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MAYFLIES (EPHEMEROPTERA) COLLECTED BY THE KYOTO UNIVERSITY PAMIR-HINDUKUSH EXPEDITION 1960

By

Masuzo UÉNO

THE COMMITTEE OF THE KYOTO UNIVERSITY SCIENTIFIC
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Mayflies (Ephemeroptera) collected by the Kyoto University Pamir-Hindukush Expedition 1960

By

Masuzo UÉNO*

The mayflies in the zoological collections which were made by Dr. Riozo YOSII during the Kyoto University Pamir-Hindukush Expedition 1960 under his leadership are mostly nymphs and subimagines, only a few of them being imagines. The writer who undertook to study them succeeded to distinguish nine species which belong to eight genera. One alpine baétine form collected on Mt. Noshaq seems to the writer to be a new species, the description of which will be given in the present article.

As far as the present material are concerned, the mayfly fauna of the Pamir-Hindukush border is composed of the elements different from those of Nepal, which have been discussed by the present writer (UÉNO, 1955, p. 314). The mayfly fauna in the district under consideration appears to be made up principally by the Central Asiatic species whose ranges of distribution are confined to Usbekistan and its northeastern districts. It will therefore be said that the present results have made apparent the southward extension of the ranges of distribution of some species.

The writer wishes to express his appreciation to Dr. Riozo YOSII who kindly placed his mayfly collection at the writer's disposal for the present study.

List of the Localities

1. Pagman, 17 June, 1960
   Ameletus alexandrae BRODSKY, 1 nymph; *Baetis* sp., 4 nymphs; *Ephemerella* sp., 3 nymphs.
2. Borak (Barak), 9–10 July, 1960
   Clocon zimini TSCHERNOVA, 1 ♀ subimago; *Ephemerella* sp., 17 nymphs.
3. Bozghilon (Bazghilon), Kotcha, 14 July, 1960
   Rhithrogena sp., 2 nymphs.
4. Noshaq, 3,800 m. above sea level, 25 July, 1960; on the surface of water of a cold spring by a lake
   Baetis noshaqensis sp. n., 12 ♀♀ imagines, 10 nymphs and 56 exuviae.
5. Noshaq, Quasideh Valley, 3,200 m. adove sea level, 1 August, 1960
   Baetis noshaqensis sp. n., 9 nymphs.

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6. Noshaq, 3,900 m. above sea level, 1 August, 1960
   Epeorus (*Iron*) sp., 5 nymphs.
7. Ishkashim, 29 August, 1960
   Ecdyonurus sp. (a), 16 nymphs; *Ecdyonurus* sp. (b), 20 nymphs; *Epeorus* (*Iron*) sp., 1 full-grown nymph; *Ameletus alexandrae* BRODSKY, 1 nymph.
8. Ishkashim, a pond, 3 September, 1960
   Ameletus alexandrae BRODSKY, 1 nymph.
9. Shiwa Lake (Shewa Lake), Darwaz, 9 September, 1960
   Ameletus alexandrae BRODSKY, 54 ♀♀ subimagines, 1 nymph and 1 exuviae.
10. Doab by Shiwa Lake (Shewa Lake), 10 September, 1960
    Baetis noshaqensis sp. n., 1 nymph.
11. Small stream by Shiwa Lake, 9 September, 1960
    Baetis noshaqensis sp. n., 1 nymph.

List of the Species according to the Taxonomic Arrangement

I. Family: Siphlonuridae

1. Genus: **Ameletus** EATON

1. Ameletus alexandrae BRODSKY
Pagman, 17 June, 1960; Ishkashim, 29 August, 1960; Ishkashim, a pond, 3 September, 1960; Shiwa Lake, 9 September, 1960.

II. Family: Heptageniidae (=Ecdyonuridae)

2. Genus: *Ecdyonurus* EATON

2. Ecdyonurus sp. (a)
Ishkashim, 29 July, 1960; Shiwa Lake, 9 September, 1960; Doab, 10 September, 1960.

3. Ecdyonurus sp. (b)
Ishkashim, 29 July, 1960.

3. Genus: *Epeorus* EATON

4. Epeorus (Iron) sp.
Noshaq, 3,900 m above sea level, 1 Augst, 1960; Ishkashim, 29 July, 1960; Shiwa Lake, 9 September, 1960.

4. Genus: *Rhithrogena* EATON

5. Rhithrogena sp.
Bozghilon, 14 July, 1960.

III. Family : Baetidae

5. Genus : *Baetis* LEACH

6. Baetis noshaqensis sp. n.

Pagman, 17 June, 1960 ; Noshaq, 3,800 m. above sea level, 25 August, 1960 ; Ishkashim, 29 August, 1960 ; a small stream by Shiwa Lake, 9 September, 1960 ; Doab by Shiwa Lake, 10 September, 1960 ; Ishkashim, 29 August, 1960.

7. Baetis sp.

Pagman, 17 June, 1960.

6. Genus : *Cloeon* LEACH

8. Cloeon zimini TSCHERNOVA

Borak, 9 July, 1960.

IV. Family : Ephemerellidae

7. Genus : **Ephemerella** WALSH

9. Ephemerella sp.

Pagman, 17 June, 1960 ; Borak, 9–10 July, 1960.

Descriptions and Notes of the Species

1. **Ameletus alexandrae** BRODSKY

BRODSKY, 1930, p. 697.

Localities : Shiwa Lake, 9 Sept., 1960, 54 subimagines, 1 exuviae, and 1 nymph ; Ishkashim, 3 Sept., 1960, 1 nymph, 29 Aug., 1960, 4 nymphs ; Pagman, 17 June, 1960, 1 nymph (all the specimens in alcohol).

A large number of subimagines enabled the writer to identify them with BRODSKY's *Ameletus alexandrae* by some features particularly the presence of a distinct black spot (so-called „Ganglion in Form", BRODSKY) on each sternite, though the structure of the forceps of the male genital part were unable to determine. BRODSKY (1930, p. 700) has recorded this species from several places east of Tashkent and as far east as Lake Issyk-Kul. He has also recorded the nymph of this species from Kasakstan and Usbekistan, but the description of it has not been accessible to the writer.

Subimago : Length of body 9.0–9.5 mm., fore-wing 10.0–10.5 mm., caudal filament 7.5 mm. (all in ♀).

Head brownish grey, eyes black. Pronotum grey, frontal margin dark brown. Meso- and metanotum grey. Abdominal tergites greyish brown, hind margin of each tergite dark brown, median line dark brown which becomes paler in poste-

rior tergites; tergites VII-IX dark brown at the sides where they meet with the sternite forming a sharp edge. A round or wedge-shaped black (somewhat reddish) spot present on the sternites III-VIII near the anterior end at the median line, as seen in the imago. Such a blackish spot present also on the ventral

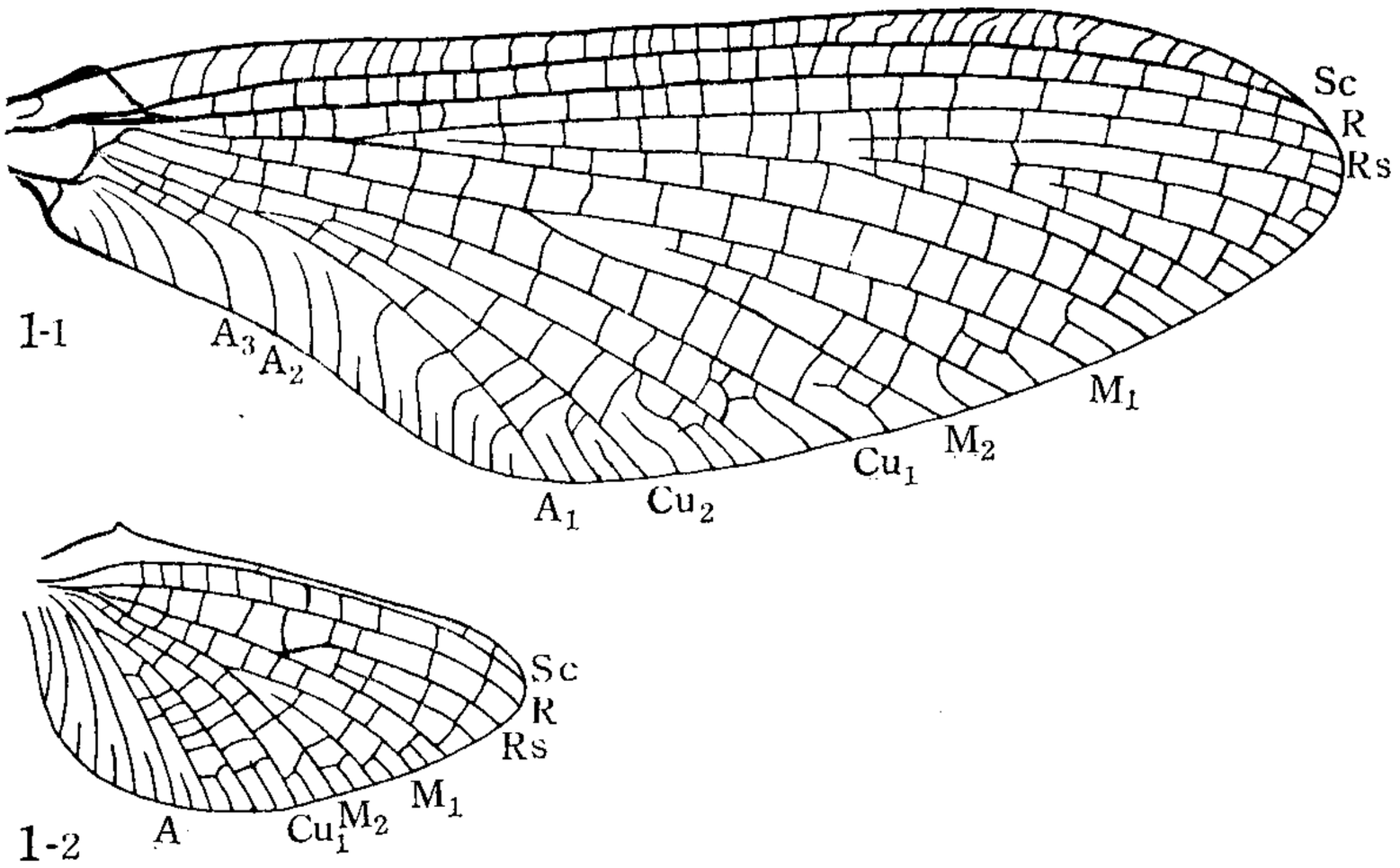

Fig. 1a. *Ameletus alexandrae* BRODSKY, ♀ subimago.
1–1, Fore-wing; 1–2, hind-wing.

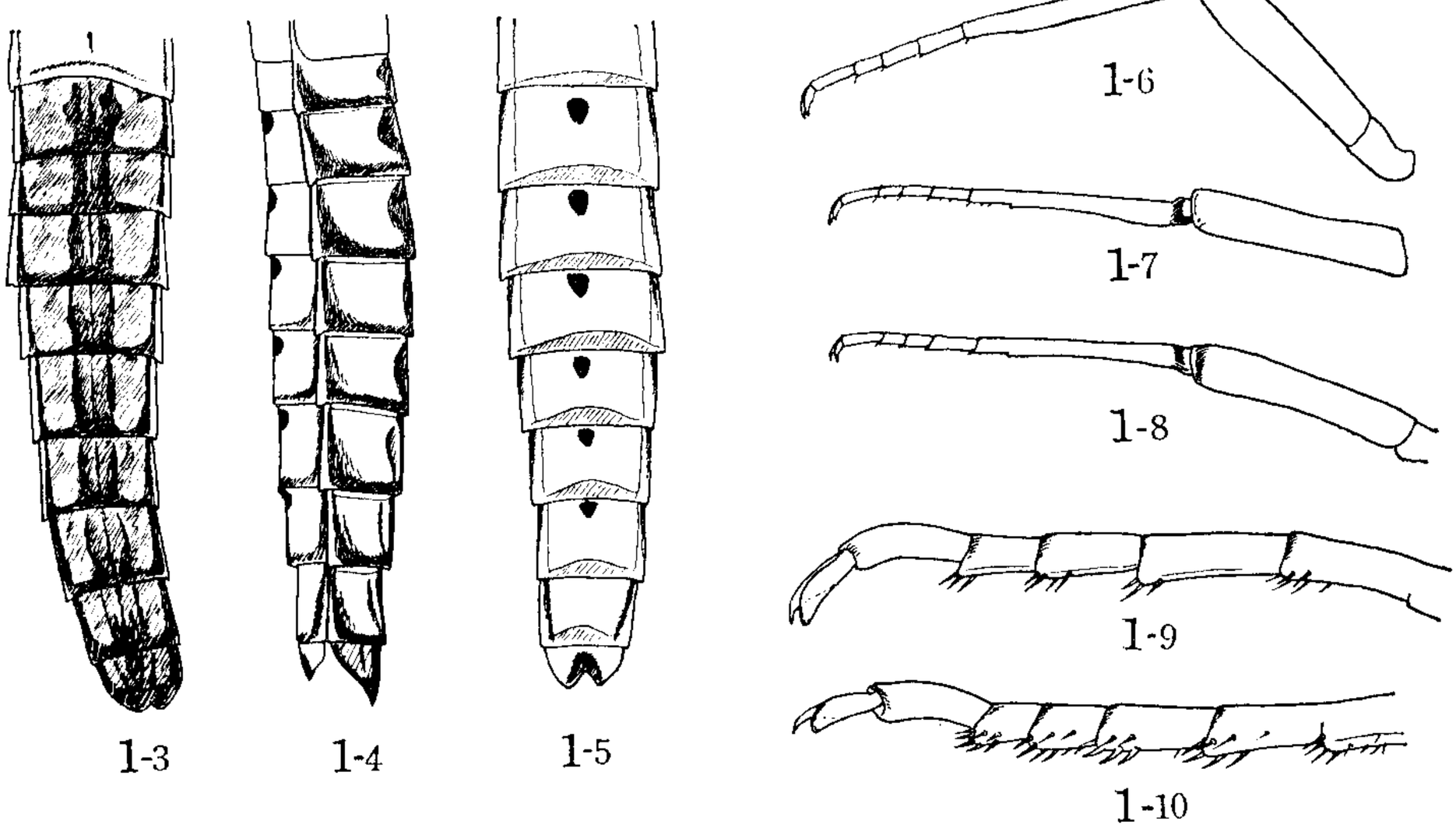

Fig. 1b. *Ameletus alexandrae* BRODSKY, ♀ subimago.
1–3, abdomen, dorsal view; 1–4, abdomen, lateral view; 1–5, abdomen, ventral view; 1–6, fore-leg; 1–7, mid-leg; 1–8, hind-leg; 1–9, tarsus of fore-leg; 1–10, tarsus of hind-leg.

surface of thoracic segments.

The distal end of each femur black. Hind tarsus nearly as long as tibia, with four movable joints, the fifth joint fused to tibia.

Both wings smoked, veins brown; Sc of fore-wing fully visible, Cu_1 and A_1 of fore-wing running parallel to each other at base. The other characters are similar to those of imago given by BRODSKY in his original description.

Nymph:

The Shiwa material consists of only one nymph whose legs, gills and caudal filaments were broken off, but the Ishkashim specimens which were preserved in the complete condition enabled the writer to determine the nymphal characteristics. Length of body 10 mm. in the Shiwa nymph, 8–12 mm. in the Ishkashim nymphs. The length of caudal filaments of the latter measured 4.5–5.5 mm.

Head narrower than pronotum, eyes large, antennae 15-jointed. Pronotum short, both sides rounded. Abdomen tapered to rearward, the tergites somewhat arched dorsally in the middle and flattened at sides where they meet with stern-

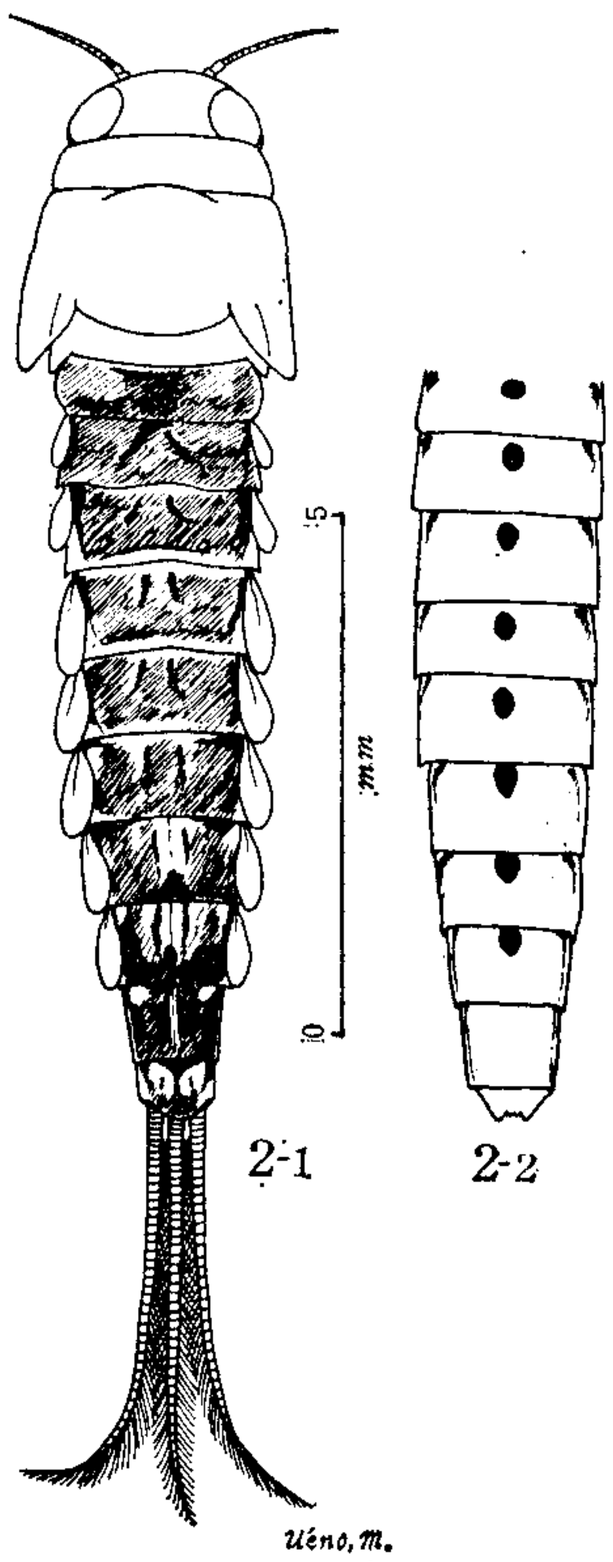

Fig. 2. Nymph of *Ameletus alexandrae* BRODSKY. 2–1, abdomen and caudal filaments, dorsal view; 2–2, abdomen, ventral view.

ites, forming an edge. Tergites brown, with a pair of dark brown stripes present on the tergites II–IX; they are divergent on the tergites II–V, but become parallel on VI–IX. As seen in the imago as well as subimago, there are present narrow dark areas somewhat convergent posteriorly close to lateral sides. On the antero-lateral corners of the tergites VII–IX present a pair of paler areas which becomes larger on the 10th tergite. Sternites brownish yellow, lateral sides brown; on the sternites I–VIII there are present, close to the anterior end, a distinct black spot on the median line; these spots are round in the first two sternites and then become ovoid or wedge-shaped on the posterior sternites. In the subimago such a spot is distinct only on the sternites III–VIII, as described already, but in the nymph they are present also on the sternites I and II. Three caudal filments, half as long as body, yellowish grey, with dark brown rings; laterial filments fringed with fine hairs only on the inner side, while the middle filament with such hairs on both sides.

Gills seven pairs, all simple, oblong-ovate, white, trachea indistinct; the 4th

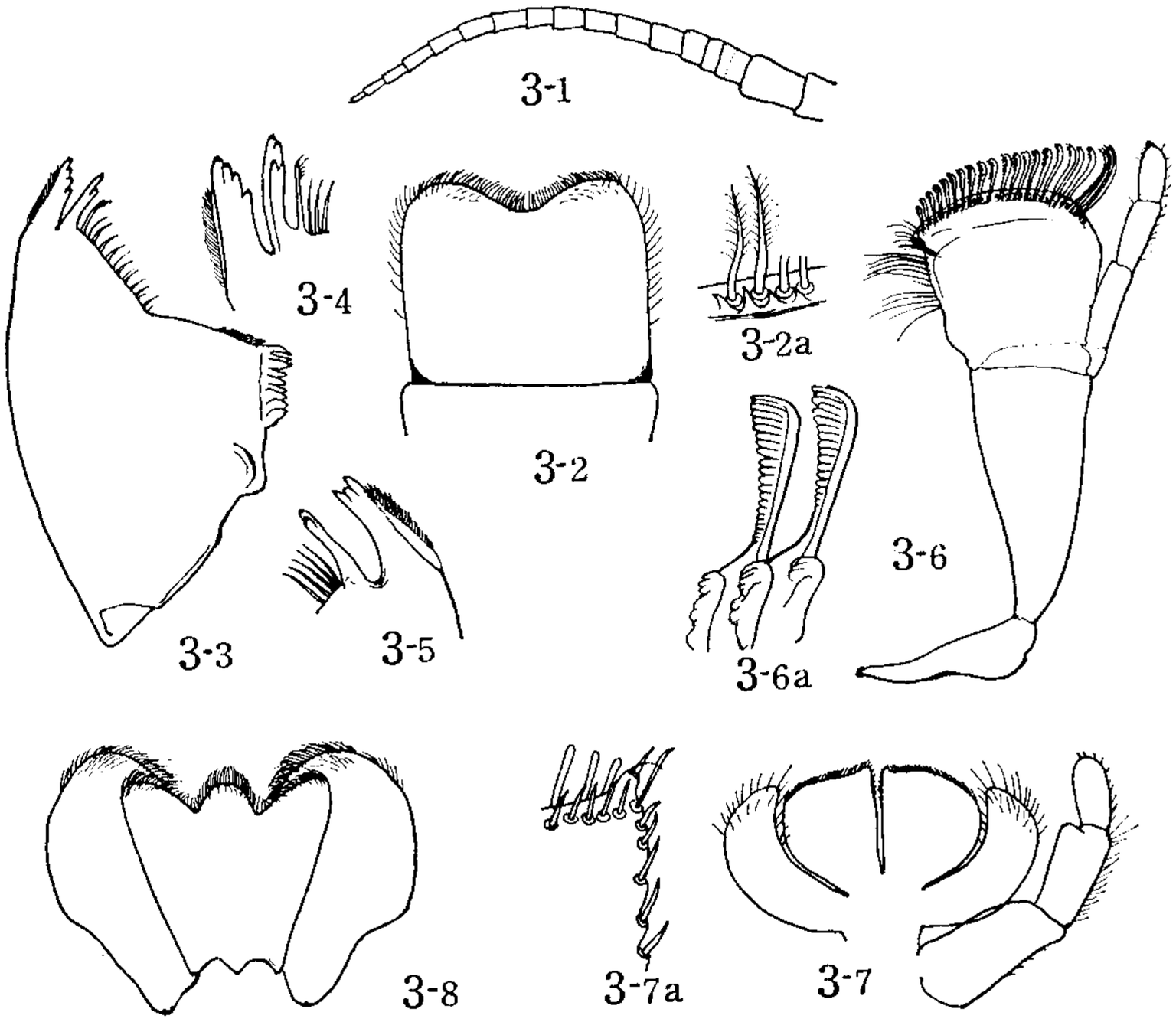

Fig. 3. Nymph of *Ameletus alexandrae* BRODSKY.
3–1, antenna; 3–2, labrum; 3–2a, bristles on the margin of labrum; 3–3. left mandible; 3–4, canine of the same; 3–5, canine of the right mandible; 3–6, maxilla; 3–6a, pectinate spines on the apical margin of galea-lancinia; 3–7, labium; 3–7a, spine arrangement of the inner apical corner of glossa; 3–8, hypopharynx.

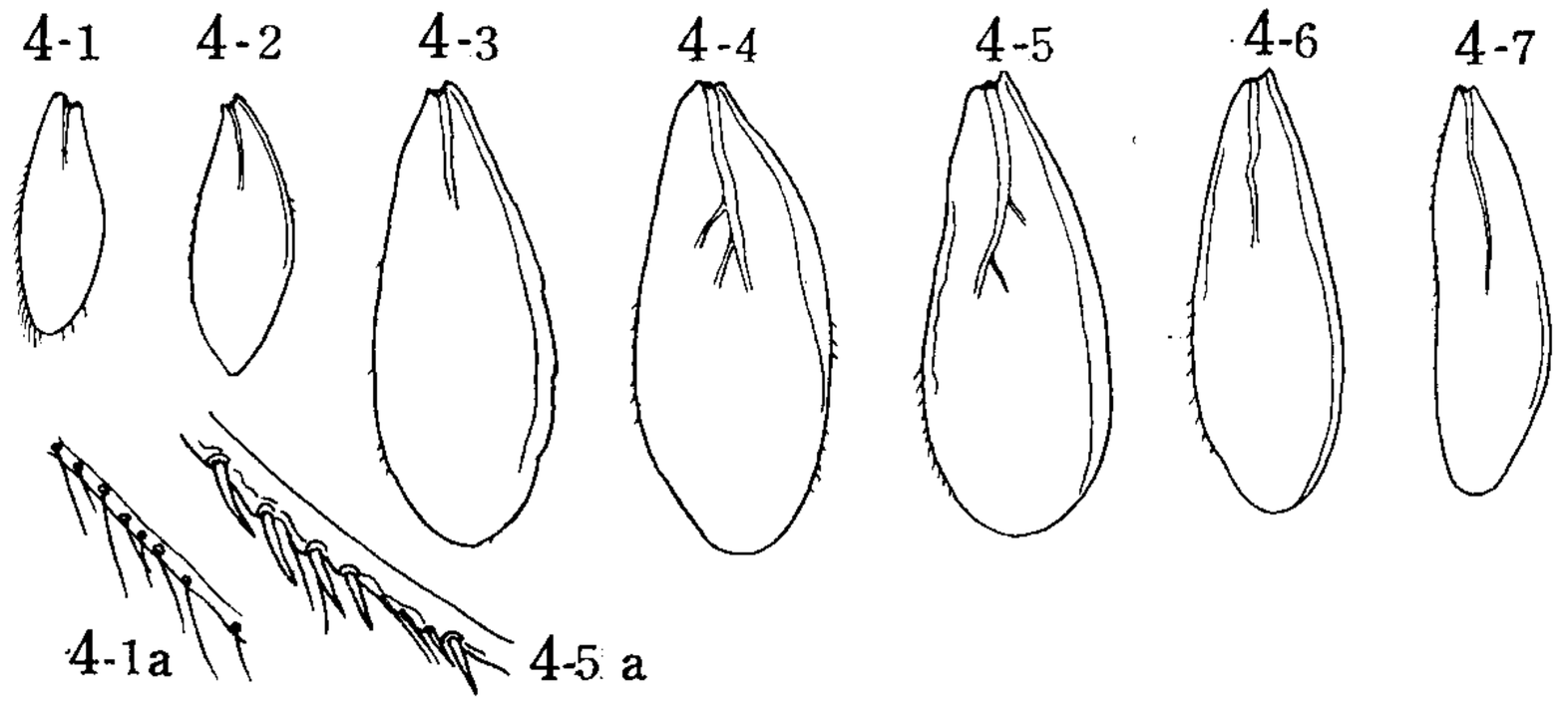

Fig. 4. Nymph of *Ameletus alexandrae* BRODSKY.
4-1～4-7, the first to the seventh gill lamellae; 4-1a and 4-5a, bristles and spines on the margin of the first and the fifth gill lamellae.

longest, 3rd and 5th subequal, the lst slightly longer than half of the 4th; the margin of the lst lamella fringed with long fine setae, but that of the other pairs with both minute spines and setae.

Mouth parts: Labrum wider than long, quadrate, front margin emarginate at middle, beset thickly with fine plumose setae (Fig. 3-1a). Mandibles rather short and robust (Fig. 3-3); canines nearly subequal, outer canine of both mandibles becomes four or three teeth at apex and fringed with fine setae on the outer side; prostheca of right mandible slender, with a few bristles only on the apical inner margin and followed by a row of bristles; left mandible without prostheca, with only a row of bristles. Maxillae (Fig. 3-6) cuneiform, distal margin wide and round, with two rows of long and short comb-like setae (Fig. 3-6a), inner margin with long bristles; maxillary palp extending beyond the distal margin of galea-lacinia. Glossae and paraglossae of labium (Fig. 3-7) nearly equal in length; the former wider than the latter, with inner margin straight, armed with short spinules (Fig. 3-7a); labial palp relatively short and robust. Median part of hypopharynx 3-lobed, lateral lobes rounded apically (Fig. 3-8).

Remarks: The mouth parts of the nymph under consideration show the characteristics of the genus *Ameletus* EATON. The markings on the abdominal tergites and sternites of this nymph, as well as of exuviae, enabled the writer to determine it as of *Ameletus alexandrae* BRODSKY. The present record has made apparent its southward distribution south of Pamir.

2. **Ecdyonurus** sp. (a)

Localities: Only the nymphs were collected. Ishkashim, 29 July, 1960, 16 nymphs; Shiwa Lake, 9 September, 1960, 11 nymphs; Doab, 10 September, 1960, 11 nymphs (all the specimens in alcohol).

Nymph: Length of body 8.0–8.5 mm., median caudal filament 8.0 mm.

This nymph is characterized by having a median dorsal tooth on each tergite. Head large and flattened, widest at the level of anterior portion of eyes, frontal margin rounded, without fringes; general colour brown, frontal portion of the median ocellus pale, a large but inconspicuous pale round median spot present near the frontal margin. Antennae slender, slightly longer than half of the head breadth. Pronotum short, slightly narrower than head, with dilated and rounded lateral margins which are prolonged behind and fused to the sides of mesonotum; colour brown, without distinct markings.

Legs large, pale yellow, with two dark broad bands on the upper surface of flattened femora, one at the proximal end and the other at the distal half and irregular in shape. The length ratio, tarsus: tibia: femur is, in the fore-leg, 1: 3.8: 4.2, mid-leg, 1: 3.2: 3.5; hind-leg, 1: 3.1: 3.3. Femora fringed with a row

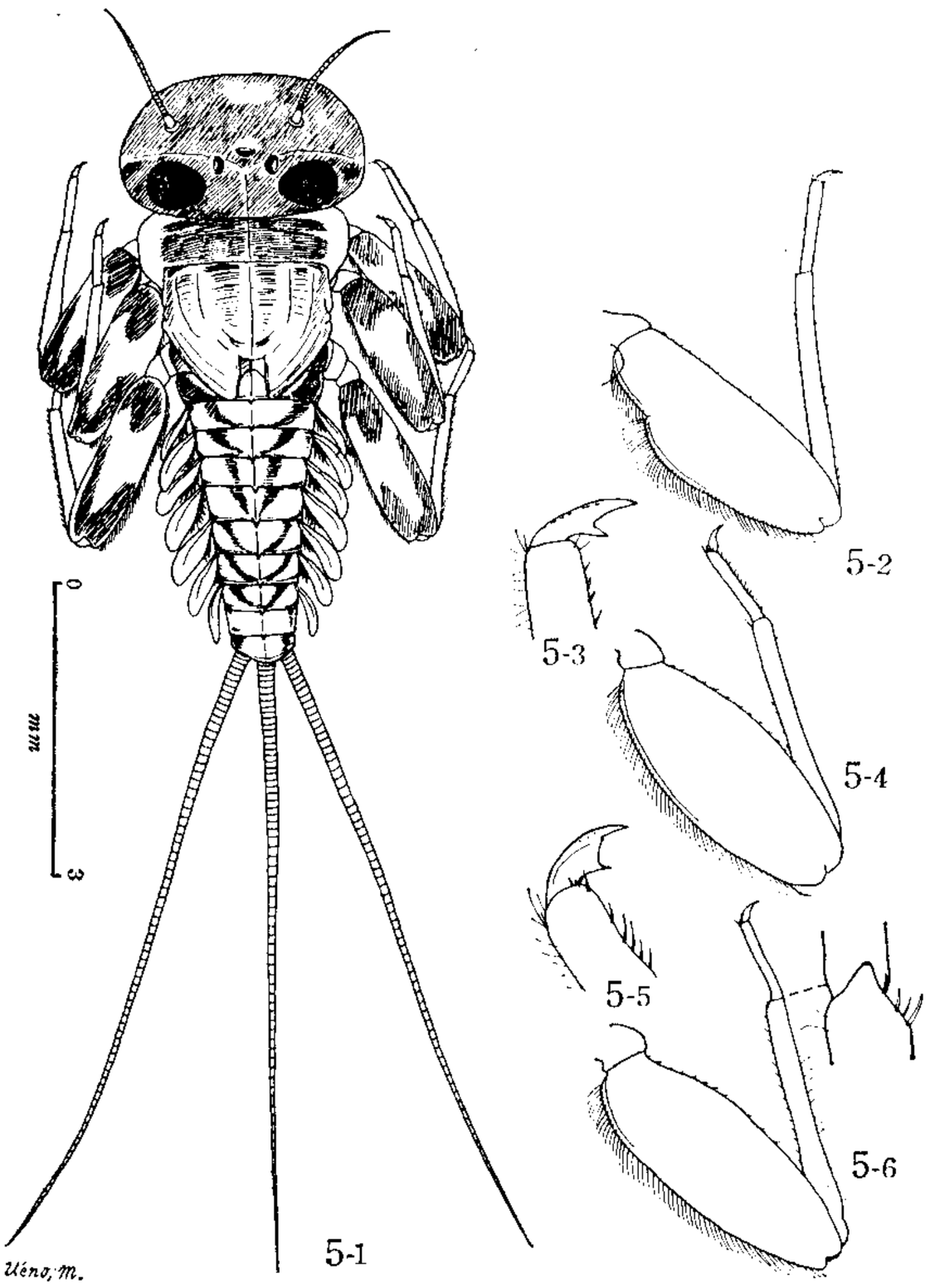

Fig. 5. Nymph of *Ecdyonurus* sp. (a).
5–1, nymph of 6 mm. in body length, dorsal view; 5–2, 5–3 and 5–6, fore–, mid–, and hind-leg; 5–3, claw of mid-leg; 5–5, claw of hind-leg.

of long bristles on the outer margin, with short minute spines on the inner margin, the upper surface covered densely with minute spines; tibiae and tarsi with long bristles on the outer margin and short spines on the inner margin; claws unidentate on the inner margin.

Labrum short and wide, four times as wide as its length, fringed with long bristles on the frontal margin (Fig. 6-1). Mandibles broad in the portion of galea-lacinia, but very slender in the basal half (Figs. 6-2, 6-3). Inner canine of the left mandible nearly as long as the outer canine, with three projections at the tip; inner margin of the outer canine crenated, with about ten blunt teeth, prostheca represented by five long and two short spines. Inner canine of the right mandible 4/5 as long as the outer canine, with about ten crenulations on the inner margin; prostheca composed of three long and two short spines. Molar surface of both mandibles well developed.

Maxillary palp (Fig. 6-4) slender, proximal joint with a row of long bristles on the outer margin, second joint fringed on the outer margin with long setae, and the terminal portion beset thickly with short bristles; galea-lacinia broad,

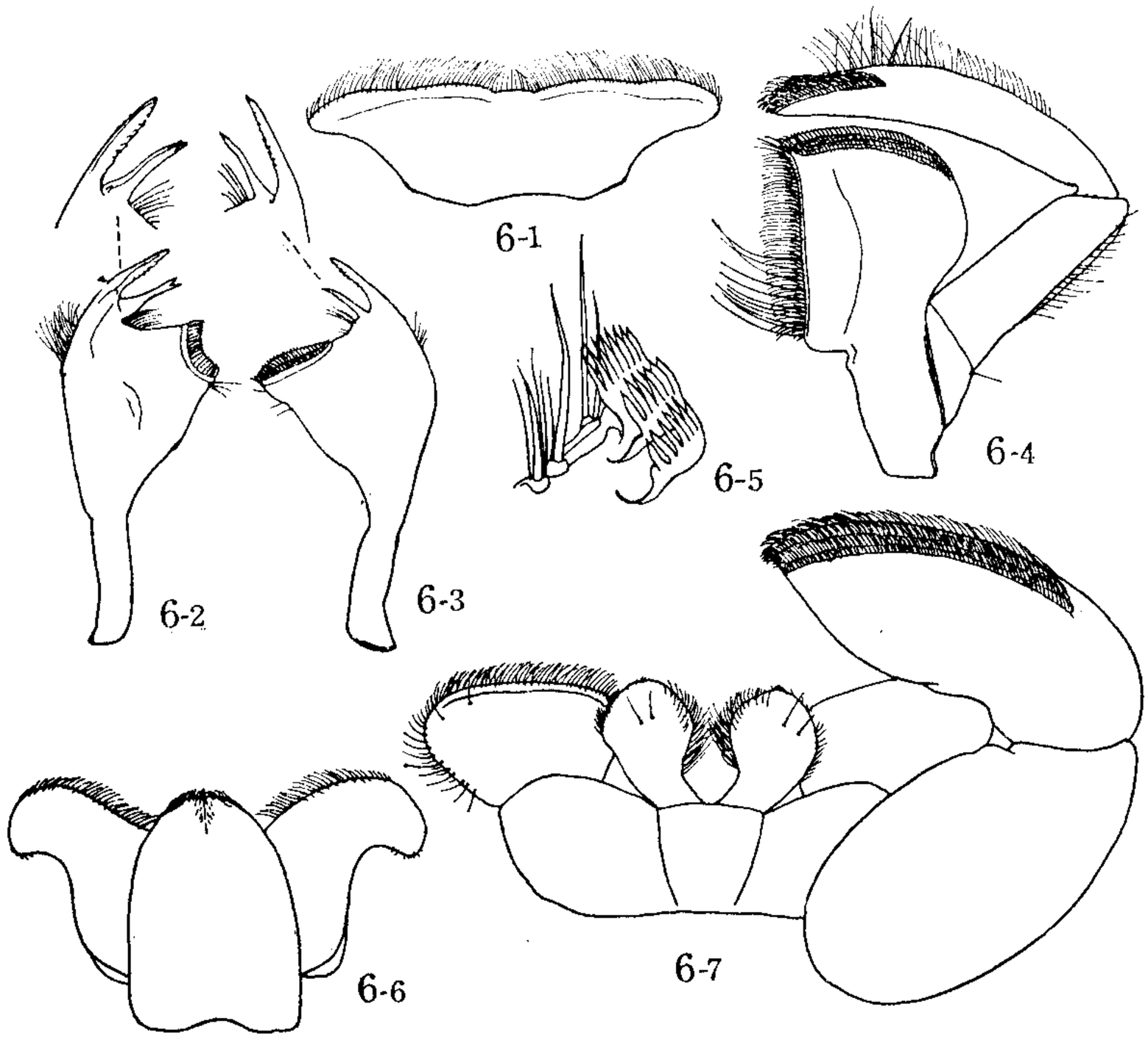

Fig. 6. Nymph of *Ecdyonurus* sp. (a).
6-1, labrum; 6-2, left mandible; 6-3, right mandible; 6-4, maxilla; 6-5, inner apical corner of galea-lacinia of maxilla; 6-6, hypopharynx; 6-7, labium.

inner margin nearly straight, on the apical margin there are two rows of long and short spines (Fig. 6–5), on the inner margin there are also two rows of long and short spines, and on the proximal half a row of about 10–11 long bristles (Fig. 6–5).

Glossae of labium small, slightly divergent apically, apical margin conical, beset thickly with long setae on the intero-apical margin, two long bristles present on the upper surface; paraglossae twice as wide as glossae, fringed thickly with long bristles on the apical margin, and with two rows of bristles; labial palp large and robust, beset thickly with bristles on the outer border of distal 2/3. Median lobe of hypopharynx rounded apically, lateral lobes strongly outcurved, outer margin sinuate, fringed with long bristles on the inner apical margin (Fig. 6–6).

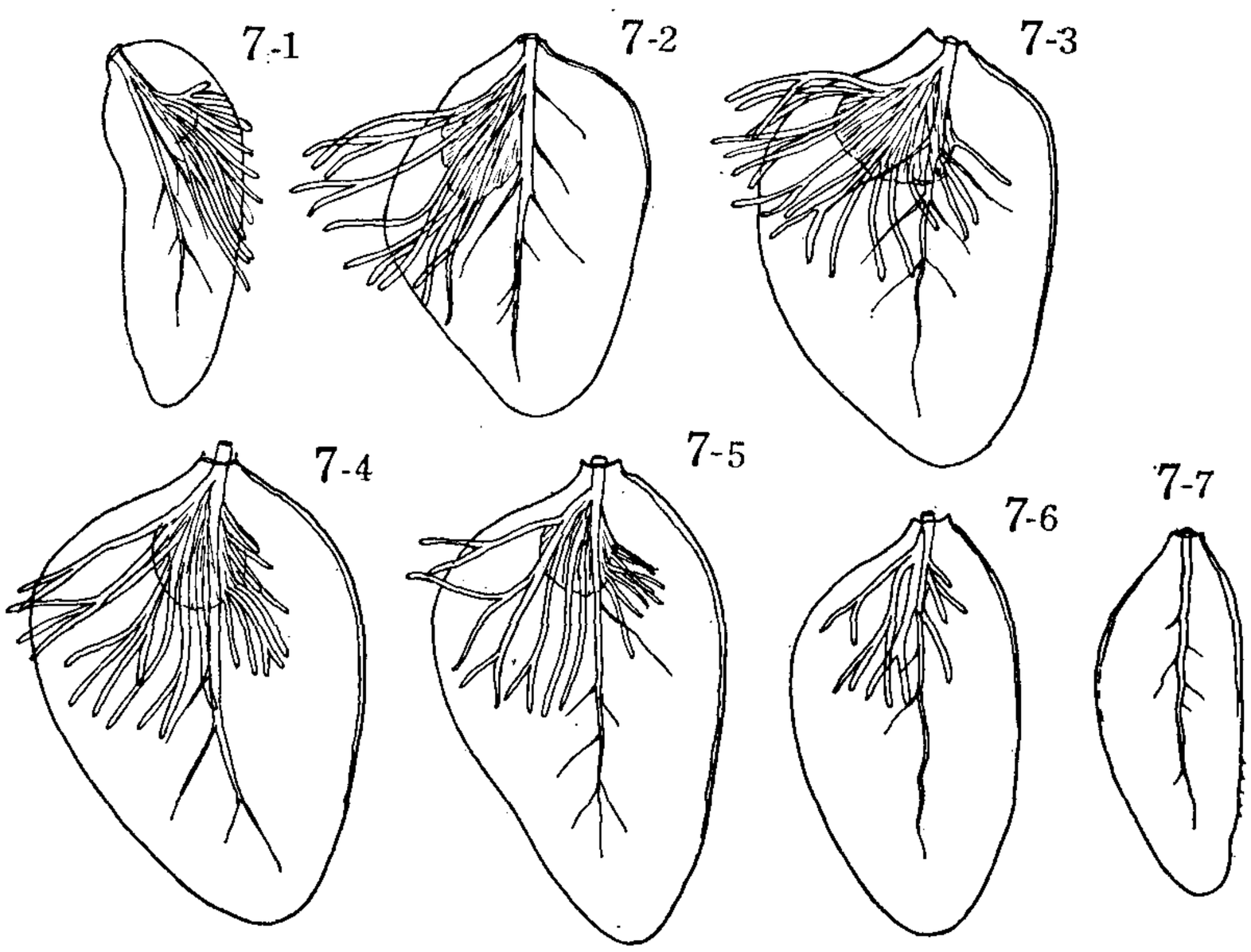

Fig. 7. Nymphal gills of *Ecdyonurus* sp. (a).
7–1～7–7, the first to the seventh gills.

Seven pairs of gills present on the abdominal segments from 1 to 7 (Fig. 5–1), all lamellate, with filamentous gills, except the seventh pair which consists of lamellae only (Fig. 7–7). The first pair of lamellae nearly as long as the seventh lamellae, both lanceolate in outline; lamellae 2 to 6 broadly ovate or obtuse ovate, the fourth lamellae largest, nearly as long as the fifth; third and sixth subequal in length, but the former much broader than the latter.

Ecdyonurus sp. (b)

Locality: Ishkashim, 29 Aug., 1960, 20 nymphs (in alcohol). Length of body

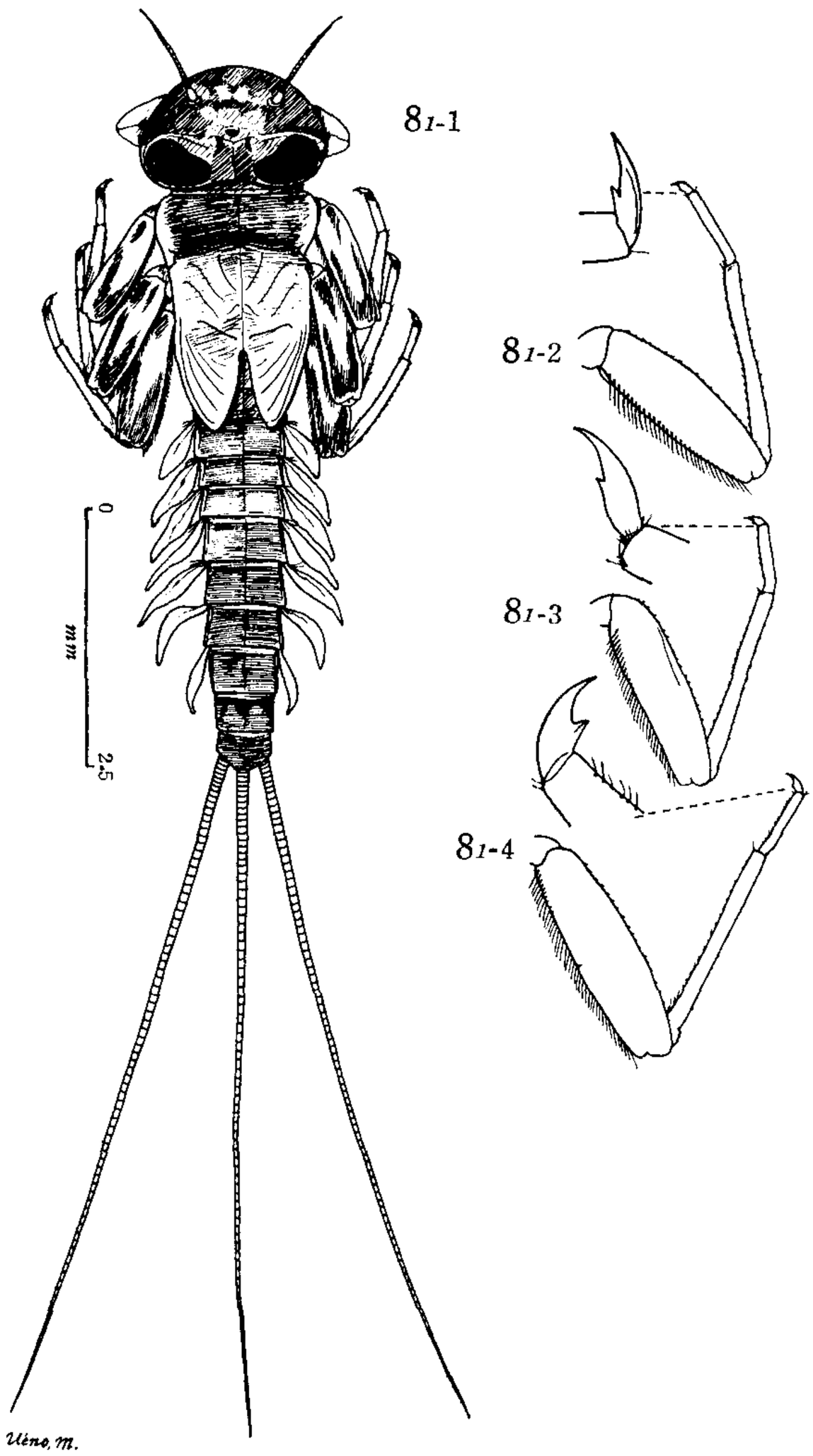

Fig. 8. 1. Nymph of *Ecdyonurus* sp. (b).
8. 1–1, nymph of 7 mm. in body length, dorsal view ;
8. 1–2, fore-leg ; 8. 1–3, mid-leg ; 8. 1–4, hind-leg.

8.0 mm., median caudal filament a little longer than 8.0 mm.

Head large, flattened, 2/3 as long as wide, frontal margin round, without fringes, hind margin slightly concave ; general colour brown, epicranial suture pale, two series of pale spots present, the one consisting of indistinct three spots in front of the median ocellus and the other four of nearly equal size between the bases of antennae. Besides these, one more indistinct pale median spot present close to the frontal margin. Seen from above, the maxillary palps protruded as elbows beyond the lateral margins of head (Fig. 8–1).

Pronotum a little narrower than head, lateral margins rounded, posterior prolongations fused to mesonotum at the sides, no distinct dark patterns on the surface.

Abdomen uniformly brown, without markings, except the ninth which has dark longitudinal stripes at median line and both sides; no tooth on the hind margin of each tergite, as seen in *Ecdyonurus* sp. (a) described before. Three caudal filaments, slightly longer than body, brown in colour.

Legs pale yellow, with two irregular dark brown cross bands on the femora of all legs (Fig. 8.1–1). Distal end of tibiae also with a dark brown band. The length ratio, tarsus : tibia : femur, is : in fore-leg, 1 : 2.5 : 2.5, mid-leg, 1 : 2.9 : 2.9, and hind-leg, 1 : 3.2 : 3.2; claws bear one tooth at the middle of inner margin. All femora fringed with long bristles on the outer margin; inner margins of all tibiae with short spines (Figs. 8. 1–2, 3, 4).

Labrum short and wide, fan-shaped, frontal margin rounded, fringed closely with setae (Fig. 8. 2–1). Mandibles broad in the portion of galea-lacinia and slender in the basal half (Figs. 8. 2–2, 8. 2–3). Inner canine of the left mandible

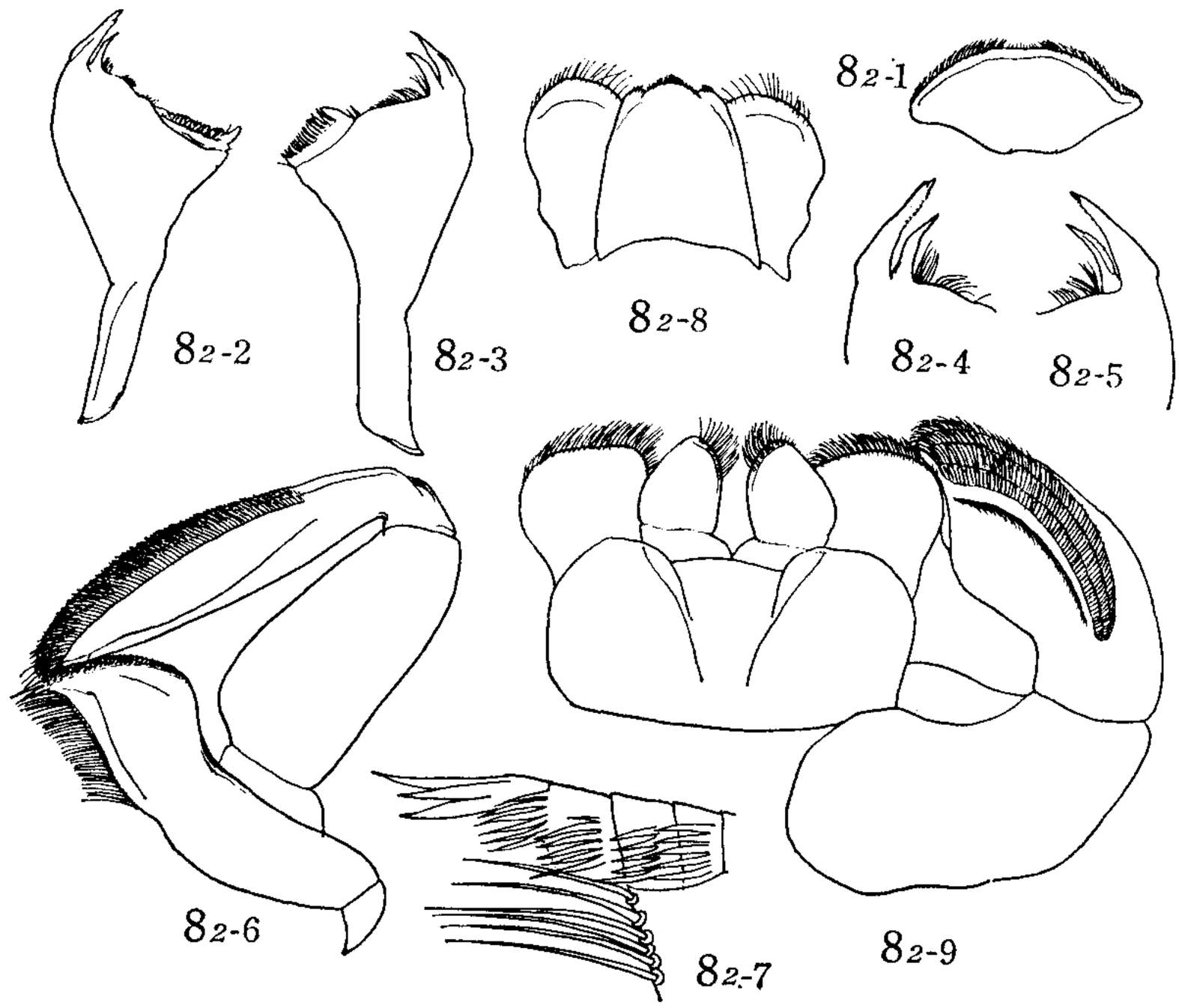

Fig. 8. 2. Nymphal mouth parts of *Ecdyonurus* sp. (b).
8. 2–1, labrum; 8. 2–2, left mandible; 8. 2–3, right mandible; 8. 2–4 and 8. 2–5, canines of the left and the right mandibles; 8. 2–6, maxilla; 8. 2–7, inner apical corner of galea-lacinia of maxilla; 8. 2–8, hypopharynx; 8. 2–9, labium,

nearly 2/3 as long as the outer one (Fig. 8. 2–4); inner margin of the outer canine with shallow crenulations; prostheca is represented by a row of long spines. Inner canine of the right mandible about 4/5 as long as the outer canine; prostheca represented by long spines.

Apical margin of maxillary galea-lacinia covered with three or four rows of combs which are composed of five or six spines (Fig. 8. 2–7); inner apical corner armed with three large processes directed inwards; inner margin fringed with a row of long bristles (Fig. 8. 2–7). Glossae of labium small, separated at the base, inner apical margin fringed with long setae; paraglossae 1.5 times as wide as glossae, apical margin fringed. Median lobe of hypopharynx trilobate, each lobe rounded, fringed with short setae; lateral lobes not out-curved as in *Ecdyonurus* sp. (a), outer margin slightly longer than body, brown in colour.

Seven pairs of gills present on the abdominal segments I–VII (Fig. 8. 1–1); all lamellate, with 1–3 filamentous gills, except the last two pairs which consist of lamellae only; first, sixth and seventh as long as each other, but the first much broader than the other two, cordate in form; the third and the fourth the largest, obtuse ovate; outer margin of all lamellae more or less thickened and fringed sparsely with short spines or bristles (Figs. 8. 3–1～7).

Remarks: This nymph probably belongs to the genus *Ecdyonurus* in the feature of pronotum, lateral margins of which are prolonged backwards and fused to the mesonotum. Of the mouth parts, the structure of the lateral lobes of hypo-

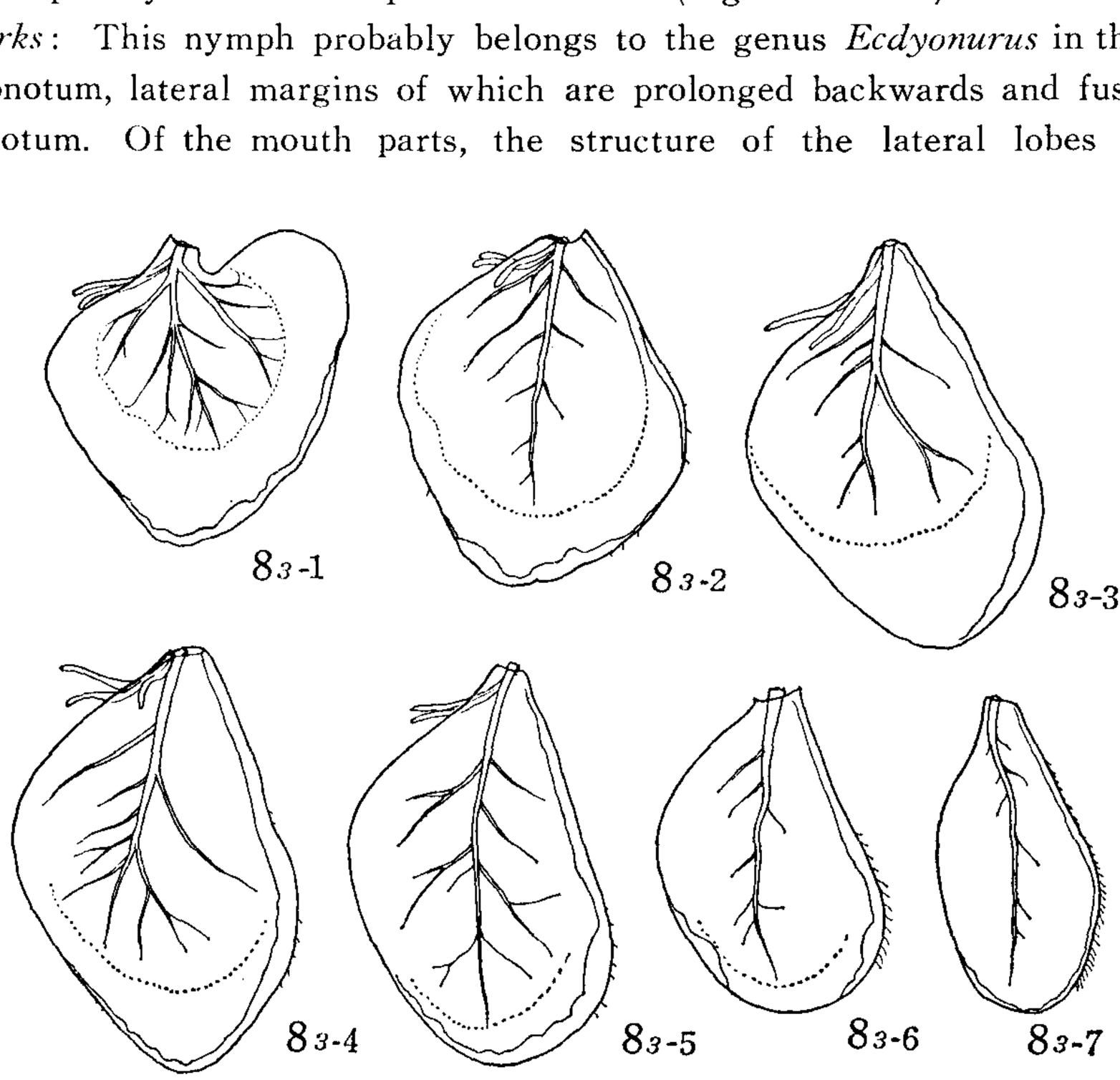

Fig. 8. 3. Nymphal gillis of *Ecdyonurus* sp. (b).
8. 3–1～8. 3–7, the first to the seventh gills, anterior view.

pharynx differ from those of the typical *Ecdyonurus* nymph, in having the outer lobes, outer margins of which are slightly sinuate. This feature may indicate the presence of a peculiar shape of hypopharynx among the nymphs of the genus *Ecdyonurus*. The queer apperance of head seen from above, i. e. the maxillary palps are protruded on both sides beyond the lateral margins of head, were seen not only in younger but also in older stages of all the specimens examined.

4. **Epeorus (Iron)** sp.

Localities: Ishkashim, 29 July, 1960, 1 nymph; Noshaq, 3,900 m. above sea level, 1 Aug., 1960, 5 nymphs; Shiwa Lake, 9 Sept., 1960, 5 nymphs (all in alcohol).

Length of body 6.0–8.5 mm., caudal filaments up to 8.5 mm. (Shiwa specimens); body 12.5 mm., caudal filaments 15 mm. (a Ishkashim specimen).

Head large and flattened, a little narrower than twice of head length, all the margins rounded, frontal margin fringed thickly with setae; compound eyes apart from the lateral margins; general colour brown, with dark brown patterns between the bases of antennae, compound eyes, and around the median ocellus (Fig. 9. 1–1); more indistinct and irregular patterns also present near the frontal margin and the outside of compound eyes. Pronotum short, lateral margins rounded, brown, with dark markings along the hind margin.

Legs relatively large; besides a row of bristles on the outer margin of each femur, there is a row of long setae on the inner margin of each tibia; claws rather large and acuminate, with no tooth on the inner margin, only in the claw of hind-leg present a few hardly visible crenulations. The length ratio, tarsus : tibia : femur, is : in fore-leg, 1 : 3.2 : 2.8; mid-leg, 1 : 3.8 : 3.7; hid-leg, 1 : 3.7 : 4.3. Femur of hind-leg is 4/5 as long as that of fore-leg. Two caudal filaments, a little longer than body.

Labrum (Fig. 9. 1–2) small, about 2.5 times as wide as its length, a shallow excavation on the frontal margin, antero-lateral margins rounded. The arrangement of spines and bristles along the margin is shown in Fig. 9. 1–3. There is a row of more than 25 short bristles on the front margin extending to lateral margins on both sides; besides these, 4 spines, 2 short and 2 long, at the median portion, and one long spine at either side of the median group, two more spines at the antero-lateral corner and three long ones on the lateral margin.

Mandibles slender, galea-lacinia portion broad (Figs. 9. 1–4, 9. 1–7); inner canine of left mandible about 2/3 as long as the outer canine, apex trifid and bears seven teeth on the outer margin; outer canine with three apical crenulations which are followed by five small crenulations on the inner margin; prostheca is represented by a row of about eight long setae (Fig. 9. 5–5). Outer canine of right mandible (Fig. 9. 1–8) with nine deep crenulations on the inner margin, inner canine nearly 1/2 of the outer canine, with about nine deep crenulations on the outer margin, apex dipartite, each part of which forms three

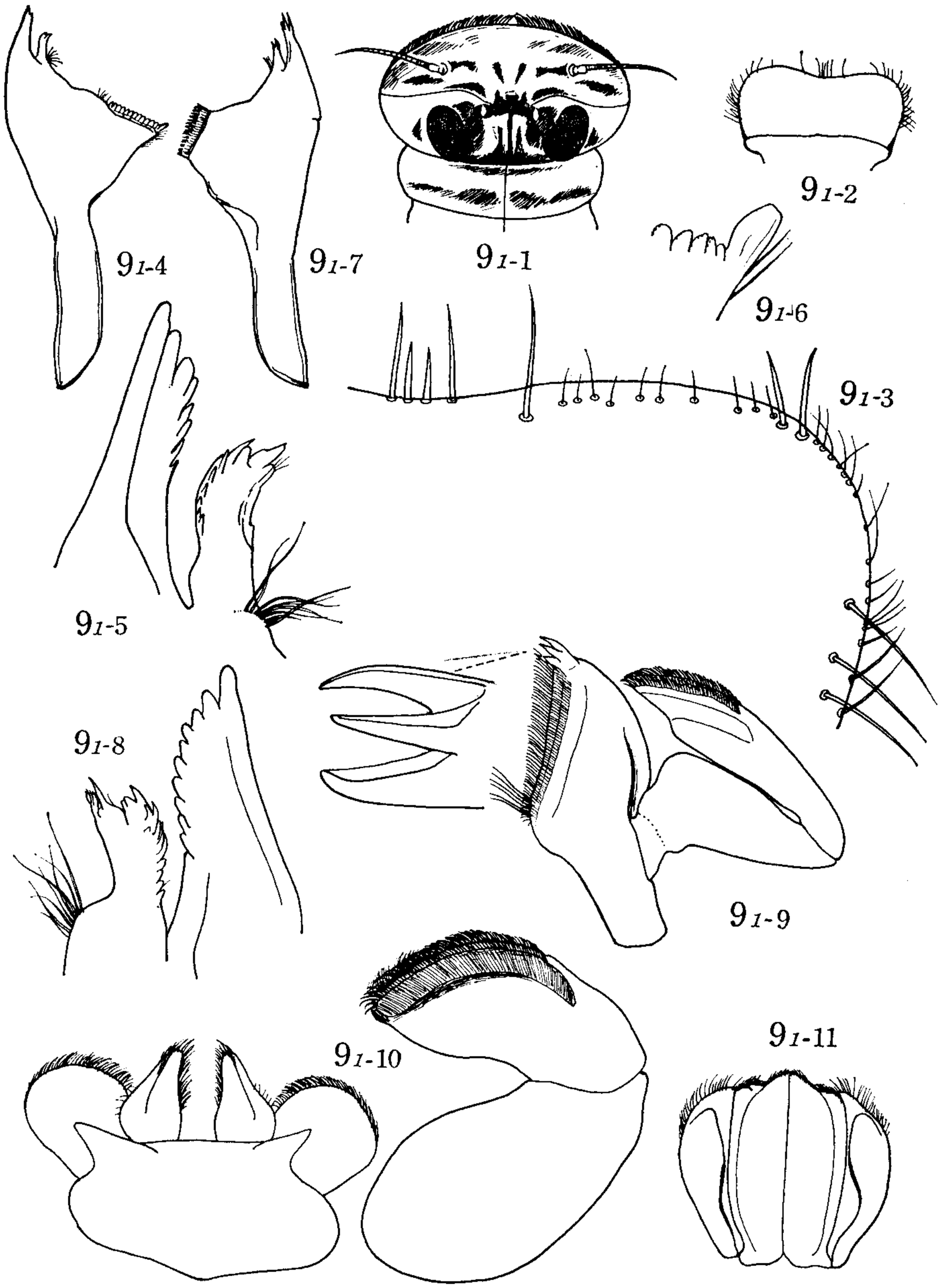

Fig. 9. 1. Nymph of *Epeorus (Iron)* sp.
9. 1–1, head and pronotum, dorsal view; 9. 1–2, labrum; 9. 1–3, right half of the anterior part of labrum, dorsal view; 9. 1–4, left mandible; 9. 1–5, canine area of the left mandible; 9. 1–6, inner end of the molar of the same; 9. 1–7, right mandible; 9. 1–8 canine area of the same; 9. 1–9, maxilla; 9. 1–10, labium; 9. 1–11, hypopharynx.

acute teeth respectively (Fig. 9. 1–8).

Distal joint of maxillary palp is somewhat dilated distally, beset with curved spines in the apical portion (Fig. 9. 1–9); galea terminates into three large teeth at its apex (Fig. 9. 1–9), no bristles or spines on the outer lateral border upper the insertion of palp; on the inner margin there are two rows of bristles, and at the proximal portion present six long bristles.

Labial palp short and broad; glossae conical, separated at base, fringed with bristles on the inner margin continued to the apex; paraglossae round (Fig. 9. 1–10). Median lobe of hypopharynx rounded at apex, lateral lobes narrower than median lobe; each lobe somewhat dilated distally and its apical margin rounded.

Seven pairs of gills present on the abdominal segments I–VII, all lamellate, with filamentous gills in tuft except the last pair in which only a finger-like gill is present (Fig. 9. 2–11). The first pair considerably large and contacts each other beneath the body (Fig. 9. 2–7), while the other pairs are cordiform (second pair), oval or ovate; tracheation distinct, outer margin thickened, armed with short spines and long setae (Figs. 9. 2–8, 9. 2–10).

Remarks: The markings on the abdominal tergites suggest that the nymph under consideration may be of *Iron montanus* BRODSKY from „Transiligebirge, Fluss Issyk, 1000–2000 m ü. M., VII.–VIII." BRODSKY (1930, p. 707) recorded a large number of nymphs of *Iron montanus* from Kasakstan, Kirgisstan and Usbekistan, but its description has not been accessible to the writer. If the first pair of nymphal gill lamellae which contact each other beneath the body is a useful character for the separation of *Iron* EATON from *Epeorus* EATON, as EATON pointed out the importance of the first gill lamellae as the generic character of *Iron*, the nymph under question should be placed under the genus *Iron*. Among the North American *Iron* (NEEDHAM & TRAVER, 1935), however, most species have normal first gill lamellae, only two species, *I. fragilis* MORGAN and *I. longimanus* EATON, having exceptionally the first pair of large lamellae which contact each other beneath the body. There is no work to make clear distinction of nymphs between *Iron* and *Epeorus*, though ULMER (1932–33) agreed with the separation of both genera according to the imaginal characters. The structure of the mouth parts shows no fundamental difference in minute detail between these two genera. EATON (1885, p. 245) has pointed out that *Iron* is intermediate in character between *Epeorus* and *Rhithrogena*, both of which have large first gill lamellae, the former having no median caudal filament and latter having such a filament in the specimens of advanced age. In the nymph of *Iron* the median caudal filament is quite absent in the specimens of advanced age. IMANISHI (1940), who made careful studies of Heptageniidae (Ecdyonuridae) of Japan and continental Asia, placed all the species hitherto ascribed to *Iron* in the genus *Epeorus*. The writer should like to retain *Iron* as a subgenus of the genus *Epeorus*, as designated by EDMUNDS and TRAVER (1954).

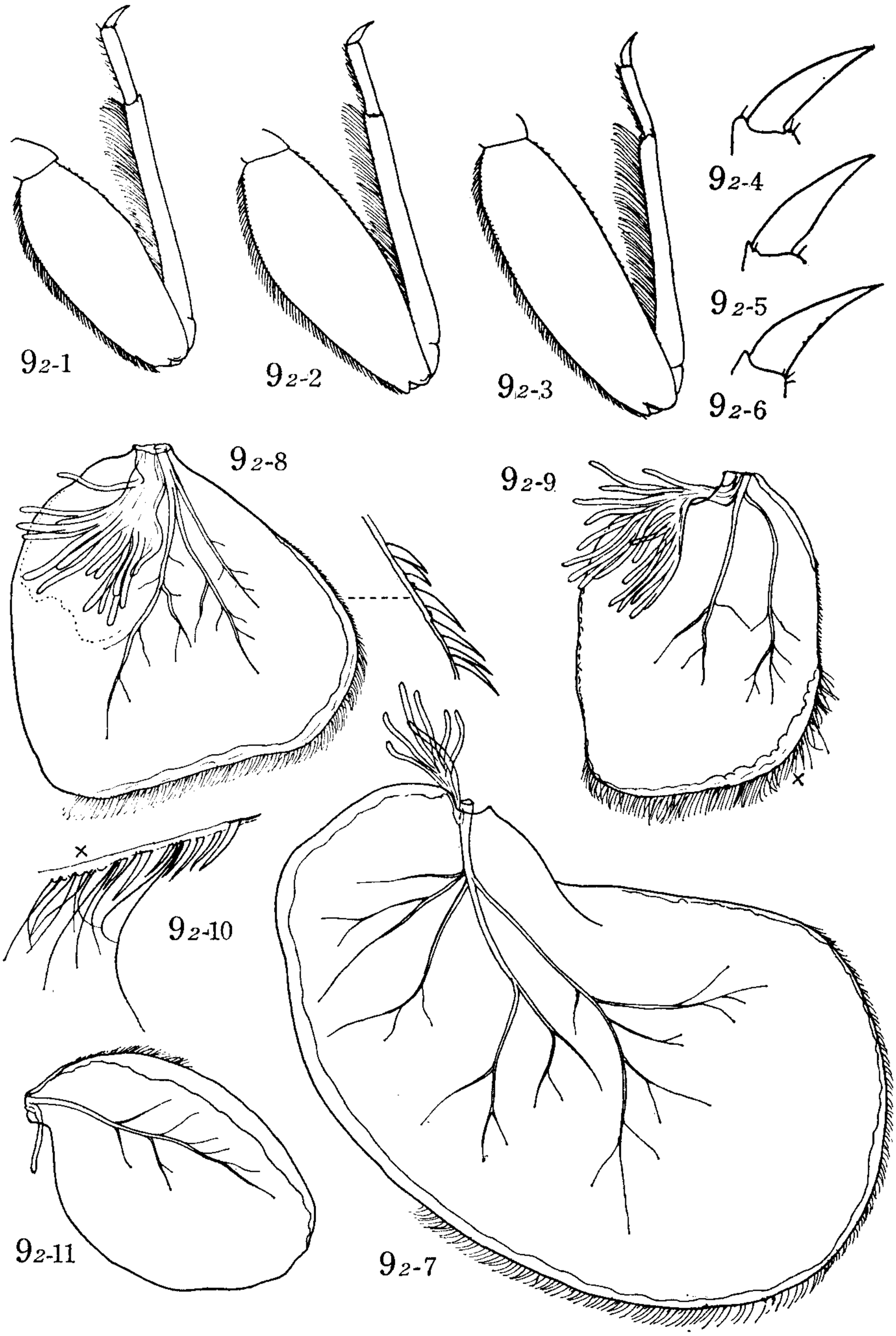

Fig. 9. 2. Nymphal parts of *Epeorus (Iron)* sp.
9. 2–1, fore-leg ; 9. 2–2, mid-leg ; 9. 2–3, hid-leg ; 9. 2–3, 9. 2–4, and 9. 2–5, claws of of fore-, mid-, and hind-leg ; 9. 2–7, left first gill ; 9. 2–8. left second gill ; 9. 2–9, left fourth gill ; 9. 2–10, fringes on the margin of the same ; 9. 2–11, left seventh gill

5. **Rhithrogena** sp.

Locality: Bazghilon, 14 July, 1960, 2 full-grown nymphs (in alcohol). Length of body: 9–10 mm, caudal filaments 8.0 mm.

This nymph resembles closely the Nepalian nymph of this genus described by the present writer (UÉNO, 1955, p. 312). Body chestnut brown to rusty brown, without distinct markings; ventral side of body and legs brownish. Caudal filaments brownish yellow.

6. **Baetis noshaqensis** sp. n.

Localities: Noshaq, 3,800 m. above sea level, 25 July, 1960, 12 ♀♀ imagines (holotype 1 ♀, paratypes 11 ♀♀), 10 nymphs, and 56 exuviae; Noshaq, 3,900 m., 9 nymphs; Ishkashim, 29 Aug., 1960, 2 nymphs; Doab by Shiwa Lake, 9–10 Sept., 1960, 1 nymph; Pagman, 17 June, 1960, 4 nymphs.

Imago (♀):

Length of body 8.5 mm., fore-wing 7.0 mm., outer caudal filaments 11.5 mm.

Head chestnut brown, eyes and ocelli black. Pronotum brown, median area pale, meso- and metanota brown. Abdomen brownish orange, hind margin of each tergite brown, segments VIII and IX pale and translucent, segments III to VIII with a pair of dark brown markings which are comma-shaped and convergent in the segments III to VI and are dots in the segments VII and VIII. Ventral part of abdomen orange yellow. Two caudal filaments, brownish grey in colour.

Hind tarsus (Fig. 10–7) with four free movable segments, the basal segment being more or less fused to the tibia; claws dissimilar (Fig. 10–8).

Wings hyaline, veins blackish brown. Fore-wing (Fig. 10–1), costal and subcostal area smoked; M not forked, simple, intercalary veins arranged in pairs. Hind-wing (Fig. 10–2, 10–3) small, 1/5 as long as fore-wing, oval in shape, with a bluntly pointed process on costal margin, and with only two longitudinal unforked veins.

No male was taken in the localities mentioned above. The length of body of the paratypes is 6.0–8.0 mm., the length of caudal filaments of the same is 9.5–11.0 mm. In the type locality (Noshaq, 3,800 m.), the just emerged females were found floating on the surface of water of a cold spring together with a large number of exuviae.

Remarks: Although the male of this new species is unknown, the female shows some characteristics different from the known species, i. e. the markings on the abdominal segments, smoked costal and subcostal area of the fore-wing, and small hind wings which have only two longitudinal veins. In the last character the present new species resembles closely *Baetis sumatrana* ULMER (1939, p. 524) which has also two longitudinal veins only, but the latter species is hardly 5 mm.

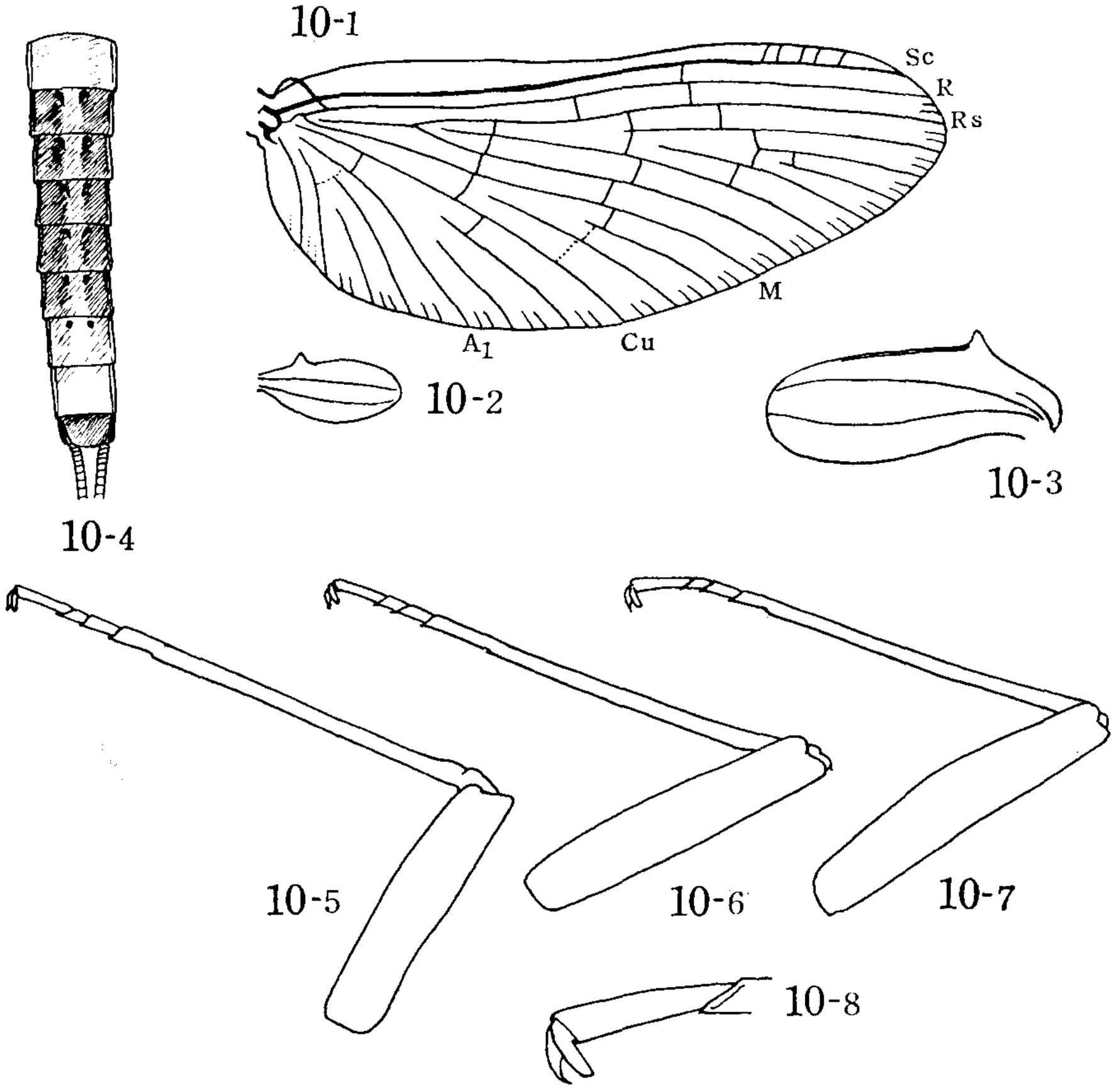

Fig. 10. *Baetis noshaqensis* sp. n., ♀ imago.
10–1 and 10–2, fore- and hind-wings; 10–3, hind-wing, enlarged; 10–4, abdomen, dorsal view; 10–5, 10–6 and 10–7, fore-, mid-, and hind-legs; 10–8, claws of hind-leg.

in length. In the neighbouring districts of the above-cited localities, *Baetis heptapotamicus* BRODSKY (1930) is known from the Talassmountain (Akssu stream), but this species is 7 mm. in length in the male and its hind-wings have three longitudinal veins. Taking the nymphal characters together, the Noshaq specimens seem to belong to a new species of the genus *Baetis*.

Nymph (full-grown) (Fig. 11):

Length of body 8.0 mm., outer caudal filaments 6.0 mm.

Body cylindrical, brown in colour. Head nearly as wide as the posterior margin of pronotum, directed downward, brown, both sides of median line dark brown; three ocelli; antennae 2/5 as long as body. Pronotum a little widened posteriorly, dark brown, median line pale; meso- and metanotum dark brown, wing-pads blackish brown.

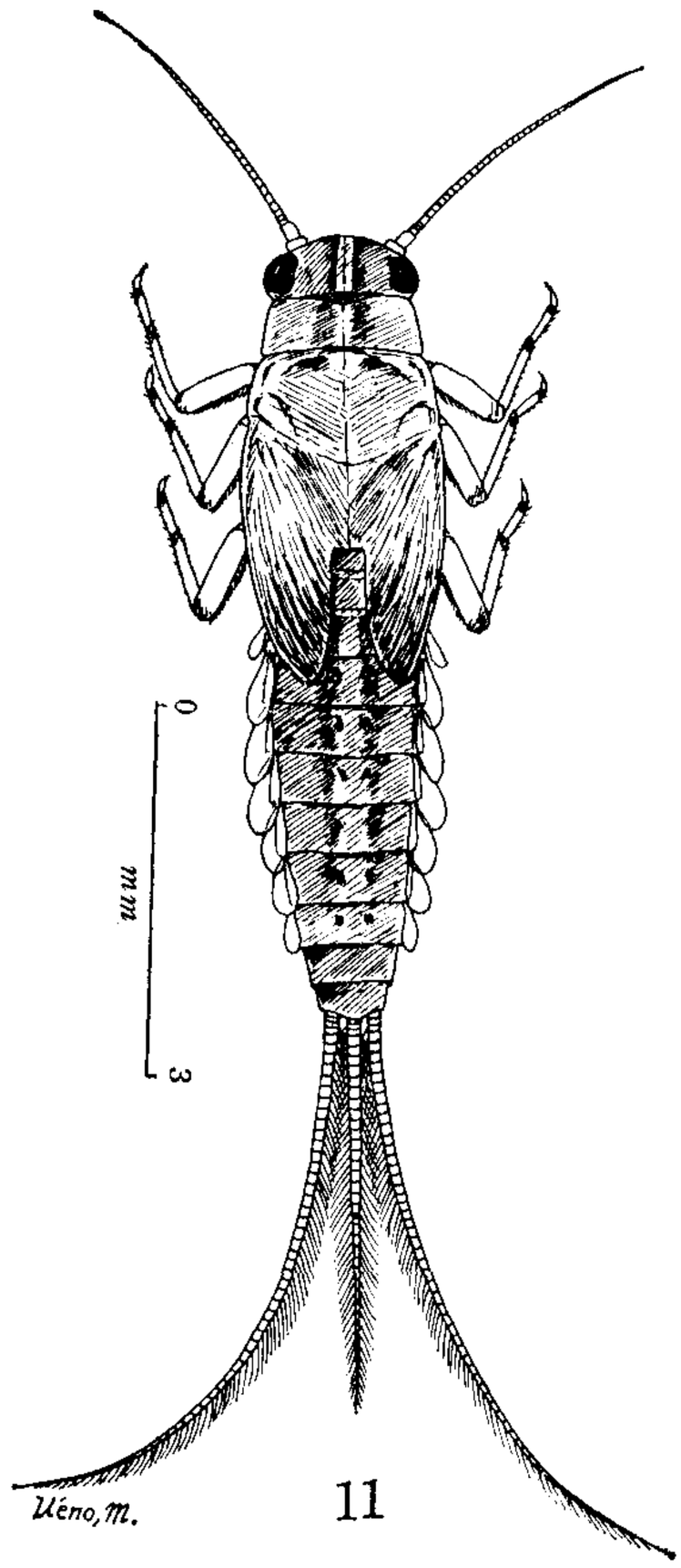

Fig. 11. *Baetis noshaqensis* sp. n.,
Nymph of 6 mm. in body length, dorsal view.

Legs slender, olive brown, distal end of each segment becomes darker; hind-leg the longest and the fore-leg the shortest, tibiae of all legs are the same length, and the tarsi and femora increase slightly in length successively, as seen in the ratio, tarsus : tibia : femur, as, in fore-leg, 1 : 2.4 : 2.3; mid-leg, 1 : 2.4 : 2.6; and hind-leg, 1 : 2.4 : 2.6. Femora fringed with a row of bristles on the outer margin; both margins of tibiae and tarsi with short spines and bristles; claws rather large, curved, with nine small teeth on the inner margin (Figs. 13–4, 13–5).

Abdominal segments tapered rearward, tergites brown, both sides of median line with dark longitudinal bands and a pair of dark brown dot-markings, as seen in the female imago, except the tergites IX and X (Fig. 11). Ventral side of thorax and abdomen somewhat paler than dorsal side. Three caudal filaments, median one shorter than the outer ones, olive brown, outer filaments fringed

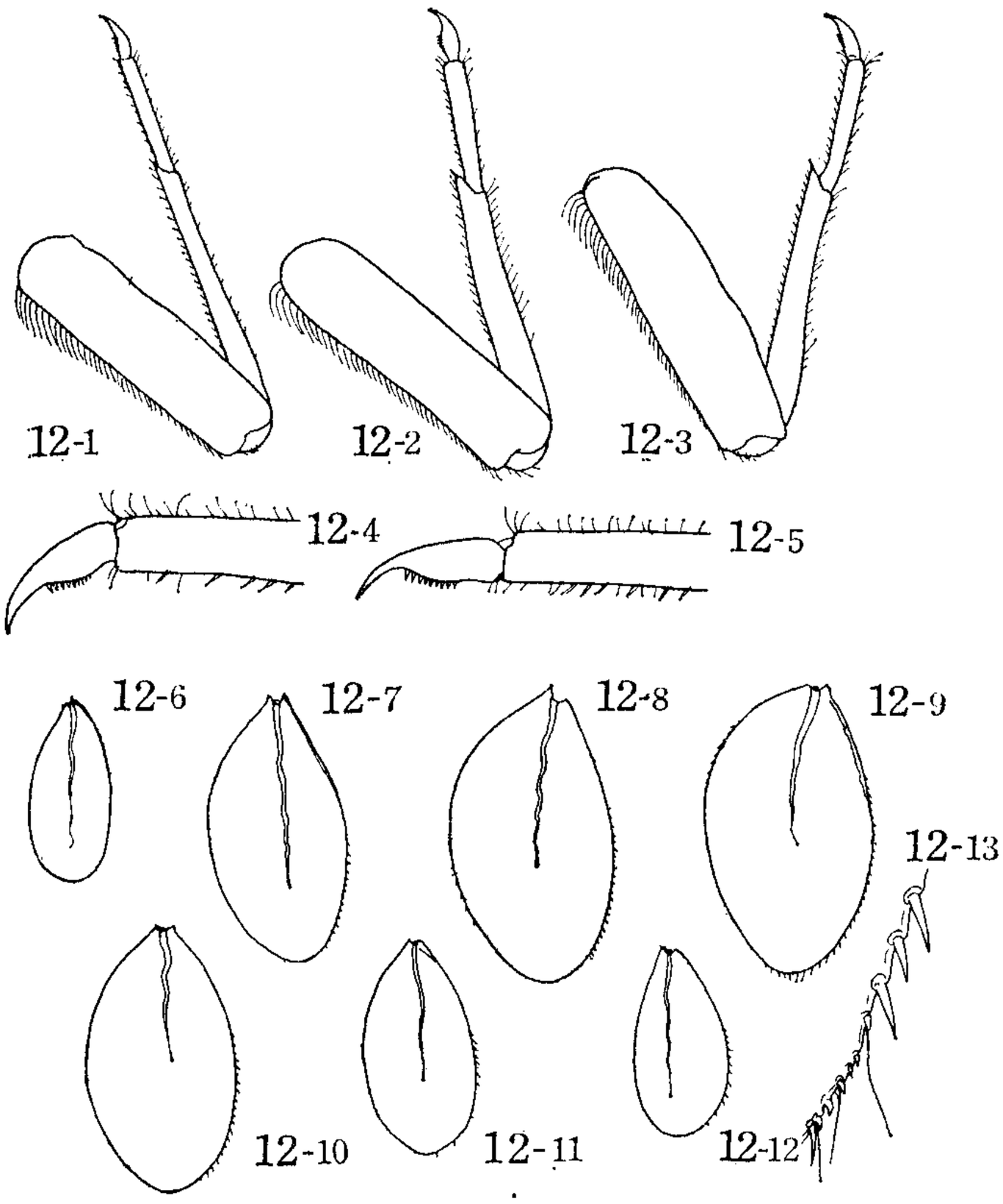

Fig. 12. Nymphal legs and gills of *Baetis noshaqensis* sp. n. 12–1, fore-leg; 12–2, mid-leg; 12–3, hind-leg; 12–4, claw of mid-leg; 12–5, claw of hind-leg; 12-6～12–12, the first to seventh gill lamellae; 12–13, spines and denticles on the margin of gill.

with only on the inner side.

Seven pairs of gills present on the abdominal segments I to VII, all simple, lamellate, ovate in shape, translucent; the first pair is the smallest, about 3/5 of the largest fourth (Figs. 13–6～13–12); the length order is, 3 and 4>5, 2>6>7>1; tracheation indistinct, only a main trachea visible; outer margin armed with short spines and fine setae (Fig. 13–13).

Labrum (Figs. 13–1, 13–2) rather large, oblong, twice as wide as long, with a shallow median notch on the rounded apical margin; a row of numerous bristles present just inside the apical margin and on the lateral margin; on the upper surface near the anterior margin there is a transverse row of stouter and longer bristles, about twelve in total number, which reaches the lateral margin on each side. The upper surface of the right half of the labrum is illustrated in Fig. 13–2.

Mandibles (Fig. 13–3) robust and pyramidal shape. Outer canine bears five teeth in the left mandible and two (three) in the right; inner canine has four teeth in the left and three (four) in the right mandibles (Figs. 13–4, 13–5); prostheca of the left mandible bears about five acuminate teeth and one long spine on its inner apical margin (Fig. 13–4), while prostheca of the right mandible bears 7–8 large acuminate teeth on the inner apical margin (Fig. 13–5).

Maxillary palp a little longer than galea-lacinia, three-jointed, the terminal joint the longest; galea-lacinia bears three terminal teeth and two rows of long and short bristles on the apical margin (Fig. 13–6).

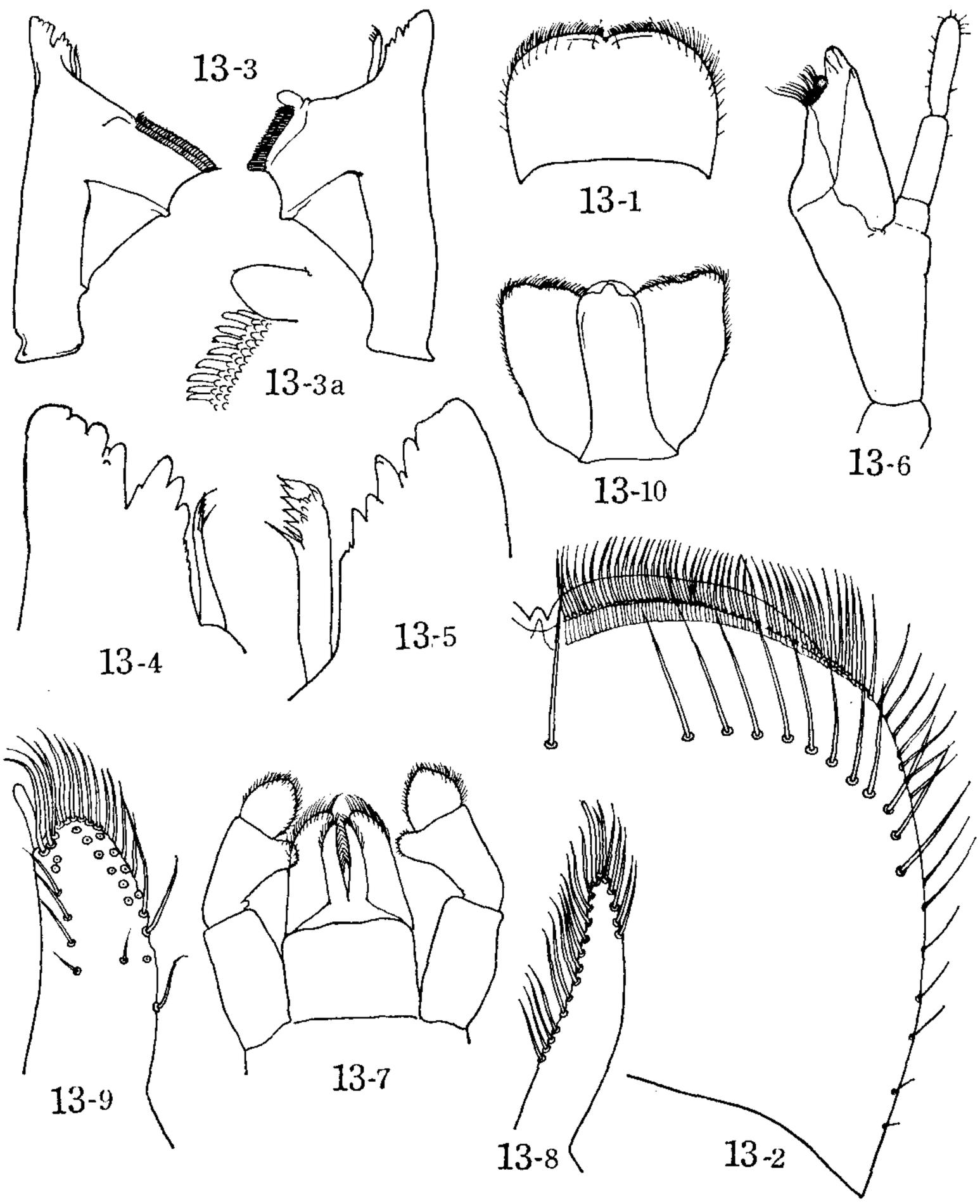

Fig. 13. Nymphal mouth parts of *Baetis noshaqensis* sp. n. 13–1, labrum; 13–2, right half of the labrum, enlarged, dorsal view; 13–3, left and right mandibles; 13–3a, part of molar of right mandible; 13–4 and 13–5, canine area of the left and right mandibles; 13–6, maxilla; 13–7, labium; 13–8, glossa of labium; 13–9, paraglossa of labium; 13–10, hypopharynx.

Paraglossae (Fig. 14–7) of labium extend a little beyond glossae; outer apical margin beset with long bristles arranged in two rows; a well-spaced row of six bristles inside the inner margin and with a large clavate seta on the inner apical corner (Fig. 14–9). Glossae slender, with a row of long bristles on the inner margin which reaches upper part of the outer margin beyond apex (Fig. 14–8). Labial palp three-jointed; second joint produced into a blunt process at its inner distal corner; terminal joint rounded conical, tip bluntly pointed, beset with numerous spines and fine bristles. Lateral lobes of hypopharynx wider than median lobe and dilated distally (Fig. 14–10).

Remarks: In the characters of the mouth parts, the present nymph resembles much the European *Baetis rhodani* (PICTET), which has been discussed in detail by MACAN (1950; cf. also UÉNO 1955). The labrum, maxillae and hypopharynx of the present nymph are of the *rhodani* type in general shape. Most features of the canine area of both mandibles are also of the *rhodani* type, but the arrangement of bristles on the glossae and paraglossae of labium of the present nymph differs from that of *rhodani*. The spines and setae on the margins of gill lamellae do not differ from those of *rhodani*, while the femora of the present nymph bear a row of long bristles which is not seen in *rhodani*. The present nymph has thus many characteristics of the *rhodani* series of the genus *Baetis* and may belong to the western Eurasian group, but its imago (♀) quite differs from any species belonging to the *rhodani* series.

7. **Cloeon zimini** TSCHERNOVA

TSCHERNOVA, 1930, p. 214.

Locality: Borak, 9 July, 1960, 1 ♀ subimago (in alcohol).

Length of body 6.5 mm., fore-wing 8.5 mm., caudal filaments 12.0 mm.

This subimago seems to be identical with *Cloeon zimini* TSCHERNOVA, particularly in the feature of abdominal markings, though no male is accessible to the writer.

Head, thorax and abdomen ochreous yellow. Abdominal tergites (Figs. 14–3, 14–4, 14–5) with brownish red markings, thus: a fine longitudinal stripe on the median line, on both sides of it present a pair of longitudinal stripes divergent posteriorly and reaches the hind margin of each tergite from II to VII; besides these, near the anterior end of each tergite there is a pair of comma-shaped markings, tips of which are prolonged behind forming convergent stripes; tergites IX and X entirely brownish red. Sternites with a pair of brownish red long stripes, somewhat divergent behind in sternites IV to V and then become parallel in VIII and IX.

Legs ochreous yellow, with a brown band at the middle of femora, proximal part of tibia and the distal part of tarsus brown; claws brown; hind tarsus with four free movable segments, the fifth fused to the tibia (Fig. 14–2). Two

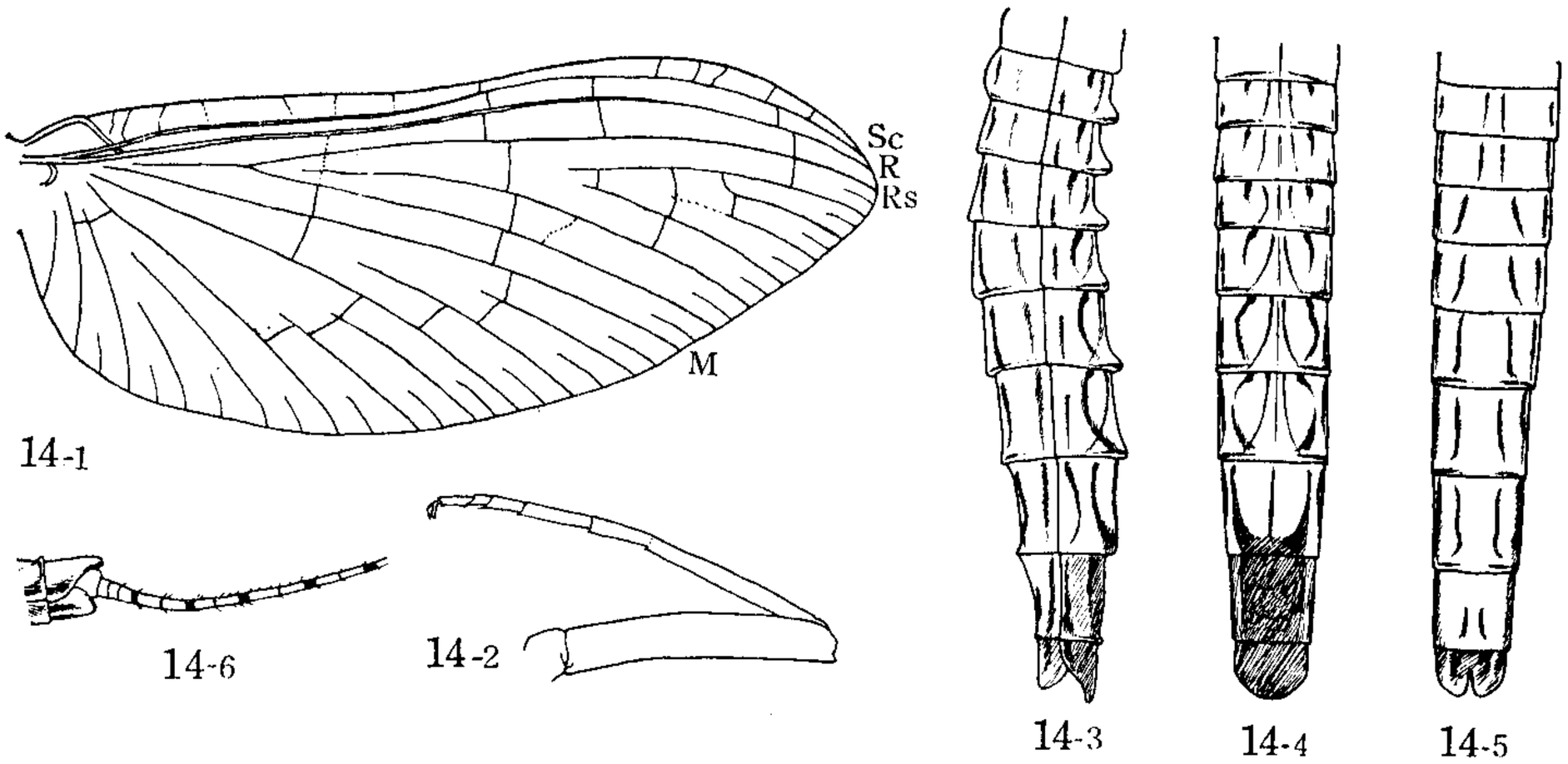

Fig. 14. *Clocon zimini* TSCHERNOVA, ♀ subimago.
14–1, fore-wing; 14–2, hind-leg; 14–3, abdomen, lateral view; 14–4, abdomen, dorsal view; 14–5, abdomen, ventral view; 14–6, basal part of caudal filament.

caudal filaments, yellowish white, composed of about 35 joints, with blackish brown rings (Fig. 14–6),

Wings brownish smoked, especially in subcostal area; M of fore-wing not forked, intercalary veins on the outer margin single (Fig. 14–1). No hind-wings.

The type specimen was collected at Chiva, northeast of Buchara, Usbekistan, and in the suburbs of Tashkent, western border of the Alai–Pamir ranges.

8. **Ephemerella** sp.

Locality: Borak, 9 July, 1960, 11 nymphs (in alcohol).
Length of body 5.0–11.0 (full-grown), caudal filaments 4.0–5.5 mm.

Body rigid, somewhat arched dorsally and flattened ventrally; widest at mesothorax; reddish brown in colour, ventral side somewhat paler, wing-pads in full-grown nymphs black.

Head directed downward, frontal margin rounded, with a shallow emargination at middle, fringed, hind margin rounded; compound eyes large; three ocelli; with three pairs of blunt tubercles, one in the bases of antennae, small one behind the hind ocelli, and the other one near the hind margin between the compound eyes; besides these, more bigger one situated in front of the median ocellus.

Pronotum shorter than wide, a little widened posteriorly, nearly as wide as head, reddish brown, without distinct markings. Abdomen short and wide; lateral extensions present on the segments III to IX (Fig. 15–1), having posterolateral processes, especially the great development in flattened posterior segments;

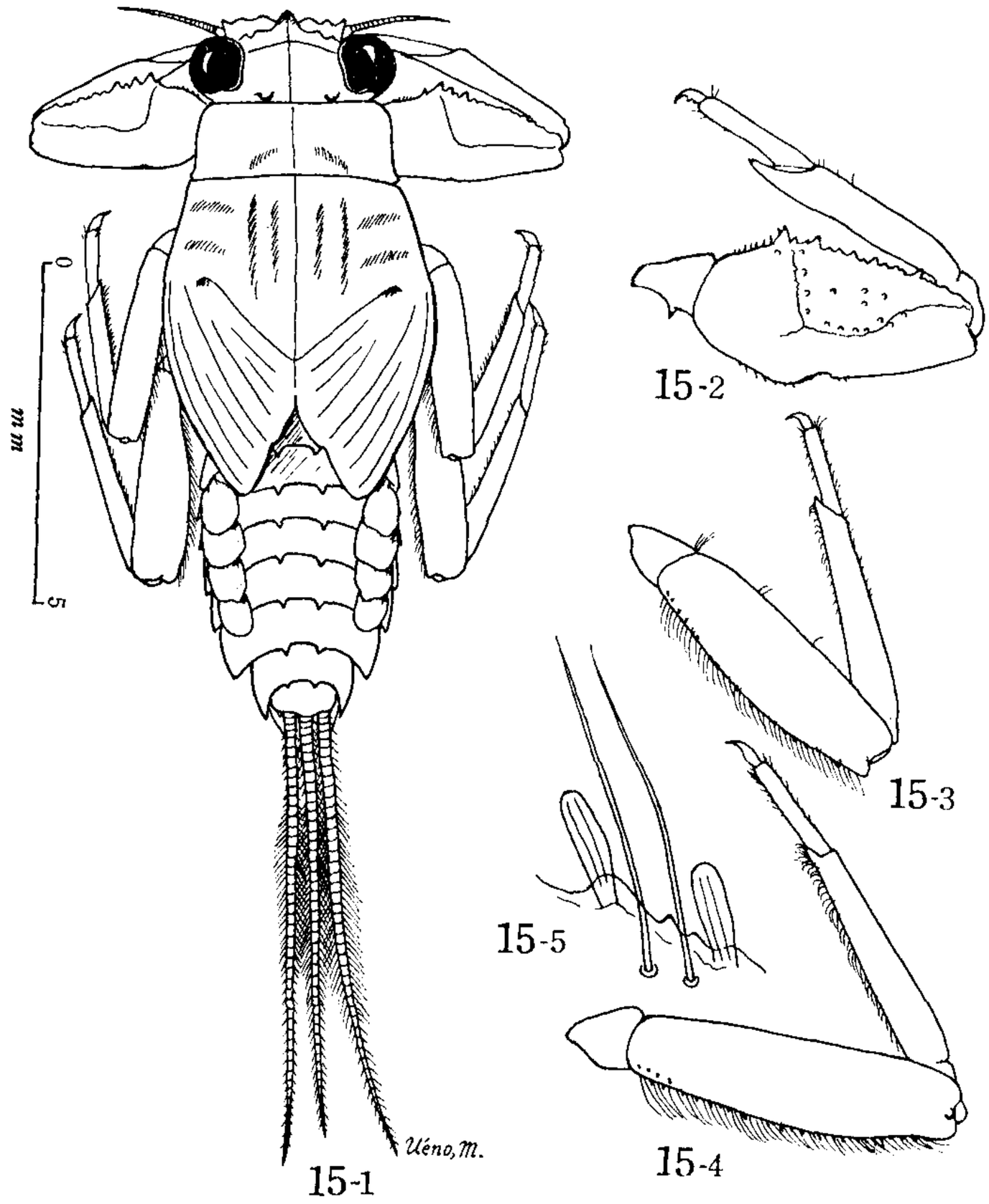

Fig. 15. Nymph of *Ephemerella* sp.
15–1, nymph of 10 mm. in body length, dorsal view; 15–2, fore-leg; 15–3, mid-leg; 15–4, hind-leg; 15–5, bristles and clavate spines on the outer margin of hind-leg.

there are a paired dorsal tubercles directed backwards on the tergites III–IX; 10th segment small and holded between the postero-lateral processes of the 9th segment. Three caudal filaments of nearly equal length, shorter than body, pale yellow, basal 1/4 with whorls of minute spines at joinings, but the remaining parts fringed with hairs on both sides (Fig. 15–1).

Legs rather large, the hind-leg the longest, and mid-leg the shortest; the length ratio, tarsus : tibia : femur is, in fore-leg, 1 : 2.3 : 2.3, mid-leg, 1 : 2.9 : 3.0, and hind-leg, 1 : 3.0 : 3.1. The fore-leg is especially robust, femur 1/2 as wide as long, widened at 1/3 from the proximal end, frontal margin armed with about 15 large and small tubercles, upper surface covered with small denticles; inner distal corner of tibia produced acutely; claw bears two small teeth on the inner margin. Mid- and hind-legs are of ordinary structure, femora fringed with a

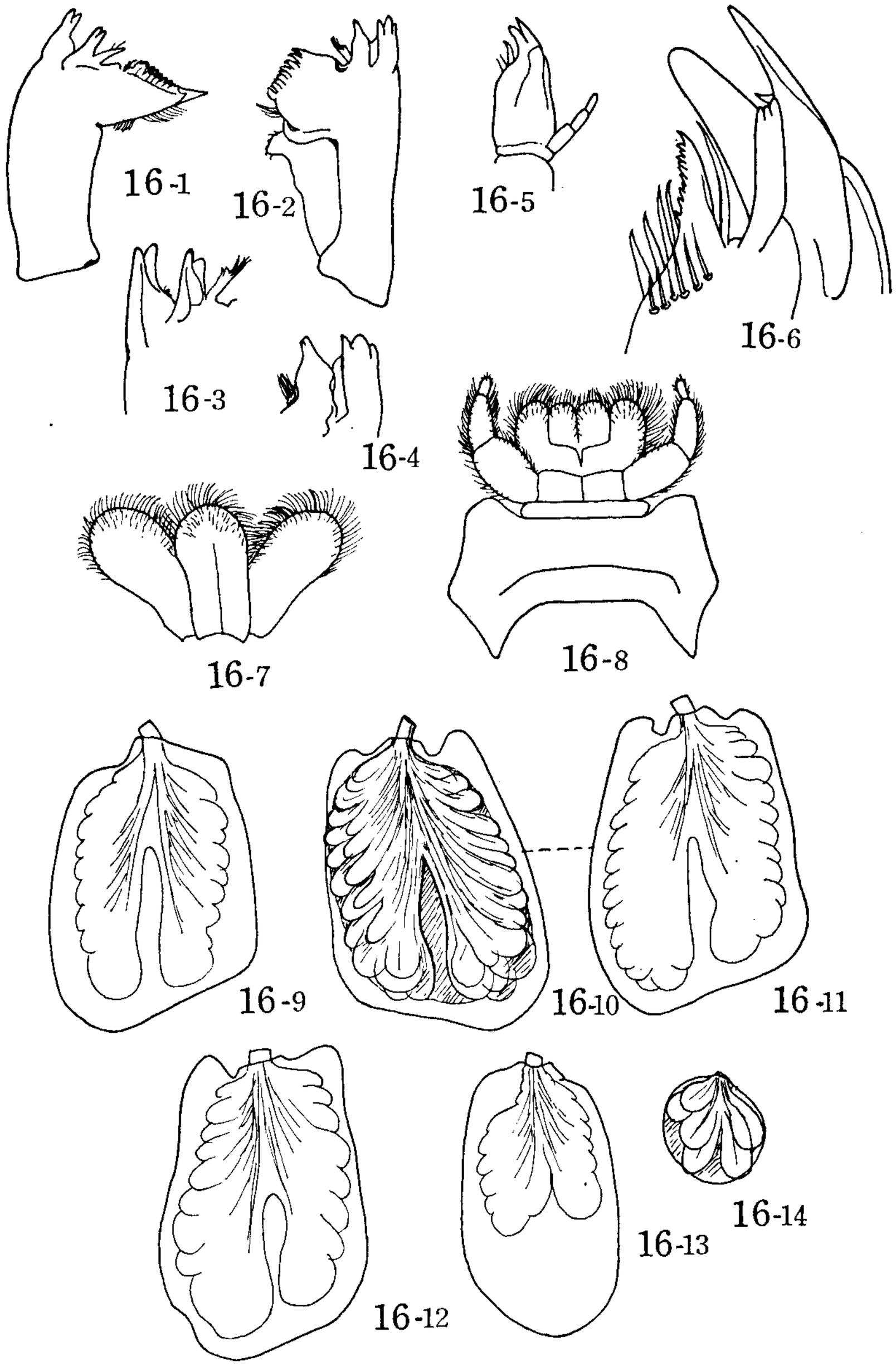

Fig. 16. Nymphal mouth parts and gills of *Ephemerella* sp.
16–1, left mandible; 16–2, right mandible; 16–3. left canines; 16–4, right canines; 16–5, maxilla; 16–6, apical part of galea-lacinia of maxilla; 16–7, hypopharynx; 16–8, labium; 16–9 first gill, anterior view; 16–10, second gill, posterior view, and 16–11, the same, anterior view; 16–12, third gill, anterior view; 16–13, fourth gill, anterior view; 16–14, fifth gill. posterior view.

row of long bristles and a row of clavate spines (Figs. 15-3, 15-4, 15-5).

Labrum more than twice as wide as long, frontal margin rounded, slightly emarginate in the median part, beset thickly with short bristles. Mandibles short and robust (Figs. 16-1, 16-2); canines short, nearly equal in length in both mandibles, prostheca well developed in both mandibles, each of them with a group of bristles on the inner apical margin (Figs. 16-3, 16-4). Maxillae conical at apex, with two terminal teeth and two more shorter serrated teeth on the inner apical margin, two rows of spines, one of which is composed of four spines on the inner margin and the other of six spines just inside the margin (Fig. 16-6); maxillary palp much shorter than the galea-lacinia, the third joint elongated conical. Glossae and paraglossae of labium (Fig. 16-8) nearly equal in length, the latter a little wider than the former, beset thickly with long bristles; labial palp relatively short and robust, terminal or the third joint rudimentary. Median lobe of hypopharynx rounded, lateral lobes also rounded apically and divergent each other.

Five pairs of gills present on the abdominal segments III to VII, wholly dorsal in position (Fig. 15-1), all lamellate and double, obtuse oval in shape, the seventh smallest and circular in shape; tracheation indistinct; all posterior lamellae are formed by two parts which cut into many small lobelets (Figs. 16-9~16-14).

Literature

Brodsky, K. 1930. Zur Kenntnis der mittelasiatischen Ephemeropteren I. (Imagines). Zool. Jahrb., Abt. f. System. Oekol. u. Geogr. d. Tiere, *59*, 681-720.

Edmunds, Jr., G. F. and J. R. Traver 1954. An outline of a reclassification of the Ephemeroptera. Proc. Entom. Soc. Washington, *56*, 236-240.

Eaton, A. E. 1883-1888. A Revisional Monograph of Recent Ephemeridae or Mayflies. Trans. Linn. Soc. London, 2. ser., *3*, 1-352.

Imanishi, K. 1940. Ephemeroptera of Manchoukuo, Inner Mongolia and Chôsen. Rept. Limnol. Survey of Kwantung and Manchoukuo, 1940, 169-263 (in Japanese).

Macan, T. T. 1950. Descriptions of some nymphs of the British species of the genus *Baetis* (Ephem.). Trans. Soc. British Entom., 10, 143-166.

Needhan, J. G., Traver, J. R. and Yin-Chi Hsu. 1935. The Biology of Mayflies, with a Systematic Account of North American Species. Ithaca, N. Y, Comstock Publ. Co., 1-759.

Tschernova, O. A. 1930. Beiträge zur Kenntnis der paläarktischen Ephemeropteren. I. Zool. Anz.. *92*, 214-218.

Ulmer, G. 1929. Eintagsfliegen, Ephemeroptera (Agnatha). Die Tierwelt Mitteleuropas, *4*, Lfg. 1*b*, 1-43.

—— 1932-33. Aquatic insects of China. Article VI. Revised key to the genera

of Ephemeroptera. Peking Nat. Hist. Bull., *7*, 195–218.

—— 1939. Eintagsfliegen (Ephemeropteren) von den Sunda-Inseln. Arch. f. Hydrobiol., Suppl.-Bd. *16*, 443–692.

UÉNO, M. 1955. Mayfly nymphs. Fauna and Flora of Nepal Himalaya, Sci. Results of the Japanese Exped. to Nepal Himalaya, 1952–1953, Vol. 1, 301–316.