sensillae, setulose on ventrolateral membranes. Cerci short, with four short tactile sensillae. Spermathecae suborbicular, partite proximally, necks very much long. Ventral receptacle brown but basal body paler, sigmoid as viewed in profile. Accessory glands about 300 microns long, 6 microns in diameter, dilated on apical quarter.

Materials examined: Kyoto, on *Aster* spp.

27. *Ophiomyia* sp.

Closely resembles the former species, but differs from it as follows. Egg guides with about forty-three minute teeth of serrations. Ninth sternite weakly sclerotized, cuneiform, shorter than tergite, without setulae laterally. Spermathecae larger. Ventral receptacle with basal stipules larger and body shorter.

Materials examined: Kyoto, on *Hemerocallis* sp.

Genus *Tylomyza* Hendel

The genus was established as a subgenus of the genus *Ophiomyia* for *Madiza pinguis* FALLÉN on the basis of the anterior direction of the orbital hairs, but was raised to full generic rank by ENDERLEIN (1936, *Siridomyza*). FRICK (1952) treated the type species in a valid genus *Tylomyza*. The female terminalia is very closely

allied to that of the genus *Ophiomyia*. The spermathecae, however, are larger and without partite proximal ends.

28. *Tylomyza madizina* (HENDEL)

Ophiomyia madizina HENDEL, 1920, Arch. Naturgesch., A, 84: 130.

Ovipositor sheath as long as sixth tergite, apodeme large, somewhat conical, pouched on apical half, strongly chitinized dorsomesally. Egg guides relatively large, about thrice as long as broad, with about ten blunt teeth of serrations, many rows of spinulae dorsoproximally and many sensillae dorsally and ventrally. Ninth segment weakly sclerotized; tergite almost as long as broad, sternite slender, with two pairs of marginal setae and many sensillae, densely setulose ventrally. Cerci short, each with four tactile sensillae. Spermathecae orbicular, necks very long, ducts also long. Ventral receptacle similar to that of *Ophiomyia maura*.

Materials examined: Female and male, 19. VI. 1954, Shibechea; female, 13. VI. 1954, Kamishihoro, Hokkaido, collected by M. SASAKAWA.

This species was recorded from Europe, North Africa, and North America, and is new to the fauna of Japan. The biology of this species is unknown.

Explanation of Plates

Plates 1-5. Female terminalia of Agromyzinae

- Fig. 1. *Agromyza albipennis* MEIGEN
 2. *Agromyza cinerascens* MACQUART
 3. *Agromyza mobilis* MEIGEN
 4. *Agromyza nigrescens japonica* TSUJITA
 5. *Agromyza oryzae* MUNAKATA
 6. *Agromyza phragmitidis* HENDEL
 7. *Agromyza reptans* FALLÉN^N
 8. *Agromyza rubi* BRISCHKE
 9. *Agromyza rufipes* MEIGEN
 10. *Agromyza spiraeae* KALTENBACH
 11. *Agromyza* sp., on *Wistaria*.
 12. *Agromyza yanonis* MATSUMURA
 13. *Japanagromyza duchesneae* SASAKAWA

- | | |
|---|---|
| 14. <i>Japanagromyza</i> sp. on <i>Pueraria</i> | 25. <i>Carinagromyza heringi</i> SASAKAWA |
| 15. <i>Japanagromyza elaeagni</i> SASAKAWA | 26. <i>Ophiomyia maura</i> MEIGEN |
| 16. <i>Japanagromyza quercus</i> SASAKAWA | 27. <i>Ophiomyia</i> sp. on <i>Hemerocallis</i> |
| 17. <i>Melanagromyza aeneiventris</i> FALLEN | 28. <i>Tylomyza madizina</i> HENDEL |
| 18. <i>Melanagromyza</i> sp. from Kyoto | |
| 19. <i>Melanagromyza</i> sp. on <i>Glycine</i> | E : Egg guide, lateral view. |
| 20. <i>Melanagromyza pulicaria</i> MEIGEN | N : Ninth segment, halves of tergite and sternite, dorsal and ventral aspects of cerci. |
| 21. <i>Melanagromyza styricicola</i> SASAKAWA | S : Spermatheca. |
| 22. <i>Melanagromyza theae</i> GREEN | V : Ventral receptacle. |
| 23. <i>Melanagromyza websteri</i> MALLOCH | |
| 24. <i>Melanagromyza yanoi</i> SASAKAWA | |

摘 要

笹川満廣：ハモグリバエの雌生殖器に関する研究

ハモグリバエの雌外部生殖器官の構造については de Meijere (1838) はじめ 2・3 の簡単な報告が見られるが、Hendel (1931) 以来分類学的記載には単に産卵鞘の大きさ並びに棘毛の有無等が扱われていたにすぎない。私はごく最近になつて種的標徴としてその重要性が認められてきた雄外部生殖器とともに雌の外部・内部生殖器の形態もまた非常に分類学的価値があることを見出した。ここに Agromyzinae の日本産 6 属 28 種について調査した諸形態の比較とそれらの分化について述べる。

概形：腹部第 7 環節はいわゆる産卵鞘となり、以下の環節は通常その中にはまり込んでいる。第 8 環節の背・腹両面には多数の鋸歯が列生する、後端にある一對の誘卵器は三角形ないしナイフ状を呈しかなり群又は種間変異に富むほか産卵習性と密接な関連性が見られる。第 9 環節は細長く、背・腹板の形状や棘毛数は種々である。第 10~11 環節は膜状、尾毛は 1 節で多数の感覚毛を装う。

内部器官は卵巣、輸卵管、受精嚢及び附属腺からなる。受精嚢は褐~黒色、球形ないし長卵形を呈し、腹面にある管状受精嚢と共に近似種間の識別に有効である。

Agromyza：邦産 12 種（未記録 5 種を含む）は 2 群に大別され、yeptans 群は rubi 群より分化が進んでいないようである。前者の中で最も原始的と考えられる reptans 亜群の誘卵器や腹面受精嚢の形態は非常に単純であり、禾本科植物の葉に産卵する種類が属するヤノハモグリバエ yanonis 及びイネハモグリバ

エ oryzae 両亜群の誘卵器の内面には有毛突起を有する。また、この群のある種の受精嚢には他に見られない横じわがある。rubi 群の誘卵器には他属と共通な鋸歯を生じ、原始的な A. rubi 以外の腹面受精嚢は非常に長く、巻いているほか諸形質の分化の程度が高い。

Japanagromyza：この新属は前小楯板棘毛の存在、平均棍の色彩等によつて Agromyza 及び Melanagromyza 属とは容易に識別できるが、雌内部生殖器官の形態にも特異なものが認められる。現在 4 種が属し、第 9 背板は U 字状を呈し、受精嚢の表面には微棘を生じ、さらに duchesneae 群の腹面受精嚢の先端には双葉状の膨大部がある。

Melanagromyza：本属も Agromyza 属と同様に誘卵器の形状によつて aeneiventris 及び pulicaria 両群に分けられ、かつそれは産卵習性に由来していることは興味深い。即ち、前群には植物の茎内を潜孔する種類が属し、種間の分化は余り顕著でない。これに反して後群のものは潜葉性で、表皮内潜孔をするチャハモグリバエ M. theae ほか pulicaria, styricicola の 2 種、Agromyza 属に近い諸形質を示す yanoi, さらに特殊化したダイズメモグリバエを含んでいる。

Carinagromyza, Ophiomyia 及び Tylomyza：Carinagromyza 属の受精嚢は本亜科中最も小さく、基部はらせん状に分裂する；Ophiomyia 属の第 9 背板は中央部が狭わまり、受精嚢の頸部は特に長い；Tylomyza 属の受精嚢の基部は分裂しない。その他の形態は Melanagromyza 属のそれと類似するようである、既知邦産種が少ないため詳しく論及できない。

Plate 1

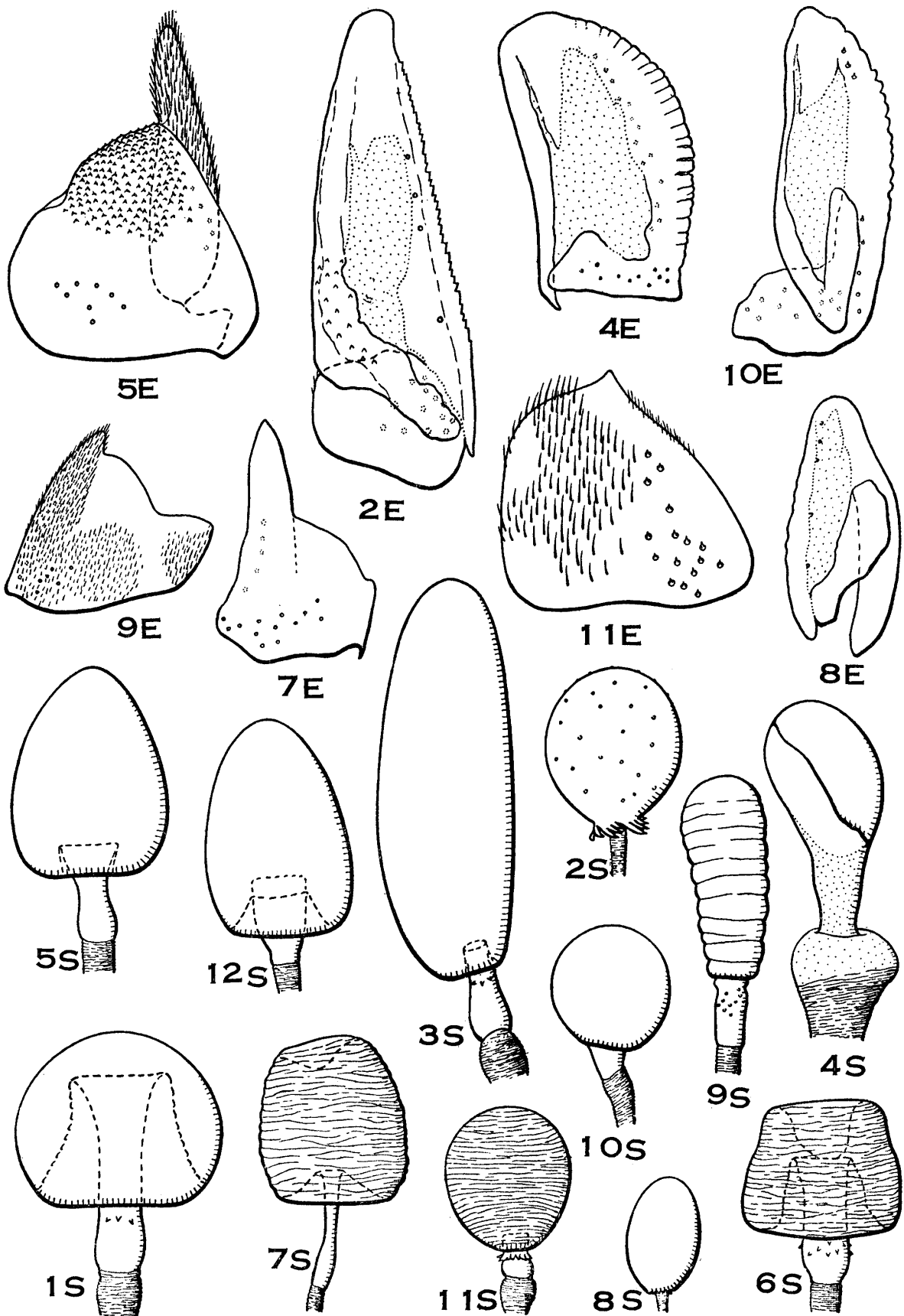


Plate 2

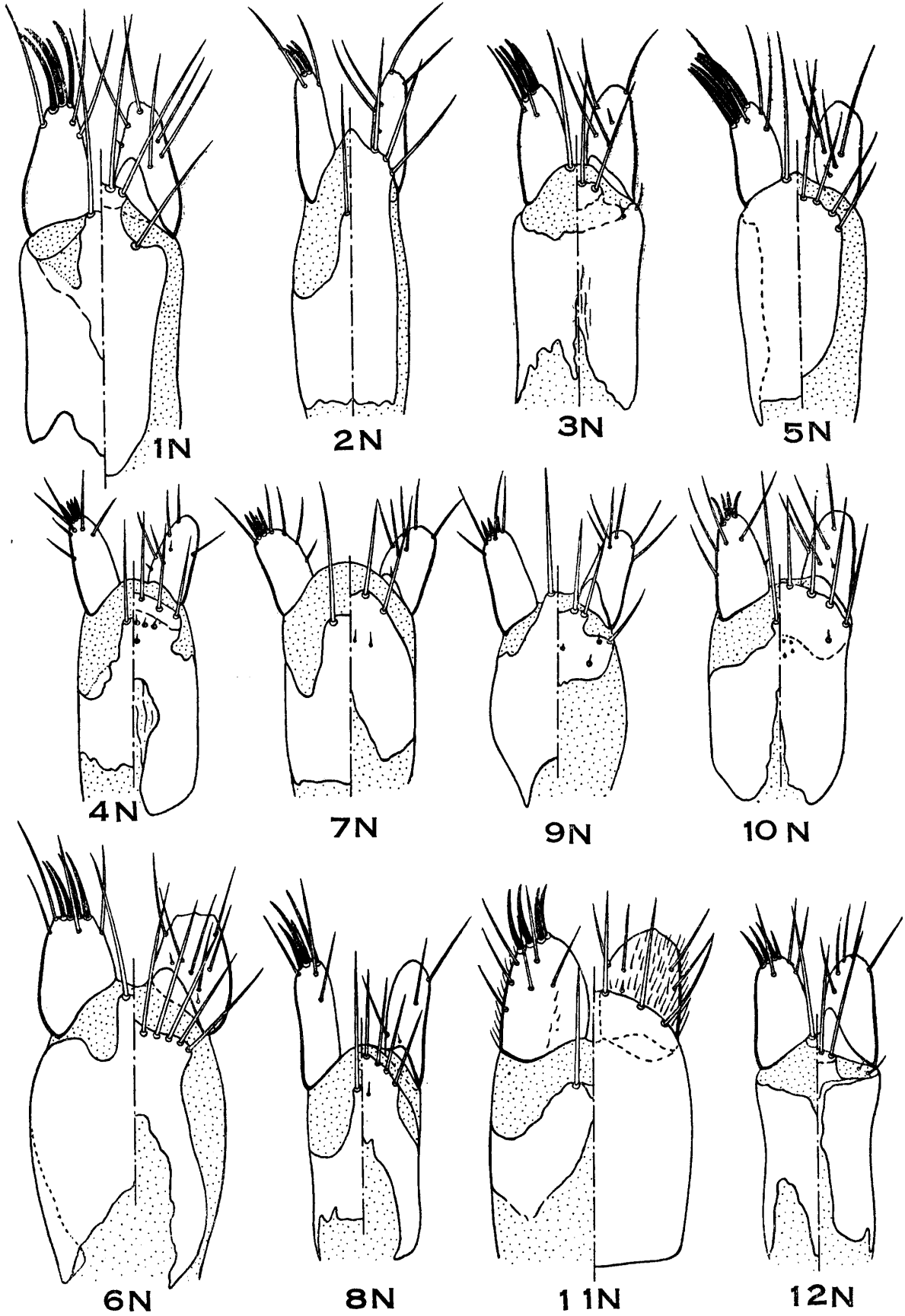
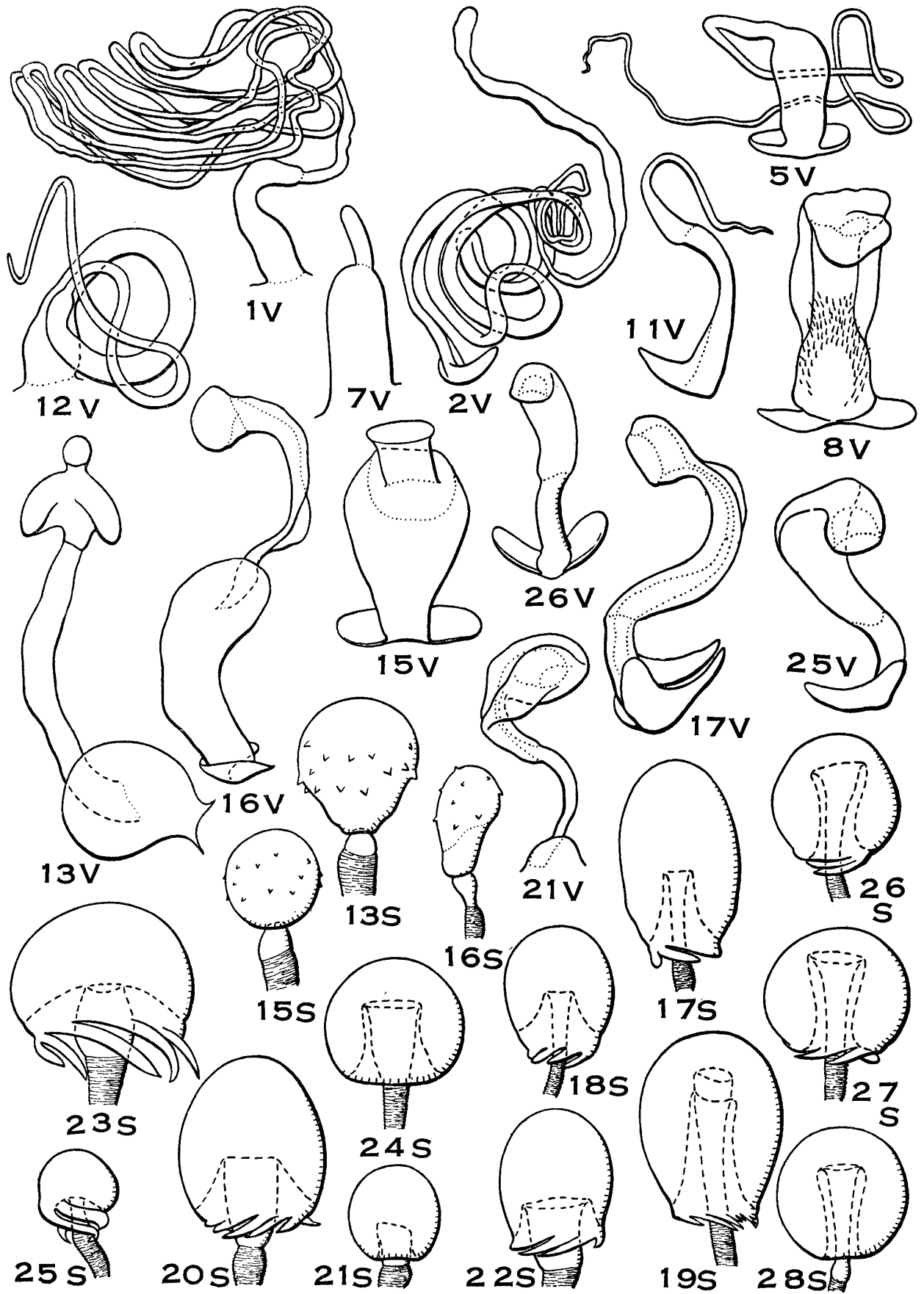


Plate 3



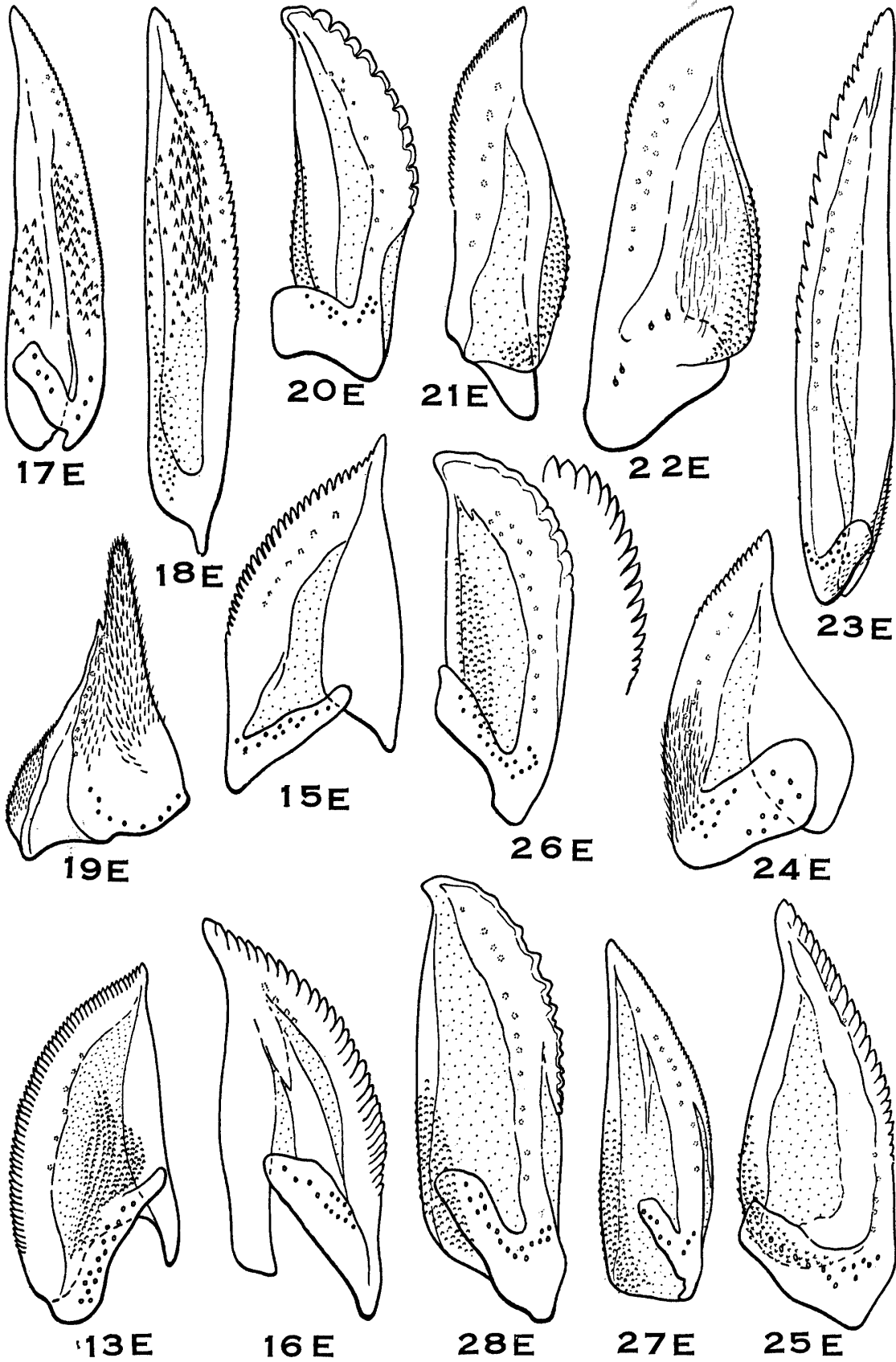


Plate 5

