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CONTRIBUTIONS TO THE KNOWLEDGE OF JAPANESE EPHEMEROPTERA[1]

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TWO PLATES AND THIRTY-FOUR TEXT-FIGURES

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It is the aim of this paper to afford a description of certain hitherto undescribed stages of the already known Japanese species of mayflies and also to report on a new genus of a baëtine mayfly, *Baëtiella*. Here is given for the first time a description of the nymphs of both *Dipteromimus tipuliformis* MacLachlan and *Bleptus fasciatus* Eaton, the habitat of which is quite limited to Japan. At the same time, general revisions on some families and genera are added in connection with their occurrences, habits and geographical distribution in expectation that it may contribute to the knowledge of Japanese mayflies.

It is a pleasure as well as a duty to express my indebtedness to Mr. K. Imanishi of the Entomological Laboratory of our university, who not only cooperated with me in the field but also gave me much help in various ways. I am much obliged to Dr. Georg Ulmer of Hamburg (Germany) for the identification of certain old species.

Family : Polymitarcidæ Klapálek.
Genus : *Polymitarcis* Eaton 1868.
Polymitarcis shigæ Takahashi 1924.
Polymitarcis shigae Takahashi, Zool. Mag., Tôkyô, 36, 1924, p. 379, fig. 6.

This is the only species of this genus so far described from Japan. A yellowish white mayfly of smaller size. Eyes and ocelli black. Pro-

[1] A contribution from the Ôtsu Hydrobiological Station, Kyôto Imperial University.

notum brown, mesonotum light brown; metanotum yellowish brown. Fore-legs blackish brown, mid- and hind-legs yellowish. Wings hyaline, colourless, apical half of the costal and subcostal field yellowish amber-colour; veins richly developed, nearly colourless, only Sc and R sepia-brown as well as the basal $\frac{1}{3}$ of M_1. Abdominal segments yellowish white, somewhat translucent, except the brownish yellow tenth segment, each tergite with dark markings. Caudal setæ white. Length of body of ♂: 10 mm., expanse of wings 22 mm, caudal setæ 17 mm.

The life-histories and habits of Japanese *Polymitarcis* have not yet been cleared up. I have, however, specimens of several nymphs collected in the Kiso River at Fukushima, Prov. of Shinano, that are identical with *Polymitarcis*. The illustrations of this nymph are given

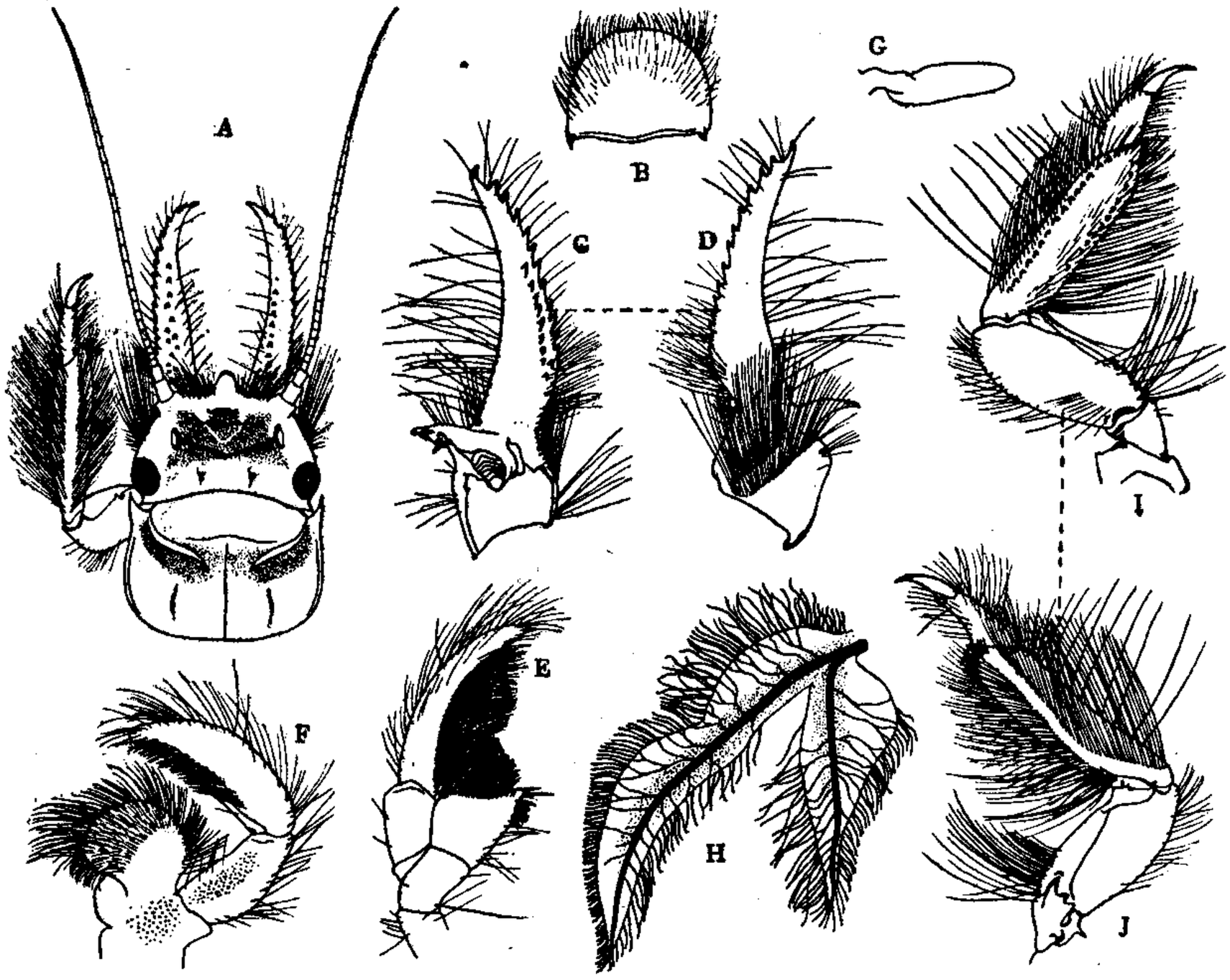


Fig. 1—*Polymitarcis* sp. (Nymph) *A*. head and pronotum, dorsal view. *B*. labrum. *C* and *D*. mandible. *E*. maxilla. *F*. labium. *G*. first gill. *H*. sixth gill. *I* and *J*. fore-leg.

in text-fig. 1. Length of body, 16.5 mm., antennæ 4.8 mm., median caudal seta 8.0 mm., outer setæ 5.0 mm.

Family : Ephemeridæ Klapálek.
Genus : *Ephemera* Linné 1746.

Under this genus there have been recorded eight species from Japan, namely : *E. sachalinensis* Matsumura, *E. japonica* MacLachlan, *E. lineata* Eaton, *E. orientalis* McLachlan, *E. strigata* Eaton, *E. formosana* Ulmer, *E. sauteri* Ulmer and *E. supposita* Eaton. Of these, the first-named species (Matsumura, Jour. Coll. Agr. Sapporo, 4, 1911, p. 9) has been recorded from Sachalin only ; the last-named three are the Formosan species. *E. japonica* and *E. lineata* are the commonest species, the latter of which has the widest range of distribution, spreading all over the Palæarctic region, from Europe and Siberia to Chôsen and Japan proper. Of four mayflies recently described by S. Matsumura (1931) as new species, namely : *E. iwatensis*, *E. jezonica*, *E. kuccharonis*, *E. koshunensis*, the last one is probably identical with either *E. formosana* or *E. supposita* judging by his short description and illustration.

The emergence of *Ephemera* in middle Japan occurs usually from May to June. In the suburbs of the city of Ôtsu that stands by the Lake Biwa, *E. lineata* is the commonest species and its annual swarming begins usually in the middle of May, continuing till the middle of September, when it appears in enormous numbers on the streets and gathers on glass windows.

Family : Potamanthidæ Klapálek.
Genus : *Potamanthodes* Ulmer 1919.

Potamanthodes formosus (Eaton) Ulmer, which has been recorded from Formosa, Cochinchina, Canton and Yunnan, was also collected from Japan (Ôtakisan, Prov. of Mimasaka), but I have never met with this species in middle and south-western Japan. *Potamanthus iyonis*, recently described by S. Matsumura (1931) from Iyo in Shikoku, seems to be identical with *Potamanthodes formosus*.

Family : Ecdyonuridæ Klapálek.

Under this family, we have six genera hitherto recorded, namely : *Epeorus* Eaton, *Iron* Eaton, *Bleptus* Eaton, *Heptagenia* Walsh, *Ecdyonurus* Eaton, and *Rithrogena* Eaton. S. Matsumura (1931) has recently described two new species under the genus *Cinygma* Eaton, but I have never met with any species from the middle and south-western Japan which can be identified with this genus. At the same time, he also proposed two new genera, *Cinygmoides* and *Kageronia*, with imperfect descriptions, the important generic characters of which are based upon the relative length of the joints of their legs. These characters are, however, often quite variable within a species or even in individuals as I already pointed out (Uéno, 1931). Judging by his descriptions and illustrations, the validity of these two genera is quite doubtful.

The distinction between *Epeorus* and *Iron* is a quite difficult matter when based upon their imagos only (cf. below, *E. latifolium* and Uéno 1931). Schoenemund (1930) is of the opinion that the validity of the existence of the genus *Iron* is very doubtful. It seems to me, however, that this hard problem may be solved by parallel examinations of imago and nymph. So far as my observation goes, Japanese *Epeorus* and *Iron* can easily be distinguished with their nymphs, even when it is impossible to draw a clear line between their imagos.

1. Genus : *Epeorus* Eaton 1881.

Epeorus latifolium Uéno 1928.

Epeorus latifolium Uéno, Mem. Coll. Sci., Kyôto Imp. Univ., Ser. B, 4, 1928, p. 34, Pl. VII, fig. 6, 6a-6o ; Horasawa, Kontyû, 3, 1929, p. 253.

Imago ♂. Head yellow-ochreous, eyes and ocelli black. Pronotum yellow-ochreous, marked with a pair of short blackish stripes convergent behined. Mesonotum whitish yellow, pleural region darker ; metanotum dark yellow-ochreous. Fore-legs pale whitish yellow, apical part of tibia dark brown, femur somewhat darker and marked with brown bands on the upper surface; mid- and hind-legs pale whitish yellow,

on upper surface of femur two dark band-like markings present. Fore-tibia (text-fig. 2, *A*) longer than femur; tersus $1\frac{3}{5}$ as long as tibia, the first joint of tarsus the longest, their joints rank 1-2-3-4-5, the tarsal claws differing in form one from another, one large and oblong, the other one smaller and hook-like (text-fig. 2, *B*). Hind-tibia (text-fig. 2, *C*) shoter than femur; the first joint of tarsus a little longer than the second, the length of joints rank 1-2-3-4, the fifth nearly as long as the first, claws dissimilar in form. Wings hyaline, quite colourless, veins fine, sepia-yellow to sepia-brown, cross veins much darker.

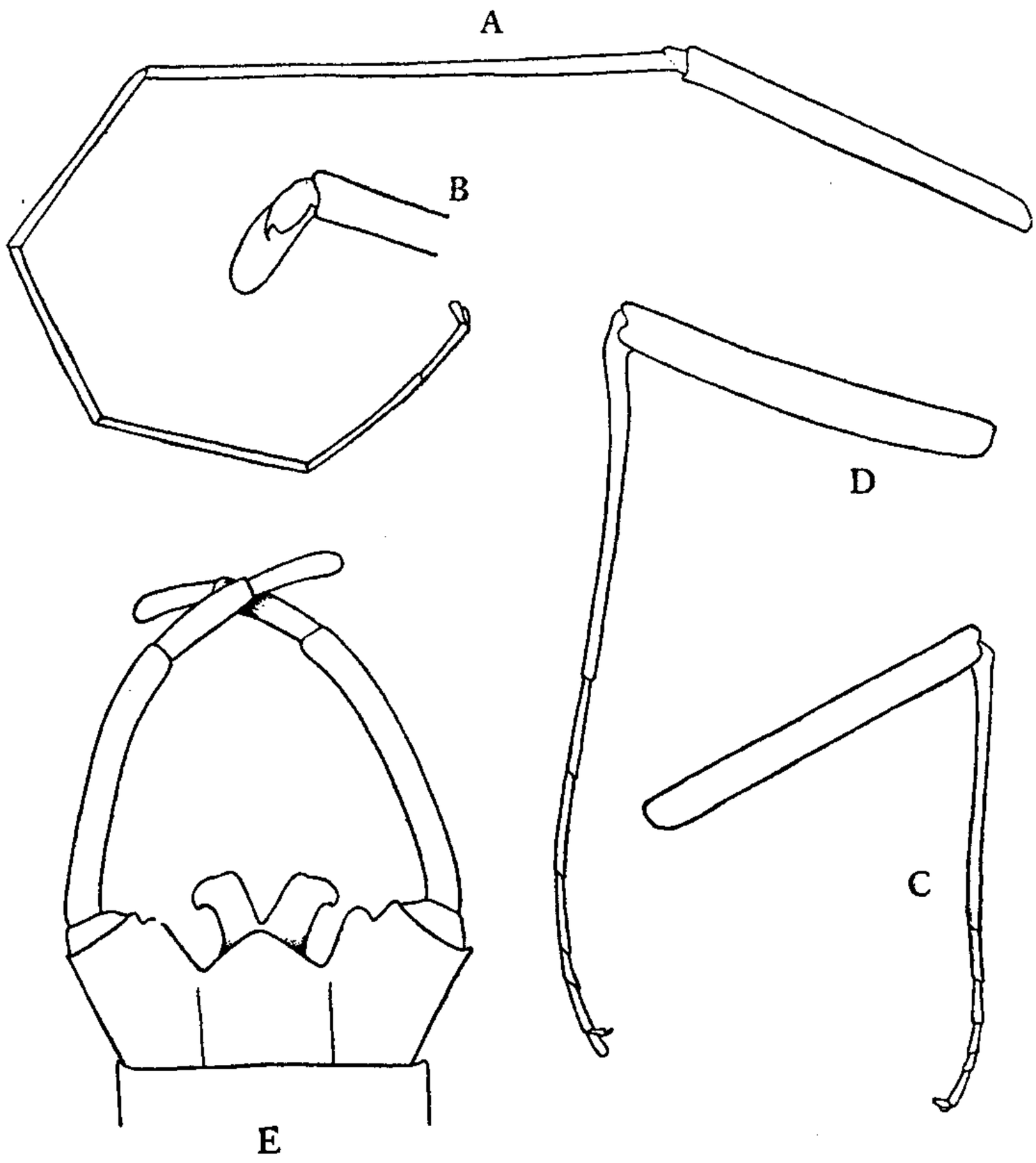


Fig. 2—*Epeorus latifolium* Uéno. (Imago). *A*. fore-leg of ♂. *B*. claws of the same. *C*. hind-leg of ♂. *D*. fore-leg of ♀. *E*. end of abdomen, ventral view.

Abdominal segments 3-7 yellowish translucent, 1-2 and 8-19 yellow-ochreous and not translucent; caudal setæ white, nearly 4-times as long as body. Hind margin of tenth sternite dilated to triangular prominence between the bases of forceps-limbs; inner side of each forceps with a bluntly-pointed expansion. Forceps-limbs (text-fig. 2, *E*) whitish yellow to white, 4-jointed, the last joint very short, the second long and slender, somewhat incurved, the last two joints combined a little shorter than the second. Penis-lobes deeply cut to the base, each lobe divergent outwards, the tips recurved downwards.

Imago ♀. General colouring as in ♂. Abdominal segments light brownish orange yellow, not translucent as in ♂; underside of abdomen pale yellow. Legs pale yellow, with brown markings; fore-tarsus (text-fig. 2, *D*) a little shorter than tibia and femur respectively, claws dissimilar.

	Body	Fore-wing	Expanse of wings	Caudal setæ
♂	9 mm.	11 mm.	23 mm.	33 mm.

It is noteworthy that the tarsal claws of the fore-legs of this species differ one from another as given above. Such a character is seen in the fore-legs of *Iron*, but in most species of *Epeorus* the claws are usually similar to one another. The nymph of *E. latifolium* has, however, evidently the characteristic structures of *Epeorus* as I have already described and illustrated.

The emergence in middle Japan occurs from May to June.

2. Genus: *Bleptus* Eaton 1885.

Bleptus fasciatus Eaton 1885.

Bleptus fasciatus Eaton, Rev. Monogr., Pt. 4, 1885, p. 243, Pl. LXV, fig. 1; Eaton, Entom. Month. Mag., 1892, Ser. 2, III, p. 303.

This species was first decribed from the male imago based upon a specimen which had been collected at Yagohara[2] in the later part of July. Eaton recorded also a female subimago in middle Japan. The hitherto-known distribution is limited to Japan only. As Mr. I. Horasawa (Tôkyô) recently succeeded in rearing the subimago from a

[2] This locality is unknown to me.

nymph which had been collected by him in a small brook on Mt. Takaoyama, west of Tôkyô, in the beginning of May, 1931, we have come to know its nymph. The description of this nymph from Kyôto is given below.

Nymph: Body robust, depressed, but not so flattened as in the nymphs of *Epeorus*, *Ecdyonurus* or *Heptagenia* (Pl. 12, fig. 1). Head large, widest across the eyes, flat, semicircular, front margin round, without fringes, hind angles slightly emerginate on the outside of eyes, surface with shallow dents in front of eyes; grayish olive brown to dark brown, leaving light median portion, a lighter space also present in front of each eye. Eyes black, lying on the dorsum of head, close to the hind margin; 3 ocelli; antennæ short, about $\frac{1}{2}$ as long as head, composed of about 15 joints, basal joint pale yellow, the remaining joints dark grey. Pronotum rather short, nearly as wide as head, slightly arched above, lateral margins round, hind angles produced backwards as seen in the nymphs of *Ecdyonurus*, dark brown, with indistinct markings; mesonotum dark brown to brownish gray, with indistinct dark markings, slightly arched above; underside of thorax pale gray.

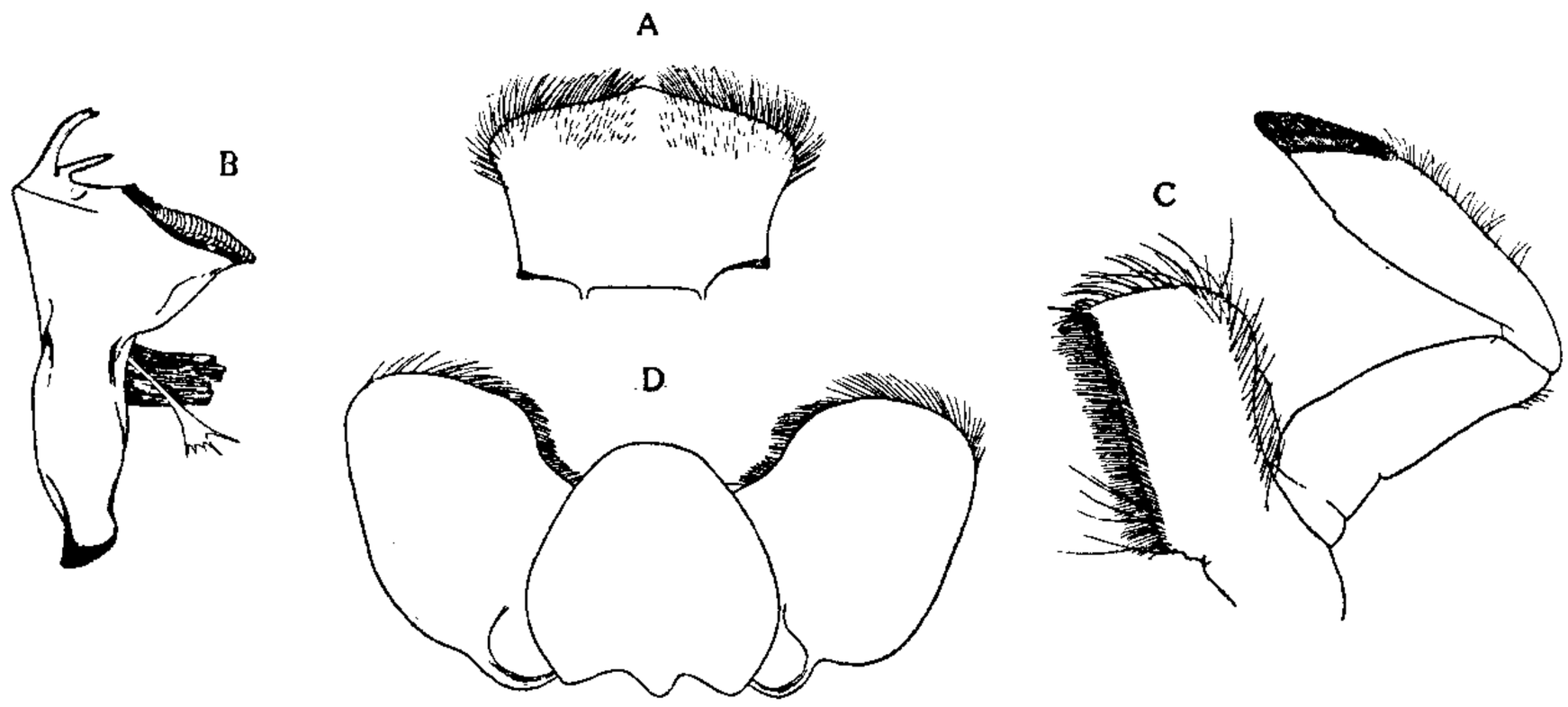


Fig. 3—Mouth-parts of a nymph of *Bleptus fasciatus* Eaton. *A*. labrum. *B*. mandible. *C*. maxilla. *D*. hypopharynx.

Mouth-parts (text-fig. 3, *A-D*) are allied in general to those of the other nymphs of Ecdyonuridae. Maxilla is like *Ecdyonurus*; lacinia broad, inner margin closely fringed; maxillary palpus 2-jointed. Labium

large and almost similar to that of *Epeorus*. Mandibles are also similar in form to those of *Ecdyonurus* or *Epeorus*, but their two canines long and slender, remote from each other. Labrum quadrangular, front margin wider than hind margin, front angles somewhat produced and rounded, front margin gradually emerginate at the middle, fringed with long hairs. Hypopharynx only is remarkably different from that of the other Ecdyonurid nymphs; outer lobes dilated in wing-like form and longer than median lobe, with close fringes on front margin; median lobe obovoid, front margin round and glabrous.

Legs rather short, stout, three pairs nearly similar in size, armed with loose spinules and without long fringes; femur robust, flattened dorso-ventrally, pale whitish yellow, with dark markings on the upper surface; tibiæ and tarsi short, pale yellow; claw pointed, armed with two short spines on inner concave margin near the tip.

Abdomen depressed, dark olive brown, with a pair of dark spots on both sides; each tergite armed on the hind margin with a short acute median spine directed behind; underside of abdomen pale gray, with a pair of brown longitudinal stripes close to the pleural regions. Caudal setæ 2, yellow, about $\frac{2}{3}$ as long as body. 7 pairs of gills

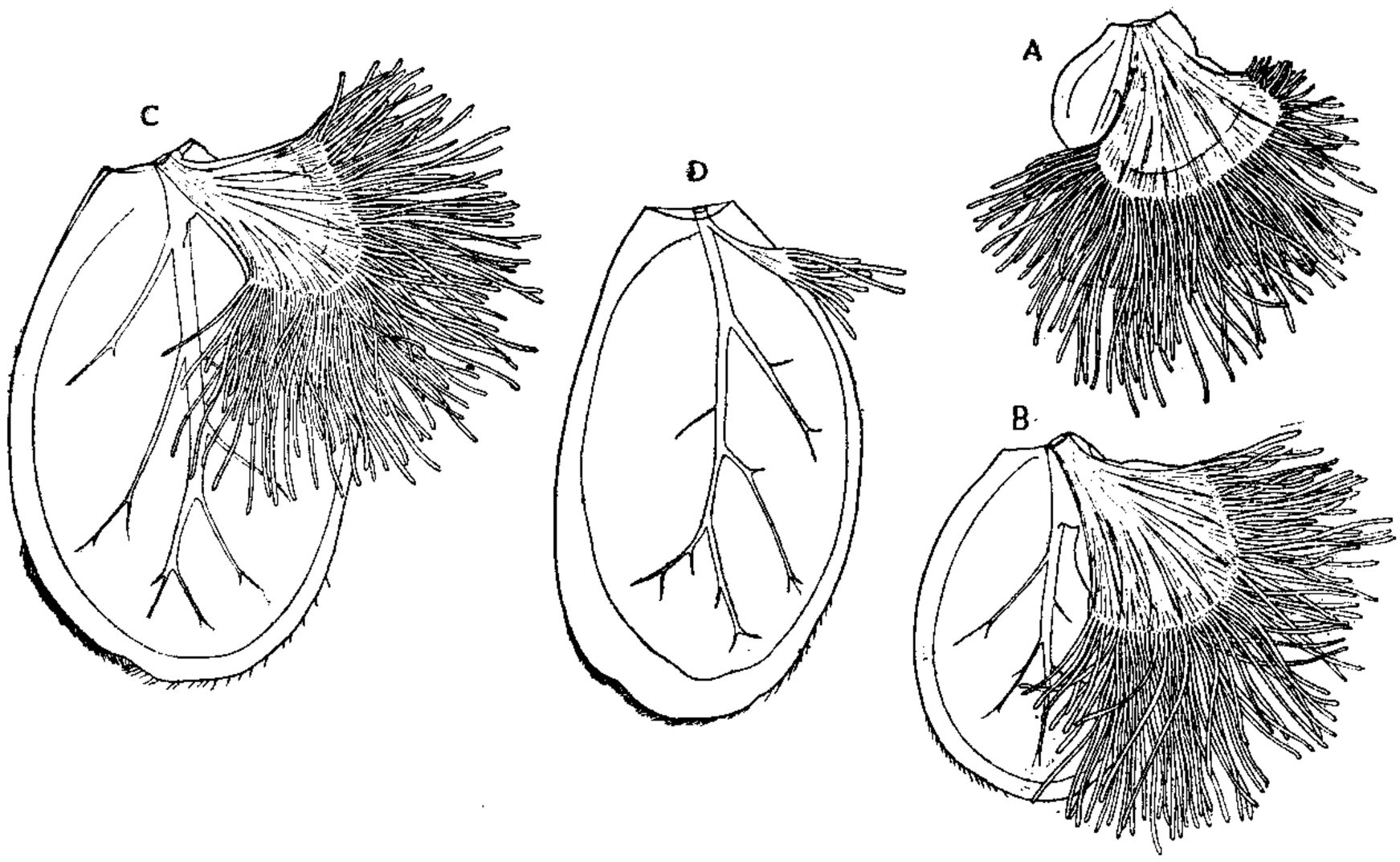


Fig. 4—Abdominal gills of a nymph of *Bleptus fasciatus* Eaton. *A*. 1st. *B*. 2nd. *C*. 3rd. *D*. 7th.

present on abdominal segments 1-7; the first pair of gills (text-fig. 4, *A*), lamella very small, somewhat ovate, grayish white, but tufts of filamentous purple gills well developed, their basal part longer than lamella, forming a flat plate of tufts. In second pair of gills (text-fig. 4, *B*), lamella becomes larger than the preceding pair, elliptical ovate, grayish white, the flattened part of filamentous gill-tufts extending slightly beyond the half of lamella. The lamellæ thus become larger in size in hinder pairs, but, on the contrary, the basal parts of filamentous gill-tufts become shorter and smaller in size and decrease in number of gill filaments. In the 7th its gill-tuft is composed of only 8 gill filaments, forming no basal plate-like part (text-fig. 4, *D*).

Body 15 mm., caudal setæ 10 mm. in a well-grown nymph.

This nymph is usually found in shallow and slowly-flowing brooks or in marginal regions of rapid streams. It is found usually on the underside of submerged stones in such stream, or is often seen scrambling up the wet surface of stones or rocks on the margin of streams, where it associates with other hygrophilous insects, e.g. perlid nymphs (*Peltoperla* sp.), trichopterous larvæ (*Psychomia*) and the larvæ and pupæ of dipterous midges (*Philorus vividis* Kitakami). They form the "Fauna hygropetrica" in the sense of A. Thienemann (1910).[3] In Kitayama, north of Kyôto, I have found it in the middle of June in a small brook under forests where it was associated with the nymph of *Dipteromimus tipuliformis* (cf. below).

3. Genus: *Ecdyonurus* (Eaton) Schoenemund 1930.

1. *Ecdyonurus japonicus* (Uéno) 1928.

Ecdyurus japonicus Uéno, Mem. Coll. Sci., Kyôto Imp. Univ., Ser. B, 4, 1928, p. 30, Pl. VI, fig. 5, 5a-5m.

Imago ♂. Head yellow, eyes and ocelli black. Pronotum yellowish brown, hinder part black. Mesonotum yellow, underside and pleural regions paler; metanotum yellow. Legs pale yellow, tibiæ und tarsi paler, apical end of each femur black; fore-legs somewhat darker; at the bases of fore- and hind-legs ,a small black dot, but in mid-leg 2 black dots present in front and behind of its coxa. Wings hyaline, iridescent, colourless, only in costal and subcostal area infuscated;

3 Thienemann, A., Ann. Biol. lacustre, 5. 1910, pp. 1-35.

veins fine, the venation is as shown in text-fig. 5 ; costal cross-veins simple, not anastomosed in the apical part, the basal part of C, Sc of fore-wing remarkably black.

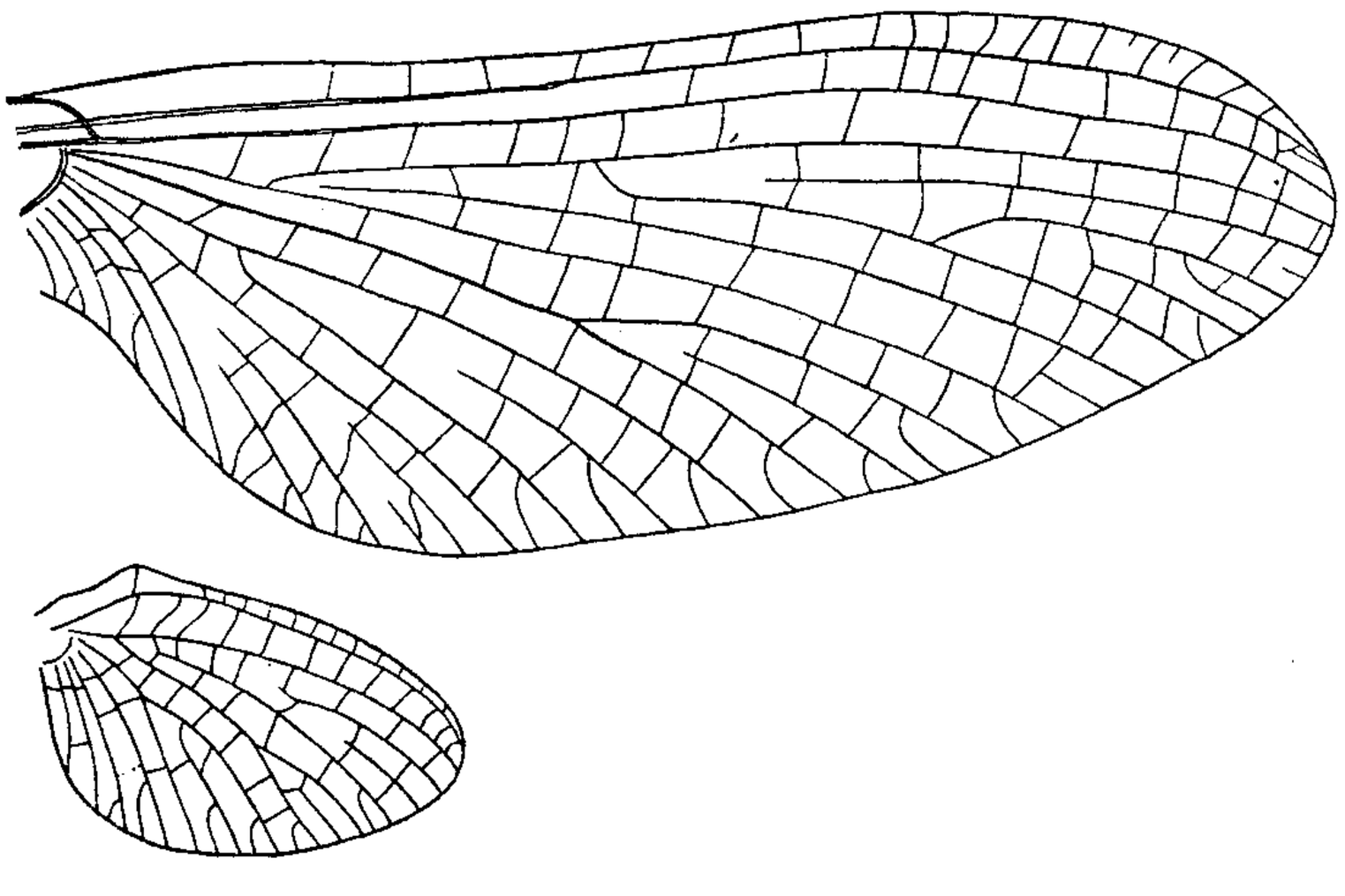


Fig. 5—Wings of *Ecdyonurus japonicus* (Uéno).

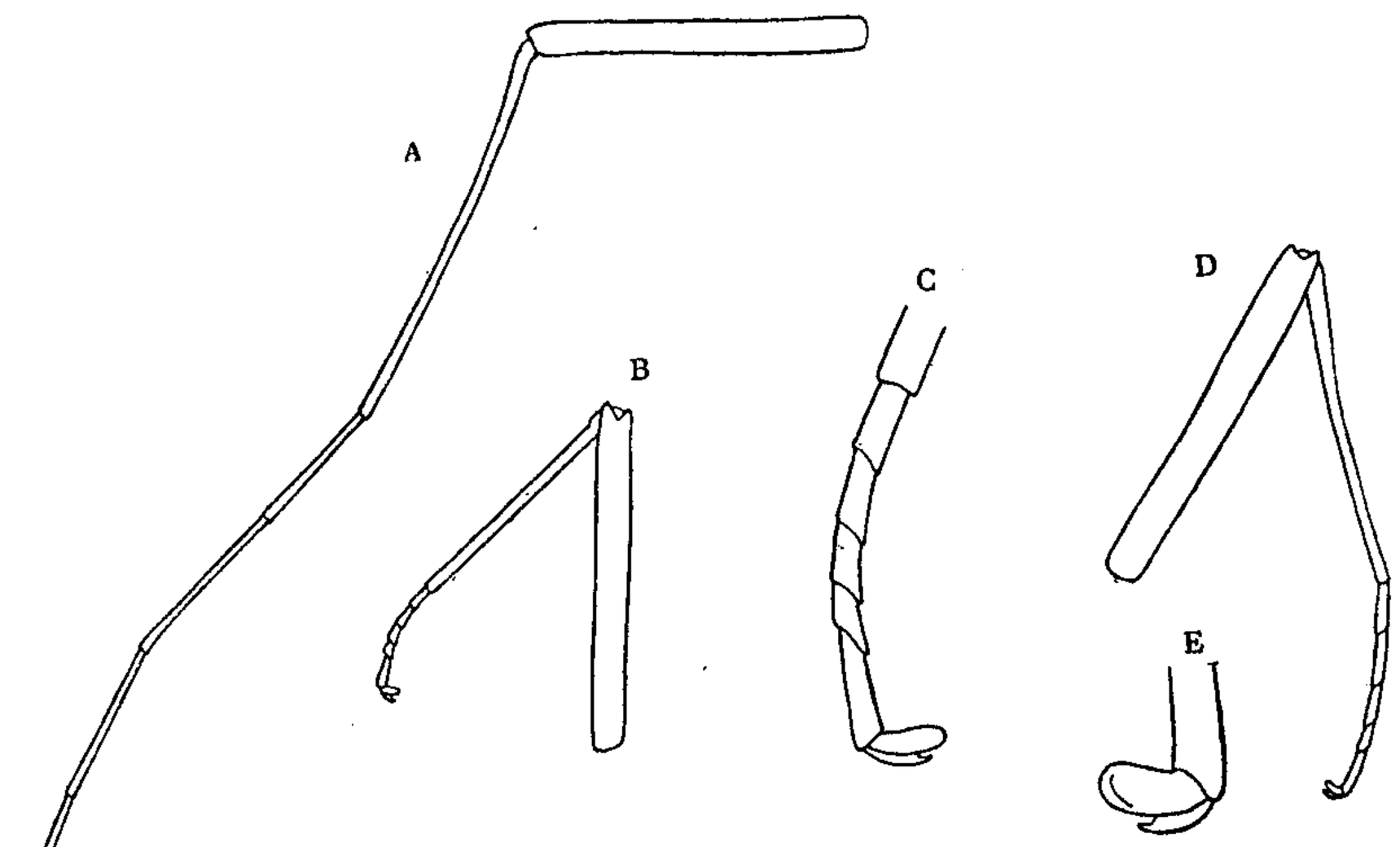


Fig. 6—Legs of *Ecdyonurus japonicus* (Uéno). *A.* fore-leg of ♂. *B.* hind-leg of ♂. *C.* hind-tarsus of ♂. *D.* fore-leg of ♀. *E.* claws of the same.

Fore-femur (text-fig. 6, *A*) $\frac{3}{4}$ as long as tibia, which is about $\frac{2}{3}$ as long as tarsus; the first joint of fore-tarsus shorter than the second, the length of joints rank 2-3-1-4-5, the fifth very short, about $\frac{1}{2}$ as long as the first, which is nearly $\frac{2}{3}$ as long as the second and this longer than the third; claws dissimilar. Hind-tibia (text-fig. 6, *B* and *C*) $\frac{2}{3}$ as long as femur, tarsus nearly $\frac{1}{2}$ as long as tibia, the first tarsal joint a little longer than the second, the fifth the longest, the length of joints rank 5-1-2-3-4; claws dissimilar.

The hind margin of tenth sternite remarkably divergent, somewhat arched between the bases of the forceps. Forceps-limbs (text-fig. 7) slender and elongated, 4-jointed, yellowish white, the basal joint short and wide, tapering to the size of the second joint, which is very long, somewhat incurved, tapering gradually distally, $2\frac{1}{2}$ times as long as the last two joints combined; the 4th joint the shortest. Penis-lobes white, widely separated, apex of each partially divided into two bluntly pointed processes and bears a large acute spine on the ventral surface near the base.

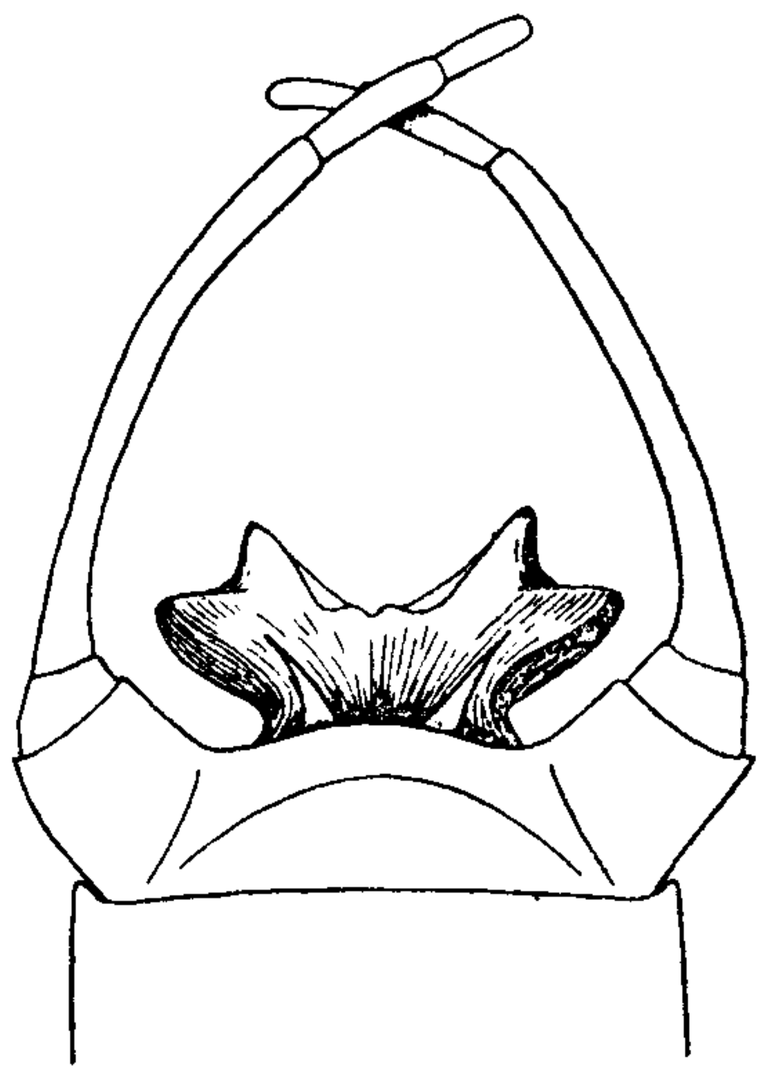


Fig. 7—*Ecdyonurus japonicus* (Uéno). End of abdomen of ♂ imago, ventral view.

Imago ♀. General colouring as in ♂. Abdominal segments yellow-ochreous, not translucent as in ♂, the dark markings on hinder portion of each tergite not so distinct as in ♂. Black dots present on the bases of legs as similar as in ♂.

	Body	Fore-wing	Caudal setæ
♂	9 mm.	11 mm.	26-27 mm.
♀	10.5 mm	12.5 mm.	22 mm.

This species is collected near mountain streams where its nymphs inhabit. The swarming in middle Japan takes place in the interval

from April to June. The nymph of this species can easily be distinguished by the presence of 4 small light spots along the front margin of the head before the eyes (Pl. 12, fig. 2). These spots are distinctly recognizable even in earlier stages.

2. *Ecdyonurus tobiironis* Takahashi 1929.

Ecdyonurus tobiironis Takahashi, Lansania, Tôkyô, 1, 1929, no. 5, p. 75.

Imago ♂. Blackish pitch-brown mayfly of medium size. Head dark brown, antennæ blackish brown, eyes gray, with blackish gray ring around the base; ocelli grayish white, its basal part black. Pronotum pitch brown; mesonotum pitch brown, pleural region pale; metanotum pitch brown; underside of thorax dark brown. Wings hyaline, somewhat amber-yellow, apical part of costal and subcostal area more darkly infuscated; veins sepia-brown, R, Sc and M pitch brown; cross-veins richly developed, costal cross-veins behind the bulla anastomosed in irregular network (text-fig. 8). Fore legs dark brown, femur marked with two black bands, one subapical and the other one at the middle. Femur of fore-leg a little longer than tibia, tarsus about twice as long

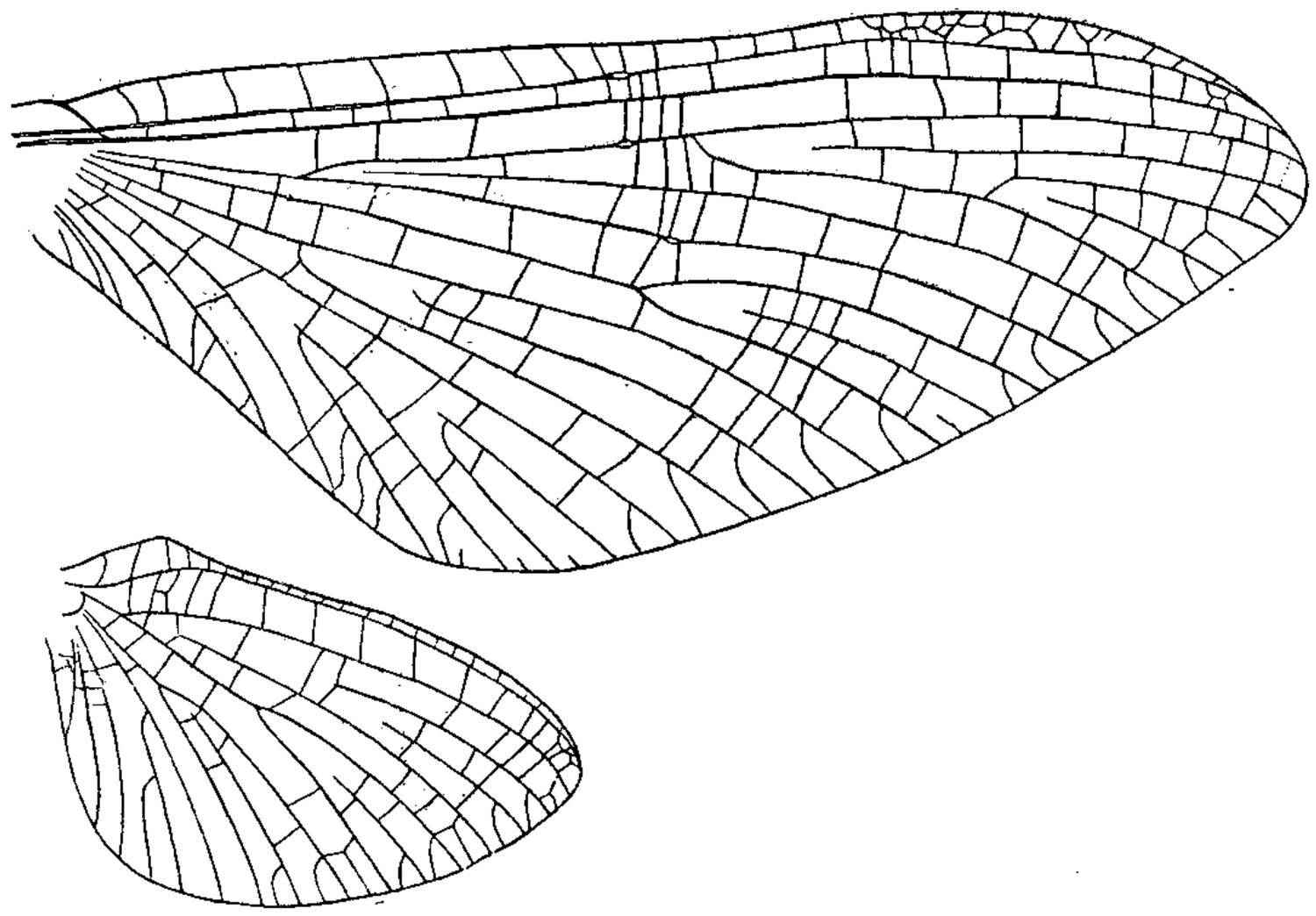


Fig. 8—Wings of *Ecdyonurus tobiironis* Takahashi.

as tibia, the first tarsal joint a little shorter than the second, the length of joints rank 2-3-1-4-5, claws dissimilar (text-fig 9, *A*). Hind-tibia $\frac{4}{5}$ as long as femur, tarsus about $\frac{1}{2}$ as long as tibia, the first tarsal joint longer than the second, joints rank 1-5-2-3-4, claws dissimilar (text-fig. 9, *B*). Mid- and hind-legs brown, the distal end of each femur darker, with a broad dark band-like marking at the middle portion.

Abdominal segments 1 and 2 brown-ochreous, 3 7 whitish translucent, hinder part of each tergite with dark brown marks, 8-10 not translucent as in the preceding tergites, 8 whitish yellow, 9 dark brown, 10 blackish pitch brown (text-fig. 10). Underside of abdominal

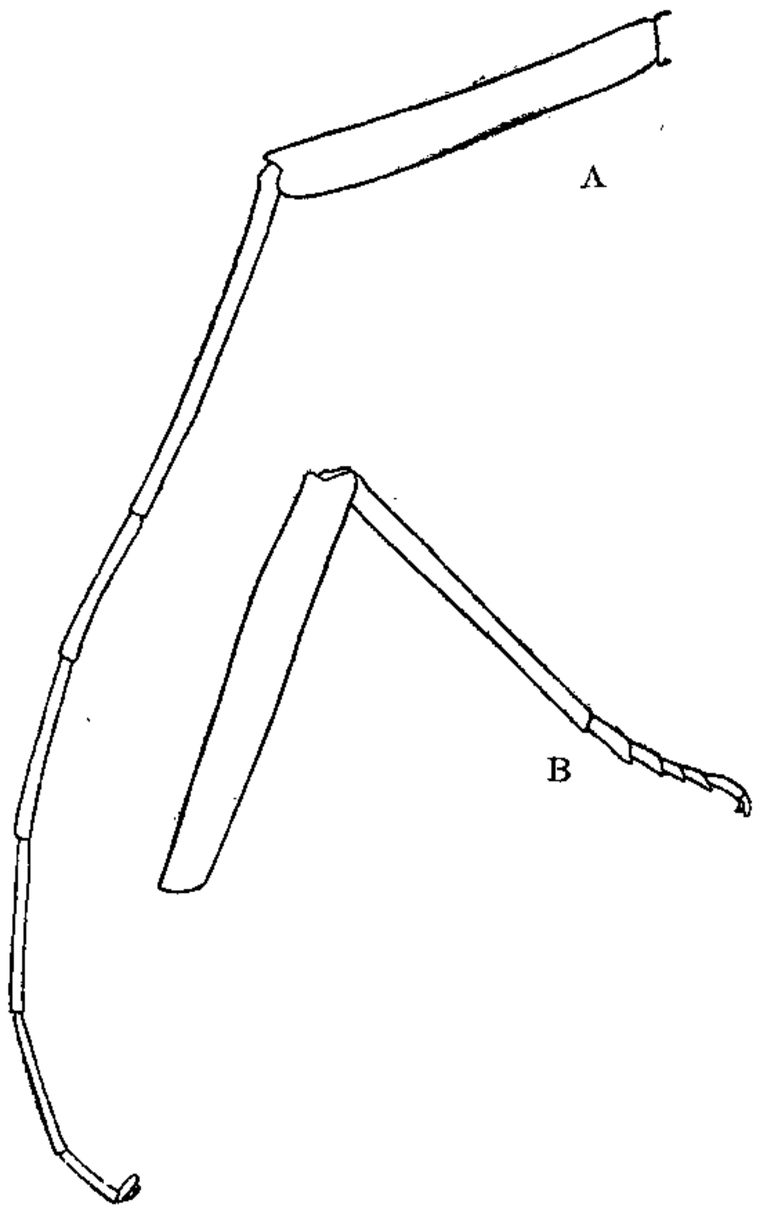


Fig. 9—*Ecdyonurus tobiironis* Takahashi. *A*. fore-leg of ♂ imago. *B*. hind-leg of ♂ imago.

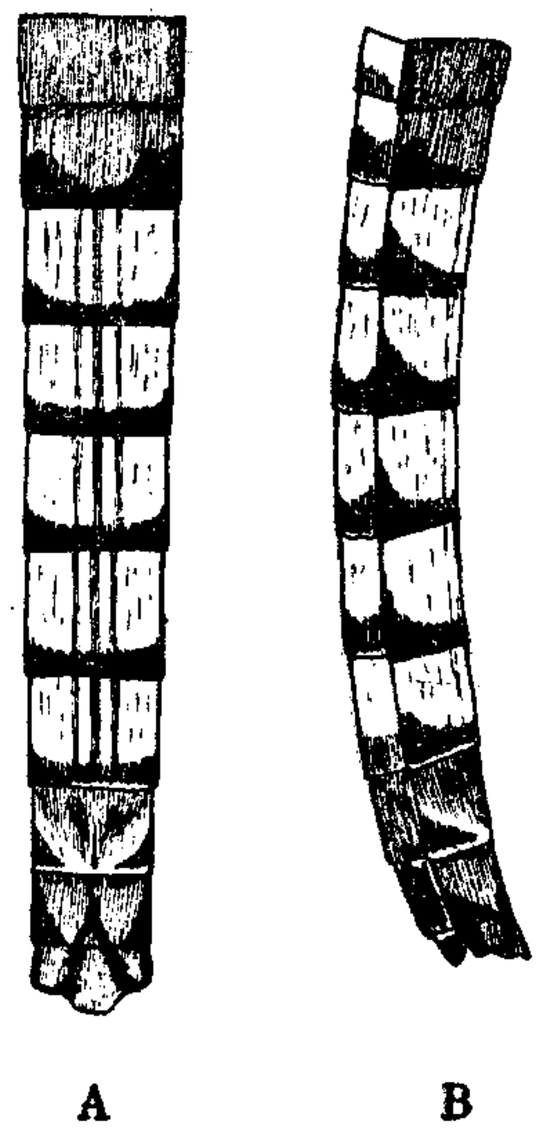


Fig. 10—*Ecdyonurus tobiironis* Takahashi. *A*. abdomen, dorsal view. *B*. the same, lateral view.

segments coloured as in dorsum, but somewhat paler, markings rather indistinct. Caudal setæ brown, joinings black. Hind margin of tenth sternite slightly arched between the bases of forceps. Forceps-limbs (text-fig. 11) long and slender, 4-jointed, basal joint very short, tapering to the size of the second joint, pitch brown; second joint about

$1\frac{2}{3}$ as long as the last two joints combined, nearly uniform diameter, brown, paler towards the end. Penis lobes (text-fig. 11) large, yellowish brown, separated, dilated in wing-like form, the inner margin curved outwards at the apex and bears an acute large blackish spine at the base, the tip of which reaches the level where the two lobes separate.

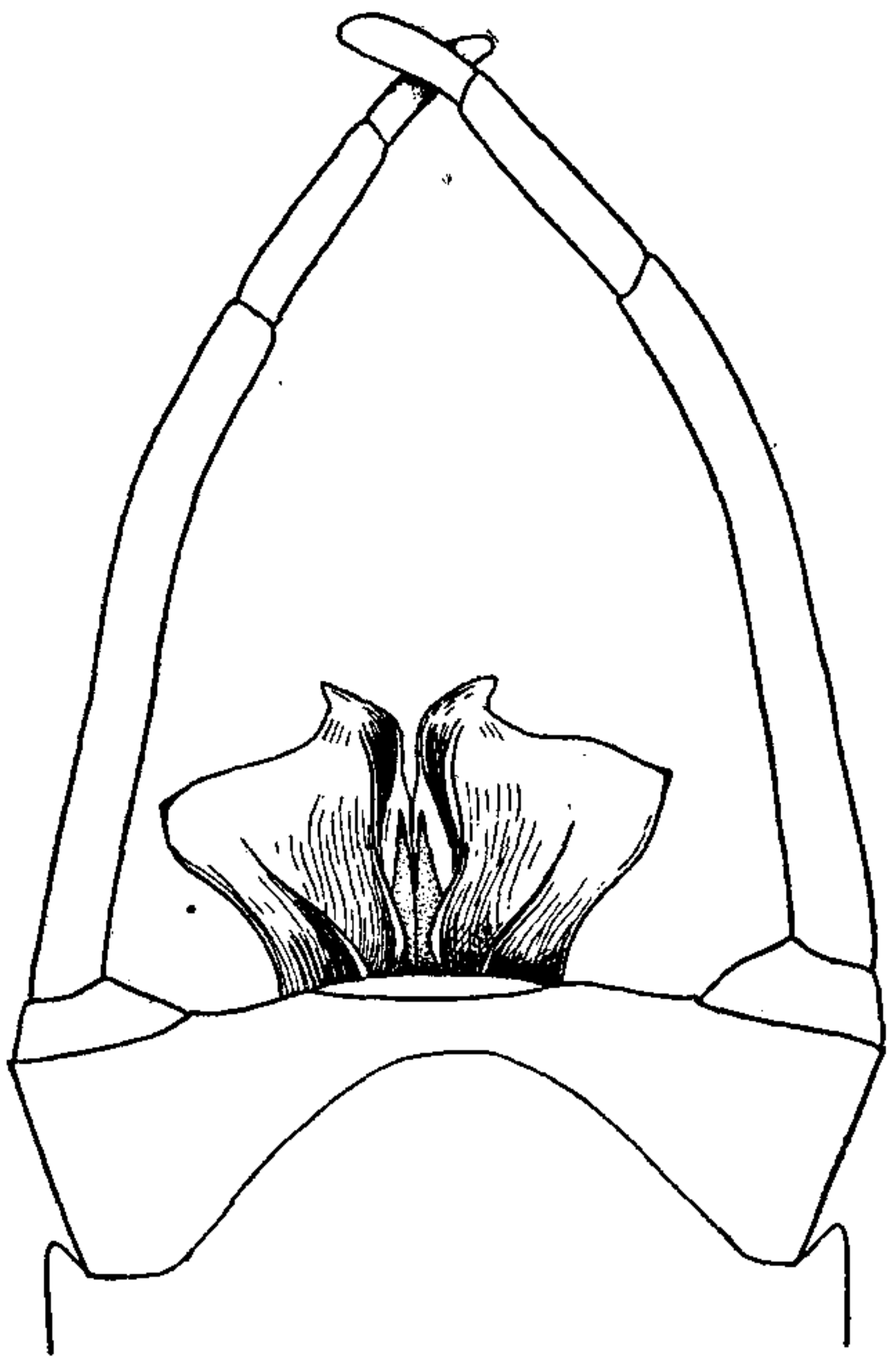


Fig. 11—*Ecdyonurus tobiironis* Takahashi. End of ♂ abdomen, ventral view.

Imago ♀. General colouring as in ♂, but on the pleural regions of abdominal segments large dark markings appear; underside of abdomen without marks, 3-7 segments somewhat translucent.

	Body	Fore-wing	Caudal setæ
♂	10 mm	11 mm.	33.5 mm.
♀	11-13 mm.	13-15.5 mm.	25 mm.

Nymph (Pl. 12, fig. *C*). Head blackish brown, without light spots or marks as seen in *Ecd. japonicus*, with only indistinct dark marks

in front of the front ocellus and between the hind ocelli; eyes gray. Head nearly as wide as pronotum, frontal margin rounded, eyes dorsal, antennæ slender, blackish brown, joinings white. Pronotum brown, lateral margin rounded, posterior angles produced behind, with indistinct dark markings; underside of thorax pale yellow. Legs depressed, yellowish brown, coxa pitch brown, femur with two dark brown bands, one at the middle and the other one subapical; tibia yellowish brown, tarsus brown; external edge of femur fringed with setæ. Abdomen dark brown above, with two pairs of light whitish spots which are fused up and become indistinct in 8-10 tergites; underside of abdomen pale grayish yellow, 7-10 sternites intensely yellow. Caudal setæ yellowish brown, joinings armed with reddish brown minute spinules. Seven pairs of gills present on abdominal segments 1-7, lamellæ 1-6 with filamentous gill-tufts, but the 7th without such tufts.

Body 10-13.5 mm., caudal setæ 13.5 mm. (subequal).

This species is common in the suburbs of Osaka, Kyôto and of Ôtsu. The emergence in the vicinity of Ôtsu occurs at the beginning of April, continuing till the end of May. The subimago resembles imago very much, but its wings are subhyaline, somewhat grayly infuscated and tinted with many dark blackish brown markings. The nymph is found in rapid mountain torrents as well as in shallow slowly-flowing small brooks half meter wide. It dwells usually beneath submerged stones, and its body and legs are often covered with silt as in the case of the stonefly nymph *Nemura*.

4. Genus: *Rhithrogena* Eaton 1881.

Rhithrogena japonica Uéno 1928.

Rhithrogena japonica Uéno, Mem. Coll. Sci., Kyôto Imp. Univ., Ser. B, 4, 1928, p. 26, Pl. iv, fig. 3, 3a-3f, v, fig. 3g-3n.

Imago ♀. Head dark olive brown, eyes and ocelli black. Pronotum brown; mesonotum dark olive brown, the middorsal line and both sides paler, lateral part pale, hind margin dark brown; metanotum dark brown. Legs pale brown, tibiæ and tarsi paler; tarsus of foreleg (text-fig. 12, *C*) a little longer than $\frac{1}{2}$ of tibia, tarsal claws dis-

similar. The first tarsal joint of hind-leg nearly as long as the second and slightly longer than the third, the fifth very long, claws dissimilar (text-fig. 12, *D*). Wings hyline, colourless, apical part of costal and subcostal area weakly brownish amber-colour; veins sepia-brown. Tergite of each abdominal segment brown, hinder part dark brown, with a pair of light spots. Underside of abdomen pale whitish brown, only the 9th segment somewhat darker, the 7th with a large dark mark at the middle. Caudal setæ brown, paler towards the tips, joinings darker.

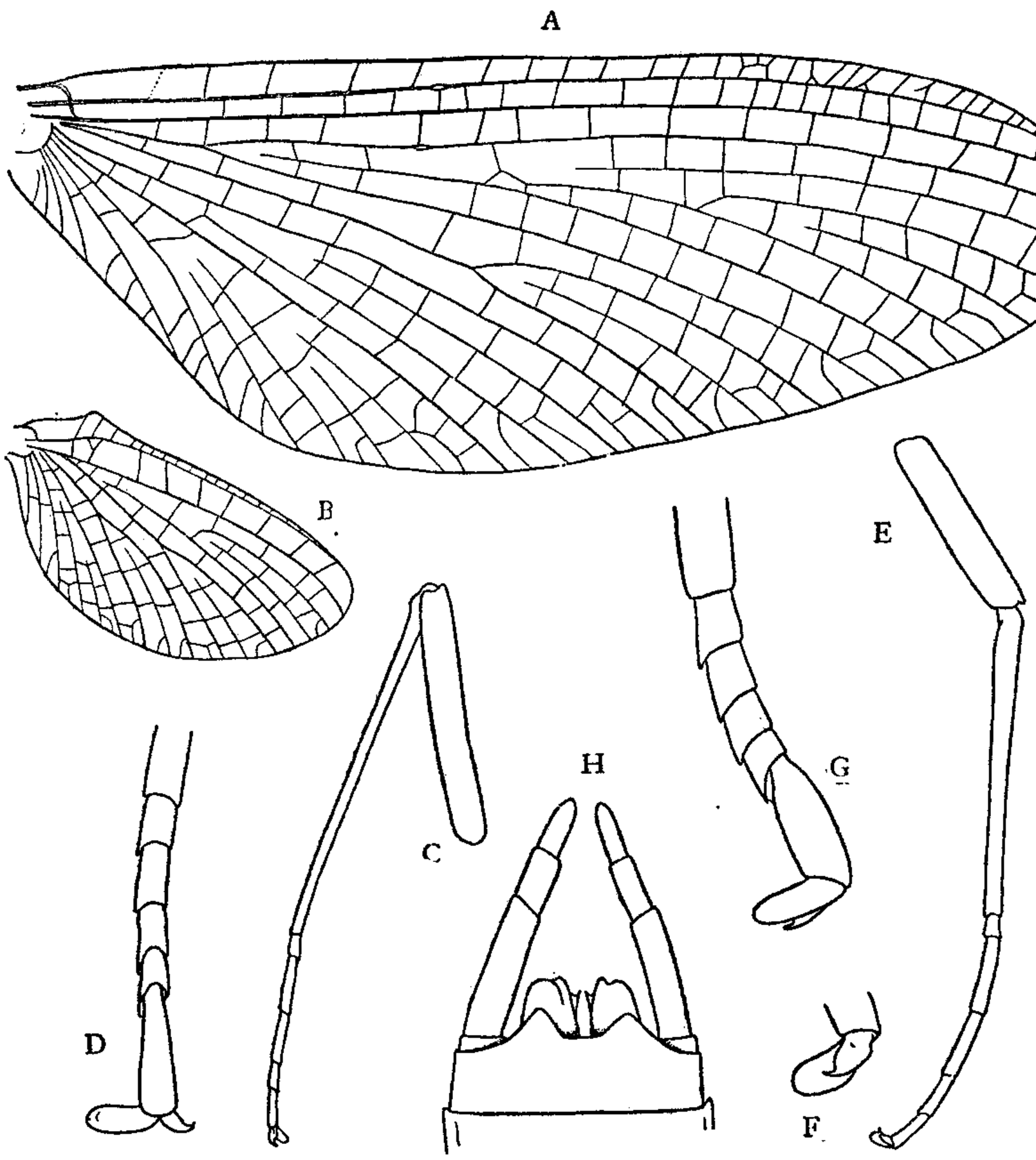


Fig. 12—*Rhithrogena japonica* Uéno *A*-*D*: imago ♀ and *E*-*H*: subimago ♂. *A* and *B*. wings. *C*. fore-leg. *D*. hind-tarsus. *E*. fore-leg. *F*. claws of the same. *G*. Hind-tarsus. *H*. end of abdomen, ventral view.

Subimago ♀. Colouring like the imago ♀, but mesonotum much paler and wings grayly infuscated.

Subimago ♂. Head light brown, eyes and ocelli black. Pronotum brown, mesonotum pale brown, hind end blackish brown, a pair of dark marks present in front and hinder parts on both sides of middorsal line, lateral margin darker; metanotum dark brown; underside of thorax brown. Abdomen like ♀ subimago, each tergite with a pair of small light spots which become larger and longer in the tenth tergite. Fore-legs brown, mid- and hind-legs paler. Hind margin of tenth sternite divided into two triangular lobes between the bases of forceps (text-fig. 12, *H*). Forceps-limbs 4-jointed. Penis-lobes separated, each lobe rounded at the apex, inner margin with an acute process near the apex.

	Body	Fore-wing	Expanse of wings	Caudal setæ
♀ imago	7.5 mm.	—	12.5 mm.	21 mm.
♂ subimago...	6.5 mm.	9 mm.	11 mm.	—

Family: Siphlonuridæ Klapálek.

1. Genus: *Siphlonurus* Eaton 1868.

Siphlonurus binotatus (Eaton) 1892.

Siphlurus binotatus Eaton, Entom. Month. Mag., 1892, p. 302. *Siphlonurus maculosus* Takahashi, Insect World, Gifu, 34, 1930, p. 114. *Siphlonisca grandiosa* Matsumura, 6000 Illus. Insects of Jap.-Emp., Tôkyô, 1931, p. 1475,

One of the largest mayflies in Japan. Body elongated, abdomen dull brownish yellow, with remarkable pitch-brown portions. Tibia of fore-leg of ♂ a little shorter than femur, tarsus $1\frac{5}{6}$ as long as tibia, tarsal joints rank 1-2-3-4-5 (text-fig. 13). Femur of hind-leg of ♂ $1\frac{2}{7}$ as long as tibia, and this as long as tarsus, the second tarsal joint nearly as long as the fifth, joints rank 1-2-5-4-3 (text-fig. 13). Femur of fore-leg of ♀ $1\frac{1}{5}$ as long as tibia, tarsus $1\frac{1}{2}$ as long as tibia, tarsal joints rank 1-2-3-5-4 (text-fig. 13). Hind-tibia of female shorter than femur, tarsus longer than tibia, joints rank 1-2-5-4-3 (text-fig. 13). Tarsal claws of all legs in both sexes alike in form.

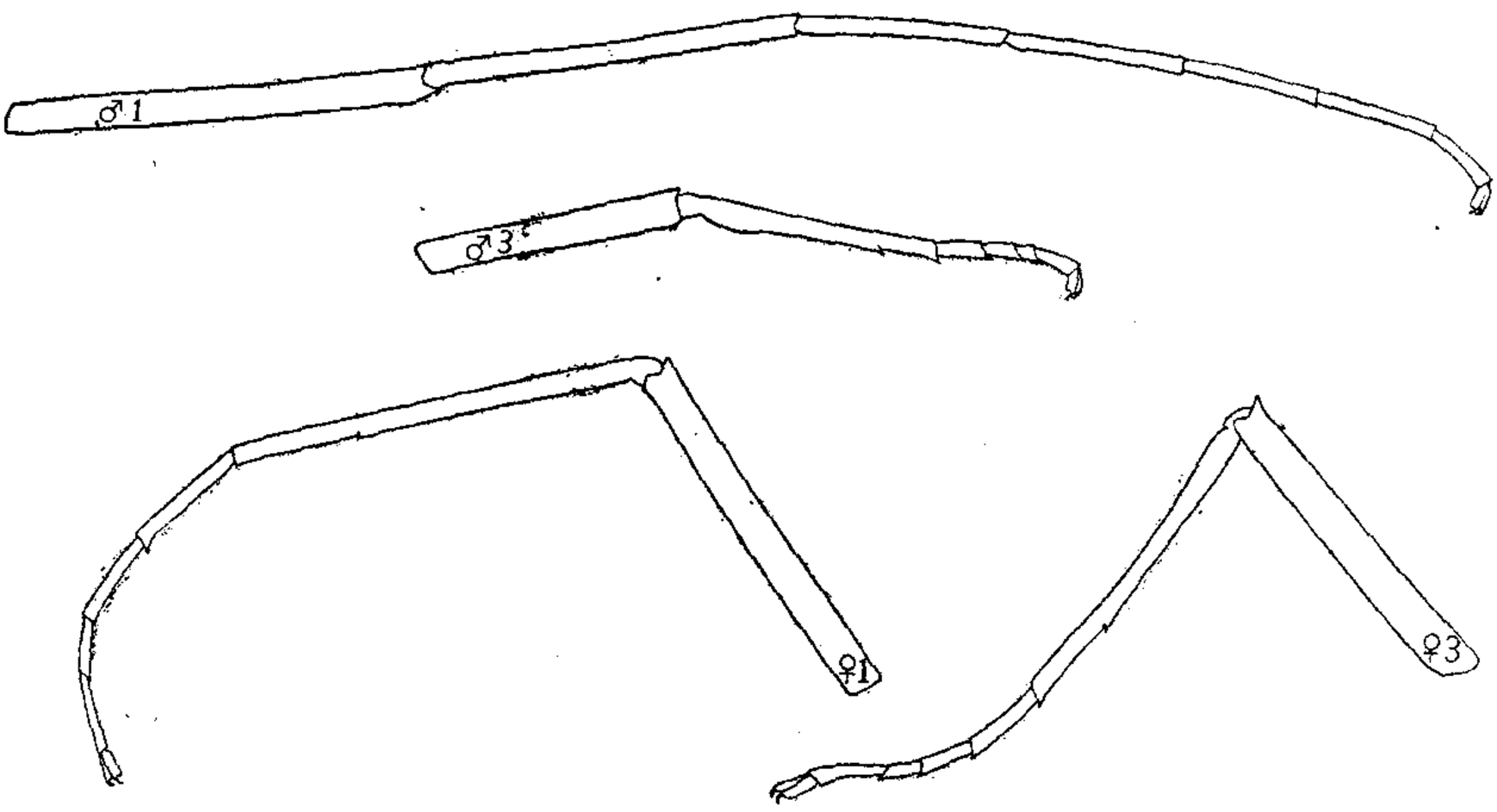


Fig. 13—Legs of *Siphlonurus binotatus* (Eaton).

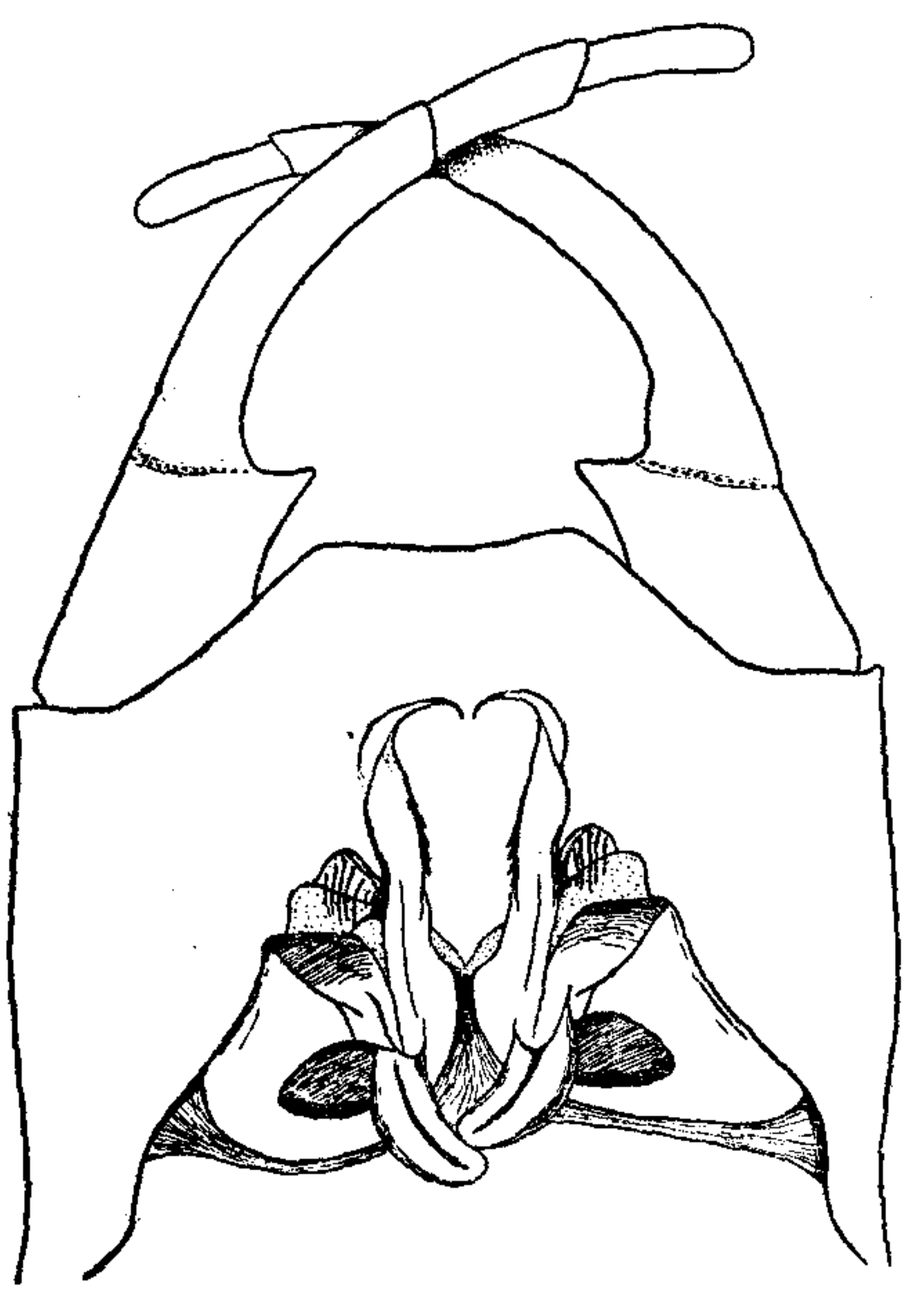


Fig. 14—*Siphlonurus binotatus* (Eaton). End of ♂ abdomen, dorsal view.

Tenth sternite of ♂ produced toward back, margin truncated, with two very low arches. Forceps-limbs (text-fig. 14) 4-jointed; basal joint short, rather thickend, produced in an acute process at intero-posterior corner, second joint rather strong, tapering gradually, arched strongly inwards, the last two joints combined about $\frac{2}{3}$ as long as the second, the last slender, clavate, apex bluntly rounded; basal two joints blackish brown, third joint brown, the last yellow. Penis-lobes separated, strongly chitinized, thin, flat, membranous, ventral edge spinulated, distorted near the apex and incurved abruptly, ending in an acute process.

	Length of body	Fore-wing	Caudal setæ
♂	19 mm.	20 mm.	28 mm.
♀	22 mm.	23 mm.	32 mm.

Nymph. I have already illustrated the nymph of this species under the name of *Siphlurus alternatus*? in my previous paper (1928) on Plate XIV, fig. 15-15 l.

Body large, robust, somewhat depressed, tapering gradually; yellowish olive green to grayish olive green, when put in alcohol its colour often becomes carmine-red. Legs rather strong, pale yellow, with a dark band on the upper surface of femur, the same marking present near the base and subapical part of tarsus; claw long, slender and pointed. Mouth-parts are shown in figs. 15b-15g, Pl. XIV given above. Gill lamellæ present on abdominal segments 1-7, first two pairs on segments 1 and 2 double, remaining five pairs all simple, broadly round, the 7th ovate; each with a strongly thickened front margin; trachea strongly developed and richly branched (text-fig. 15 *A* and *B*).

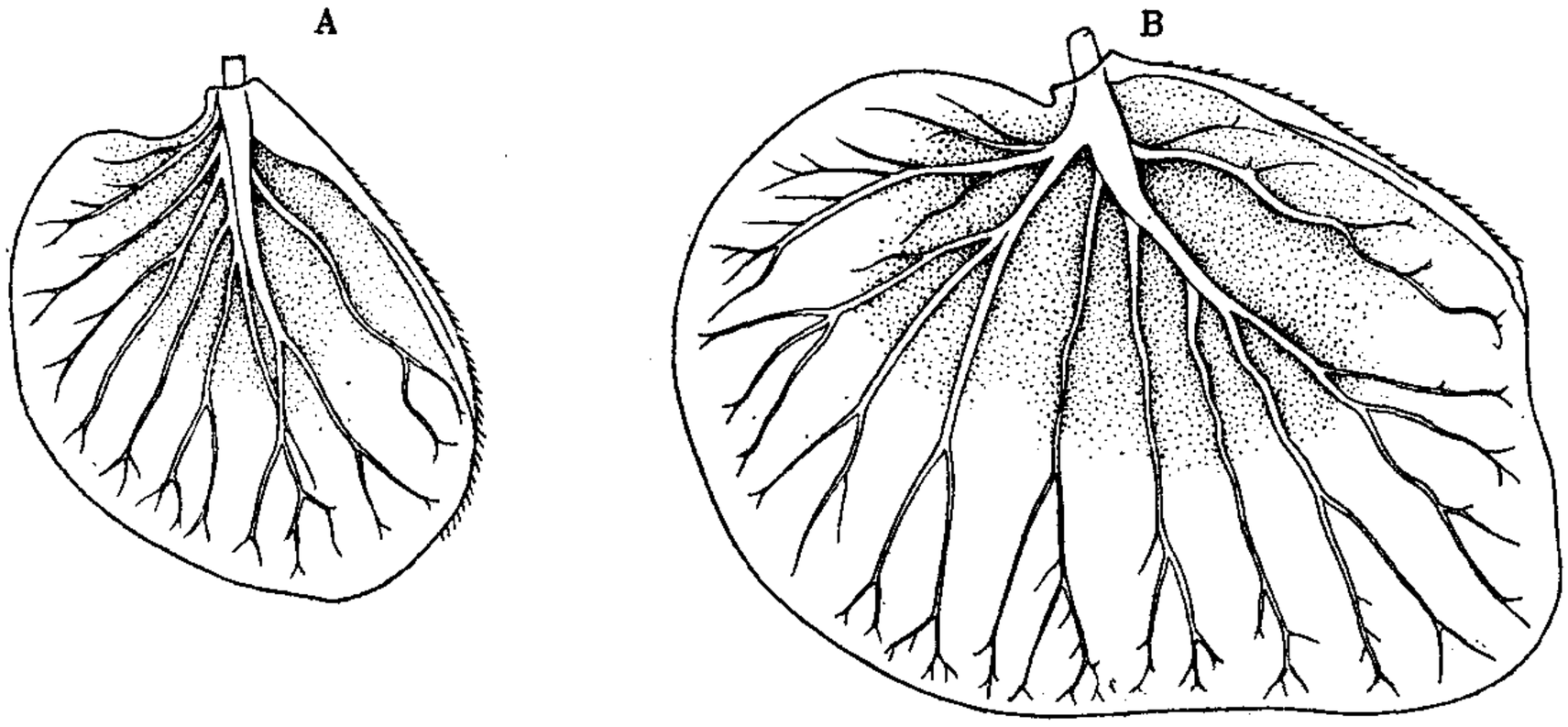


Fig. 15—*Siphlonurus binotatus* (Eaton). *A*. 7th and *B*. 3rd gill lamella of a nymph.

This nymph usually dwells in stagnant or slowly-flowing waters, as in the littoral region of lakes and swamps covered by plants, or marginal, less rapid parts of rivers. It is very active and swims skilfully. It is also able to inhabit either waters highly polluted by the outflows of industrial factories or natural waters of acid reaction polluted by humic substances or mineral acids. I once discovered it in Lake Tadé

at Nikkô, where the water in the marginal region shows an acid reaction (pH = 5.2) on account of the development of *Sphagnum*-bog on the margin.

The swarming in middle Japan occurs usually in a hot evening in June. The subimago has dull brown body and obscure gray wings.

2. Genus: *Ameletus* Eaton 1887.

Ameletus montanus Imanishi 1930.

Ameletus montanus Imanishi, Trans. Nat. Hist. Soc. of Formosa, 20, 1930, 110, p. 265, fig. 3-5.

Imago ♂. Chestnut brown beautiful insect of medium size. Eyes large, ash gray, in living insect they are beautifully glittering, yellowish green. Fore-legs blackish brown, mid- and hind-legs pale yellowish brown, tarsi somewhat smoky. Tibia of fore-leg (text-fig. 16, *A*) a little shorter than femur, tarsus $1\frac{4}{5}$ as long as tibia, the first tarsal joint less than $\frac{1}{2}$ of the second, which is subequal to the third, joints rank 3-2-4-5-1. Femur of hind leg of male $1\frac{1}{6}$ as long as tibia, and this $1\frac{2}{7}$ as long as tarsus, tarsal joints rank 2-1-5-4-3 (text-fig. 16, *B*).

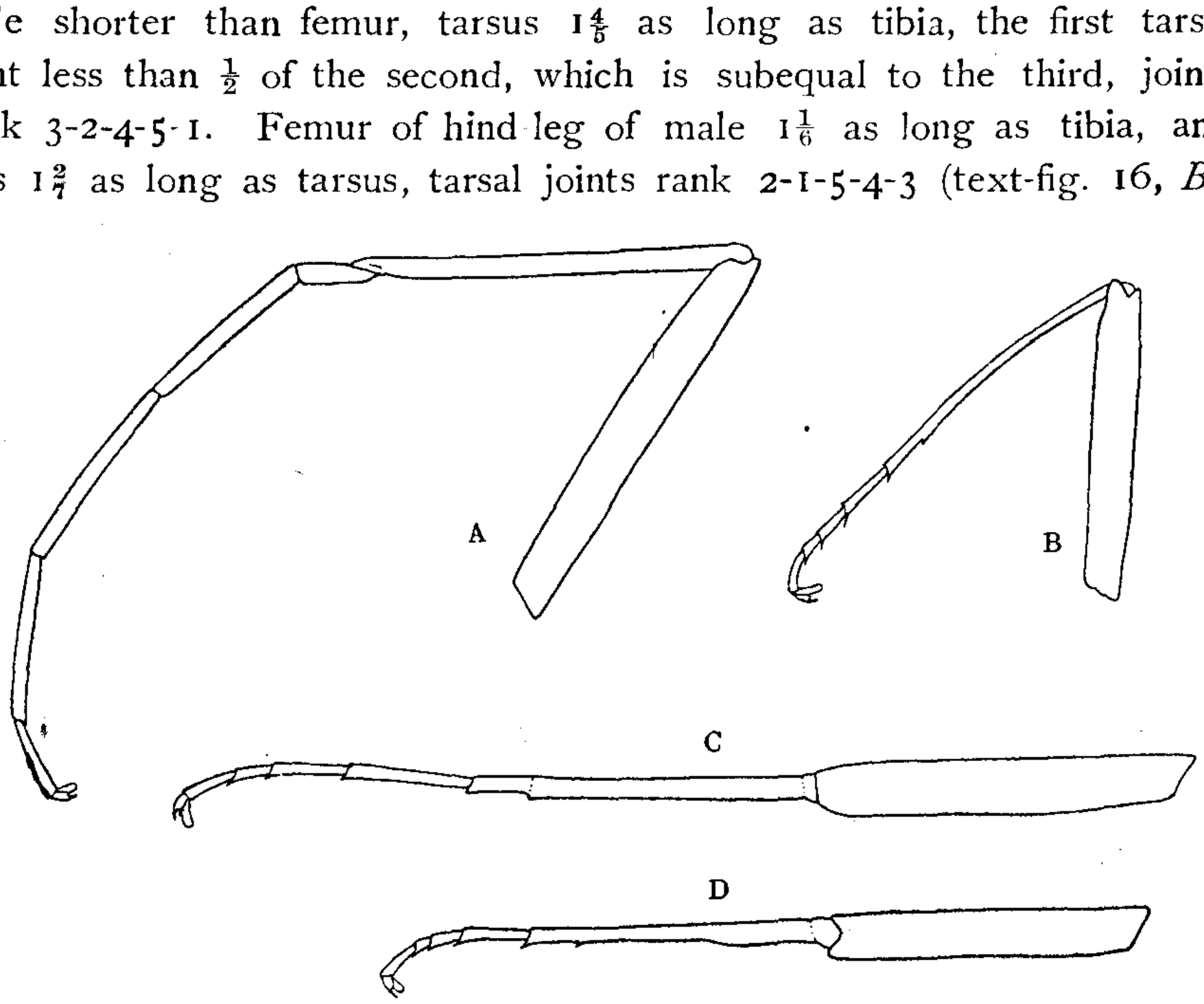


Fig. 16—Legs of *Ameletus montanus* Imanishi. *A*. fore-leg of ♂. *B*. hind-leg of ♂. *C*. fore-leg of ♂. *D*. hind-leg of ♀.

Fore-leg of female: femur $1\frac{1}{8}$ as long as tibia, tarsus nearly as long as femur, tarsal joints rank 2-3-1-5-4, the second joint being the longest and nearly twice as long as the first (text-fig. 16, *C*). Hind leg of female: femur $1\frac{1}{4}$ as long as tibia, and this $1\frac{1}{3}$ as long as tarsus, tarsal joints rank 1-2-5-4-3 (text-fig. 16, *D*). Tarsal claws of all legs in both sexes dissimilar.

Wings hyaline, with metallic lustre, near the roots brown, pterostigmatic area somewhat brownish infuscated. In costal field behind the bulla many cross-veins, some of which are anastomosed; between A_1 and A_2 are present 6-7 cross-veins, reaching the hind margin.

Hind margin of the tenth sternite deeply cut at the median line, forming two arched lobes (text-fig. 17, *A*). Forceps-limbs 4-jointed, the basal joint rather thick, tapering, the second joint $1\frac{2}{3}$ as long as the last two joints combined, the last joint slender, a little shorter than the 3rd joint. Penis-lobes (text-fig. 17, *B* and *C*) widely separated from each other, each lobe slender, somewhat incurved and upcurved, the inner edge dilated in a narrow membranous plate which is spinulated on its margin. Median caudal seta rudimentary, only 1 or 2 joints (text-fig. 17, *C*).

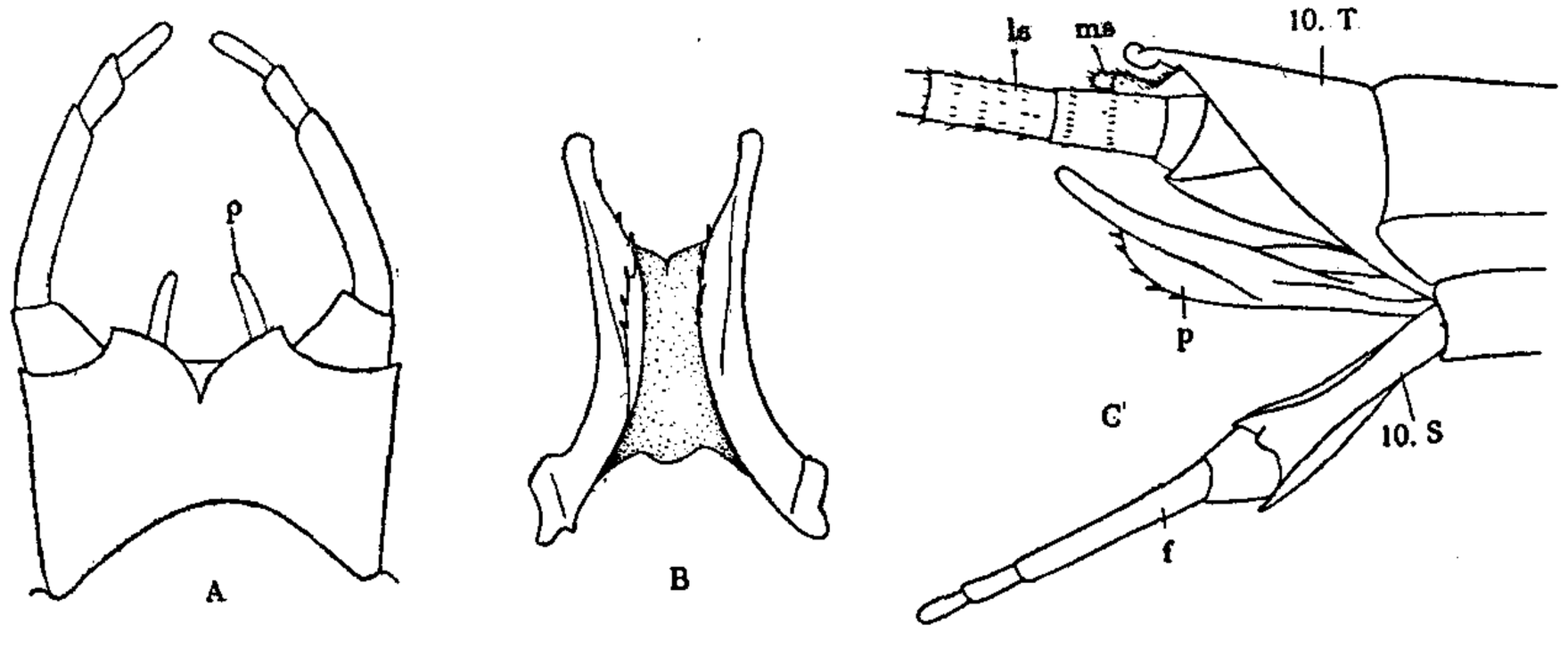
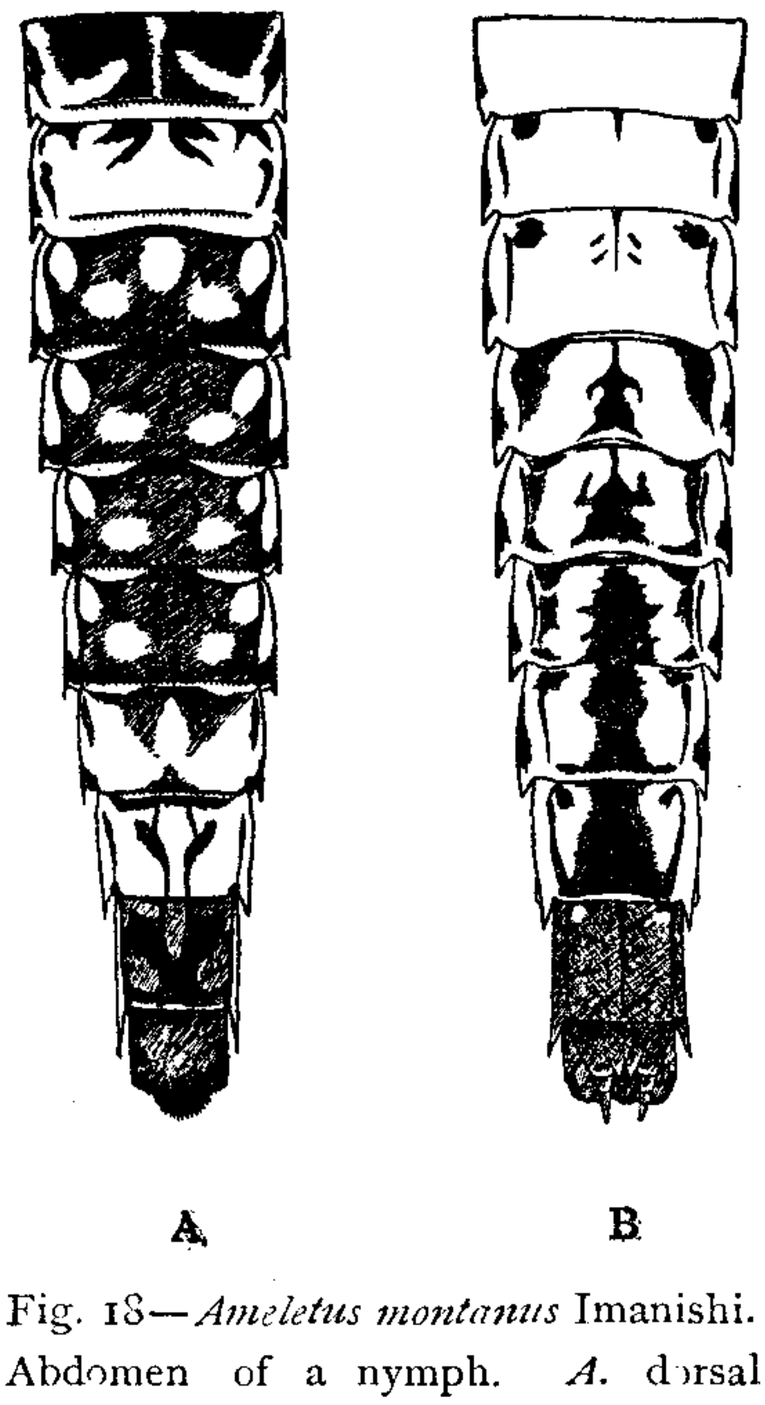


Fig. 17—Male genitalia of *Ameletus montanus*. *A*. end of abdomen, ventral view. *B*. penis, ventral view. *C*. end of abdomen, lateral view. *10. T* and *10. S*. 10th tergite and sternite. *ls*. lateral caudal seta. *ms*. median caudal seta. *p*. penis. *f*. forceps.

Imago ♀. Tenth sternite bilobed.

Nymph (Pl. 13, fig. 5): Body elongated, with arched thorax and

vertical face. Head short, greenish olive gray, eyes large, dorso-lateral, face vertical, ocelli in front; antennæ short, bare, yellowish gray, several middle joints blackish brown. Pronotum a little wider than head, rather short, arched above, closely applied to the front of prothorax, greenish gray, with dark marks on both sides; mesonotum high, arched above, dark greenish gray, with distinct markings; wing cases reaching the anterior part of the second abdominal segment. Legs slender, stout, pale yellow, on the upper surface with dark brown band at the middle of femur, the same bands are also present on sub-apical part of tibia and near the base of tarsus; claws strong, pointed and black.



A B

Fig. 18—*Ameletus montanus* Imanishi. Abdomen of a nymph. *A*. dorsal view. *B*. ventral view.

Abdominal segments grayish yellow green above, paler below. Tergite 1 with broad symmetrical markings almost all over it, tergite 2 with a pair of black markings at the front, tergites 3-6 with blackish short stripes near the frontal margin, these stripes being divergent behind, tergites 3-6 dark gray leaving two pairs of light round areas, only in tergite 3 an additional median round area present; tergite 7-8 with narrow dark area, 9-10 dark entirely; sternites 4-8 marked with a broad dark area on middle portion, 9-10 entirely dark gray (text-fig. 18, *A* and *B*).

Abdomen gradually tapering toward the end, somewhat depressed, postero-lateral corners of hinder segments produced in an acute, thin, flat spine directed backwards. Caudal setæ three, subequal, rather short and stout, fringed with long, soft hairs; on outer setæ these fringes only on the inner side, their middle third distictly blackish brown and brown again at the tips.

Seven pairs of gill lamellæ present on abdominal segments 1-7, all

simple and nearly similar in form, the first the smallest and elogated ovate (text-fig. 19, *A*), the others ovate (text-fig. 19, *B*), the 7th elongated (text-fig. 19, C); trachea strongly developed, front margin somewhat thickened and a longitudinal chitinous ridge present on lamellæ 2-7.

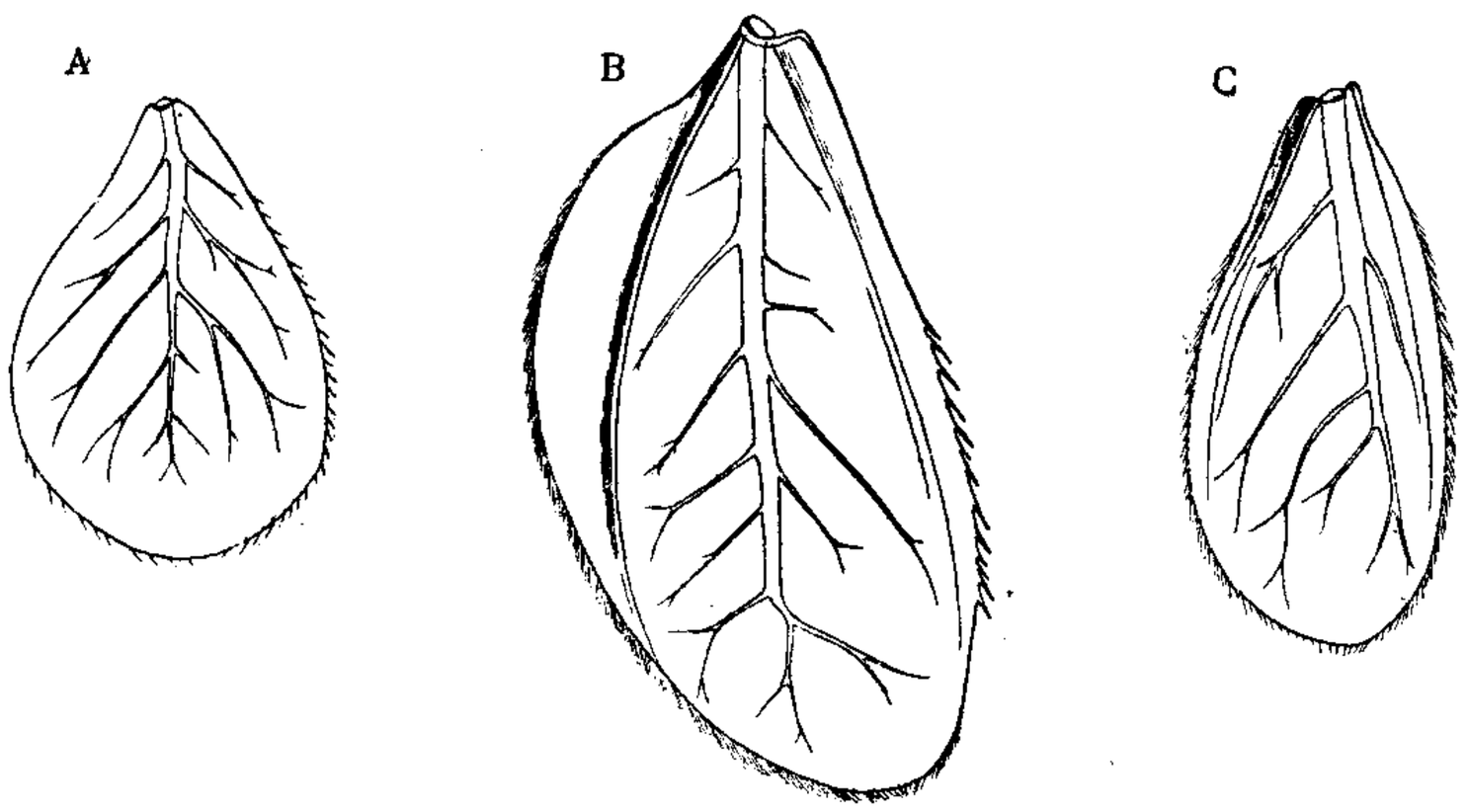


Fig. 19—*Ameletus montanus* Imanishi. *A*. 1st. gill lamella of a nymph. *B*. 4th gill lamella of the same. *C*. 7th gill lamella of the same.

Mouth-parts are shown in text-fig. 20. Mandibles (text-fig. 20, *C*) stout, triangular, armed with two large canines on apex, the outer one of which being serrated externally and nearly as long as the inner;

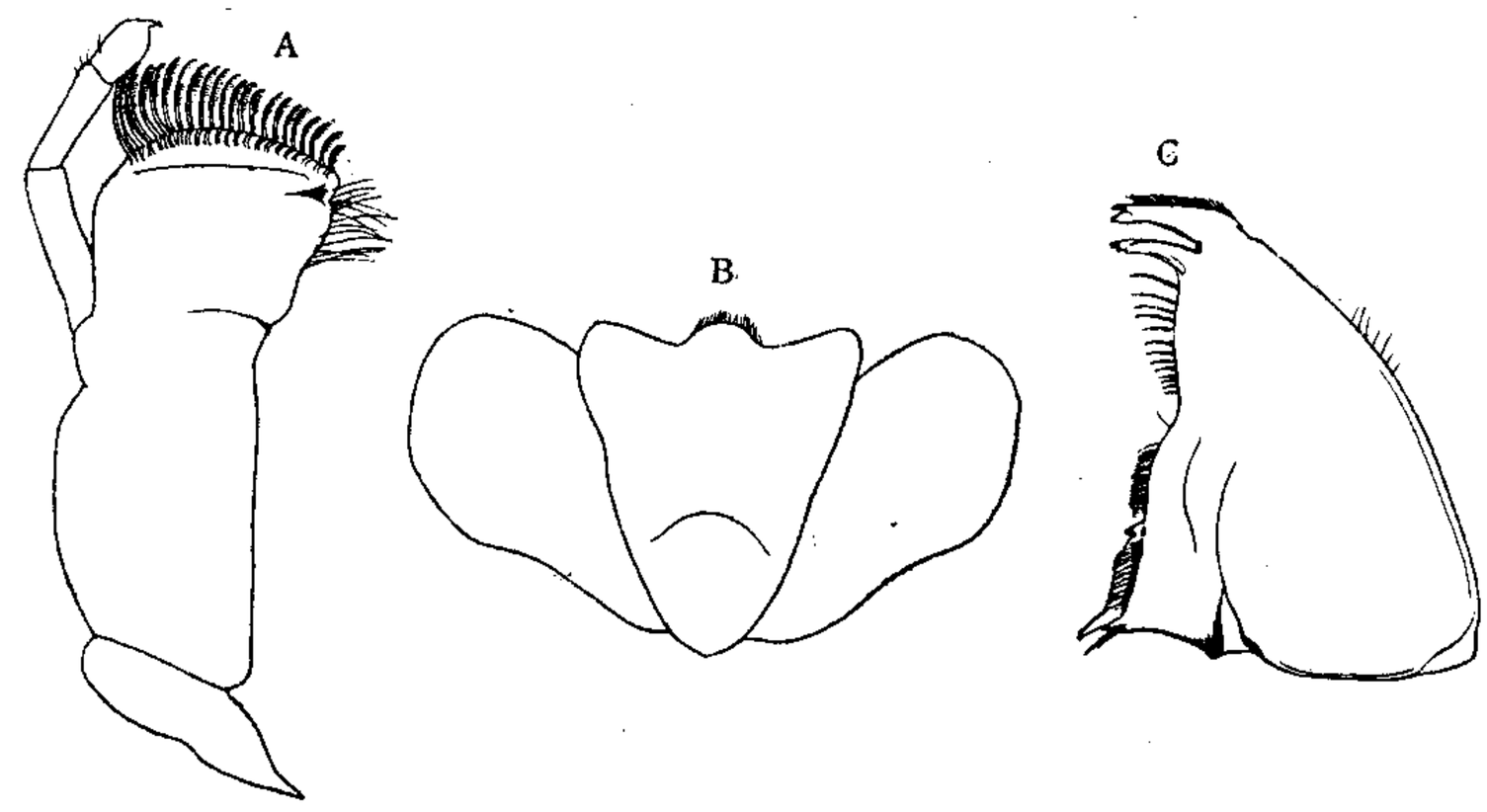


Fig. 20—Nymphal mouth-parts of *Ameletus montanus*. *A*. maxilla. *B*. hypopharynx. *C*. mandible.

the margin between the inner canine and the molar provided with two series of strong setæ. Lacinia of maxilla (text-fig. 20, *A*) trapezoidal, its distal border fringed with a series of 20 to 23 strongly-arched, beautifully-pectinated hooks; maxillary palpus 3-jointed, basal joint nearly as long as the last two joints combined, the last joint short and with an acute process on the apex. Hypopharynx (text-fig. 20, *B*) large and broad; front angles of median lobe somewhat produced in front, frontal margin convex at the middle; lateral lobes dilated in wing-like form.

This nymph inhabits rapidly-flowing mountain streams where it is found usually on the underside of submerged stones. It is of active behaviour and swims skilfully. The swarming takes place in the middle of June in the suburbs of Kyôtô and of Ôtsu. The subimago resembles the imago very much, but its wings have brownish tints along the cross-veins.

3. Genus: *Dipteromimus* MacLachlan 1875.

Dipteromimus tipuliformis MacLachlan 1875.
Dipteromimus tipuliformis MacLachlan, Eaton, Rev. Monogr., p. 213.
Dipteromimodes suzukii Matsumura, 6000 Illus. Insects of Jap.-Empire, Tôkyô, 1931, p. 1474.

Imago ♂. A large and yellow mayfly with a slender body which reminds us of a dipteran crane-fly. The description given below is based upon living insects. Head yellow, eyes black, ocelli grayish white, basal margin black, antennæ dark gray, with long and yellow basal joint. Pronotum chrome yellow; mesonotum reddish light brown to dark red brown, hinder part reddish yellow; metanotum chrome yellow. Fore-wing hyaline, colourless, with metallic lustre, narrow and elliptical, rapidly narrowed to the roots, apical parts of costal and subcostal fields amber-yellow, veins dark sepia-brown. Hind-wing very small and rudimentary, trilateral, veins much reduced. Legs reddish yellow, tibiæ and tarsi dark red brown, the knee of each femur black.

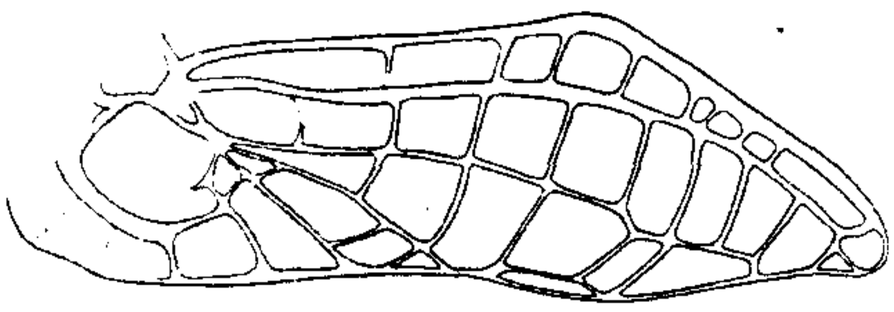


Fig. 21.—Hind-wing of *Dipteromimus tipuliformis* ♂.

Tarsus of fore-leg a little longer than twice the tibia which is about $\frac{6}{8}$ as long as the femur; the first joint of tarsus subequal to the second, this a little longer than the third, the fifth about $\frac{1}{3}$ as long as the first, the joints rank 1-2-3-4-5; claws alike in form, narrow and uncinate (text-fig. 22). Hind-tarsus nearly as long as tibia which is $\frac{6}{7}$ as long as femur, tarsal joints rank 1-2-5-3-4; the first about $1\frac{1}{2}$ as long as the second, the fifth subequal to the third, the 4th about $\frac{1}{2}$ as long as the third; claws alike in form, narrow and uncinate.

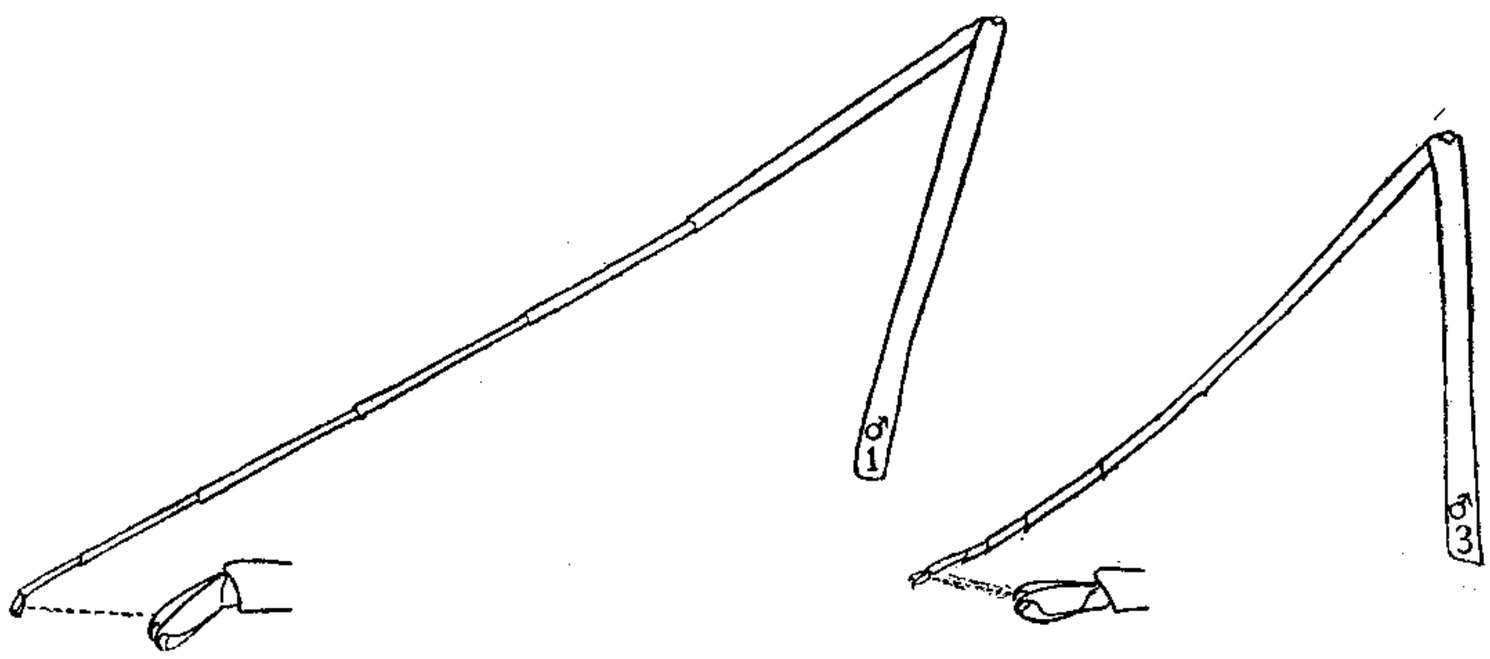
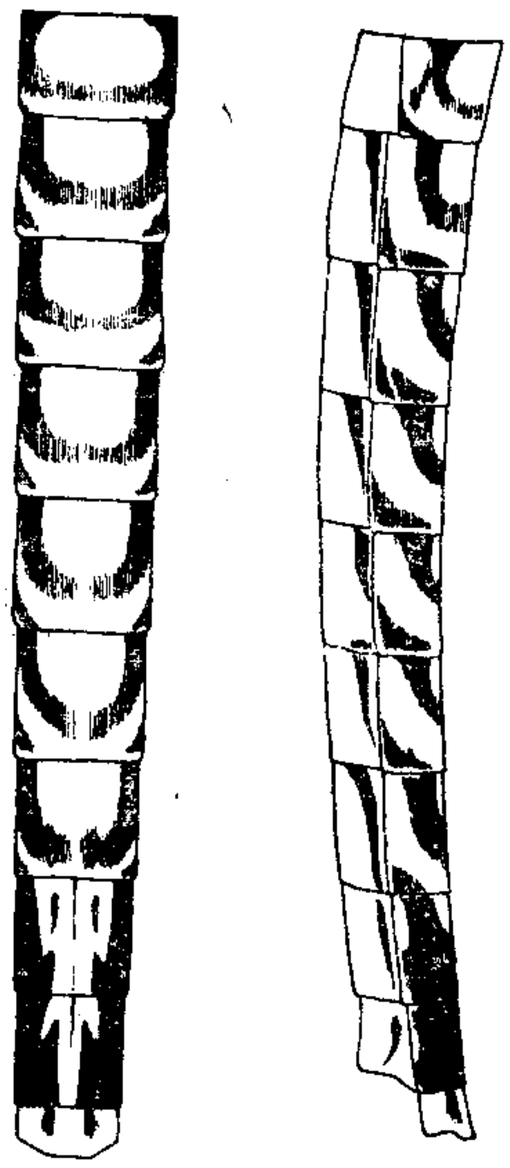


Fig. 22—Legs of *Dipteromimus tipuliformis* MacLachlan.

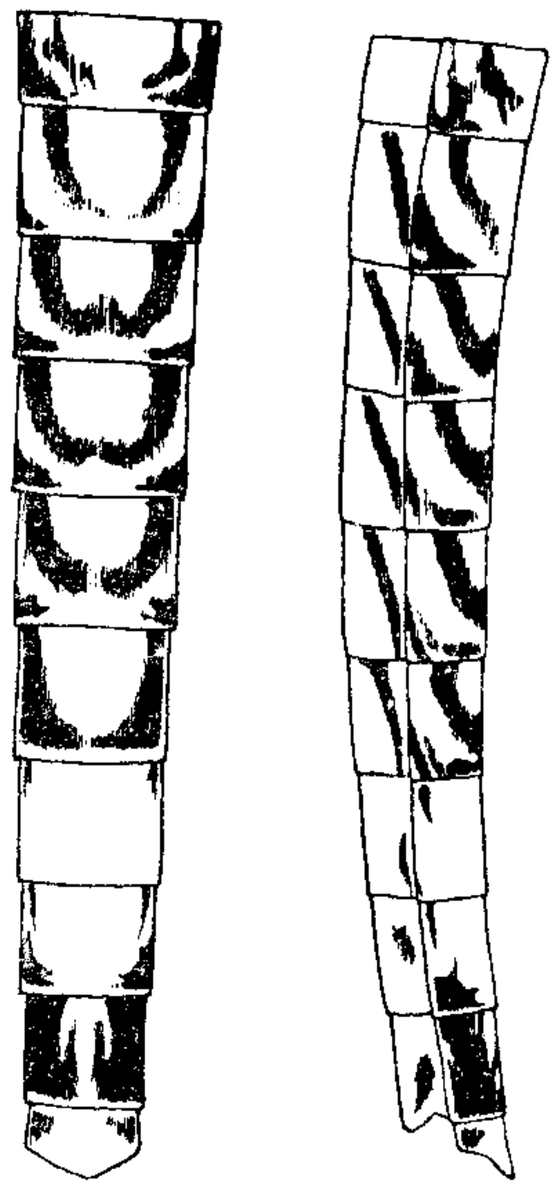
Abdomen slender, elongated, tapering gradually, yellow and often red brownish yellow; abdominal segments 1-6 translucent, tergites 1-7 with broad U-shaped blackish brown markings, the lateral portion of tergites 8-9 blackish brown, tergite 10 with a pair of blackish brown stripes; underside of abdomen pale yellow, with a pair of blackish brown longitudinal striations, which are somewhat divergent behind and close to the chrome yellow pleural sutures, and overlapping the following tergite (text-fig. 23). In another example, which had been collected in Prov. of Yamato, these colourations are somewhat different (alcoholic specimen) as shown in text-fig. 24. In this case, tergite 1 was without distinct U-shaped markings, tergites 2-6 with V, U or W-shaped markings, 7-8 entirely without such markings.

Hind margin of the tenth sternite deeply excavated. Forceps-limbs slender, incurved, 4-jointed; the first joint short and wide, somewhat thickened, the second long, incurved, inner margin minutely denticulated; the remaining two joints combined about $\frac{2}{5}$ as long as the second. Penis-lobes narrow, apex rounded, without process or spines.



A B

Fig. 23—*Dipteromimus tipuliformis* MacLachlan. Abdomen of an imago (Kyôto, July). *A*. dorsal view. *B*. lateral view.



A B

Fig. 24—*Dipteromimus tipuliformis* MacLachlan. Abdomen of an imago (Abutogé, Yamato, August). *A*. dorsal view. *B*. lateral view.

Imago ♀. Resembles the male very much, but somewhat larger and robust; the dark markings on the abdominal tergites are not so distinct as in the male.

	Length of body	Fore-wing	Caudal setæ
♂	13-14.5 mm.	13-15 mm.	26-21-26 or 23-21-23 mm.
♀	16 mm.	18.5 mm.	—

Subimago. Very closely resembles the imago, but the colouration is somewhat paler. Pronotum yellow, except its reddish brown frontal part. Wings sub-hyaline, grayish, veins yellowish white, pterostigmatic region milky. Legs yellow, knees reddish brown. Caudal setæ blackish brown. Length of body 13 mm., Fore-wing 14 mm, Caudal setæ 16-13-16 mm.

Remarks: This curious species was first described from a specimen of male imago which had been collected by v. Siebold in Japan. The

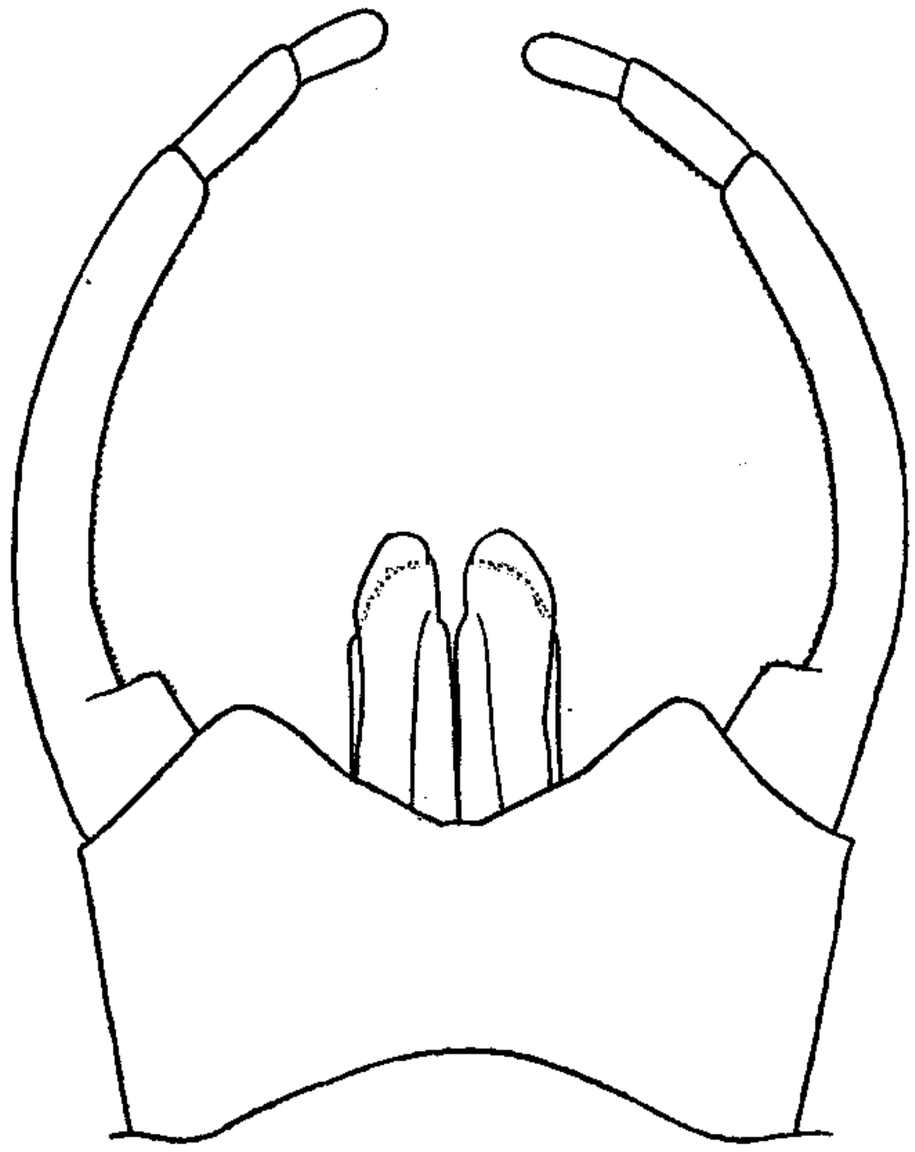


Fig. 25—*Dipteromimus tipuliformis* MacLachlan.
End of ♂ abdomen, ventral view.

distribution hitherto recorded is quite limited in Japan. According to the records of collections, it seems to be rather widely distributed in middle Japan: Kitayama, north of Kyôto, Prov. of Yamashiro; Abu-tôgé, Prov. of Yamato; Yoshino, Prov. of Yamato; Ôeyama, Prov. of Tamba; Komono, Prov of Isé; Yamato (Eaton, Rev. Monogr., p. 214); Tôkyô (Eaton, *l.c.*, p. 214); Gifu, Prov. of Mino (Eaton, Entom. Month. Mag., 1892, p. 302), etc.

In Kitayama, the north suburb of Kyôto, the first imago appears in the middle of June, their swarming continuing till the middle of July. Once in 1929, I observed its emergence as late as in the end of August, by a small stream of the forest at Abu-tôgé, west of Yoshino, Prov. of Yamato. At Kitayama, it is usually observed resting on broad round leaves of a big composite *Ligularia sibirica* that covers the brooks where it swarms. The number of the males is greater than that of the females, which is very scanty. The nymph dwells in shallow brooks covered by a thick growth of a large phanerogamic plant as mentioned above. The description of the nymph is given later on.

Recently S. Matsumura[4] proposed to establish a new genus *Dipteromimodes* with the genotype *D. suzukii* Matsumura, which is closely allied to *Dipteromimus*. According to him, the generic characters of this new genus are that the hind tarsus is longer than the tibia and that the median caudal seta is longer than the body. The median seta of *Dipteromimus* is, however, nearly twice as long as the body. The relative length of tarsus and tibia is too variable to be adopted as an important character. Judging by his imperfect description and illustration, *Dipteromimodes suzukii* must have been named as a form of *Dipteromimus tipuliformis*.

Nymph: Body slender and elongated (Pl. 13. Fig. 6). Head large, arched above, face vertical; yellow, the area surrounded with three ocelli, surrounding areas at the bases of antennæ and narrow spaces behind the eyes are dark brown (text-fig. 26, *a*, *b* and *c*). Eyes large, elliptical, black; ocelli three, large, white; antannæ slender, composed of nearly 30 joints, nearly as long as the head and thorax combined, the second basal joint very long, slender, yellowish white. Pronotum short, arched above, yellow ochreous, frontal part dark brown, with dark markings on each side of middorsal line. Mesonotum grayish yellow. Underside of thorax white, pleural regions gray. Legs slender, pale yellow, coxæ white, tibiæ and tarsi somewhat light yellow, spinulated. All legs of nearly similar size; tarsus a little longer than tibia, and this shorter than femur, tarsus and tibia combined $1\frac{1}{2}$ as long as femur; claw long, slender and pointed. 7 pairs of gill lamellæ present on abdominal segments 1-7, all simple and without tufts of filamentous gills; each lamella thin, flat, elongated ovate, purple in

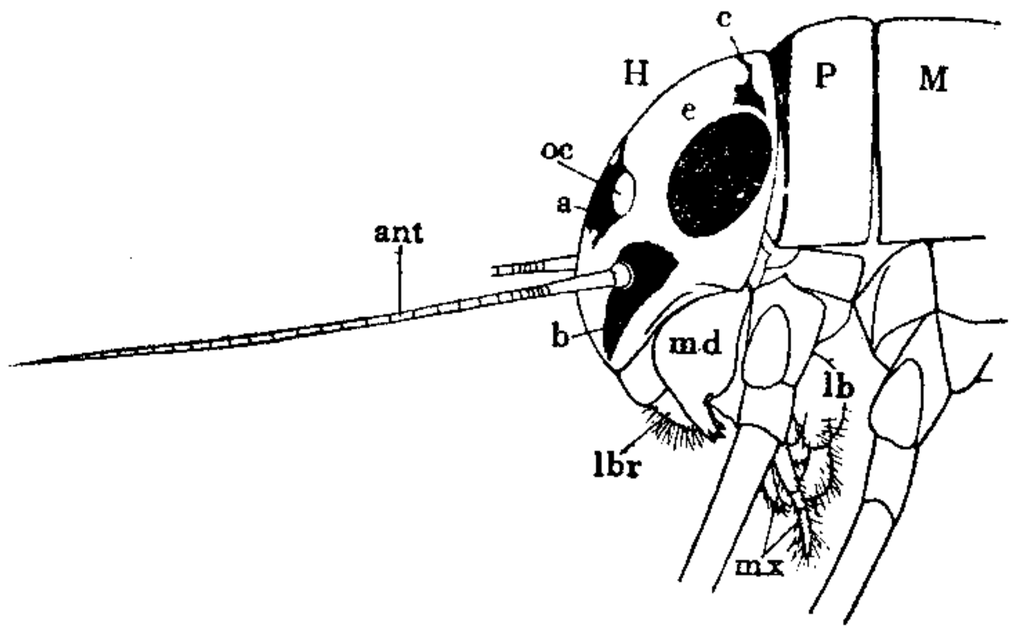


Fig. 26—*Dipteromimus tipuliformis* MacLachlan. Head and anterior part of thorax of a nymph, lateral view. *ant.* antenna, *e.* compound eye, *oc.* ocellus, *lbr.* labrum, *md.* mandible, *mx.* maxilla, *lb.* labium, *H.* head, *P.* pronotum, *M.* mesonotum.

4 6000 Illust. Insects of Jap.-Empire, Tôkyô, 1931, p. 1474.

colour, front margin thickened, the first lamella lanceolate ; trachea richly developed (text-fig. 27, *A-D*).

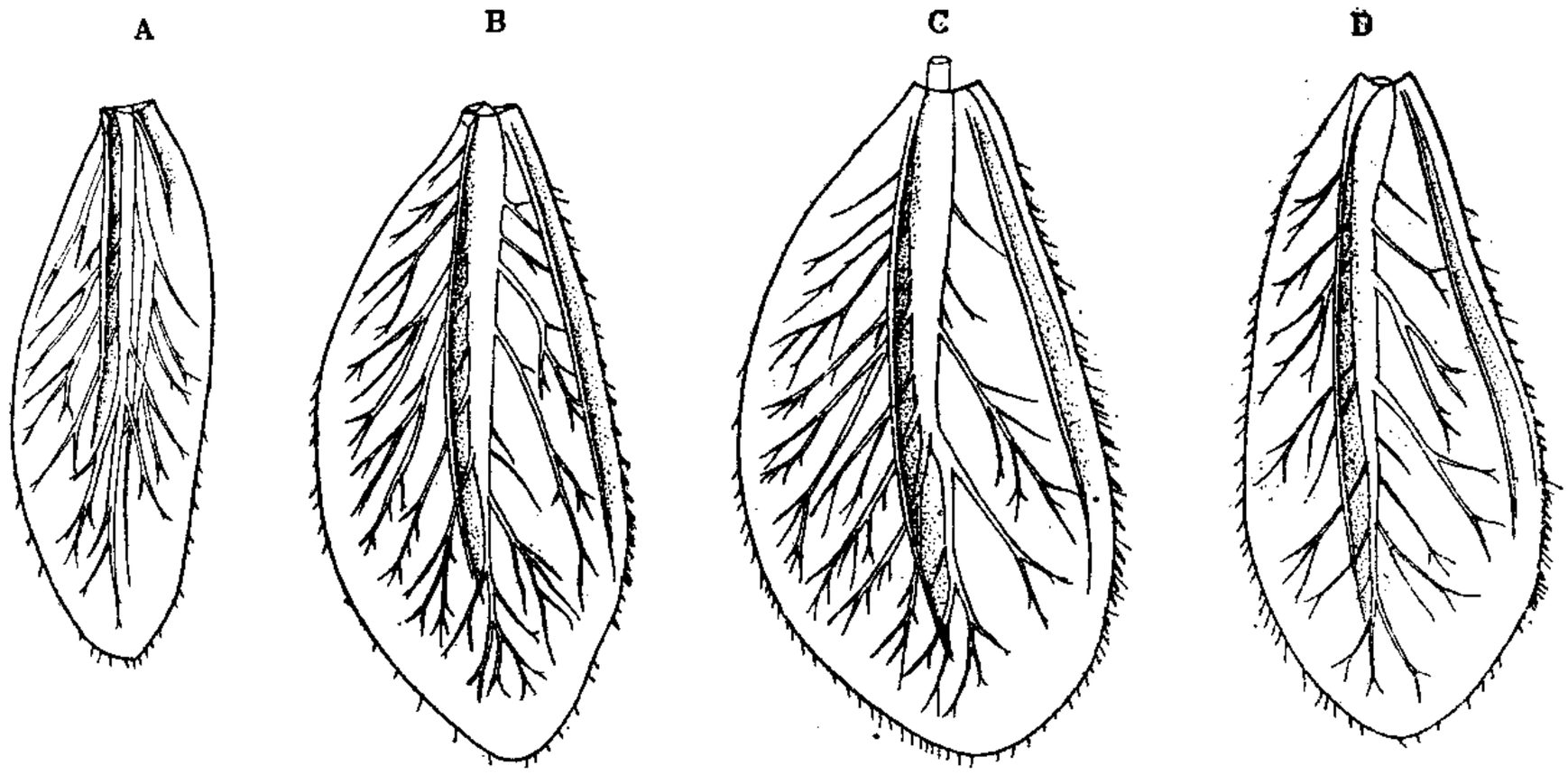


Fig. 27—*Dipteromimus tipuliformis* MacLachlan. Gill lamellæ of a nymph. *A*. *B*. 2nd. *C*. 5th. *D*. 7th.

Mouth-parts are shown in text-fig. 28. Labrum (text-fig. 28, *A*) quadrangular, angles rounded, frontal margin concave at the middle portion, fringed with long hairs. Mandibles stout, molar stronglydeveloped (text-fig. 28, *B* and *C*). Frontal margin of median lobe of hypopharynx somewhat convex, provided with minute setæ, lateral margin dilated obtusely and fringed with long hairs (text-fig. 28, *D*). Lacinia of maxilla small, 4 strong spines on apex, inner margin fringed with stout setæ, apical border without pectinated hooks as seen in the maxilla of the nymph of *Ameletus* ; maxillary palpus rather long, 3-jointed, joints 2 and 3 combined a little longer than the basal, the second very short, the last joint somewhat incurved, clavate, apex bluntly pointed, fringed with long setæ (text-fig. 28, *E*). Labium differs remarkably from that of the nymphs of the other species of Siphlonuridæ (text-fig. 28, *F* and *G*). Labial palpus thick and short, 3-jointed, inner edge of basal joint broadly enlarged in thin, memberanous, semiorbicular expansion, the last joint broad, somewhat broadened distally and truncate abruptly, armed with numerous minute spinules on terminal surface ; glossæ and paraglossæ large, each forming a round plate, supported by a short lobe derived from a part of mentum as is the case

with stipes of mushrooms ; surface of each plate provided with numerous minute spines and hairs.

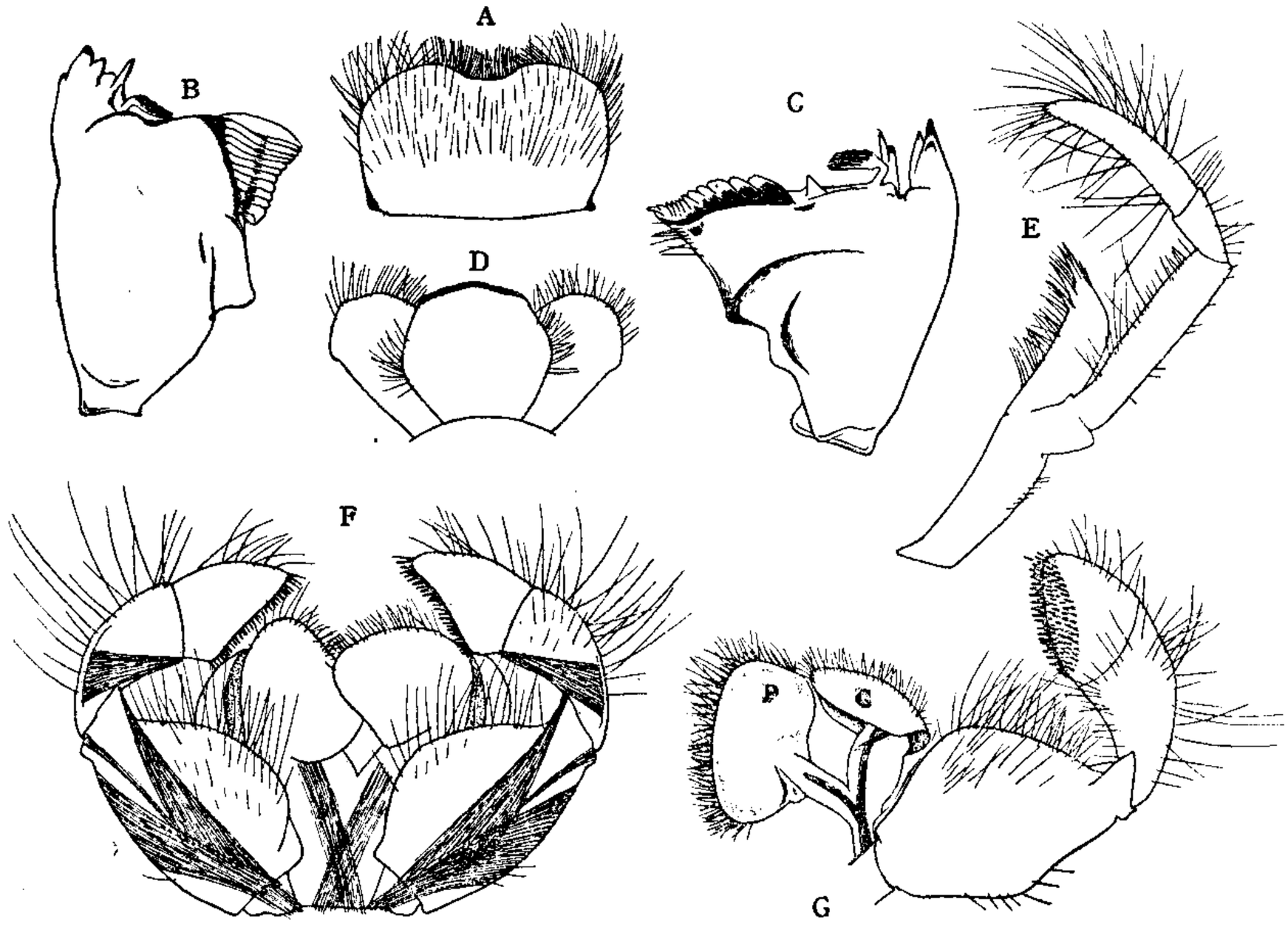


Fig 28—*Dipteromimus tipuliformis* MacLachlan. Mouth-parts of a nymph. *A.* labrum. *B* and *C.* mandibles. *D.* hypopharynx. *E.* maxilla. *F.* labium. *G.* the same, separated. P-paraglossa ; G glossa.

Length of body 13 mm.; caudal setæ 10-6.5-10 mm.

This nymph can be distinguished from the nymphs of other Siphlonuridæ by the following characteristic features :

i) The hinder abdominal segments produced on both sides in an acute spine directed behind, while in the nymphs of other Siphlonuridæ the hinder abdominal segments—at least the 9th segment—are produced in an acute spine.

ii) The median caudal seta is shorter than the outer, while with the nymphs of other Siphlonuridæ all setæ are nearly of same length, the medain seta being often a little longer than the outer.

iii) The glossæ and paraglossæ of the labium are stiped as in a mushroom.

Appendix.

A preliminary key to the hitherto-known nymphs of the Siphlonuridæ of Japan.

1. All gill lamellæ simple 2
— At least first two pairs of gill lamellæ double; broadly oblique round..... 1. *Siplonurus* Eaton (1868).
2. Besides gills on abdominal segments 1-7, a tuft of filamentous gills present upon the coxa of fore-leg and the base of maxilla respectively; frontal edge of fore-leg fringed with long hairs; infero-distal end of tibia of fore-leg fringed with long hairs; infero-distal end of tibia of fore-leg with a long and pointed spine .... 2. *Isonychia* Eaton (1871).[5]
— Gills present on abdominal segments 1-7 only; frontal edge of fore-leg not fringed; fore-leg without a spine 3
3. Postero-lateral corners of hinder abdominal segments produced into an acute, thin, flat spine directed behind; caudal setæ subequal; apical border of lacinia of maxilla long, fringed with a series of pectinated hooks; labium in ordinary type ... 3. *Ameletus* Eaton (1887).
— Postero-lateral corners not produced; median caudal seta evidently shorter than the outer two; lacinia of maxilla narrowed toward apex and without pectinated hooks; glossæ and paraglossæ of labium stiped in mushroom-like form .... 4. *Dipteromimus* MacLachlan (1875).

Family: Baëtidæ Klapálek.

So far as my investigations go, under this family have hitherto been recorded four genera from Japan, namely: *Baëtis* Leach, *Centroptilium* Eaton, *Pseudocloëon* Bengtsson and *Cloëon* (Linné) Bengtsson. With a form described by K. Imanishi (1930) under the genus *Acentrella* Bengtsson, I shall deal in detail later on. The Japanese species of this family have received little attention and need a much more detailed study.

5 A nymph illustrated on Pl. XIII. of my previous paper (Uéno 1928) under the name of *Chirotonetes japonicus* (*?*) was ascertained by a subsequent study to be in reality the nymph of *Isonychia japonica* (Ulmer).

Baëtis bioculatus (Linné) 1736.

This is one of the commonest and most widely distributed species in Japan. Its range of distribution is so wide that it has been recorded from the whole Holarctic Region (Lestage 1930). The emergence in the regions of Kyôto and Ôtsu takes place from the end of March to the end of April. Matsumura (1931) has established a new species *B. japonicus* (*l.c.*, p. 1472) based upon a form formerly identified as *B. bioculatus*, but, judging by his description he seems to be mistaken in identification, for his differential diagnosis of his new species is evidently that of *B. bioculatus*. Therefore, it must be noted here that *B. bioculatus* is still widely spread in Japan.

Centroptilium rotundum Takahashi 1929.

Fig. 29—Hind-wing of *Centprotilium rotundum* Takahashi.

This species is characterized by its hind-wing which has a strongly coiled hook-like costal process at $\frac{1}{3}$ from the roots. Length of body (♂) 6 mm., fore-wing 7 mm., caudal setæ 8 mm.

Distribution: Honshû (Utsunomiya) and Shikoku (Zentsuji). The swarming occurs in July and December.

Baëtiella n.g.

Imago. Fore-wing with a pair of intercalary veinlets in each cell along the whole hind margin as is the case of *Baëtis*, 8 costal cross-veins

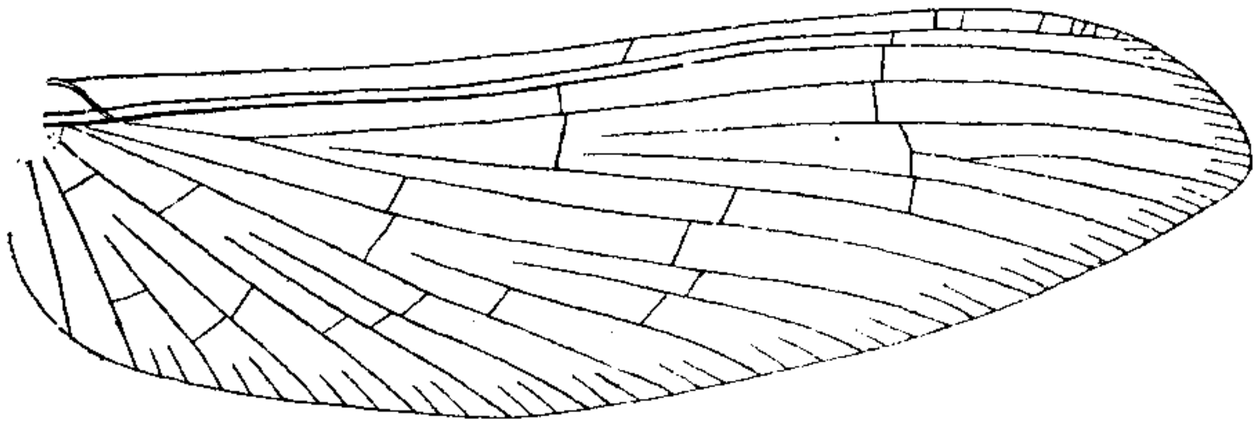


Fig. 30—Fore-wing of *Baëtiella japonica* (Imanishi).
(After Imanishi 1931).

behind the bulla, no cross-veins before the bulla. Hind-wings wanting. Forceps-limbs of male 4-jointed, the first joint large and rather thickened, the second joint very short, the third elongated and somewhat incurved, the last about $\frac{1}{3}$ as long as the third, clavate, apex rounded.

Nymph (Pl. 13, fig. 4): The nymph of this genus I have already treated as an undetermined form of *Acentrella*? (Uéno 1928).

Body slender, cylindrical, tapering gradually toward end, widest across the mesothorax. Eyes dorsal, ocelli three; antennæ a little shorter than head and thorax combined. Pronotum wider than head, its front margin narrower than hind margin, lateral margins rounded. Mouth-parts closely allied to those of the nymph of *Baëtis*, but the last joint of labial palpus short, obtusely conical, not widened distally as in *Baëtis* and the joining between joints 3 and 2 indistinct; glossæ and paraglossæ slender, narrowed toward tips (text-fig. 31, *A*). Hypopharynx short and narrow, median lobe rounded at apex, lateral lobes parted in two arches (text-fig. 31, *B*).

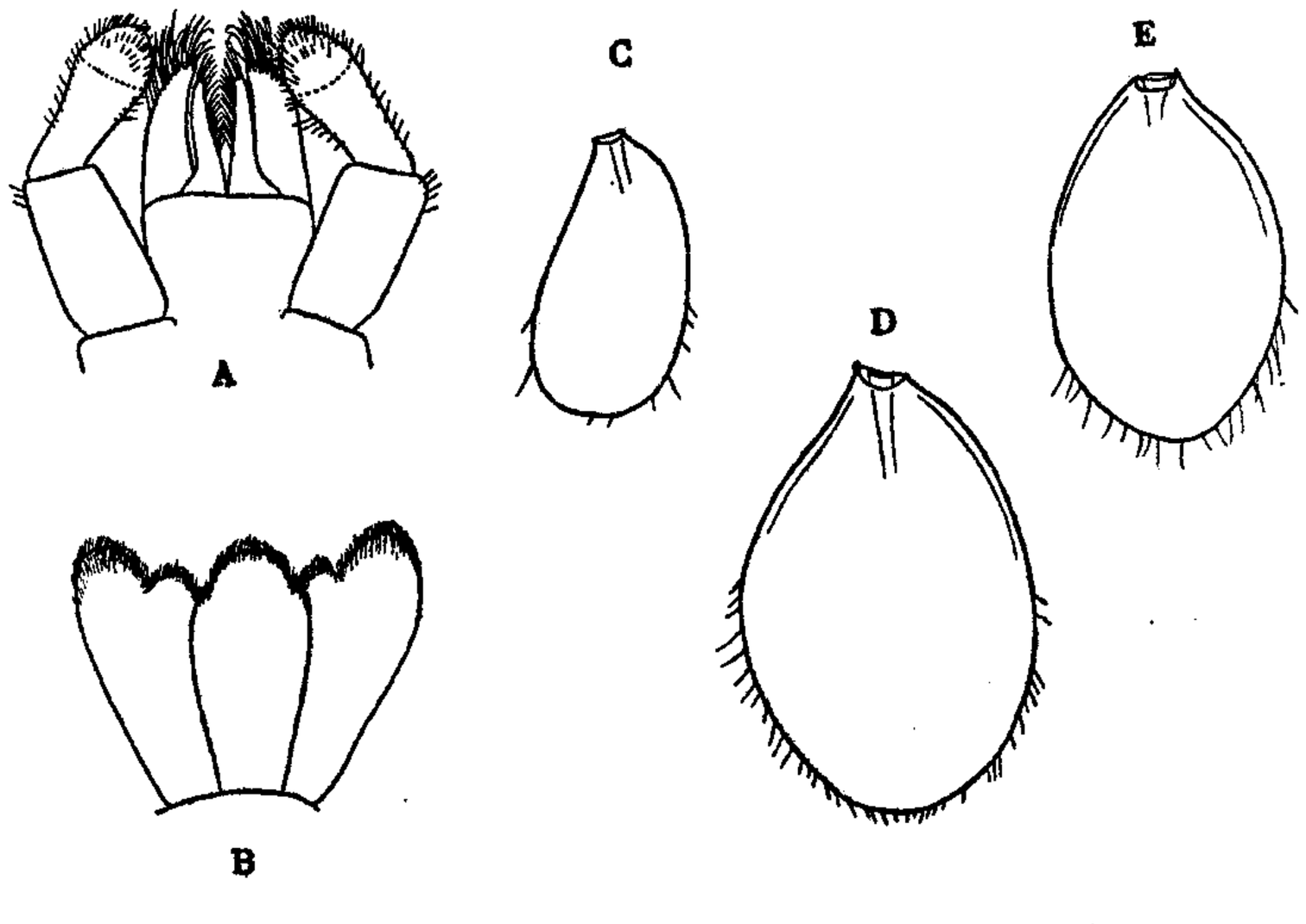


Fig. 31—*Baëtiella japonica* (Imanishi) (nymph). *A*. labium. *B*. hypopharynx. *C*. 1st. *D*. 4th and *E*. 7th gill lamella.

Legs rather long, all pairs nearly of similar size; tibia nearly as long as femur, fringed thickly on upper edge. Seven pairs of gills present

on abdominal segments 1-7, all simple, generally in similar form, ovate, margin round, trachea weakly developed (text-fig. 31, *C-E*). Caudal setæ 2, longer than body, glabrous, median seta quite absent (Pl. 13, fig. 4).

Genotype: *Acentrella japonica* Imanishi, Trans. Nat. Hist. Soc. of Formosa, 20, 1930, 110, p. 263, fig. 1-2.

Remarks: The most important characteristics of this new genus are as follows: (i) absence of hind-wings, (ii) caudal setæ of the nymph are 2, (iii) last joint of the labial palpus obtusely conical.

The first character, viz. the absence of the hind-wing is seen in the family Baëtidæ in *Cloëon*-group only, namely: *Pseudocloëon*, *Procloëon* and *Cloëon*. Of these, the fore-wing of *Pseudocloëon* only has marginal intercalary veinlets in pairs. In this respect, the present new genus is related much more closely to *Cloëon*-group, especially *Pseudocloëon* than to *Baëtis*-group. The structure of the forceps-limbs of the male is, however, of the type of *Baëtis*, the last joint being not slender and the last sternite having no penis-cover. Examining nymphal characters, we are able to find at once some remarkable differences from the nymphs of other Baëtidæ. The first of all, the nymph of *Baëtiella* has only two glabrous caudal setæ which are longer than the body, and the last joint of its labial palpus is obtusely conical as already mentioned above.

The nymph of *Baëtiella japonica* (Imanishi) inhabits usually very rapidly-flowing mountain streams and often it is found in cascades. The structure of its body shows that it is highly adapted to such an environment, i.e. the body slender, legs rather long and strong, eyes on the dorsum of the head and scanty hairs or fringes on the body and legs, etc.

The swarming takes place in the regions of Kyôto and Ôtsu usually in the middle of May. The nymph is one of the most important components of the stone-fauna in mountain streams of Japan, where it associates with some other mayfly nymphs, e g. *Iron* sp., and some dipterous larvæ and pupæ, such as: *Philorus*, *Blepharocera*, *Curupira* and *Deuterophlebia*. Judging by the widely-spread occurrence of the nymph in mountain torrents, *Baëtiella japonica* seems to be rather widely distributed in Japan.

Family: Ephemerellidæ Klapálek.

1. Genus: *Ephemellera* Walsh 1862.

Ephemerella trispina Uéno, 1928.

Ephemerella trispina Uéno, Mem. Coll. Sci., Kyôto Imp. Univ., Ser. B, 4, 1928, p 45, Pl. X, fig. 11, 11a-11n.

Imago ♂. Turbinate eyes gray, eyes black, ocelli grayish white, under half of them black; antennæ brown. Pronotum blackish chestnut-brown, mesonotum pitch-brown, hinder part black, both sides pale white; metanotum pitch-brown. Underside of thorax chestnut-brown, middle portion of prothorax somewhat paler. Fore-legs (text-fig. 32, *A*) blackish brown, femur somewhat paler; fore-tibia $1\frac{1}{4}$ as long as the femur; claws dissimilar. Mid- and hind-legs yellowish brown, darker band-like markings present on the upper surface of femur, tibia and tarsus darker; hind-tarsus (text-fig. 32, *B*) about $\frac{1}{3}$ as long as tibia, claws dissimilar. Wings hyaline, colourless, costal and subcostal fields gray, veins grayish brown, only R_1, M_1 and M_2 blackish brown.

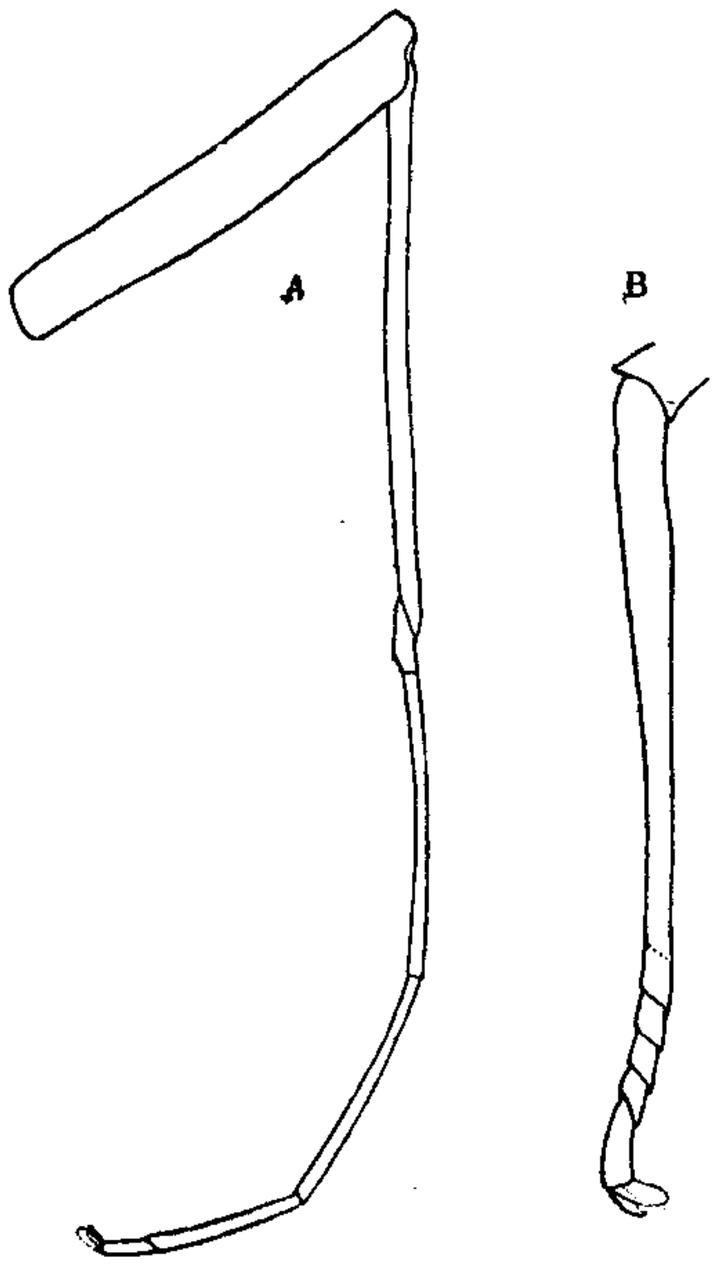


Fig. 32.—Legs of *Ephemerella trispina* Uéno. *A*. fore-leg of ♂. *B*. hind-leg of ♂.

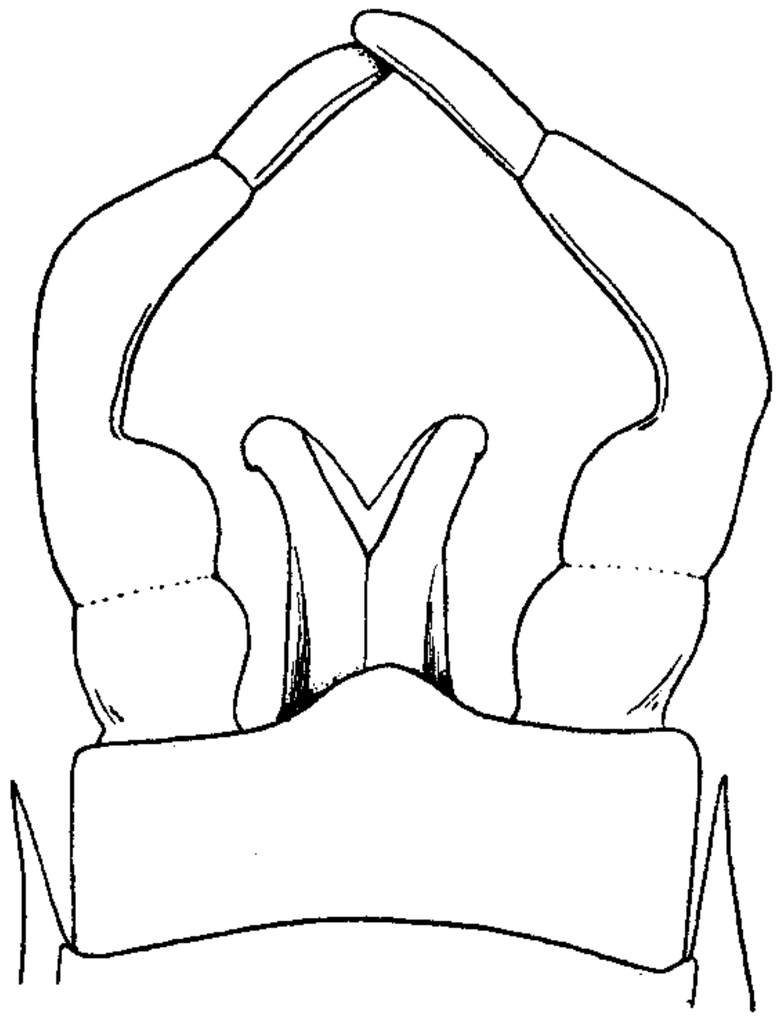


Fig. 33.—*Ephemerella trispina* Uéno. End of ♂ abdomen, ventral view.

Tergite of each abdominal segment pitch-brown, hind margin pale white, tergite 8-10 black; sternites reddish brown, with a pair of two dark marks on each side, among which many irregular indistinct darker markings are present; 9-10 sternites blackish brown. The basal $\frac{1}{3}$ of caudal setæ pitch-brown, joinings white, last $\frac{2}{3}$ yellowish white, joinings white. Tenth sternite convex at the middle of hind margin. Forceps-limbs 3-jointed, thick, brown, the basal joint short and rather thickened, the second joint stout, tapering to the size of the last joint, strongly bent inwards, inner side strongly excavated, the last joint rather slender. Penis serparated at apex, each lobe without appendages.

Body 13 mm., fore-wing 14.5 mm., caudal setæ 14 mm.

♀ unknown.

The relative length of the tibia and the femur of the fore-leg and the male genitalia evidently differ from those of the known species of *Ephemerella*. The emergence in the suburbs of Kyôto begins from the end of May.

2. Genus: *Chitonophora* Bengtsson 1909.

In my previous paper (Uéno 1928) there is described an ephemerellid nymph under the name of *Ephemerella nigra*.[6] Dr. Eduard

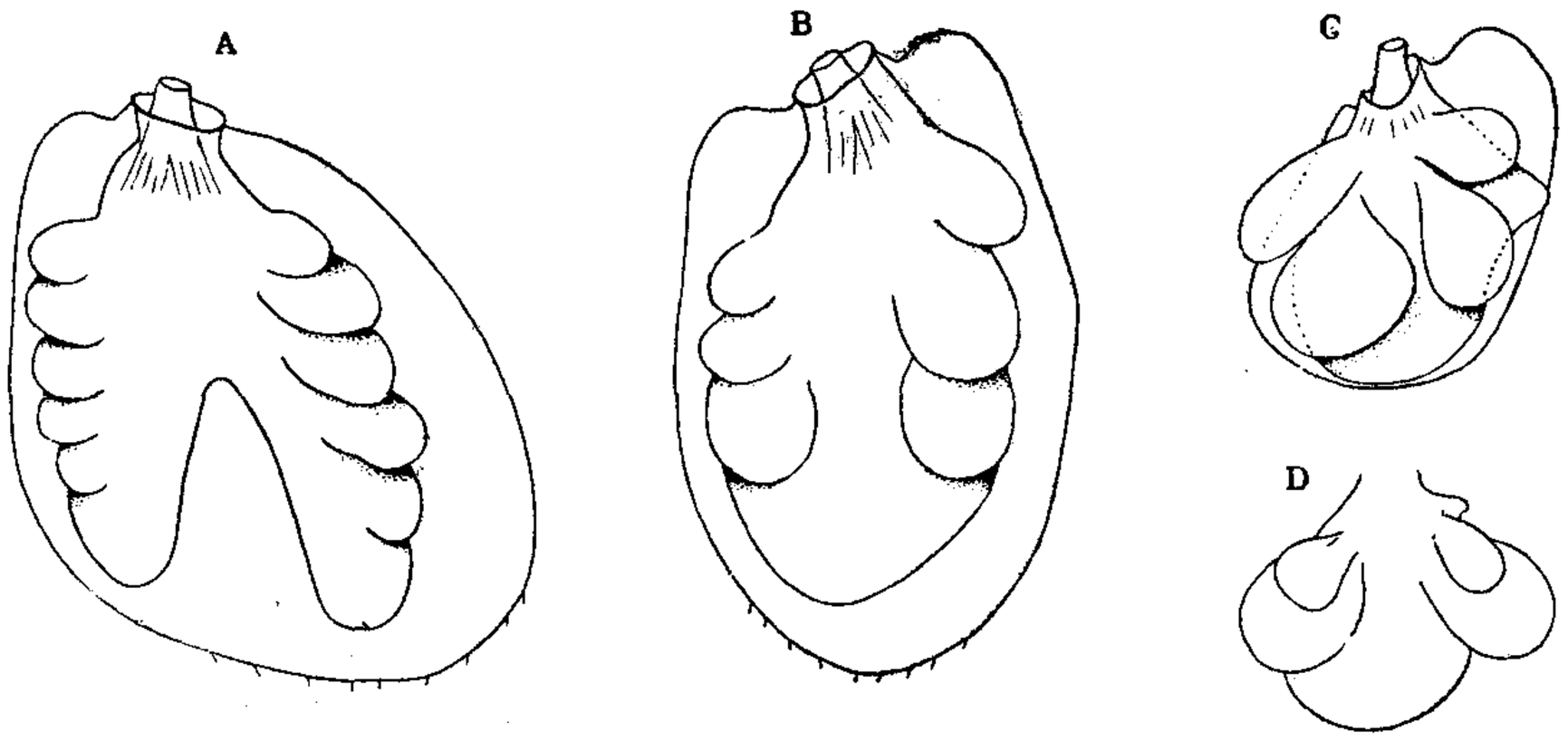


Fig. 34—*Chitonophora* (?) *nigra* (Uéno). Gill lamellæ of a nymph. *A*. 1st. *B*. 4th. *C* and *D*. 5th.

6 p. 44, Pl. IX., Fig. 9, 9a-9n.

Schoenemund of Geisenkirchen (Germany) was kind enough to suggest to me[7] that it might probably be a nymph of the genus *Chitonophora* judged by the character of the last gill lamellæ. Unfortunately, we have not yet succeeded in rearing the male imago of this species, only the female imago having been obtained, but careful examinations convinced me with that *E. nigra* is a little different insect from *Ephemerella*. It seems rather to be identical with *Chitonophora*. Noticeably enough, in *nigra*, however, the auriculate lobelets on the base of the hind (under) lamella of the fifth gill are present in two pairs (text-fig. 34, *A-D*). According to Bengtsson's original description (1909, p. 6) and illustration (1930, p. 7) and also Schoenemund's description and illustration (1928 and 1930), the fifth gill lamella in *Chitonophora* is characterized by the possession of only a single pair of auriculate lobelets. If *nigra* is really a form of *Chitonophora*, the geographical range of this genus extends as far as the Far East. The distribution of this genus has been limited to Central and North Europe[8], excepting a record from Kamchatka[9].

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7 A private communication. Also cf. Schoenemund, Wien. Entom. Ztg., 45, 1928.

8 Bengtsson, Tromsö Museums Arshefter, Naturhistorisk Avd. Nr. 1,1 5/7, 1930, p. 10.

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PLATES

PLATE 12

Fig. 1. *Bleptus fasciatus* Eaton. Kitayama, near Kyôto. *July.*

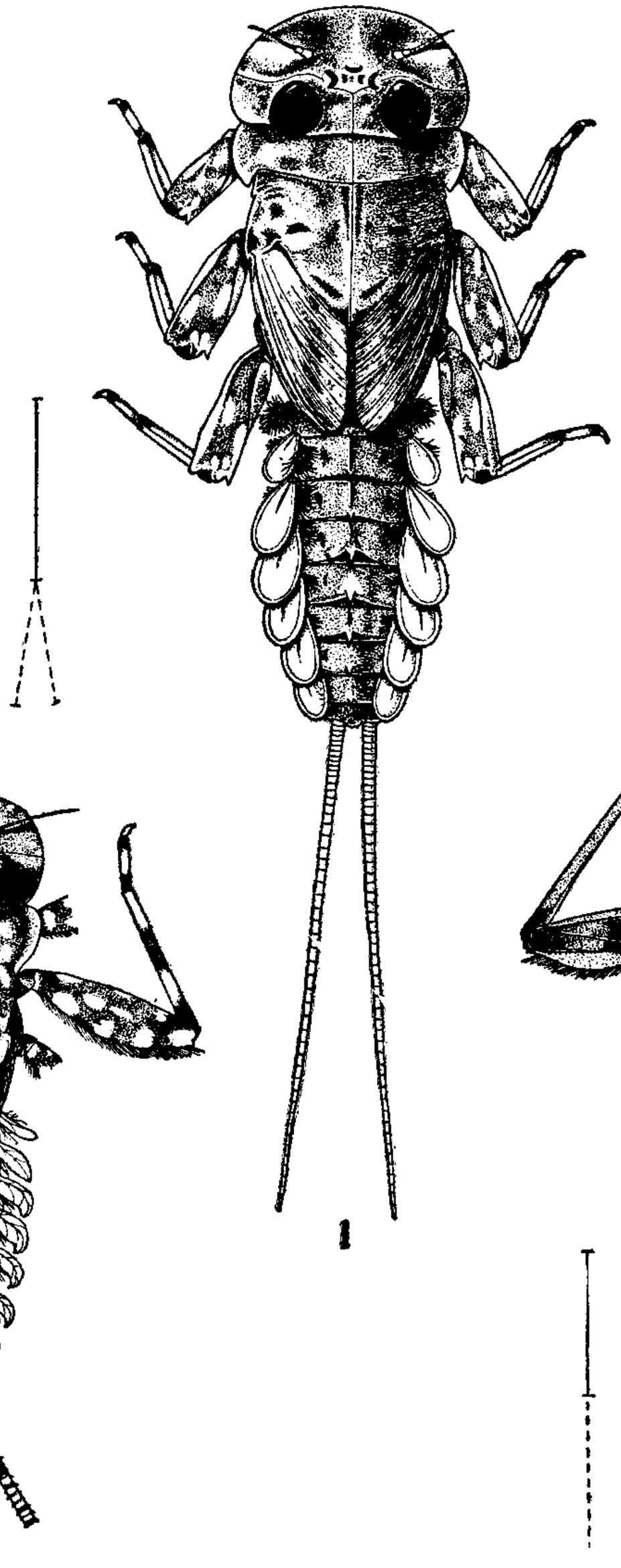
Fig. 2. *Ecdyonurus japonicus* (Uéno). Lake Kawaguchi. *June.*

Fig. 3. *Ecdyonurus tobiironis* Takahashi. Ôtsu. *April.*

JAPANESE MAYFLY NYMPHS

MASUZO UÉNO

PLATE 12



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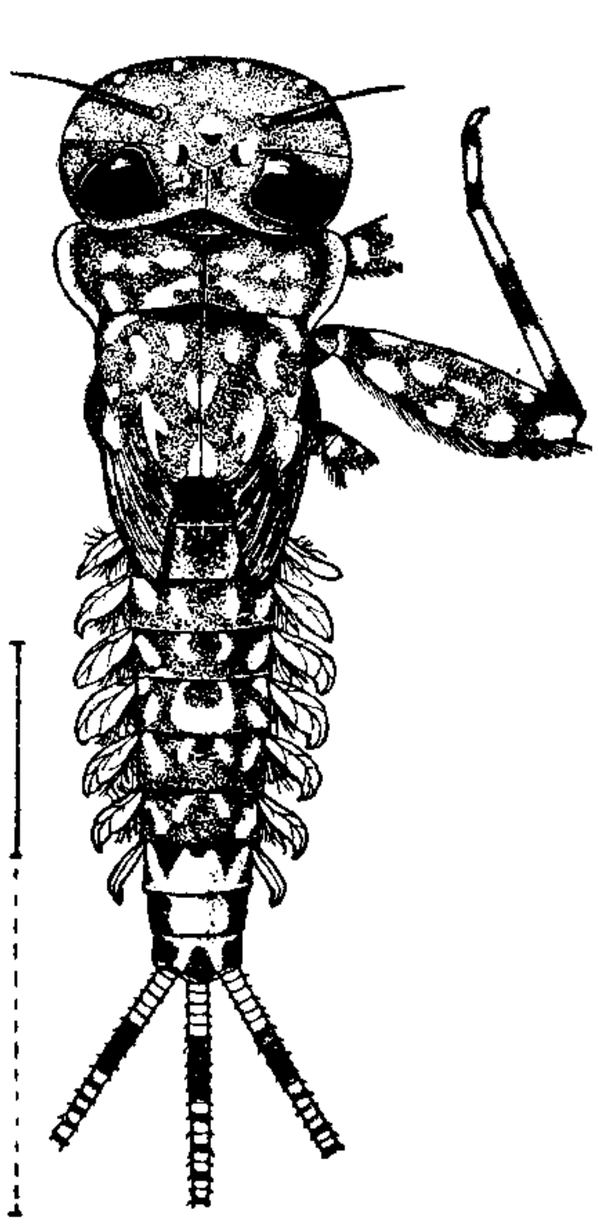

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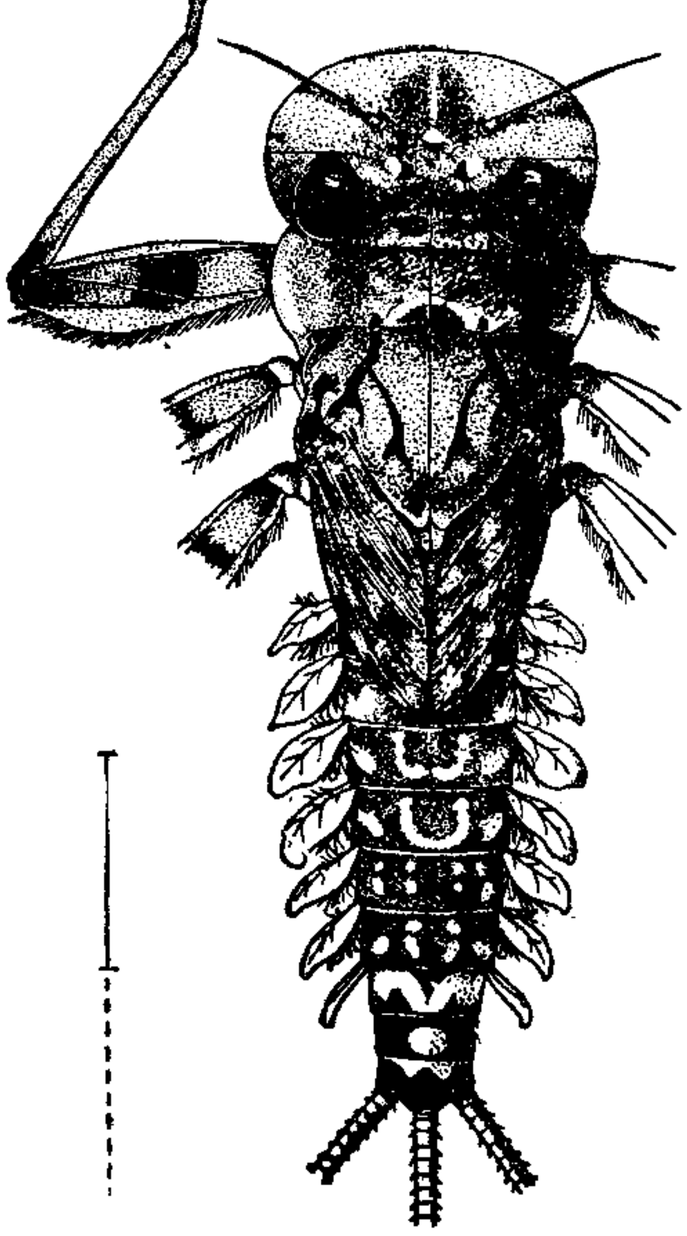

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PLATE 13

Fig. 4. *Baëtiella japonica* (Imanishi). Kamikôchi, Prov. of Shinano, *July*.

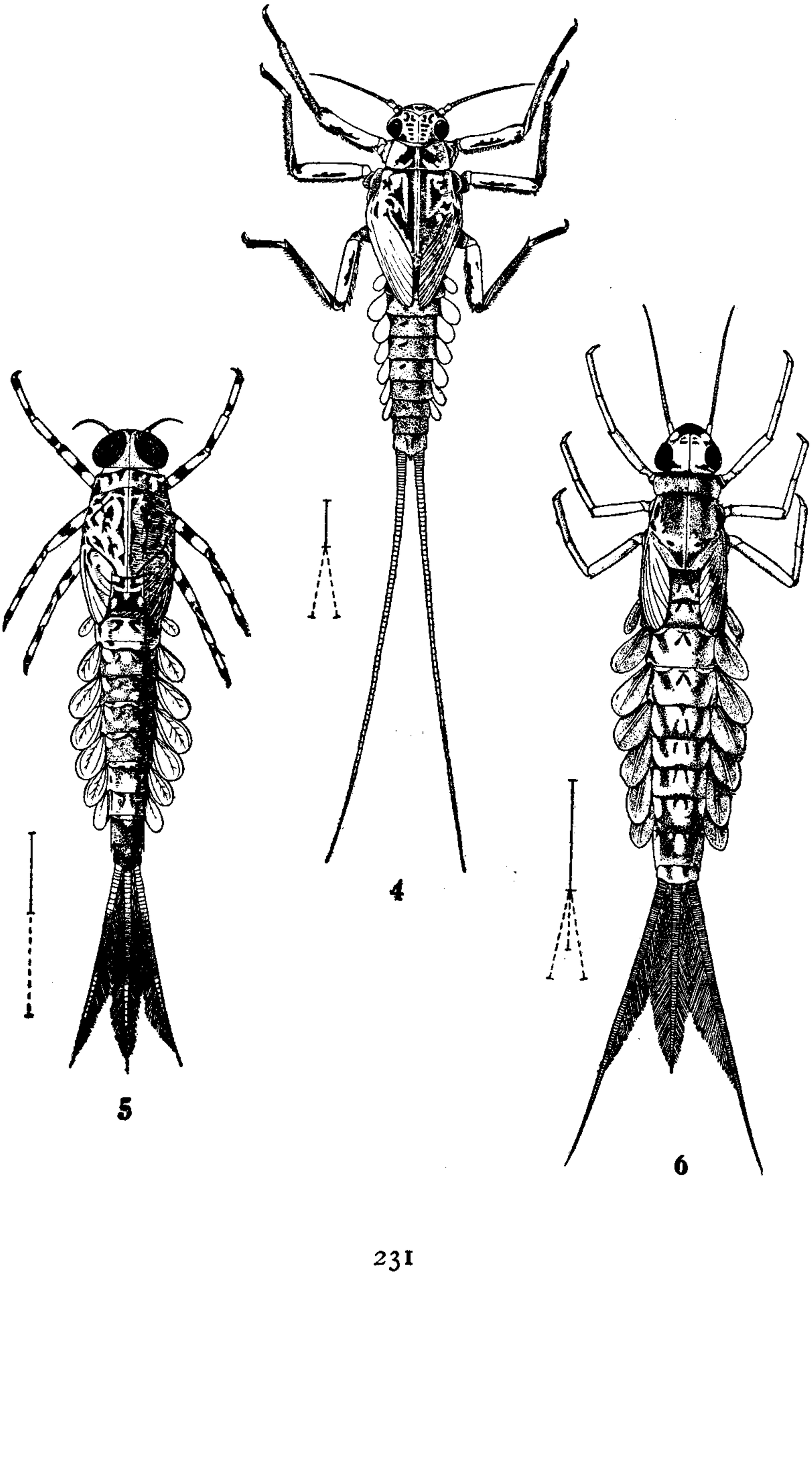
Fig. 5. *Ameletus montanus* Imanishi. Kibuné, near Kyôto. *April*.

Fig. 6. *Dipteromimus tipuiformis* MacLachlan. Kitayama, near Kyôto. *July*.

JAPANESE MAYFLY NYMPHS

MASUZO UÉNO

PLATE 13



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