

A SYSTEMATIC STUDY OF THE MYCETOPHILIDAE OF  
JAPAN (DIPTERA): PART 1. A REVISION OF THE  
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A SYSTEMATIC STUDY OF THE MYCETOPHILIDAE  
OF JAPAN (DIPTERA)  
PART 1. A REVISION OF THE SUBFAMILY DITOMYIINAE

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**Introduction**

The family Mycetophilidae, a prominent component of the dipterous fauna in the temperate woodlands, flourish in the Japanese Archipelago which is complicated in its geographical features and covered with a rich flora of various broad-leaved and conifer trees. The Japanese mycetophilid fauna consists not only of the advanced groups such as Mycetophilinae and Sciophilinae which are rich both in numbers of species and individuals, but also of rather primitive groups such as Ditomyiinae, Diadocidiinae, and Bolitophilinae which are abundant in the humid woodlands.

The Japanese Mycetophilidae were first studied by Matsumura. Then Okada (1934-1940) published a series of papers in which he revised several subfamilies, and also a monograph of the species found in Hokkaido. Several species, mostly from northern Honshu, were described by Shinji (1938-1939). Recently Sasakawa (1960-1964) recorded some twenty additional species and described several new species from Japan. However, the Japanese fauna seems to be still poorly known, and numerous species remain undescribed. For example, the genus *Diadocidia*, hitherto represented by only one known Japanese species, contains at least six species, and the genus *Neuratelia* has several species groups with at least sixteen species, although only two have been described.

For the past ten years I have collected Japanese Mycetophilids with the object of revising the Japanese fauna, and now have a fairly rich collection of these midges. This paper is the first part of a revisional study of the Mycetophilidae of Japan based on this collection. In this paper the subfamily Ditomyiinae is treated.

The Ditomyiinae are regarded as a primitive group of Mycetophilidae, and are treated as a distinct family by some authors. In the Holarctic Region this subfamily is represented by two genera, *Ditomyia* and *Symmerus*,

which contain a comparatively small number of the described species. Three other subfamilies, Diadocidiinae, Keroplatinae and Bolitophilinae, more or less resemble the present subfamily in having the vein  $M_{3+4}$  connected basally to  $M_{1+2}$ . The Ditomyiinae are, however, readily distinguished from these subfamilies by the following combination of venational characters: the R-fork with long branch of  $R_4$  usually separated by r-m crossvein, and the first basal cell united with the second as a result of the disappearance of the stem of M. The pronotal chaetotaxy also distinguishes the Ditomyiinae from other subfamilies.

This subfamily was first recorded from the Japanese Islands by Okada (1936), who referred several Japanese specimens to the European species *Symmerus annulatus* Meigen and described a new species, *Symmerus antennalis*, but later (1939) he pointed out that the Japanese specimens of the former species were specifically distinct from the European, and described them as a new species, *brevicornis*. Sasakawa (1963) revised the subfamily; he described a new species of *Ditomyia*, and illustrated the male genitalia of the known *Symmerus* species. Thus this subfamily is hitherto represented by three species in Japan.

In this paper I describe three new species of the genus *Symmerus*, one new species of the genus *Ditomyia*, erect a new genus for *Ditomyia japonica* Sasakawa, give redescriptions for all the known Japanese species of the subfamily, and discuss the intrageneric relationships in the genus *Symmerus*.

The fungus-gnats of this subfamily are collected by sweeping the undergrowth and the sheltered places of woods; the larvae of the Palaearctic species have been reared from *Polyporus*, *Polystichus*, *Capinus* and *Lenzites*.

### Subfamily Ditomyiinae

Three genera occur in Japan. The Holarctic *Ditomyia* Winnertz and *Symmerus* Walker are similar to each other in wing venation, but the former is easily distinguished from the latter by its long  $R_4$  and rounded compound eyes. The genus *Asioditomyia*, here described as new, is quite distinctive in its reduced maxillary palpus and the absence of r-m crossvein.

#### Key to the Japanese genera of Ditomyiinae

1. Fork of  $R_{4+5}$  proximad of that of  $M_{1+2}$ ; C extending slightly beyond tip of  $R_5$ ; compound eye rounded, not strongly emarginate on inner margin ..... 2
- Fork of  $R_{4+5}$  distad of or above that of  $M_{1+2}$ ; C ending at tip of  $R_5$ ; compound eye reniform, distinctly emarginate on inner margin ..... *Symmerus*
2. Maxillary palpus consisting of 4 segments;  $R_{4+5}$  connected with  $M_{1+2}$

- by a distinct r-m crossvein ..... *Ditomyia*  
 Maxillary palpus consisting of 1 segment; r-m crossvein absent,  
 therefore  $R_{4+5}$  connected with  $M_{1+2}$  at a point or these two veins  
 anastomosed with each other for a short distance .....  
 ..... *Asioditomyia* gen. nov.

### Symmerus Walker

*Symmerus* Walker, 1848, List Dipt. Brit. Mus. 1: 88. Type-species: *Symmerus ferrugineus* Walker, 1848 (mon.)=*Mycetobia annulata* Meigen, 1830.

*Plesiastina* Winnertz, 1852, Stett. ent. Zeit. 13: 55. Type-species: *Mycetobia annulata* Meigen, 1830 (designated by Coquillett, 1910).

**Generic characters:** Compound eye reniform, haired, strongly emarginate above antennal socket, approaching each other to a varied extent in front of median ocellus, rarely almost touching. Ocelli three in number, placed in a wide triangle or a transverse line, median one smaller than lateral ones. Frons above antennae occasionally haired, face densely hairy. Antenna 2+15-segmented; 2 basal segments short and setose; flagellar segments cylindrical, frequently laterally compressed and dentate, rarely with a ventral pectination in some segments, last segment of flagellum minute; flagellar segments densely pilose, without outstanding setulae. Maxillary palpus of 4 segments, last segment variable in length. Mouth parts short. Mesonotum evenly short-haired, postnotum sometimes sparsely short-haired. Legs long and slender, short-haired, tibiae with short setae; tibial spurs well developed, formula 1:2:2. Wing covered with macrotrichia in addition to microtrichia on the whole surface; C ending at or slightly beyond tip of  $R_5$ ; Sc obsolescent a little beyond humeral crossvein;  $R_4$  long, fork of  $R_{4+5}$  distad of that of  $M_{1+2}$ ; basal portion of Rs oblique; r-m crossvein short but always present; branches and stem of  $M_{1+2}$  fine and sometimes indistinct;  $M_1$  and  $M_2$  gradually divergent on basal portion; 1A fine and complete to wing margin. Abdomen elongate, 1st to 7th segments large and externally visible, 8th segment much reduced and concealed by the 7th. Male genitalia usually rotated 180°; epandrium large; cerci lobate, sometimes much elongate or spatulate, pilose; hypandrium usually narrow, sometimes broadly fused with gonocoxites, or produced posteriorly as a lamella; gonostylus variable in shape, with a sclerotic band with fine serration situated in its membranous apical margin. Female terminalia: 8th tergum setose; 8th sternum enlarged, with a deep membranous notch invading from posterior margin, and with bristles on posterior margin; 9th tergum small and almost bare; ventral part of 8th segment usually with an invaginated apodeme; 10th tergum small with a few longish setae; cerci of 2 segments, basal segment broad, apical segment oval, both strongly compressed.

**Geographical distribution:** Holarctic, extending into the Oriental

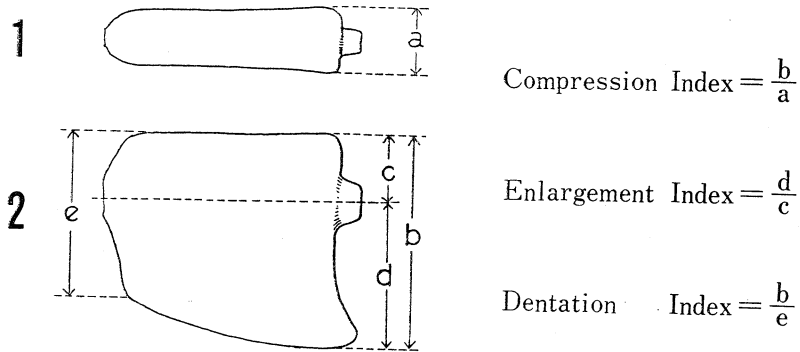
Region. This genus hitherto contains nine species, of which two species occur in Europe, two in Japan, one in the mountain region of Taiwan, and four in the Nearctic Region. One extinct species is known from in Baltic amber. In this paper three new species and a new subspecies of a known species, *brevicornis*, are described from Japan.

**Intragenetic relationship of the Japanese species:** Our knowledge concerning the Japanese species of the genus *Symmerus* is restricted to the integumental morphology of the adult insects. The life history and the immature stages have not been investigated for any Japanese species. Thus only the adult morphology offers data from which we presume the intragenetic phylogenetic relationship. The major specific differences can be recognized in the following characters of the adult external structures: the length and shape of the antennae, the formation of the eye-bridge caused by the approximation of anterodorsal expansions of the compound eyes, the wing shape and some venational characters, the detailed structures of the male genitalia (shape, pilosity and comparative size of cerci, shape of hypandrium, shape of dorsal phallosome, shape of phallic sclerite, structures of gonostylus, especially the enlargement of the apical membranous area and the size of a serrate sclerotic band) and shape and setae of the 9th abdominal sternum of the females.

For some of the above-mentioned characters, it seems to be possible that we arrange different condition of each character in a transformation series and determine the generalized and advanced conditions of such morphoclines based on the accessory criteria of the general comparative morphology of the Nematocerous Diptera. Such characters are mainly antennal and male genital characters.

Concerning the antenna, there are three characters, of which the transformation series are evidently almost correlated with each other. The first character is the length of antenna. In the males of *akikooae* and *antennalis* the antennae are short, the length does not much exceed the thoracic length, while in *elongatus* and *fuscicaudatus* they are almost  $2 \times$  as long as the thorax, and in *brevicornis* more than  $2.5 \times$  thoracic length. Among three species of which females are known the sexual difference of the antennal length is not distinctive in a species with short antennae, *antennalis*, but in *fuscicaudatus* and *brevicornis* with long antennae the difference increases, and the relative length of antenna to thorax in males is nearly  $1.5 \times$  of that in females which have the short antenna only  $1.6 \sim 1.7 \times$  as long as thorax. The fact that the sexual difference of antennal length is slight in the species with short antennae and it is much differentiated in the species with long antennae strongly suggests that the short antenna subequal to the thorax is a plesiomorphic condition and its elongation is apomorphic.

The second character of the antennae is the lateral compression of the flagellar segments. The flagellar segments, especially of the basal



Figs. 1—2. Diagrammatic figures of a ♂ flagellar segment of *Symmerus*. 1: Dorsal aspect. 2: Lateral aspect.

Table 1. Some antennal indices of 4th flagellar segment of *Symmerus* spp. ♂ (♀).

	<i>antennalis</i>	<i>akikoeae</i>	<i>elongatus</i>	<i>fuscicaudatus</i>	<i>brevicornis</i>
Antennal L/Thoracic L	1.1—1.2 (1.2)	1.0	1.9	2.1 (1.6)	2.6—2.9 (1.7)
Compression Index	1.5 (1.4)	1.6	2.2	2.2 (1.8)	2.8 (2.0)
Enlargement Index	1.5 (1.4)	1.5	2.1	2.3 (1.7)	3.6 (2.1)
Denatation Index	1.2 (1.0)	1.3	1.2	1.5 (1.2)	2.1 (1.7)

♀ indices in parentheses.

portion of the flagellum have the following transformations: (1) lateral compression, (2) enlargement of ventral portion, (3) dentation at the ventrodistal corner. These three transformations are expressed as follows: the lateral compression is indicated as the ratio of the maximum thickness to the width (compression index); the enlargement of the ventral portion as the ratio of thickness of ventral portion to that of dorsal portion divided at the middle of intersegmental projection (ventral enlargement index); the dentation at the ventrodistal corner as the ratio of the maximum thickness at posterior portion to that of subbasal portion (dentation index) (Figs. 1-2). These indices of the 4th flagellar segment show that the degrees of the compression, of the enlargement of ventral portion, and of the dentation of the ventrodistal corner are correlated with each other, and these are also correlated with the relative length of the antenna to the thorax.

In the female these indices are always smaller than those in the male, and the sexual difference increases in the species with the long antennae. The cylindrical, ventrally weakly expanded flagellar segments are plesiomorphic and the laterally compressed and ventrodistally strongly expanded flagellar segments are apomorphic judging from the general

comparative morphology of the Mycetophilidae, the sexual differences of the indices, and the correlation between these indices and the relative length of antenna to the thorax. The extremely advanced condition of the apomorphic flagellar segments are seen in the Taiwanese *Symmerus pectinatus* Saigusa, in which the posterodistal corner of the 1st to 10th segments is produced into a long pectination.

The third character of the antennae is the relative lengths of the last flagellar segment and the penultimate segment. This ratio is the largest in *antennalis*, but it becomes much smaller in the species with long antennae. The size of the last segment is not very variable specifically (125-250  $\mu$ ), while the penultimate segment is much elongated in the species with long antennae.

The male genital structures offer some important data for phylogenetic considerations. The plesiomorphic structures of the male genitalia of the Bibionomorphous Nematocera are almost certainly as follows: epandrium and hypandrium each a moderately large, rectangular sclerite without special modifications; each cercus a comparatively small lobe-like structure which is not much larger than the epandrium, simple in shape and finely setose; gonocoxite a simple, stout structure independent from epandrium and hypandrium; dorsal wall of gonocoxites proximally expanded and connected with each other below anus forming the bridge which is more or less produced posteriorly as the tegmen or dorsal phallosome; gonostylus of a simple finger-like structure, its apical portion frequently furnished with specialized setae with a clasping function. These plesiomorphic criteria may be applicable to the genitalia of the genus *Symmerus*.

The epandrium is rectangular, simple and nearly  $2/3 \times$  as long as gonocoxites in most species of *Symmerus*, but in *elongatus* its posterior margin is broadly and moderately deeply emarginate. The cercus is plesiomorphic in *akikoe*, in which it is small and lobate and much shorter than gonocoxite ( $0.7 \times$ ), and its setae, especially those on the ventral surface, are not differentiated. In the other species, the cerci are modified by lamellation or elongation and the cercal setae are denser and variable in shape and direction. In *antennalis* the cercus is  $1.1 \times$  as long as the gonocoxite, apparently more lamellate than in *akikoe*, and its ventral setae are inclined towards the basal portion of cerci. More strongly lamellate cerci are seen in *brevicornis* and *elongatus*. In the former species the cercus is broad, much flattened, almost  $1.8 \times$  as long as the gonocoxite, and almost parallel-sided, its ventral setae become denser and some marginal setae curved. In the latter species, the organ is the longest, almost  $2 \times$  as long as gonocoxite and much flattened, but its setae are not as dense as in *brevicornis*. The cercus of *fuscicaudatus* is peculiarly modified. It is rather long, nearly  $1.7 \times$  as long as the gonocoxite; it is not lamellate but cylindrically elongated on its apical  $1/2$ , and its ventral setae are very dense, much lengthened and apically curled, with some setae on

distal margin of the cercus stiff and curved ventrally. In this genus the cerci are changed from the small, sparsely short-setose, lobate plesiomorphic condition to the elongate, lamellate or cylindrical, apomorphic condition accompanied with some specialization of the ventral and apical setae.

The plesiomorphic hypandrium is well preserved in *akikoeae*. In this species it is trapezoidal and apparently independent from the gonocoxites. In *antennalis* it is still plesiomorphic as in the former species, but it is furnished with a pair of finger-like processes of uncertain origin. The hypandrium of *brevicornis* is more advanced than in *antennalis*; it is connected with the gonocoxites and its posterior portion is bent postero-dorsally. In *fuscicaudatus* the hypandrium is small, but it is rather broadly fused with the gonocoxites. The most specialized condition of the hypandrium is seen in *elongatus*. In this species the hypandrium is shifted posteriorly, much enlarged and has a hairy longitudinal ventral keel; thus it becomes a large projected lamella extending beyond the posterior extremity of gonocoxites. The posterior shift of the hypandrium in this species results in the approximation of basal portions of the gonocoxites, with which the anterior portion of the hypandrium is completely fused.

The gonostylus of the genus *Symmerus* have an apical sclerotic band having a minutely serrate margin which probably has a clasping function. This is one of the apomorphic characters of this genus. The most plesiomorphic condition of the gonostylus is preserved in *akikoeae*, in which the organ is a moderately long, simple structure provided apically with a marginally serrate sclerotic band which is not surrounded by a membranous area but arises directly from the sclerotic wall of the gonostylus, and has a few stiff setae on a weak protuberance at the inner surface of apical portion of the gonostylus. The gonostylus of *antennalis* is somewhat advanced from that of the former species; it is somewhat swollen, the serrate band is more enlarged and surrounded by a membranous area, and the protuberance at inner apical surface is represented by a short projection ornamented with a few spine-like bristles. In *elongatus*, the gonostylus is rather simple in shape, but the membranous region surrounding the serrate band is much enlarged and occupies the apical 2/3 of its outer wall, and the serrate band is much more lengthened than in *antennalis*, while the inner apical wall of the gonostylus has only stiff setae. The gonostylus is much modified in *fuscicaudatus* and *brevicornis*. In the former species, it is vertically much thickened towards the apex, thus the apical margin is longer than the dorsal, its apical surface is broadly membranous and furnished with a long serrate band and a long shagreen-like dark band, the former only slightly shorter than the entire apical margin. In *brevicornis*, the gonostylus is enlarged as in *fuscicaudatus*, a hairy protuberance on ventroproximal surface becomes more or less prominent (homologous with the finger-like process of the Taiwanese *pectinatus*), the shagreen-like dark

band is long, but the serrate band is comparatively short, and apical sclerotic portion of the gonostylus bears several stiff setae which are prominent especially on the outer margin. The transformation of the gonostylus may be summarized as follows: the shape is changed from a style- or finger-like condition to a swollen or apically dilated condition; the apical serrate hook becomes a long band with numerous serrations surrounded by a broad membranous area; the inner apical protuberance bearing stiff setae is reduced in correspondence with the enlargement of the serrate band and the deformation of the gonostylus.

The dorsal phallosome is not much differentiated in all species except *fuscicaudatus*, in which the organ is strongly compressed laterally. In *antennalis* the phallosome is provided with a short process at the base of each gonocoxite.

The phallic sclerite seems to be preserved in the plesiomorphic condition in *antennalis* and *brevicornis*. It is somewhat modified in *akikooae* and *fuscicaudatus*, while in *elongatus* its apodemal process is completely reduced.

Judging from the above-mentioned characters, the male genitalia as a whole are most plesiomorphic in *akikooae* and only slightly less plesiomorphic in *antennalis*. The other three species have strongly modified genitalia, but the directions of the transformation from the generalized condition are different from each other; at most *fuscicaudatus* is somewhat similar to *brevicornis* in this respect. The transformation series of the male genitalic characters, especially of the modification of gonostylus and the enlargement of the cerci, is apparently well correlated with that of the antennal characters.

Among the known females, *antennalis* is presumably most primitive in the posterior marginal structure of the female 8th abdominal sternum. In this species this sternum has an entire simple posterior margin which bears less differentiated submarginal setae. In *brevicornis* and *fuscicaudatus*, this margin becomes double owing to the formation of a secondary free edge along a row of setae which are primitively submarginal. This secondary margin is only weakly undulate in *fuscicaudatus*, while in *brevicornis* it becomes strongly undulate and the margin itself is much more expanded posteriorly than the primary margin. The posterior marginal setae are most strongly thickened and decrease in number in *fuscicaudatus*.

The wing characters are not easily arranged in a transformation series, but the following tendency may be pointed out. In *antennalis* and *akikooae*, the wing is broad and vein  $R_5$  does not reach the extreme tip of the wing. In the other species, the wing is narrow, and  $R_5$  extends to the extreme wing apex.

The followings are the intrageneric phylogenetic relationships of the Japanese species and some foreign ones based on the morphological data

discussed above.

*Akikoae* and *antennalis* represent the most primitive position in the phylogeny. They have almost all the plesiomorphic characters. The resemblance of these two species, however, is apparently due to symplesiomorphy, and does not indicate close phylogenetic relationship. In some other characters they differ much from each other. In *akikoae* the apical segment of the maxillary palpus is extremely lengthened, a complete and broad eye-bridge is formed, and the postnotum does not bear setae. On the other hand, *antennalis* is slightly advanced from *akikoae* in the formation of a pair of processes on each hypandrium and the gonocoxal bridge, the lamellate cerci, and the stout curved gonostylus. The Nearctic *S. lautus* Loew and *S. dilutus* Fisher are apparently most closely related to *antennalis*, but they are probably slightly generalized in the simple gonocoxal and hypandrial elements of the male genitalia. It is noteworthy that these three species all have the setae on the postnotum.

*Elongatus*, *fuscicaudatus* and *brevicornis* are much more advanced than the above-mentioned species, but phylogenetically they might have evolved along different lineages. On the basis of antennal characters, the cerci and the gonostylus, *elongatus* is not as much differentiated as the other two species, and moreover it has the setose postnotum as in the primitive *antennalis* and its allies, but the hypandrium is specialized and the phallic sclerite completely lacks in the apodemal rod.

*Fuscicaudatus* and *brevicornis* seem to resemble each other more than they do *elongatus*. However, most of the similarities between them are due to symplesiomorphy or convergence. The lamellate enlargement of the cercus and the peculiar setose margin of the apical sclerotic wall of the gonostylus are apomorphic developments in *brevicornis*. On the other hand, *fuscicaudatus* is differentiated in the strongly compressed dorsal phallosome, the cylindrically lengthened unique cercus and the great development of the serrate sclerotic band of the gonostylus. The Nearctic *S. coqulus* Garrett seems to be closely related to *fuscicaudatus*, but it is slightly generalized in short simple cercal setae. The Taiwanese *pectinatus* is apparently most closely related to *brevicornis*, and these two species undoubtedly compose a distinct monophyletic group. *Pectinatus* and *brevicornis* have many characters, including both plesiomorphic and apomorphic ones, in common. *Pectinatus* has the cercus bearing two specialized clusters of setae on its ventral surface, a large triangular hypandrium, a slender finger-like ventral process of the gonostylus, many strong bristles on the outer margin of the gonostylus, and pectination on some flagellar segments. These characters all represent the more advanced condition in the transformation series found in the *brevicornis*-lineage.

The apparent phylogenetic relationship is shown schematically in Fig. 3.

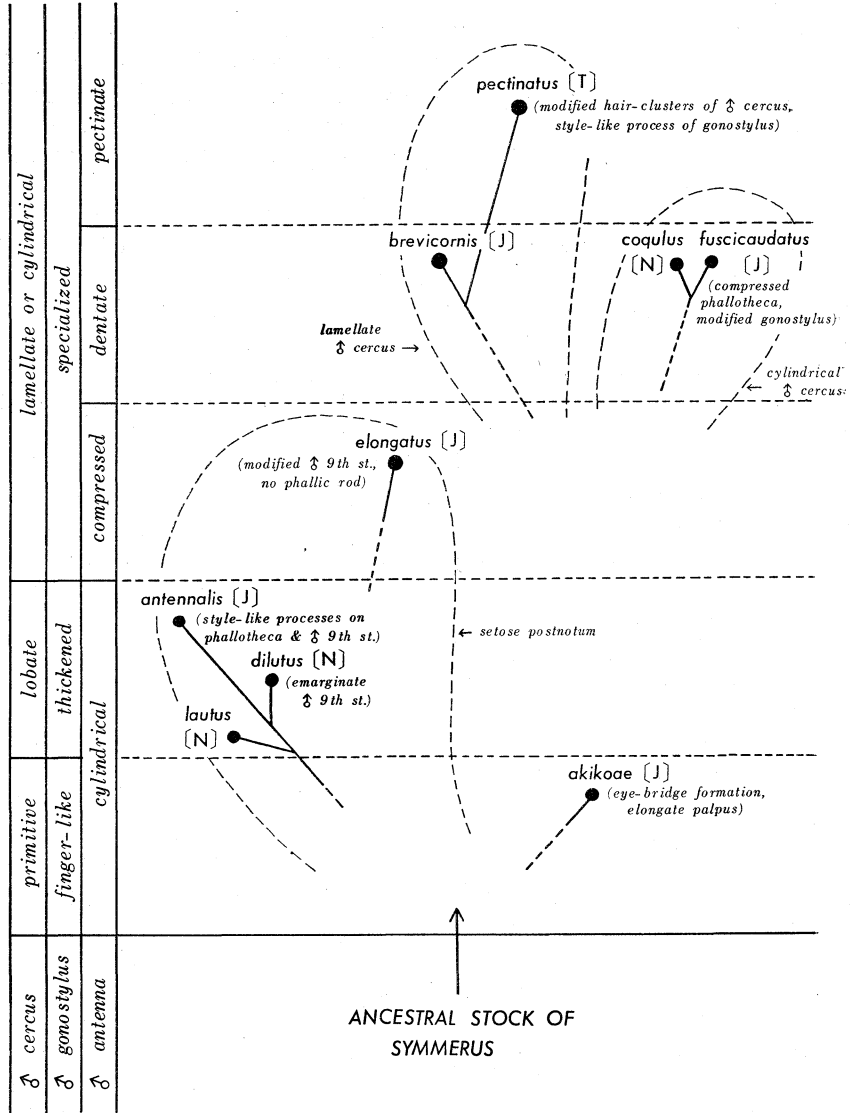


Fig. 3. Phylogenetic relationships of some *Symmerus* species.

### Key to Japanese species of *Symmerus*

Male.

1. Flagellar segments of antenna almost cylindrical (Pl. 12, Fig. 21); flagellum shorter than 1.5 × thoracic length ..... 2:

- Flagellar segments of antenna compressed laterally (Pl. 12, Figs. 22-24);  
flagellum much longer than  $1.5 \times$  thoracic length ..... 3
2. Mesonotum predominantly shining black (Pl. 11, Fig. 15); postnotum  
haired on its posterior portion; halter yellow; 7th abdominal  
tergum black;  $f_3$  yellow ..... *antennalis* Okada  
Mesonotum entirely dull yellow (Pl. 11, Fig. 16); postnotum bare; halter  
with black tip; 7th abdominal tergum yellow;  $f_3$  blackish.....  
..... *akikoe* sp. nov.
3. Cercus white at least on its apical  $1/2$ , broadly lobate ..... 4  
Cercus yellowish brown to dark brown, tapered on its posterior  $1/2$ .  
Mesoscutum with three blackish bands which are usually confluent  
with each other on posterior portion; postnotum bare; halter  
yellowish ..... *fuscicaudatus* sp. nov.
4. Mesonotum orange-yellow to yellowish brown, sometimes marked with  
2 oval brown spots above wing bases (Pl. 11, Fig. 17); postnotum  
bare; halter with black tip; abdomen not elongate, its terga rather  
dull deep brown to black and paler on anterior portions (Pl. 9,  
Fig. 6); hypandrium of  $\sigma$  genitalia not extending posteriorly beyond  
the level of gonocoxites.....*brevicornis* Okada..... 5  
Mesoscutum evenly shining dark brown; postnotum haired; halter  
yellow to yellowish brown; abdomen elongate, its terga uniformly  
shining dark brown (Pl. 8, Fig. 4); hypandrium of  $\sigma$  genitalia  
extending posteriorly beyond the level of gonocoxites.....  
..... *elongatus* sp. nov.
5. Setae on outer surface of apical portion of gonostylus long and needle-  
like; hypandrium weakly concave on posterior  $1/2$  (Figs. 22-23) ...  
.....*brevicornis brevicornis* Okada  
Setae on outer surface of apical portion of gonostylus short and thorn-  
like; hypandrium strongly concave on posterior  $1/2$  (Figs. 18-19)...  
..... *brevicornis yamatoensis* subsp. nov.

## Female.

1. Flagellar segments of antenna strongly compressed laterally (Pl. 12,  
Figs. 26-27); postnotum bare ..... 2  
Flagellar segments of antenna almost cylindrical (Pl. 12, Fig. 25);  
postnotum haired. Body uniformly shining dark brown; 8th ab-  
dominal sternum with seta-like bristles on its posterior margin;  
cercus whitish ..... *antennalis* Okada
2. Cercus whitish; posterior margin of 8th abdominal sternum strongly  
undulate, with several seta-like bristles (Fig. 27) .....  
..... *brevicornis* Okada  
Cercus yellowish brown; posterior margin of 8th abdominal sternum  
weakly undulate with several stiff black bristles (Fig. 29) .....  
..... *fuscicaudatus* sp. nov.

***Symmerus antennalis* Okada, 1936**

*Symmerus antennalis* Okada, 1936, Ins. Mats. 11: 58 (type-locality: Sapporo, Hokkaido).

*Symmerus antennalis*: Okada, 1939, Jour. Fac. Agr. Hokkaido imp. Univ. 42: 288.

*Symmerus antennalis*: Sasakawa, 1963, Akitsu 11: 18 (recorded from Sapporo in Hokkaido, Mt. Hakuba (=Mt. Shiroumadake), Nagano Pref., Sandankyô, Hiroshima Pref. in Honshu).

♂ (Pl. 8, Fig. 2). *Coloration*: Body mostly dark brown to blackish brown. Head yellowish brown to dark brown, very thinly greyish pollinose; vertex broadly blackish brown, its anterior portion in front of ocelli almost shining; face yellow to yellowish brown; antenna yellow, rarely brown, its apical 1/2 infuscated towards the blackish tip; mouth parts and maxillary palpus yellow to yellowish brown. Thorax (Pl. 11, Fig. 15) shining blackish brown on terga, yellow on pleura; mesoscutum narrowly yellowish along lateral margins and scuto-scutellar suture; scutellum yellowish brown and infuscated to dark brown on disc; postnotum and pleurotergite uniformly dark brown, very thinly greyish pollinose; meso-epimeron and meso-katepisternum rarely tinged with brown. Legs entirely yellow, spurs black. Wing slightly infuscated and with yellowish brown veins; halter yellow. Abdomen subshining blackish brown, 1st and 4th sterna and posterior 1/2 to 1/3 of 3rd and 4th terga yellow, anterolateral corners of 2nd tergum sometimes pale; in the specimens from the subalpine region of the Chubu District of Honshu, abdomen entirely shining dark brown, only 1st and 2nd sterna pale to yellowish brown. Genitalia yellow to yellowish brown, except for blackish sclerotic band at tip of gonostylus.

*Structure*: Vertex and occiput short-setulose; frons with several setulae. Compound eyes rather widely separated from each other on frons. Antenna (Pl. 12, Fig. 21) in macerated condition slightly longer than thorax (measured from the most anterior portion of mesoscutum to the posterior end of postnotum) (50:43-47); flagellum almost cylindrical and only slightly compressed laterally, very short-pilose; 5th flagellar segment 1/2 × as long as thick; final flagellar segment 1/2 × as long as penultimate segment. Maxillary palpus short, all segments subequal in length; 3rd segment thickest, and with a dark dorsal concavity which seems to be a sensory organ.

Postnotum hairy. Thorax clothed with yellow to yellowish brown

Table 1. Relative lengths of leg segments of *Symmerus antennalis* ♂.

	Femur	Tibia	Tarsus				
			1	2	3	4	5
Front leg	105	100	96	54	39	27	27
Middle leg	147	165	111	54	39	30	27
Hind leg	192	261	120	57	42	33	27

hairs. Relative lengths of leg segments as in Table 1. Wing as in Pl. 13, Fig. 31, rather broad;  $R_4$  usually  $1/2 \times R_5$ .

Abdomen clothed with rather short brown hairs. Male genitalia rotated  $130-180^\circ$  to left, as long as 7th abdominal tergum, rather primitive in structure; epandrium rectangular, slightly shorter than wide; cercus short, lamellate, oval in shape, nearly  $1.7 \times$  as long as epandrium; gonostylus simple, curved inwards, narrowed apically into a short projection which is furnished with several small spines, subapical membranous area with a short sclerotic serrate band; hypandrium rectangular,  $2/3 \times$  as long as wide, with a pair of stylus-like lateral processes which are slender, straight and extend almost to the posterior corner of gonocoxites; dorsal phallosome broad, phallic organ a small rectangular plate with a moderately long internal rod.

Length: Body 3.7-4.9 mm: wing 4.1-5.5 mm.

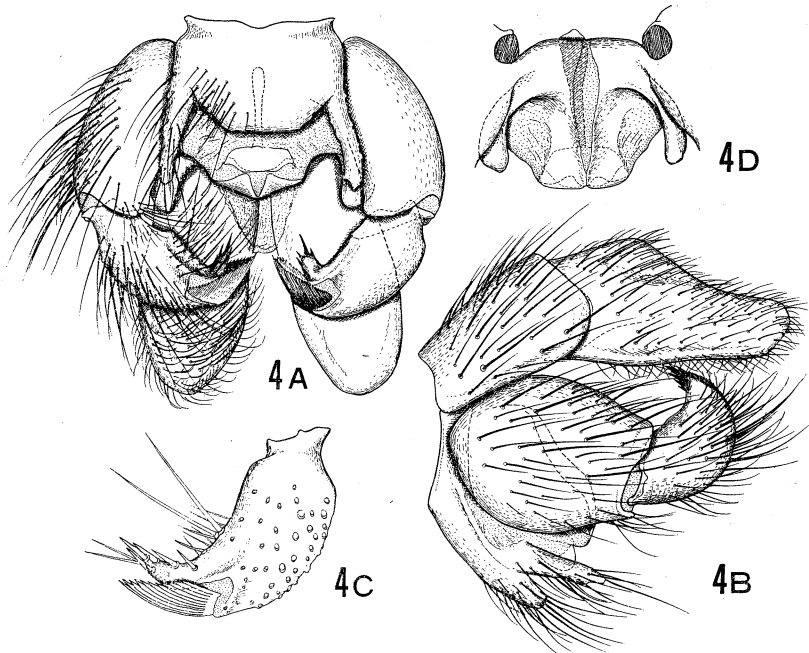


Fig. 4. *Symmerus antennalis* Okada, ♂. 4A: ♂ genitalia, most of setae on left half omitted, ventral aspect. 4B: Same, lateral aspect. 4C: Gonostylus, dorsal aspect. 4D: Dorsal phallosome.

♀ (Pl. 8, Fig. 2). *Coloration*: Body extensively shining blackish brown; membrane, sides of pronotum, shaft of halter yellowish; terminalia yellowish white; legs dark brown, tibiae and tarsi greyish brown; wing much darker than in ♂.

*Structure*: Antenna (Pl. 12, Fig. 25) slightly longer than thorax (50:43);

flagellum cylindrical, but slenderer than in ♂, most of flagellar segments slightly longer than thick. Wing as in Pl. 13, Fig. 32. Terminalia (Figs. 25-26): 8th sternum sparsely setose, and with a row of bristles on its posterior submargin; venter of 9th abdominal segment rather deeply invaginated into a lamellate process; cercus with 1st segment large and broad, 2nd segment shorter than thick.

Length: Body 4.1-4.7 mm; wing 4.2-4.5 mm.

*Geographical distribution*: *S. antennalis* is widely distributed in Japan. It is known from Hokkaido, Honshu and Kyushu, and possibly it occurs in Shikoku. Its habitats are found from evergreen oak forests of lowlands of Kyushu to the subalpine conifer forests of northern Japan.

*Specimens examined*: [Hokkaido] 1 ♀, Aizankei (1,100 m alt.), Mts. Daisetsuzan, 17. vii. 1962 (T. Saigusa). [Honshu] 1 ♂, Shosenkyo (600 m alt.), Yamanashi Pref., 6. vi. 1962 (T. Saigusa); 1 ♂ 1 ♀, Mt. Daisen, Tottori Pref., 24. vi. 1968 (M. Honda). [Kyushu] 2 ♂ ♂, Mt. Inunakiyama (300 m alt.), Wakamiya, Fukuoka Pref., 25. v. 1961 (T. Saigusa); 2 ♂ ♂ 1 ♀, Kyusuikei (600 m alt.), Mt. Kujusan, Oita Pref., 28. v. 1967 (T. Saigusa).

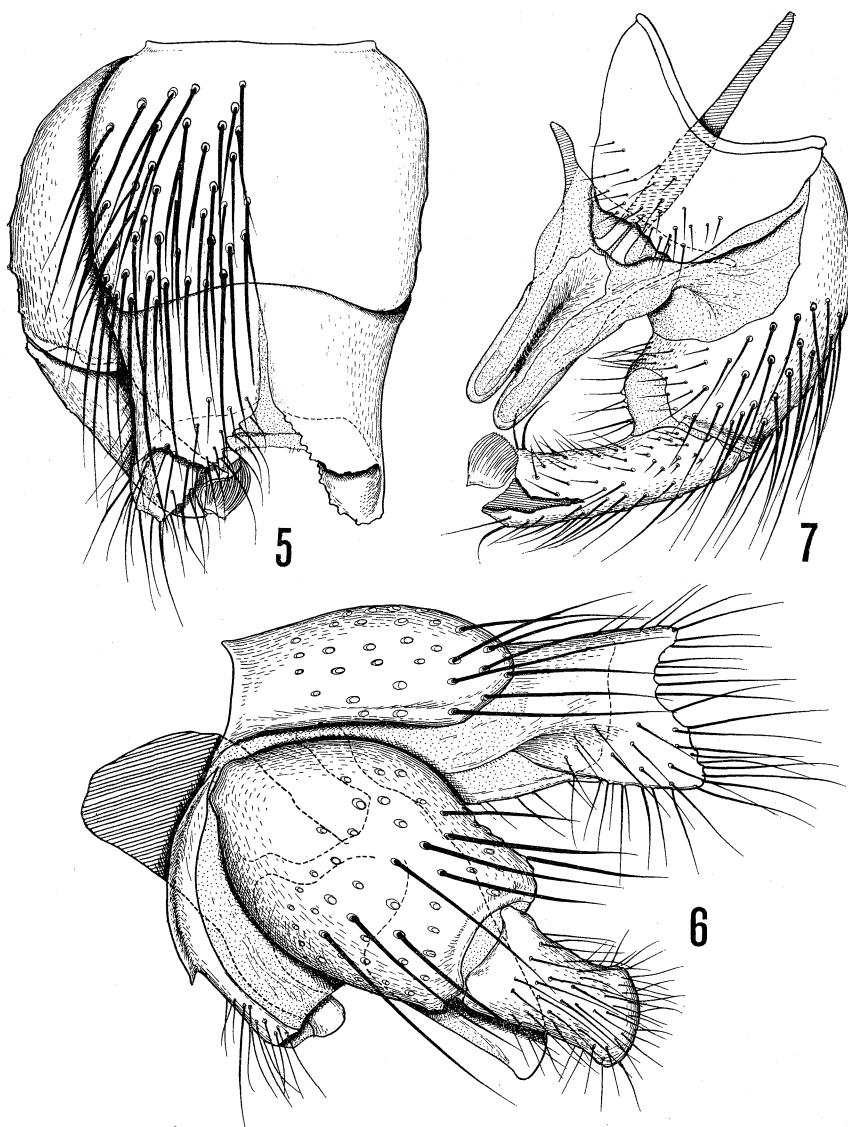
### *Symmerus akikoeae* Saigusa, sp. nov.

♂ (Pl. 8, Fig. 3). *Coloration*: Body extensively dull yellow, with black markings on abdomen. Head including antenna and mouth parts yellowish brown, ocellar prominence black. Thorax (Pl. 11, Fig. 16) uniformly dull yellow, not shining. Meso-katepisternum only slightly darkened. Legs yellow, hind femur blackish brown, tibiae and tarsi somewhat infuscated. Wing greyish infuscated, darker than in the other Japanese species, and veins brown; halter black with yellow shaft. Abdomen yellow, terga subshining, sterna matt; 2nd tergum brown, 5th and 6th segments entirely blackish brown. Genitalia yellow, apical portion of gonostylus infuscated.

*Structure*: Described from the dried type-specimen, only antenna and abdomen macerated with KOH solution. Head (Figs. 16-17) much flattened, vertex much more strongly elevated than in the other Japanese species. Vertex, occiput, and face clothed with dark brown hairs, of which postocellar ones and lower occipital ones are longer and stiff; frons with several minute hairs. Ocellar region prominently raised, with median

Table 2. Relative lengths of leg segments of *Symmerus akikoeae* ♂.

	Femur	Tibia	Tarsus				
			1	2	3	4	5
Front leg	111	100	96	45	33	27	24
Middle leg	141	156	108	48	39	27	25
Hind leg	165	234	105	45	39	27	26



Figs. 5-7. *Symmerus akikoe* sp. nov., ♂. 5: ♂ genitalia, most of setae on right half omitted, dorsal aspect. 6: Same, lateral aspect. 7: Same, tergal parts and right gonopod omitted, apical portion of gonostylus somewhat broken, ventral aspect.

ocellus nearly  $1.2 \times$  as large as lateral ones in diameter. Compound eyes practically touching each other above antennal sockets, the eye bridge broad. Antenna nearly  $2/3 \times$  as long as thorax in dried condition, slightly shorter than thorax in macerated condition (50:53); flagellar segments

short and cylindrical, only slightly compressed laterally, densely greyish brown pilose, final flagellar segment minute, shorter than  $1.6 \times$  as long as penultimate segment; 5th flagellar segment  $1/2 \times$  as long as thick. Maxillary palpus much more elongate than in the other Japanese species; basal segments short, 3rd segment almost as long as basal 2 segments together; 4th segment slender, nearly  $2 \times$  as long as the 3rd.

Thoracic hairs yellow, except those on meso-episternum black; post-notum bare. Legs rather short and thick. Relative lengths of leg segments as in Table 2. Wing as in Pl. 13, Fig. 33, broad; stem of  $R_4$  and  $R_5$  and that of  $M_1$  and  $M_2$  rather short.

Abdomen rather short, its hairs moderately long, yellowish brown on yellow sclerites and black on blackish brown portions. Genitalia small, almost as long as 7th abdominal sternum, rotated  $90^\circ$  to left, structurally very primitive; epandrium rectangular, slightly shorter than wide, densely setose; cercus short, shorter than epandrium, lobate rather than lamellate, bearing setae on apical  $1/2$ , its posterior margin weakly emarginate; gonocoxites widely separated by hypandrium which is trapezoidal, strongly emarginate anteriorly, and bears short setae on posterior  $1/2$ ; gonostylus short, cylindrical and simple in structure, its apical portion with a short sclerotic serrate band and a few stiff setae; dorsal phallosome elongate and apically bifurcate, phallic organ with a long apodemal process.

Length: Body 3.8 mm; wing 4.5 mm.

*Type-locality*: Kanayama (1,400 m alt.), Sudama (Masutomi), Yamanashi Pref., Honshu, Japan.

*Geographical distribution*: This species is known only from the mountain deciduous forest (*Quercus mongolica* zone) of the type-locality.

*Holotype*: ♂, Kanayama, 12. viii. 1961 (T. Saigusa).

*Remarks*: This new species is easily distinguished from the known species by the coloration of the body, especially by the dull yellow thorax, and by the well-developed eye-bridge.

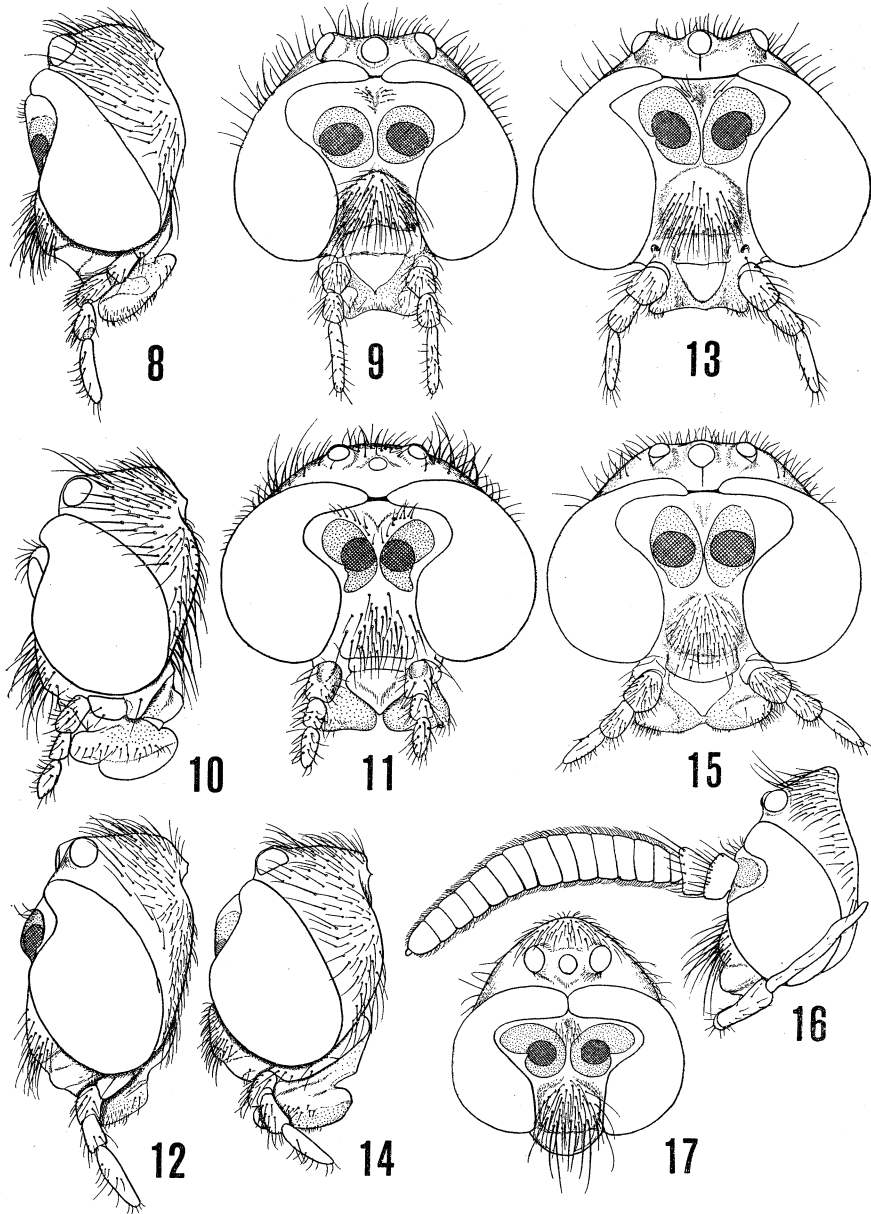
### ***Symmerus brevicornis* Okada, 1939**

*Symmerus annulatus*: Okada, 1936, Ins. Mats. 11: 57 (nec Meigen, 1838) (recorded from Sapporo, Hokkaido and Mt. Daisen, Honshu).

*Symmerus brevicornis* Okada, 1939, Jour. Fac. Agr. Hokkaido imp. Univ. 42: 287 (type-locality: Sapporo, Hokkaido).

*Symmerus brevicornis*: Sasakawa, 1963, Akitsu 11: 16 (recorded from Hikosan, Kyushu and Omogo, Shikoku).

♂ (Pl. 9, Figs. 5-6). *Coloration*: Thorax yellow and abdomen mostly blackish. Head dark yellowish brown to brown, very thinly brownish pollinose, vertex broadly black; face yellow to yellowish brown; antenna, mouth parts and maxillary palpus brown, 2 basal segments of antenna usually yellow. Thorax (Pl. 11, Fig. 17) yellow; mesoscutum subshining yellow, in subsp. *brevicornis* a pair of oval brownish markings occasionally



Figs. 8-17. Heads of *Symmerus* spp., ♂. 8 & 9: *Symmerus brevicornis brevicornis* Okada. 10 & 11: *Symmerus antennalis* Okada. 12 & 13: *Symmerus elongatus* Saigusa, sp. nov. 14 & 15: *Symmerus fuscicaudatus* Saigusa, sp. nov. 16 & 17: *Symmerus akikoae* Saigusa, sp. nov., holotype, in dried condition. Figs. 8, 10, 12, 14, 16: Lateral aspect. Figs. 9, 11, 13, 15, 17: Frontal aspect.

appearing on sides of scutum, in subsp. *yamatoensis* an additional median brownish band appearing between the lateral markings; ventral 1/2 of pleurotergite blackish brown, dorsal margin of metapleuron sometimes brownish. Legs yellow, tibiae and tarsi greyish brown to dark brown. Wing somewhat infuscated, and veins dark brown; halter black, its shaft yellow. Abdomen dull dark brown to blackish brown, with a coating of brownish pollen which is much denser than in *antennalis*, basal portion of 2nd to 5th terga and sterna usually pale to dark yellowish brown in varied degrees. Genitalia dark brown, cercus white except for infuscated basal portion.

*Structure*: Vertex, occiput and face clothed with longish black hairs; frons with a few minute hairs. Compound eyes much approximated to each other, and only separated by the diameter of median ocellus. Antenna (Pl. 12, Fig. 22) long, a little more than  $2.5 \times$  as long as thorax, flagellar segments strongly compressed, 1st to 8th segments produced ventrodistally and almost triangular in shape, 9th to 14th segments elongate rectangular; 5th segment slightly shorter than its apical thickness, and  $2 \times$  as long as its basal thickness; final flagellar segment about  $1/10 \times$  as long as penultimate segment. Maxillary palpus rather long, 1st segment short, 2nd slightly longer than 1st and thickest, 3rd subequal to 2nd in length; 4th elongate,  $2 \times$  as long as 3rd segment; 2nd segment without a dorsal concavity.

Postnotum bare, thoracic and coxal setulae longish and black. Relative lengths of leg segments as in Table 3. Wing as in Plate 14, Figs 37 & 38;  $R_4$  moderately long.

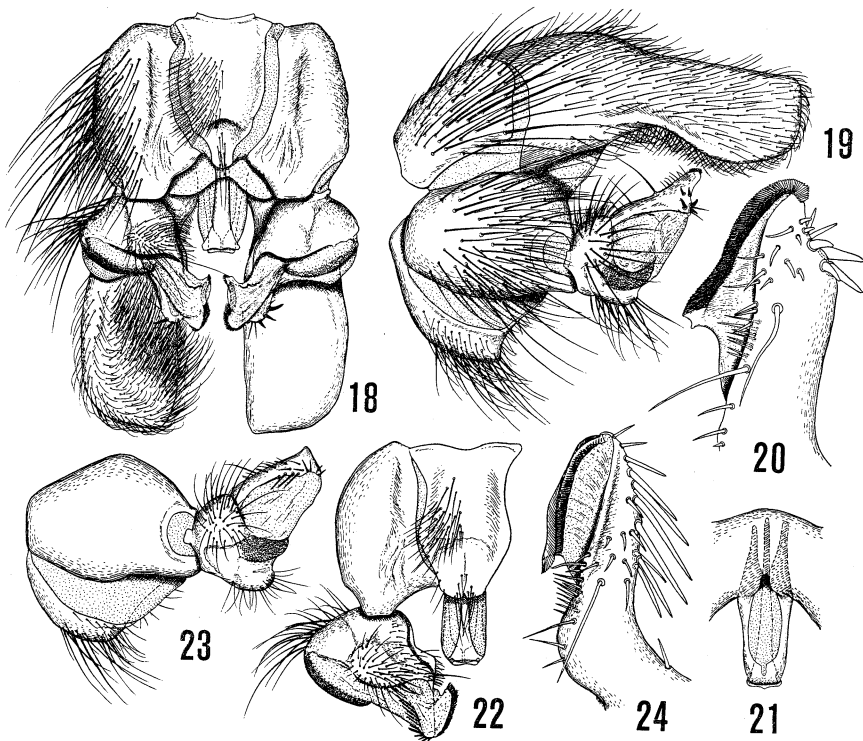
Table 3. Relative lengths of leg segments of *Symmerus brevicornis brevicornis* ♂.

	Femur	Tibia	Tarsus				
			1	2	3	4	5
Front leg	76	100	74	41	34	24	22
Middle leg	93	138	76	40	32	25	22
Hind leg	134	176	101	51	37	28	24

Abdomen moderately long, densely clothed with longish black hairs. Genitalia (Figs. 18-24) large, nearly  $2 \times$  as long as 7th abdominal tergum; epandrium rectangular,  $1/2 \times$  as long as wide, weakly narrowed posteriorly; cercus large, lamellate, and rectangular, weakly constricted near middle, densely clothed ventrally with fine white hairs which become somewhat darkened on basal portion of cercus; hypandrium long and broad, distinctly narrowed and curved dorsally beyond the middle, its apex not reaching to posterior corner of gonocoxites; gonostylus onion-shaped, globosely swollen basally, then tapered towards inner apical projection

which is furnished with some prominent bristles subspecifically variable in length, outer distal surface broadly membranous and having a short sclerotic serrate band along the apical projection and a dark pigmented shagreen-like stripe from basal swollen portion of gonostylus; dorsal phallosome long and narrow, phallic organ of a slender sclerite proximally represented by an internal rod.

Length: Body 4.7-6.0 mm; wing 4.9-5.7 mm.

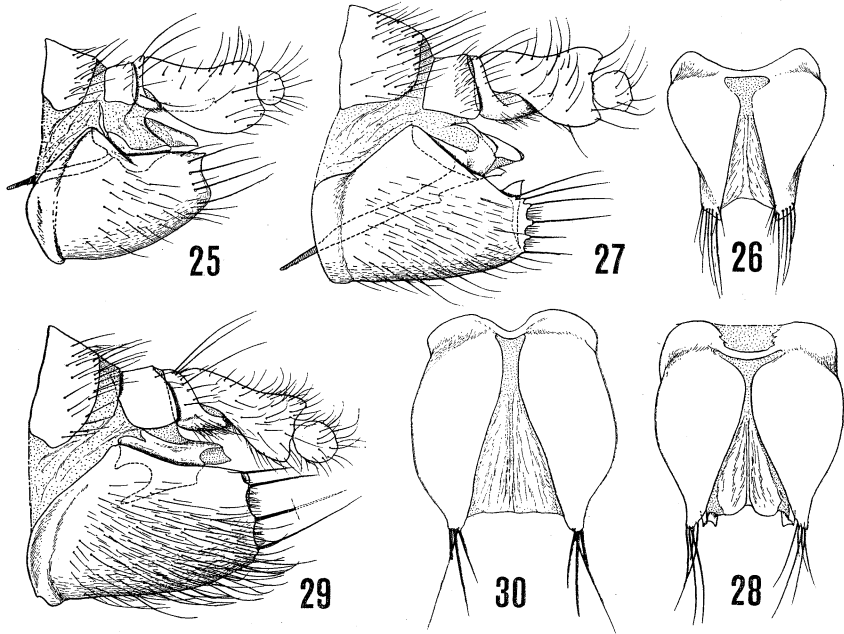


Figs. 18-21. *Symmerus brevicornis yamatoensis* Saigusa, subsp. nov., ♂.

Figs. 22-24. *Symmerus brevicornis brevicornis* Okada, ♂. 18: ♂ genitalia, ventral aspect, most of setae on left side omitted. 19: ♂ genitalia, lateral aspect. 20 & 24: Apical portion of left gonostylus, dorsal aspect. 21: Dorsal phallosome and phallic organ, dorsal aspect. 22: ♂ genitalia, tergal elements and left gonopod omitted, ventral aspect. 23: Same, lateral aspect.

♀ (Pl. 9, Fig. 7). *Coloration*: Body extensively dark brown to blackish brown. Head and thorax almost entirely dark brown, head thinly brownish pollinose, thorax subshining, and with lateral portions of pronotum, ventral portion of propleuron and dorsal margin of meso-epimeron yellowish. Legs entirely dark brown with black spurs. Wing (Pl. 14, Fig. 39) more infuscated

than in ♂, veins dark brown; halter black with yellowish brown shaft. Abdomen dull blackish brown; basal portion of 2nd to 5th terga may be pale to brown; cercus yellowish white, somewhat infuscated on base of 1st segment.



Figs. 25-30. Female terminalia of *Symmerus* spp. 25 & 26: *Symmerus antennalis* Okada. 27 & 28: *Symmerus brevicornis yamatoensis* Saigusa, subsp. nov. 29 & 30: *Symmerus fuscicaudatus* Saigusa, sp. nov. Figs. 25, 27, 29: ♀ terminalia, lateral aspect. Figs. 26, 28, 30: Eighth abdominal sternum, ventral aspect.

**Structure:** Antenna (Pl. 12, Fig. 26) slightly shorter than in ♂,  $1.7 \times$  as long as thorax (50:30); apical flagellar segments thicker than in ♂, ventrodistal projection of basal flagellar segments weaker. Terminalia (Figs. 27-28): 8th abdominal sternum more densely setose than in *antennalis*, and with a row of several bristles on each side of posterior margin, sockets of these bristles on denticulated projection on the strongly undulate secondary margin; venter of 9th segment ornamented with a long invaginated process; cercus with 1st segment large and broad, 2nd segment almost as long as broad.

Length: Body 5.2-5.4 mm; wing 5.4-5.8 mm.

**Geographical distribution:** *S. brevicornis* is widely distributed from Hokkaido, Honshu, Shikoku to Kyushu.

**Geographical variation:** This species is represented by two distinct geo-

graphical races, namely *brevicornis* Okada from Hokkaido, and *yamatoensis* subsp. nov. from Honshu and Kyushu. These races are quite easily distinguished in the male genitalia. The author did not examine specimens from Shikoku, but they presumably belong to *yamatoensis*.

### ***Symmerus brevicornis brevicornis* Okada, 1939**

In this subspecies the apical portion of the wing is rather obtuse, with costa beyond tip of  $R_1$  short, strongly curved (Pl. 14, Fig. 37). In the ♂ genitalia, the outer wall of apical portion of gonostylus bears many long, spine-like bristles and the hypandrium is rather weakly bent dorsally beyond the middle (Figs. 22-24).

*Geographical distribution*: This subspecies is known from Hokkaido, where it occurs from the sea coast to the subalpine forests of Mts. Daisetsuzan.

*Specimens examined*: [Hokkaido] 1 ♂, Kiyokawa, Ashoro, Tokachi, 23. vii. 1967 (T. Saigusa); 1 ♂, Berabonai, Ashoro, 24. vii. 1967 (T. Saigusa); 1 ♂, Onpetsu (2 m alt.), Shiranuka, 31. vii. 1967 (T. Saigusa); 1 ♂, Aizankei (1,100 m alt.), Mts. Daisetsuzan, 19. vii. 1963 (A. Nakanishi); 1 ♂, Mt. Apoidake, Hidaka, 18. vii. 1967 (T. Saigusa); Hoheikyo, Sapporo, 18. vii. 1961 (A. Kato).

### ***Symmerus brevicornis yamatoensis* Saigusa, subsp. nov.**

In this subspecies, the apical portion of the wing is more produced than in subsp. *brevicornis*, with the costa beyond tip of  $R_1$  more gently curved than in *brevicornis* (Pl. 14, Fig. 38). In the ♂ genitalia, the outer wall of apical portion of gonostylus bears several short, thorn-like bristles and the hypandrium is strongly bent dorsally beyond the middle (Figs. 18-21).

*Type-locality*: Kanayama (1,400 m alt.), Sudama (Masutomi), Yamanashi Pref., Honshu, Japan.

*Geographical distribution*: This southern race of *brevicornis* is known from Central Honshu to Kyushu. The author did not examine the specimens from Kyushu, but the genitalia illustration of the male specimen from Mt. Hikosan given by Sasakawa (1963) apparently shows that the specimen is subspecifically almost identical with the specimens from the type-locality.

*Holotype*: ♂, Kanayama, 11. viii. 1961 (T. Saigusa).

*Paratypes*: [Honshu] 1 ♂, Kanayama, 11. viii. 1961 (T. Saigusa); 1 ♂, Kanayama, 25. vii. 1964 (F. Nakasuji); 1 ♀, Mt. Oginosen, Tottori Pref., 17. vii. 1962 (A. Nakanishi). [Kyushu] 1 ♀, Mt. Hikosan, Fukuoka Pref., 4. viii. 1951 (K. Yasumatsu).

### ***Symmerus elongatus* Saigusa, sp. nov.**

♂ (Pl. 8, Fig. 4). *Coloration*: Body dark brown with yellowish thoracic

pleura. Head dark brown, very thinly brownish pollinose, frons and mouth parts yellowish brown; antenna dark brown except basal 2 segments yellow. Mesoscutum shining dark brown, paler around sides of pronotum; pleurotergite mostly brown, otherwise thorax evenly yellow. Legs yellow, apical tarsomeres somewhat infuscated. Wing slightly tinged with yellowish brown, veins brown; halter brown with yellowish shaft and paler apex. Abdomen subshining dark brown, sterna yellow, posterior sterna infuscated. Genitalia dark brown, cerci yellowish white.

*Structure*: Vertex, occiput and face clothed with short black hairs; frons with a few minute hairs. Compound eyes widely separated from each other by nearly  $4 \times$  diameter of median ocellus on frons. Antenna (Pl. 12, Fig. 23)  $2 \times$  as long as thorax (95:50); flagellar segments strongly compressed laterally, but without a prominent ventrodiscal dentation, only in basal 6-7 segments distal margin slightly longer than basal margin; 5th flagellar segment almost as long as thick (7:6); final segment minute, about  $1/8 \times$  as long as penultimate segment. Maxillary palpus rather long, basal 3 segments almost subequal in length, but the 2nd slightly thicker and longer; the 4th elongate,  $2 \times$  as long as the 3rd; the 3rd without a dorsal concavity.

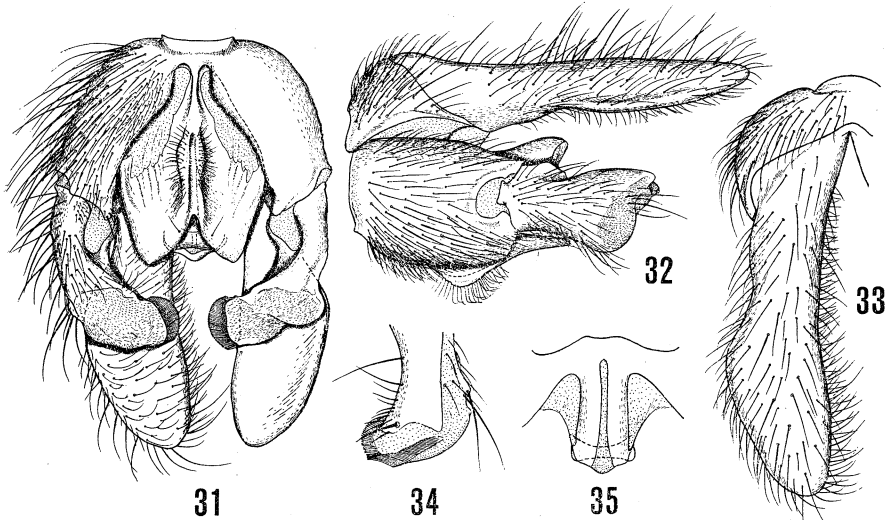
Table 4. Relative lengths of leg segments of *Symmerus elongatus* ♂.

	Femur	Tibia	Tarsus				
			1	2	3	4	5
Front leg	87	100	84	51	36	24	21
Middle leg	111	153	90	45	36	24	21
Hind leg	156	207	99	51	39	27	24

Postnotum hairy. Thorax clothed with longish black hairs. Relative lengths of leg segments as in Table 4. Wing as in Pl. 13, Fig. 34; moderately broad, its apical portion rather obtuse,  $R_4$  moderately long.

Abdomen much elongate, clothed with short black hairs. Genitalia (Figs. 31-35) rather large,  $1.5 \times$  as long as 7th abdominal tergum; epandrium transverse,  $1/4 \times$  as long as wide, its posterolateral portions considerably extended posteriorly; cercus large, lamellate, and much elongate, weakly constricted near the middle, its apical  $1/2$  gradually tapered to rounded apical margin; cercus rather sparsely haired; hypandrium an apically bilobate, large, broad sclerite, of which the basal portion is not pigmented, only the ventromedian portion connected with gonocoxites, the median portion raised as a blunt hairy keel, posterior margin of hypandrium exceeding tip of gonocoxites; gonostylus moderately large and almost evenly broad, curved inwards, its apical  $1/2$  broadly membranous and with a broad serrate band; dorsal phallosome rather broad, sclerotized portion separated

into 2 longitudinal stripes; phallic organ transverse, rectangular, without an internal rod.



Figs. 31-35. *Symmerus elongatus* Saigusa, sp. nov., ♂. 31: ♂ genitalia, most of setae of left side omitted, ventral aspect. 32: Same, lateral aspect. 33: Epandrium and left cercus, dorsal aspect. 34: Right gonostylus, dorsal aspect. 35: Dorsal phallosome and phallic organ, dorsal aspect.

Length: Body 6.1-6.4 mm; wing 5.6-5.8 mm.

*Type-locality*: Kitazawa Tōge (2,000 m alt.), Mt. Senjōdake, Akaishi Range, Yamanashi Pref., Honshu, Japan.

*Geographical distribution*: This species is known only from the sub-alpine conifer forest at the type-locality.

*Holotype*: ♂, Kitazawa-tōge, 25. vii. 1961 (T. Saigusa).

*Paratype*: [Honshu] 1 ♂, same data as holotype.

*Remarks*: This new species is easily distinguished from the known species by the combination of the following characters: the uniformly shining dark brown mesonotum, the haired postnotum, and peculiar hypandrium of the male genitalia.

### *Symmerus fuscicaudatus* Saigusa, sp. nov.

♂ (Pl. 9, Fig. 8, Pl. 10, Fig. 9). *Coloration*: Head yellowish brown, vertex broadly blackish brown; mouth parts yellowish brown, palpus somewhat infuscated; antenna dark brown, with basal 2 segments yellow. Thorax (Pl. 11, Fig. 18) brown; mesoscutum yellowish brown and subshining, with 3 broad blackish brown bands which are very narrowly separated from each other, and usually united with each other on posterior 1/2 of

mesoscutum; scutellum pale at sides; prothorax and pleural membranes yellow, borders of pleural sclerites of meso- and metathorax yellowish. Legs yellow, tibiae and tarsi slightly infuscated to greyish brown. Wing slightly infuscated, with brown veins; halter yellow. Abdomen rather dull, dark brown to blackish brown; posterior portion of terga and sterna, and anterior portions of 1st to 4th terga having a tendency to be pale; in the darkest specimens abdomen blackish brown, posterior margins of 1st to 4th and 7th terga, posterior 1/2 of all sterna yellow; in the most yellow specimens, posterior margins of 1st to 6th terga, anterior 1/3 of 1st to 4th terga, posterior 2/3 of 7th tergum, most of 1st to 4th sterna, posterior margins of 5th to 6th sterna, whole of 7th sternum yellow. Genitalia dark brown to blackish brown, cerci yellowish brown to dark yellowish brown.

*Structure*: Vertex, occiput and face clothed with short black hairs; frons with 2-3 minute setulae. Compound eyes much approximated to each other, separated by diameter of median ocellus. Antenna long,  $2 \times$  as long as thorax (107:50); flagellar segments strongly compressed laterally, basal 6-7 flagellar segments weakly produced at ventrodistal corner; basal 3 segments almost triangular in shape; 5th flagellar segment slightly longer than thick (7:6); final segment almost  $1/10 \times$  as long as penultimate segment. Maxillary palpus rather long, basal 3 segments almost subequal in length; the 2nd slightly thicker and without a dorsal concavity, the 4th elongate,  $1.5 \times$  as long as the 3rd.

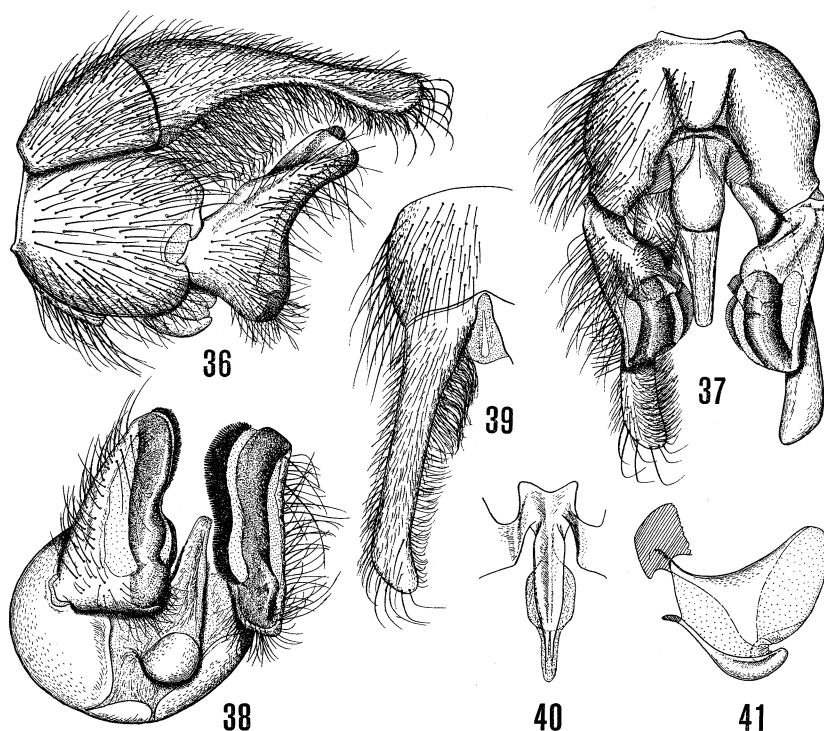
Thoracic hairs short and yellowish. Postnotum bare. Coxal hairs rather long and brown. Relative lengths of leg segments as in Table 5. Wing as in Pl. 13, Figs. 35, elongate, its apical portion produced,  $R_4$  moderately long.

Table 5. Relative lengths of leg segments of *Symmerus fuscicaudatus* ♂.

	Femur	Tibia	Tarsus				
			1	2	3	4	5
Front leg	82	100	78	45	33	21	15
Middle leg	102	153	81	45	33	22	18
Hind leg	138	192	93	51	39	24	18

Abdomen elongate, clothed with dark brown to black hairs. Genitalia (Figs. 36-41) large,  $1.5 \times$  as long as 7th abdominal tergum; epandrium moderately large, rectangular and  $1.2 \times$  as long as wide in dorsal aspect; cercus long, narrow and rather flattened, its basal portion broad, much tapered before the middle to the apex, cercus densely black-haired beneath, pile on basal portion long and curled apically, setae on apical margin stiff and weakly curved ventrally; hypandrium small and broadly connected with gonocoxites, its apical margin rounded and not exceeding tip of

gonocoxites; gonostylus nearly triangular in lateral aspect, its distal margin long and broadly membranous, and with an inner long serrate sclerotic band and an outer dark shagreen-like band; dorsal phallosome long and strongly compressed; phallic sclerite spoon-shaped, with a short internal rod.



Figs. 36-41. *Symmerus fuscicaudatus* Saigusa, sp. nov., ♂. 36: ♂ genitalia, lateral aspect. 37: Same, most of setae of left side omitted, ventral aspect. 38: Same, tergal elements omitted, obliquely posteroventral aspect. 39: Epandrium and left cercus, dorsal aspect. 40: Dorsal phallosome and phallic organ, dorsal aspect. 41: Same, lateral aspect.

Length: Body 6.0-7.6 mm; wing 6.3-7.2 mm.

♀ (Pl. 10, Fig. 10). *Coloration*: Extensively dark brown. Vertex blackish brown. Sides of pronotum, ventral portion of propleuron, pleural membranes yellow. Mesonotum and abdominal terga subshining. Legs dark brown to brown. Wing (Pl. 13, Fig. 36) more infuscated than in ♂, with dark brown veins; halter brown with shaft and extreme tip yellow.

*Structure*: Antenna (Pl. 12, Fig. 27) slightly shorter than in ♂, 1.6 × as long as thorax (50:31), apical flagellar segments thicker than in ♂, ventrodistal projections of basal flagellar segments weaker than in ♀ of

*brevicornis* Okada. Terminalia (Figs. 29-30): 8th abdominal sternum densely short-setose, with 3-4 spine-like bristles on each side of posterior margin, sockets of these bristles on the weakly undulate secondary margin; venter of 9th segment without a long invaginate process; 1st segment of cercus long and rather narrower than in *brevicornis*, 2nd segment circular.

Length: Body 6.6-7.4 mm; wing 6.7-7.1 mm.

*Type-locality*: Kitazawa-tôge (2,000 m alt.), Mt. Senjô-dake, Akaishi Mountains, Honshu, Japan.

*Geographical distribution*: This species is distributed in Hokkaido (deciduous forests of low mountains) and Central Honshu (deciduous forests of mountain region to conifer forests of subalpine region).

*Holotype*: ♂, Kitazawa-tôge, 8. viii. 1961 (T. Saigusa).

*Paratypes*: [Hokkaido] 1 ♂, Mt. Rausu-dake, Shari, 4. viii. 1967 (T. Saigusa); 1 ♂ 1 ♀, Mt. Soranuma-dake near Sapporo, 8. viii. 1962 (T. Saigusa); 1 ♂, Rubesu, Shibetsu, Nemuro, Hokkaido, 25-28. viii. 1971 (K. Yamagishi). [Honshu] 1 ♂, Kanayama (1,400 m alt.), Sudama (Masutomi), Yamanashi Pref., 12. viii. 1961 (T. Saigusa); 1 ♂, Karasawa (2,400 m alt.), Mt. Hodaka-dake, Hida Range, Honshu, 19. viii. 1963 (T. Saigusa); 1 ♂, Kitazawa-tôge (2,000 m alt.), 26. vii. 1961 (T. Saigusa); 1 ♂, Kitazawa-tôge, 27. vii. 1961 (T. Saigusa); 2 ♂♂ 1 ♀, same data as holotype; 6 ♂♂, Mt. Kiso-Komagatake (1,800 m alt.), Kiso Range, Honshu, 9. viii. 1963 (T. Saigusa).

*Remarks*: This new species closely resembles *S. coquilus* Garrett, 1925 from the Nearctic Region, but the new species is easily distinguished from the latter by the male cercus clothed with denser, longer pile.

### Ditomyia Winnertz

*Ditomyia* Winnertz, 1846, Stett. ent. Zeit. 7: 164. Type-species: *Ditomyia trifasciata* Winnertz, 1846 (mon.) = *Mycetobia fasciata* Meigen, 1818.

**Generic characters**: Vertex elevated; face naked or sparsely hairy. Compound eyes rounded and hemispherical, widely separated on frons. Ocelli 3 in number, placed in a transverse line, median one smaller than lateral ones. Antenna 2+15-segmented, flagellar segments cylindrical and pilose, possessing a few setae; final segment much smaller than penultimate segment. Maxillary palpus of 4 segments, 2nd segment long and thicker than the others, 4th segment rarely much reduced as in *fasciata*. Mouth parts short. Mesoscutum, scutellum, propleuron hairy, but meso-anepisternum and postnotum bare. Legs long, slender and short-haired, tibiae with short setae; tibial spurs well developed, formula 1:2:2. Wing covered with macrotrichia in addition to microtrichia on the whole surface; C ending at tip of R; Sc reduced to a short stump beyond humeral crossvein; R<sub>4</sub> much long, longer than stem of R<sub>4+5</sub>; forking point of R<sub>4+5</sub> usually proximad of that of M<sub>1+2</sub>; basal portion of Rs oblique to R<sub>1</sub>; r-m crossvein short, branches and stem of M<sub>1+2</sub> weak; M<sub>1</sub> and M<sub>2</sub> gradually divergent from

each other; 1A fine but complete to wing margin. Abdomen elongate, 1st to 7th segments long and visible externally, 8th very short and almost concealed by the 7th. Male genitalia in Japanese species not rotated; epandrium much reduced, cercus moderately large; hypandrium broadly fused with gonocoxites; gonostylus with an inner sclerotic plate having serrate margin. Female terminalia almost as in *Symmerus*.

**Geographical distribution:** Holarctic in distribution. Two species occur in Europe, one of which, *macroptera*, is also recorded from Saghalin; two species is known from the Nearctic Region. In this paper a new species is described from Japan.

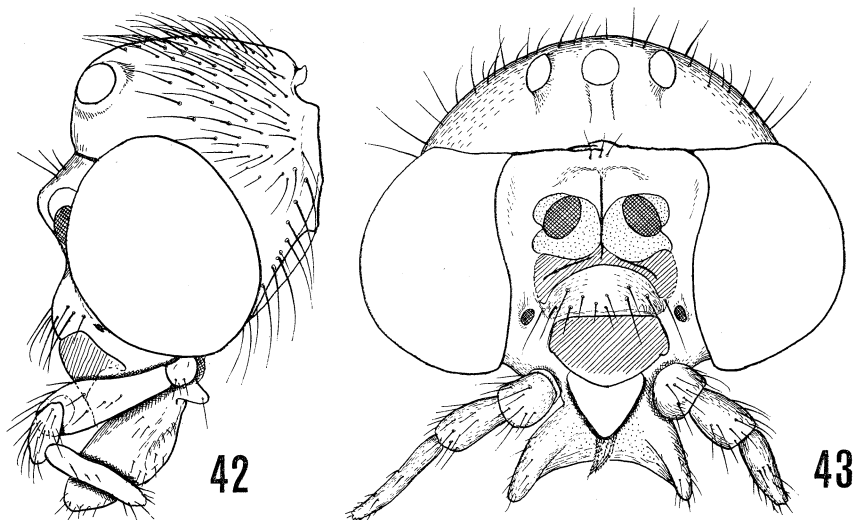
### *Ditomyia claripennis* Saigusa, sp. nov.

♂ (Pl. 10, Fig. 11). *Coloration:* Yellowish brown with dark brown markings. Head dark brown to blackish brown, densely greyish pollinose, frons yellowish brown, clypeus dark brown, mouth parts yellowish brown with brownish maxillary palpi; antenna blackish brown, basal 2 segments yellow. Thorax (Pl. 11, Fig. 19) yellowish brown, dull and only slightly shining; mesoscutum with a broad dark brown central band and a pair of oval blackish lateral bands, which are very narrowly and indistinctly separated from each other by a fine yellowish streak, anterolateral and lateral portions, and prescutellar area, broadly yellowish brown; prothorax entirely yellow, meso- and metapleura infuscated, ventral 1/2 of pleurotergite and postnotum except for yellowish lateral margins dark brown. Legs yellow, with black spurs; tibiae and tarsi slightly infuscated. Wing with a light yellowish brown tinge, veins pale brown; halter yellow, infuscated at middle 1/3. Abdomen subshining dark brown, posterior 1/3 of each tergum and sternum except 1st tergum yellow. Genitalia dark yellowish brown, apical portion of gonostylus shining black.

*Structure:* Vertex broad and elevated, clothed with short black hairs; frons with a few hairs; face with several longish hairs. Compound eye minutely pilose, rounded, hemispherical, its anterodorsal portion angulate (Figs. 42-43). Antenna (Pl. 12, Figs. 28 & 30)  $1.8 \times$  as long as thorax, flagellar segments cylindrical, with several black setulae most of which are arranged in a circle beyond the middle of segment; final segment  $1/2 \times$  as long as penultimate segment. Maxillary palpus long, 1st segment small and almost fused with palpifer, 2nd segment long, more or less flattened and dilated apically, 3rd segment shorter than 1/2 of the 2nd, 4th segment cylindrical, slightly shorter than 2nd segment. Labella short but prominent.

Pronotum with a stiff bristle at each side. Mesoscutum clothed with yellowish brown hairs and bristles, the latter scattered at sides and arranged in a pair of subdorsal rows. Relative lengths of leg segments as in Table 6. Wing as in Pl. 14 Fig. 42;  $3 \times$  as long as wide, basal 1/4 almost free from macrotrichia;  $R_4$   $2 \times$  as long as apical section of  $R_{4+5}$ ; r-m crossvein

at the middle of wing; forking point of  $R_4$  and  $R_5$  slightly proximad of that of  $M_1$  and  $M_2$ .

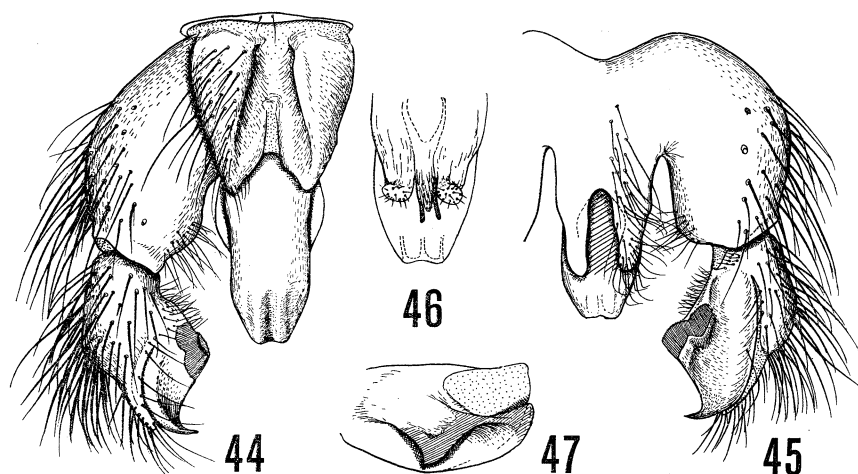


Figs. 42-43. *Ditomyia claripennis* Saigusa, sp. nov., ♂. 42: Head, lateral aspect. 43: Same, frontal aspect.

Table 6. Relative lengths of leg segments of *Ditomyia claripennis* ♂.

	Femur	Tibia	Tarsus				
			1	2	3	4	5
Front leg	60	100	81	42	30	21	15
Middle leg	78	129	69	33	23	20	15
Hind leg	96	156	81	33	27	20	15

Abdomen elongate, clothed with fine yellowish brown hairs. Genitalia (Figs. 44-47) small,  $1.2 \times$  as long as 7th abdominal tergum; epandrium reduced to a slender transverse band bearing a pair of setulae at dorsomedian portion; cercus triangular in shape, more or less elongate; hypandrium broadly fused with gonocoxites, its apical portion produced into a pair of long processes; gonocoxite extending caudad of cercus; gonostylus weakly curved inwardly and possessing an inner sclerite which is sharply pointed apically in dorsal aspect, and has a semicircular serrate band; dorsal phallosome a moderately broad elongate sclerite concealing the phallic organ; the latter consisting of a median process and a pair of fine lateral processes surrounded by a pair of apically setulose paramere-like lobes.



Figs. 44-47. *Ditomyia claripennis* Saigusa, sp. nov., ♂. 44: ♂ genitalia, right gonopod omitted, dorsal aspect. 45: Same, ventral aspect. 46: Dorsal phallosome and phallic organ, ventral aspect, magnification different. 47: Right hand gonostylus, inner aspect.

Length: Body 5.0-5.7 mm; wing 6.2-6.9 mm.

♀ (Pl. 10, Fig. 12). *Coloration*: Almost as in ♂, but yellowish portion of abdominal tergum broader, abdominal sterna entirely yellow to light yellowish brown. *Structure*: Almost as in ♂; 8th abdominal sternum with 4-5 stiff setae on each lateral portion of its weakly undulate posterior margin; basal segment of cercus 1.7 × as long as wide, evenly widening apically, apical segment of cercus almost circular, its diameter only slightly less than width of the basal segment.

Length: Body 6.0 mm; wing 6.3 mm.

*Type-locality*: Aizankei (1,100 m alt.), Mts. Daisetsuzan, Hokkaido, Japan.

*Geographical distribution*. This species is known only from the mixed conifer and broad-leaved forests of subalpine region of the type-locality.

*Holotype*: ♂, Aizankei, 10. vii. 1967 (T. Saigusa).

*Paratypes*: [Hokkaido] 1♂1♀, Aizankei, 18. vii. 1962 (T. Saigusa).

*Remarks*: This new species resembles *D. macroptera* Winnertz, 1852 from Central Europe and Saghalin in the hyaline wing without any markings, but the new species may be distinguished from the latter by the different thoracic markings and the longer and more slender second segment of the maxillary palpus.

### *Asioditomyia* Saigusa, gen. nov.

*Generic characters*: Very similar to *Ditomyia*. Head small, more or

less flattened; vertex much elevated and compound eyes placed on ventral  $1/2$  of head. Transverse suture connecting compound eyes on frons disappearing; a short dorsomedian suture running from median ocellus to middle of frons. Vertex and occiput hairy, frons and face bare. Ocelli 3 in number, placed in a transverse line, median one smaller than lateral ones. Compound eye rounded and hemispherical. Antenna moderately long, 2+15-segmented; flagellar segments weakly compressed, each with several setulae arranged in a circle at the middle of segment; last segment small, about  $1/2 \times$  as long as penultimate segment. Maxillary palpus represented by a small globose segment bearing a few setulae. Labella rather small. Thorax very hump-backed, almost as high as long. Pronotum with a seta at each side; upper portion of pro-episternum with a vertical row of a few setae. Mesoscutum setose, with stiff bristles at sides and in a pair of subdorsal rows; meso-anepesternum and postnotum bare. Legs long and slender, tibiae with several fine bristles, tibial spurs well developed, formula 1:2:2. Wing almost as in *Ditomyia*, densely covered with macrotrichia in addition to microtrichia; C a little exceeding tip of  $R_5$ ; Sc represented by a short stump beyond humeral crossvein; basal section of Rs oblique to  $R_1$ ;  $R_4$  long, nearly  $2 \times$  as long as apical section of Rs; forking point of  $R_4$  and  $R_5$  proximad of that of  $M_1$  and  $M_2$ ; r-m crossvein absent, so stems of R-fork and M-fork emitted from a point; 1A fine and complete to wing margin. Abdomen elongate, 1st to 7th segments visible externally, 8th concealed by 7th segment. Male genitalia: Epandrium rectangular and bare; hypandrium and gonocoxites fused and forming coxosternum; cercus almost as in *Ditomyia*; gonostylus large and elongate triangular in shape, and with a long serrate band along its inner margin. Female terminalia resembling those of *Ditomyia*.

Type-species: *Ditomyia japonica* Sasakawa, 1963.

**Phylogenetic relationships:** The genus *Asioditomyia* is morphologically most similar to *Ditomyia* in the structure of antenna, rounded compound eyes, thoracic chaetotaxy and elongate  $R_4$ , and it has no close relationship to *Symmerus* and the *Australosymmerus*-group. *Asioditomyia*, however, is apparently much advanced from *Ditomyia* in the following characters: labial palpus reduced to only one segment, while it is represented by 4 segments in *Ditomyia*, a plesiomorphic character of the Ditomyiinae; no transverse suture between compound eyes on frons, this suture well developed both in *Ditomyia* and *Symmerus*; stem of R-fork and M-fork are emitted from a point in *Asioditomyia*, but these stems are usually distinctly separated by the r-m crossvein in *Ditomyia*, *Symmerus* and the *Australosymmerus*-group; gonocoxites of the male genitalia are so completely fused with the hypandrium that no independent element of the hypandrium can be recognized. On the other hand, the genus *Asioditomyia* retains the well developed epandrium of the male genitalia which is much reduced at least in the Japanese *Ditomyia claripennis* Saigusa.

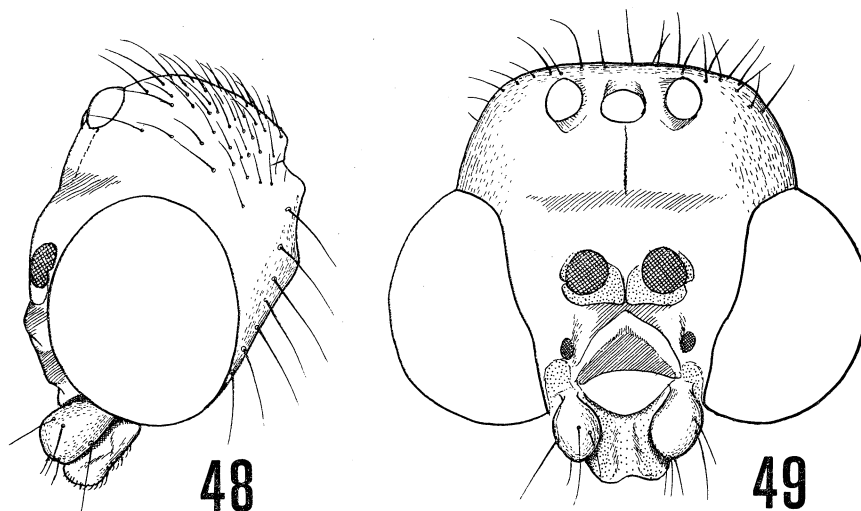
**Geographical distribution:** This genus contains the type-species, *japonica*, distributed in Honshu and Kyushu of Japan and an undescribed species in Central Nepal which very much resembles the Japanese species.

***Asioditomyia japonica* (Sasakawa, 1963), comb. nov.**

*Ditomyia japonica* Sasakawa, 1963, Akitsu 11: 16 (Type-locality: Mt. Odaigahara, Nara Pref., Honshu, Japan).

♂ (Pl. 11, Fig. 13). **Coloration:** Head yellowish brown and greyish pollinose; ocellar triangle blackish brown, frons and clypeus dark brown; antenna dark brown except for basal 2 segments yellow; mouth parts, including palpus, yellow. Thorax (Pl. 11, Fig. 20) dull yellow to yellowish brown; prothorax with 3 brown portions on each side at the levels of humerus, the middle, and ventral margin of pleuron; mesoscutum with M-shaped dark brown marking and a narrow infuscation at its extreme front, scutellum and postnotum dark brown except for dark dorsolateral portions of the latter; meso- and metathoracic pleura with broad subdorsal and ventral dark brown stripes which are connected by an entirely dark brown pleurotergite. Legs yellow, tips of all coxae and extreme base of front coxa dark brown. Wing considerably infuscated, with dark brown veins; halter yellow. Abdomen dark brown on terga, yellow on sterna, terga only slightly shining, and each with yellow band on anterior 1/4. Genitalia dark brown, inner edge of gonostylus black.

**Structure:** Vertex and occiput clothed with black hairs; compound eyes hemispherical,  $2/3 \times$  as deep as head, very widely separated from



Figs. 48-49. *Asioditomyia japonica* (Sasakawa), ♂. 48: Head, lateral aspect. 49: Same, frontal aspect.

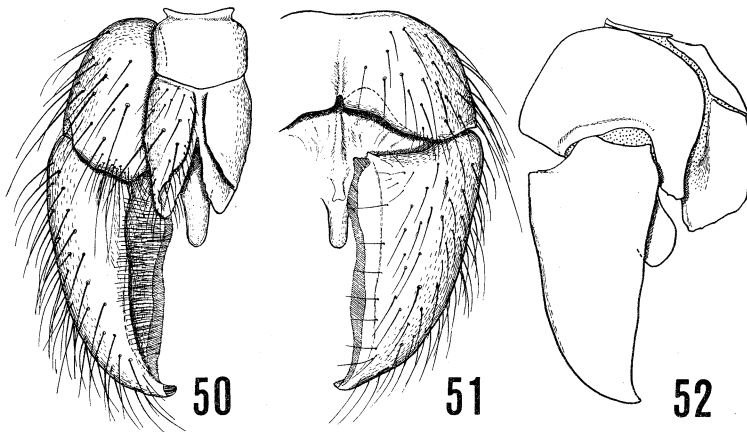
each other on face and frons; lateral ocelli large, median ocellus slightly smaller than the lateral ones (Figs. 48-49). Antenna (Pl. 12, Fig. 29)  $1.5 \times$  as long as thorax, flagellar segments weakly compressed laterally, basal segments almost as thick as long, 12nd to 14th segments somewhat longer than thick, last segment oval and  $1/2 \times$  as long as penultimate segment; 1st to 14th flagellar segments each with several erect black setae circularly arranged at middle of the segment. Maxillary palpus oval, almost as large as 1st antennal segment, and bearing several hairs.

Thorax strongly hump-backed; thoracic hairs and bristles black. Relative lengths of leg segments as in Table 7. Wing as in Pl. 14 Figs. 40 and 41, very broad,  $2.5 \times$  as long as wide, apex of united basal cells considerably proximad of the middle of wing.

Table 7. Relative lengths of leg segments of *Asioditomyia japonica* ♂.

	Femur	Tibia	Tarsus				
			1	2	3	4	5
Front leg	66	100	66	—	—	—	—
Middle leg	72	117	57	24	18	12	11
Hind leg	90	141	62	25	21	14	12

Abdomen elongate, clothed with short dark brown hairs. Genitalia (Figs. 50-52) moderately large,  $1.8 \times$  as long as 7th abdominal tergum; epandrium small, rectangular, quite bare; cercus well developed, its tip exceeding posteriorly beyond tip of gonocoxites; posterior surface of coxo-



Figs. 50-52. *Asioditomyia japonica* (Sasakawa), ♂. 50: ♂ genitalia, right hand gonopod omitted, dorsal aspect. 51: Same, ventral aspect. 52: Same, outline, lateral aspect.

sternum deeply excavated; gonostylus with outer margin evenly curved inwards, inner margin almost straight, the tip pointed, a long serrate sclerotic band situated on inner margin of gonostylus; dorsal phallosome strongly compressed laterally; phallic sclerite with a short internal rod.

Length: Body 4.1 mm; wing 4.3 mm.

♀ (Pl. 11, Fig. 14). *Coloration*: Almost as in ♂, abdomen more infuscated, cercus dark brown. *Structure*: Almost as in ♂; 8th sternum with 3 stiff setae on each side of its posterior margin, which is strongly emarginate between the setae; cercus with basal segment only slightly longer than wide, apical segment circular, its diameter subequal to width of basal segment.

Length: Body 4.0 mm; wing 4.9 mm.

*Geographical distribution*: This species is hitherto recorded from only the type-locality. It is now known from the deciduous forests of the mountain region of Central Honshu and Kyushu.

*Specimens examined*: [Honshu] 1♂, Kanayama (1,400 m alt.), Sudama (Masutomi), Yamanashi Pref., 7. vi. 1962 (T. Saigusa). [Kyushu] 1♀, Chôjbaru—Bôgazuru (ca. 1,200 m alt.), Mt. Kujûsan, Oita Pref., 13. vi. 1968 (T. Saigusa).

### Type depository

The type-specimens of the new species described in this paper are all preserved in the author's collection at the Biological Laboratory, College of General Education, Kyushu University, Fukuoka, Japan.

### Acknowledgements

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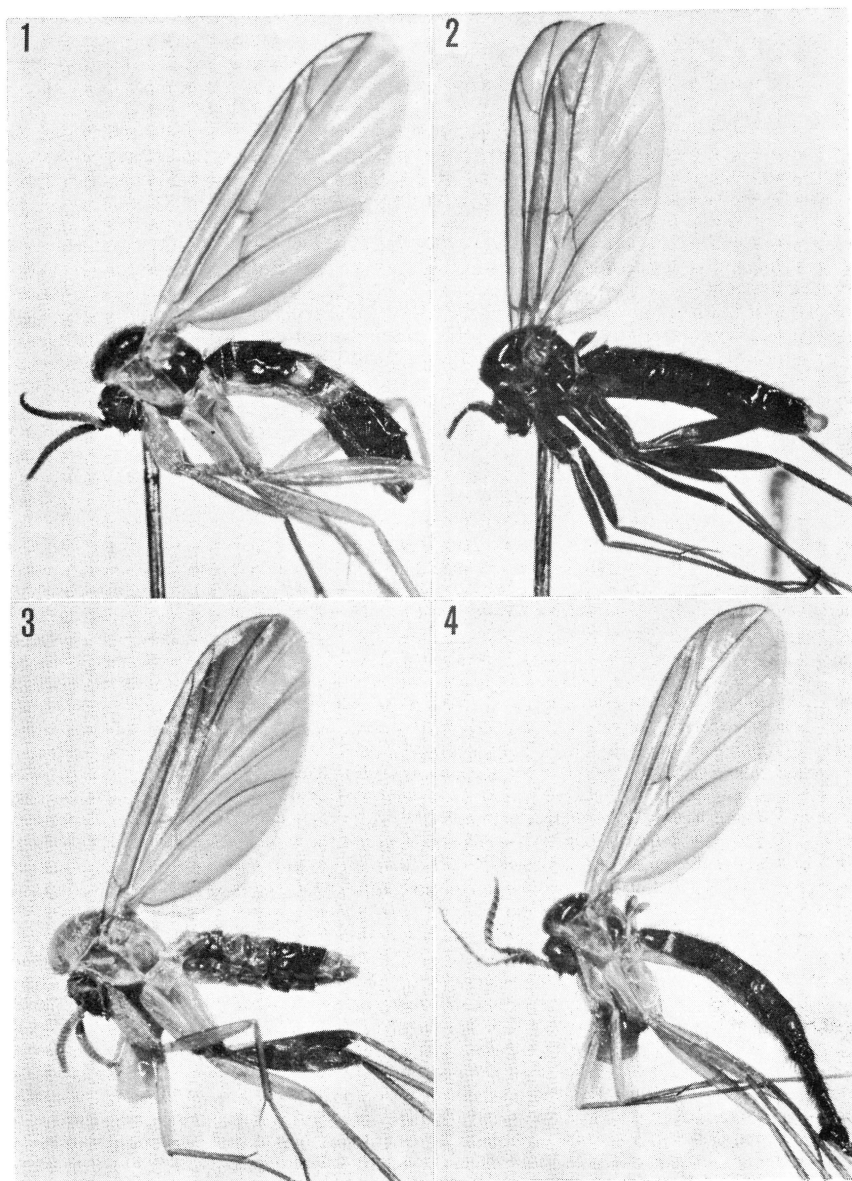
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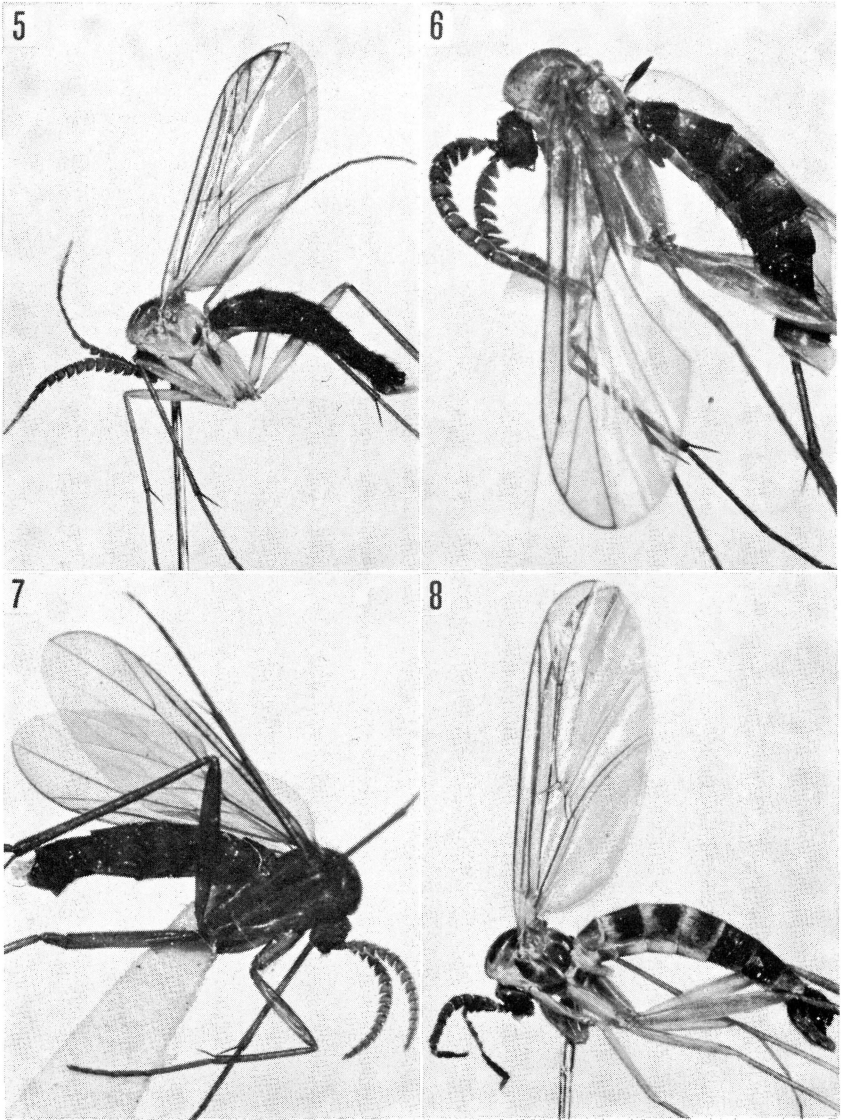
### Explanation of Plate 8

- Fig. 1. *Symmerus antennalis* Okada, ♂.
- Fig. 2. Ditto, ♀.
- Fig. 3. *Symmerus akikoeae* Saigusa, sp. nov., ♂ holotype.
- Fig. 4. *Symmerus elongatus* Saigusa, sp. nov., ♂ holotype.



### Explanation of Plate 9

- Fig. 5. *Symmerus brevicornis brevicornis* Okada, ♂.
- Fig. 6. *Symmerus brevicornis brevicornis* Okada, ♂, specimen with distinct abdominal bands.
- Fig. 7. *Symmerus brevicornis yamatoensis* Saigusa, subsp. nov., ♀.
- Fig. 8. *Symmerus fuscicaudatus* Saigusa, sp. nov., pale-coloured ♂.



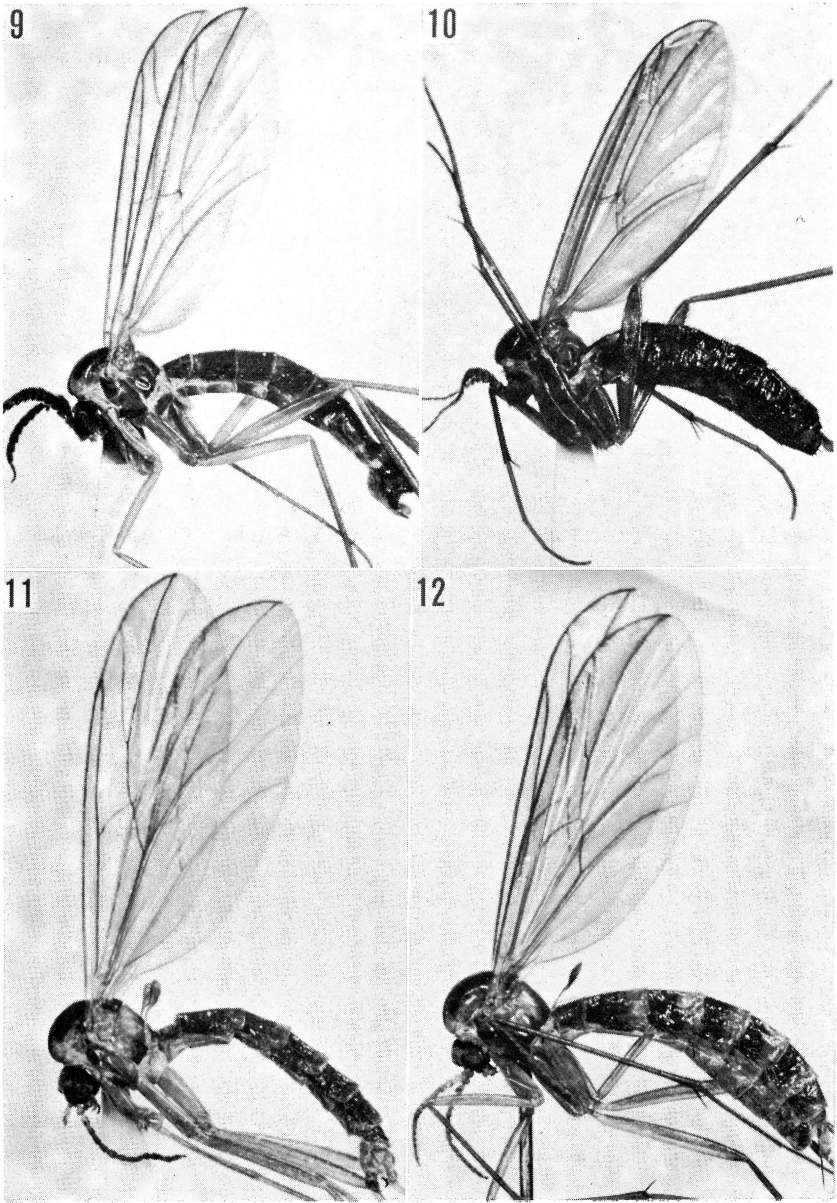
### Explanation of Plate 10

Fig. 9. *Symmerus fuscicaudatus* Saigusa, sp. nov., dark-coloured ♂.

Fig. 10. Ditto, ♀.

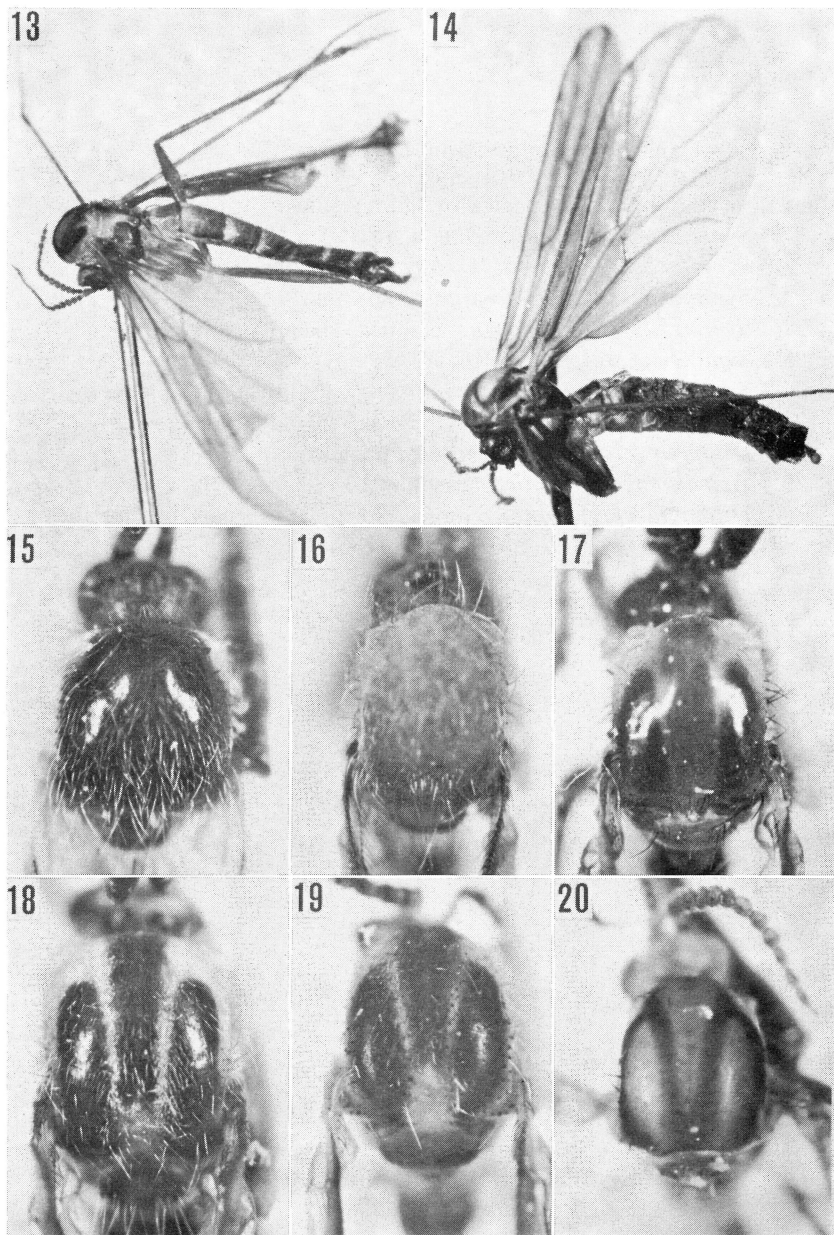
Fig. 11. *Ditomyia claripennis* Saigusa, sp. nov., ♂.

Fig. 12. Ditto, ♀.



### Explanation of Plate 11

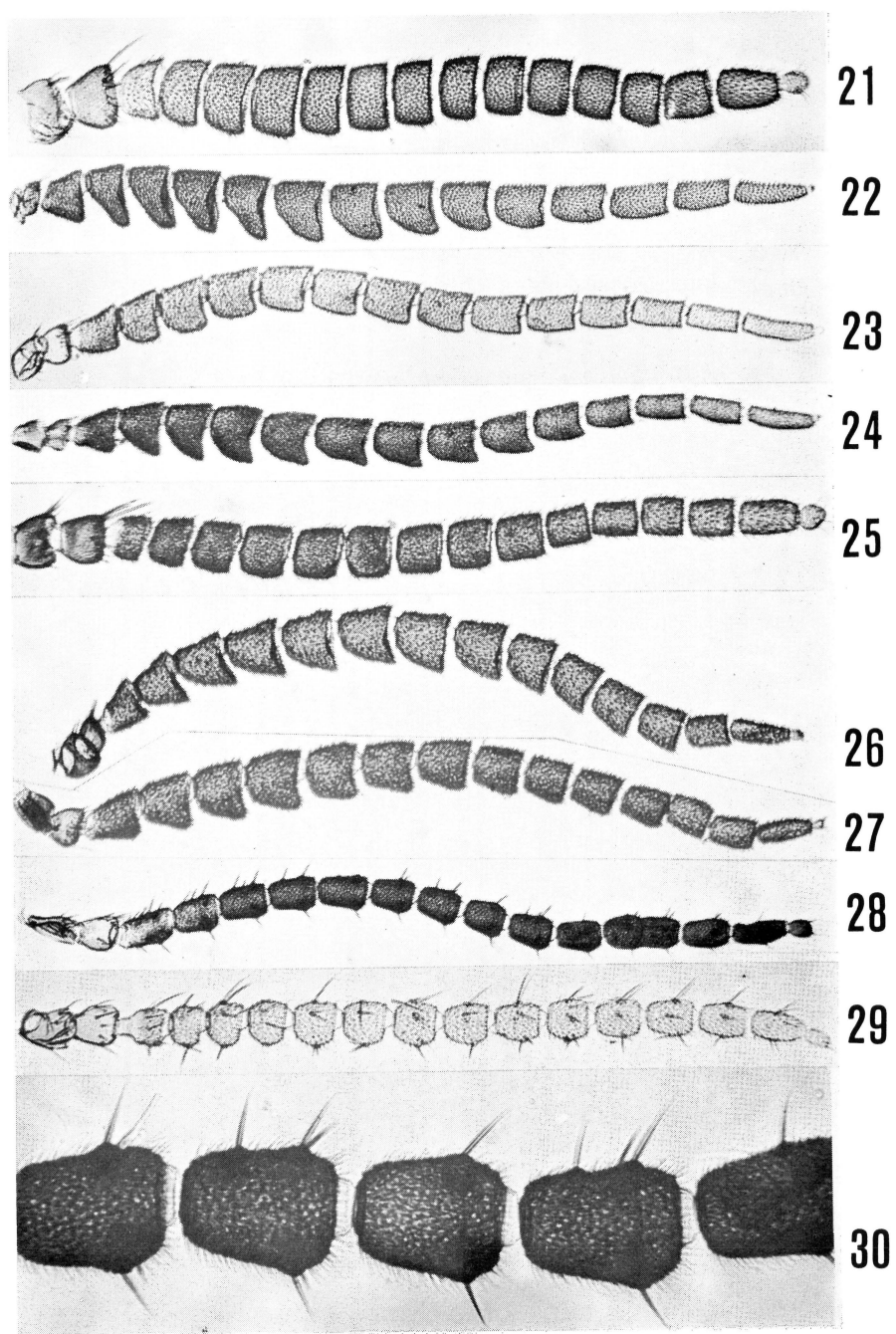
- Fig. 13. *Asioditomyia japonica* (Sasakawa), ♂.  
Fig. 14. Ditto, ♀.  
Figs. 15-20. Dorsal aspect of thorax.  
Fig. 15. *Symmerus antennalis* Okada, ♂.  
Fig. 16. *Symmerus akikoe* Saigusa, sp. nov., holotype ♂.  
Fig. 17. *Symmerus brevicornis yamatoensis* Saigusa, subsp. nov., ♂.  
Fig. 18. *Symmerus fuscicaudatus* Saigusa, sp. nov., ♂.  
Fig. 19. *Ditomyia claripennis* Saigusa, sp. nov., ♂.  
Fig. 20. *Asioditomyia japonica* (Sasakawa), ♂.



### Explanation of Plate 12

Antennae of the Japanese species of Ditomyiinae.

- Fig. 21. *Symmerus antennalis* Okada, ♂.
- Fig. 22. *Symmerus brevicornis brevicornis* Okada, ♂.
- Fig. 23. *Symmerus elongatus* Saigusa, sp. nov., ♂.
- Fig. 24. *Symmerus fuscicaudatus* Saigusa, sp. nov., ♂.
- Fig. 25. *Symmerus antennalis* Okada, ♀.
- Fig. 26. *Symmerus brevicornis yamatoensis* Saigusa, subsp. nov., ♀.
- Fig. 27. *Symmerus fuscicaudatus* Saigusa, sp. nov., ♀.
- Fig. 28. *Ditomyia claripennis* Saigusa, sp. nov., ♂.
- Fig. 29. *Asioditomyia japonica* (Sasakawa), ♂.
- Fig. 30. *Ditomyia claripennis* Saigusa, sp. nov., ♂, part of flagellum.



### Explanation of Plate 13

Wings of the Japanese species of Ditomyiinae.

Fig. 31. *Symmerus antennalis* Okada, ♂.

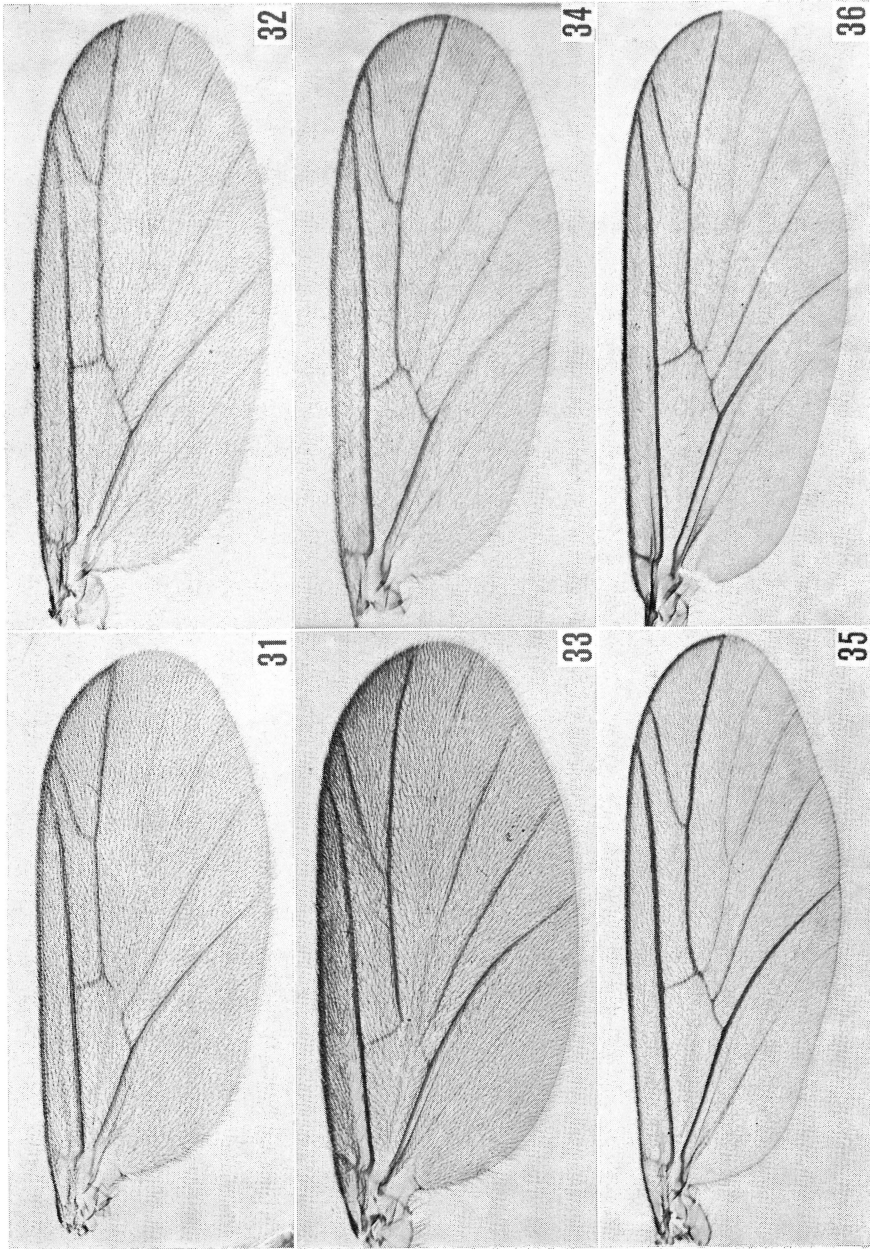
Fig. 32. Ditto, ♀.

Fig. 33. *Symmerus akikoe* Saigusa, sp. nov., holotype ♂.

Fig. 34. *Symmerus elongatus* Saigusa, sp. nov., ♂.

Fig. 35. *Symmerus fuscicaudatus* Saigusa, sp. nov., ♂.

Fig. 36. Ditto, ♀.



### Explanation of Plate 14

Wings of the Japanese species of Ditomyiinae.

Fig. 37. *Symmerus brevicornis brevicornis* Okada, ♂.

Fig. 38. *Symmerus brevicornis yamatoensis* Saigusa, subsp. nov., ♂.

Fig. 39. Ditto, ♀.

Fig. 40. *Asioditomyia japonica* (Sasakawa), ♂.

Fig. 41. Ditto.

Fig. 42. *Ditomyia claripennis* Saigusa, sp. nov., ♂.

