

New Genus and Species of Atalophlebiinae (Ephemeroptera: Leptophlebiidae) from Southern India

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ABSTRACT A new genus of Atalophlebiinae, *Edmundsula*, is established for a new species, *Edmundsula lotica*, described from male and female imagos and nymphs from Courtallam, Tamil Nadu, southern India. Phylogenetic relationships of *Edmundsula* are discussed and biological notes are included.

WHILE STUDYING mayfly populations of hill streams of Courtallam, Tamil Nadu State, in southern India (Sivaramakrishnan and Job 1981), I collected and reared mayfly nymphs representing a new genus in the family Leptophlebiidae. Based on these collections, a new genus *Edmundsula*, is established here for a new species, *E. lotica*.

Terminology and procedures used in the descriptions follow those of Peters et al. (1978).

Edmundsula, gen. nov. (Fig. 1-28)

Edmundsula [nomen nudum]. Sivaramakrishnan and Job 1981: 110.

Imago. Length of male: body 8.0-8.2 mm; forewings 8.2-8.3 mm. Length of female: body 9.6-9.8 mm; forewings 9.9-10.0 mm. Eyes of male separated on meson of head by a distance 2-fold width of lateral ocellus, dorsally upper portion circular-shaped, lower portion $\frac{3}{4}$ length of upper portion; eyes of female separated on meson of head by a length 4-fold maximum width of eye. Wings (Fig. 2-5): maximum width of forewings $\frac{2}{3}$ maximum length of forewings; vein Rs of forewings forked a little more than $\frac{1}{4}$ of distance from base to margin; vein MA forked $\frac{1}{2}$ of distance from base to margin, fork symmetrical; vein MP forked about $\frac{1}{3}$ of distance from base to margin, fork asymmetrical; vein ICu, attached to CuA, remainder of Cu-A area as in Fig. 2; cross veins numerous, some cross veins in distal half of cell C weakly anastomosed (Fig. 3). Costal margin of hind wings (Fig. 4-5) with blunt costal projection; apex of costal projection located less than $\frac{1}{2}$ distance from base; apex of hind wings acute, pointed; cross veins few. Legs: ratios of segments of male forelegs, 1.20:1.00(1.38 mm):0.05:0.25:0.20:0.11:0.10. Claws of a pair dissimilar (Fig. 6), one apically hooked, the other obtuse, padlike. Male genitalia (Fig. 7-9):

segment 3 of forceps a little shorter than length of segment 2, segment 2 of forceps $\frac{1}{5}$ length of segment 1, apex of segment 3 as in Fig. 7; base of forceps broad, its inner margin forming a smooth curve and indented near base; length of styliger plate along median line $\frac{1}{3}$ maximum width; posterior margin of styliger plate (Fig. 7) with paired small submedian protuberances; penes (Fig. 7-9) divided, tubular, broader at base and tapering towards apex; apex of each penis lobe curved ventrally, outer margin of apical half of each penis lobe with a row of spinules (Fig. 8-9). Posterior margin of sternum 7 of female entire without medial extension (Fig. 11-12). Ninth sternum of female cleft as in Fig. 10. Terminal filament a little longer than cerci.

Mature Nymph. Head prognathous. Antennae 2- to 4-fold as long as maximum length of head. Mouthparts (Fig. 17-26): length of labrum $\frac{2}{3}$ width; dorsal hair on labrum as in Fig. 17; submedian and anterior areas of hair ventrally; anteromedian emargination with 4 to 5 denticles (Fig. 18-19). Clypeus as in Fig. 17, margins straight. Left mandible as in Fig. 21; outer margin smoothly curved as in Fig. 21, 8 to 10 long hairs on median area of outer margin; prosthecal tuft well developed (Fig. 21). Lingua of hypopharynx with well developed lateral processes, apex of submedian lobes with short hair, anterior margin of lingua deeply cleft; superlingua as in Fig. 20 with a row of hairs along anterior margin, lateral margins blunt. Segment 2 of maxillary palpi a little shorter than length of segment 1; segment 3 of palpi a little shorter than length of segment 2, triangular; V-shaped ridge near the ventral, inner, anterolateral margin of maxillae; hair on maxillae as in Fig. 23. Labium as in Fig. 24; segment 2 of palpi $\frac{3}{4}$ length of segment 1; segment 3 of palpi subequal to length of segment 2, triangular, with a row of short, heavy spines on inner dorsal margin; paraglossae ventral to glossae; glossae L-shaped in distal aspect with lateral lobe extended dorsal to para-

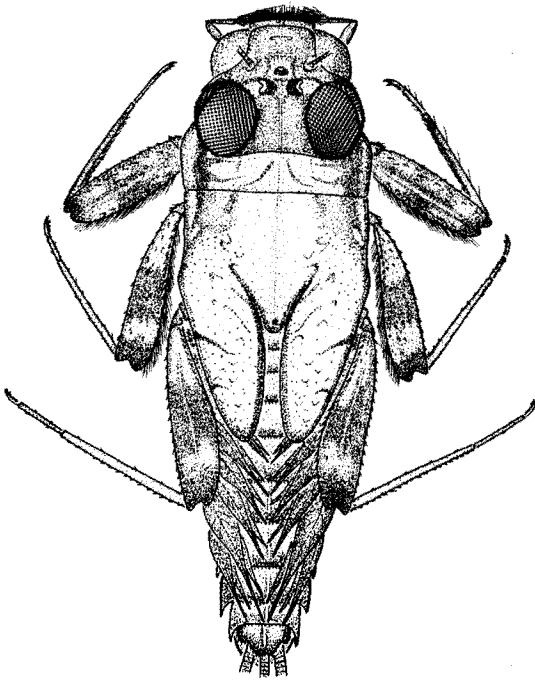


Fig. 1. Mature male nymph of *E. lotica*.

glossae (Fig. 24–26). Legs (Fig. 13–16): maximum width of tibiae $1\frac{1}{2}$ -fold maximum width of tarsi, tibiae in cross section subelliptical (Fig. 14); outer margin of femora indented near apex so tibiae can draw partially into femora (Fig. 13); apex of claws hooked and narrow, denticles on claws progressively larger apically, apical denticle much larger (Fig. 16). Gills (Fig. 27–28): gills on segments 1 to 7; dorsal and ventral portions of lamellae of gill 1 slender, lanceolate, with few tracheae (Fig. 27); dorsal and ventral portions of lamellae of gills 2 to 7 lanceolate, long, smoothly tapered to apex (Fig. 28); main trunk of tracheae along median line of lamellae; tracheae branched. Posterolateral spines on abdominal segments 4 to 9, spines progressively larger posteriorly, apices of spines on 8 to 9 sharp. Terminal filament a little longer than cerci.

Etymology. *Edmundsula*, feminine; named for Prof. G. F. Edmunds, Jr., in honor of his significant contribution to the study of mayflies.

Type-species. *Edmundsula lotica*, sp. nov.

Discussion. *Edmundsula* can be distinguished from all genera of the Leptophlebiidae by the following combination of characters. Imagos: (1) fork of MP and fork of ICu, from CuA in the forewings occur about $\frac{1}{3}$ of the distance from the base of wings to margin; both forks are asymmetrical (Fig. 2); (2) costal margin of hind wings (Fig. 4–5) possesses a blunt costal projection; apex of costal projection is located less than $\frac{1}{2}$ distance from base of wings; (3) claws of a pair are dissimilar, one apically hooked, the other obtuse, padlike (Fig. 6); (4) penes are divided, tubular, broader at base and

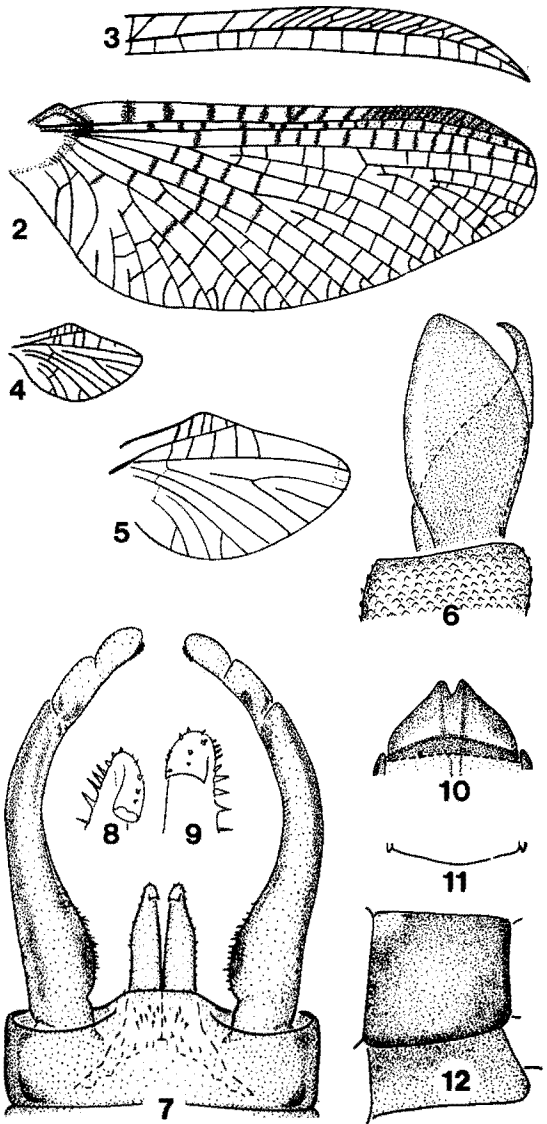


Fig. 2–12. *E. lotica*. Fig. 2–5, 7–9. Male imago: (2) forewing; (3) apical region of cell C of forewing enlarged; (4) hind wing; (5) hind wing enlarged; (7) genitalia, ventral view; (8–9) detail of apex of penis lobe. Fig. 6, 10–12. Female imago: (6) hind claw; (10) ninth sternum; (11) posterior margin of seventh sternum; (12) lateral view of seventh abdominal segment.

tapering towards apex; apex of each penis lobe is curved ventrally (Fig. 7–9); and (5) ninth sternum of female is cleft apically as in Fig. 10. Nymph: (1) gills are present on abdominal segments 1 to 7; dorsal and ventral portions of lamellae of gill 1 are slender and lanceolate with few tracheae (Fig. 27); dorsal and ventral portions of lamellae of gills 2 to 7 are lanceolate, long, and smoothly tapered near apex (Fig. 28); (2) segment 3 of labial palpi has a row of short heavy spines on inner dorsal margin as in Fig. 24; (3) denticles on claws are progres-

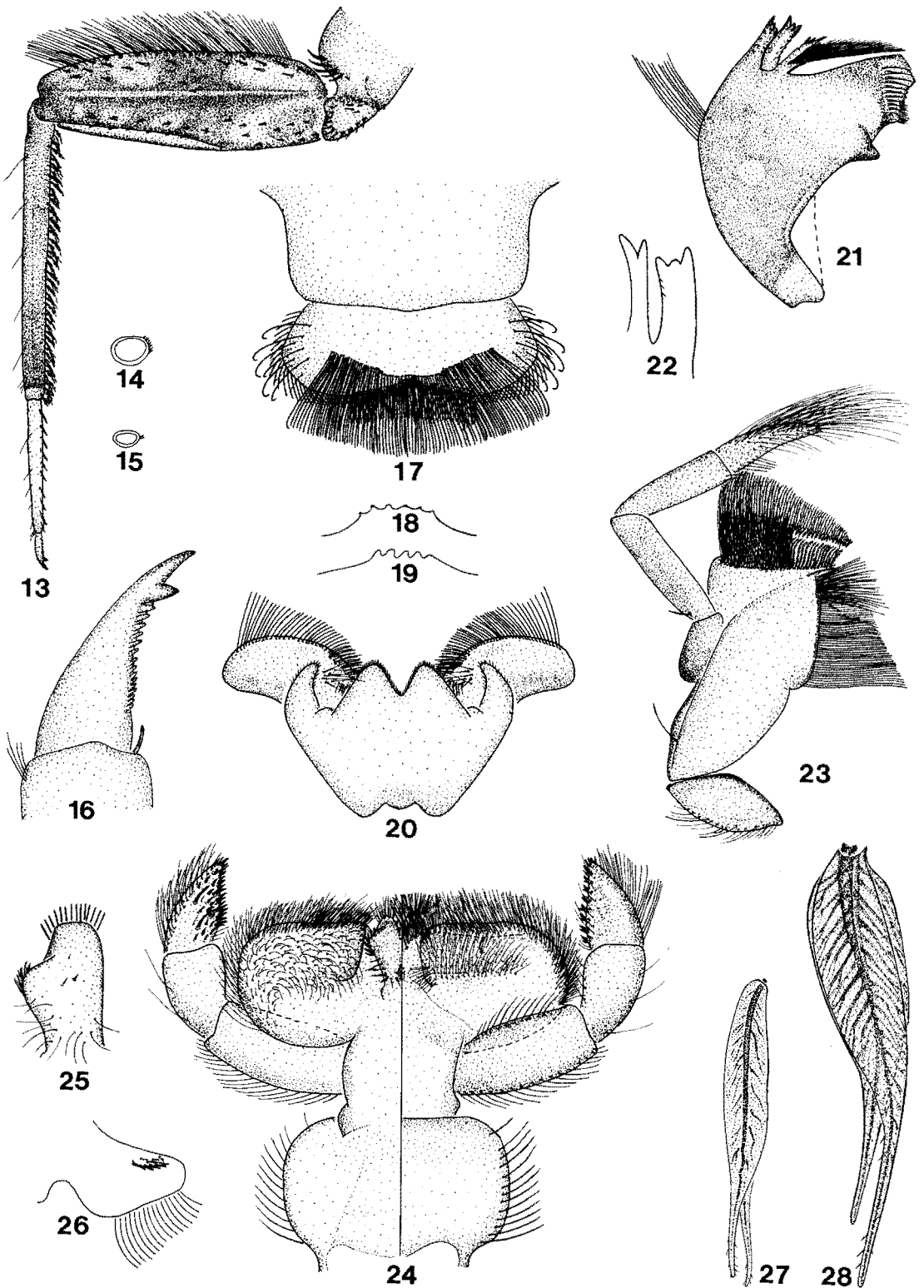


Fig. 13-28. *E. lotica*, mature nymph: (13), foreleg; (14-15) cross sections of tibia and tarsus; (16) foreclaw; (17) clypeus and labrum; (18-19) detail of anteromedian emargination of labrum; (20) hypopharynx; (21) left mandible; (22) incisors of right mandible; (23) right maxilla, ventral view; (24) labium (venter on right, dorsum on left); (25) glossa, dorsal view; (26) glossa, lateral view; (27) gill 1; (28) gill 4.

sively larger apically, apical denticle is much larger (Fig. 16); and (4) posterolateral spines occur on abdominal segments 4 to 9, spines progressively larger posteriorly, apices of spines on segments 8 to 9 sharp (Fig. 1).

Edmundsula displays several primitive character states and is the only genus of Atalophlebiinae from the Indian subcontinent with heavy short spines on the inner dorsal margin of the third segment of the labial palpi. However, it is difficult to determine its nearest relative based on derived character states. A tenuous link with *Neozephlebia* Penniket from New Zealand might be suggested from the dorsolateral expansion of the glossae (see Towns 1983), but an adequate evaluation of its phylogenetic position requires further study of genera in Madagascar, South Africa, and Australia. *Edmundsula* can be distinguished from other south Indian Leptophlebiidae by the following combination of characters. Imagos: (1) eyes of male are separated on meson of head by a distance 2-fold width of a lateral ocellus; (2) claws of a pair are dissimilar, one apically hooked, the other obtuse, padlike (Fig. 6); (3) penes are divided, broader at base and tapering towards apex; apex of each penis lobe is curved ventrally (Fig. 7); and (4) posterior margin of sternum 7 of female is entire without median extension (Fig. 11-12). Nymph: (1) gills are present on abdominal segments 1 to 7; dorsal and ventral portions of gill 1 are slender and lanceolate with few tracheae (Fig. 27); dorsal and ventral portions of lamellae of gills 2 to 7 are lanceolate, long, and smoothly tapered near apex (Fig. 28); (2) segment 3 of labial palpi has a row of heavy spines on inner dorsal margin as in Fig. 24; (3) denticles on claws are progressively larger apically, apical denticle is much larger (Fig. 16); and (4) outer margin of mandibles is smoothly curved as in Fig. 21 with 8 to 10 long hairs on median area of outer margin (Fig. 12).

Because the foreclaw of the male imago is spread unnaturally on a slide, the hind claw of the female imago is figured; however, male imaginal foreclaws are also dissimilar. In slide mounting the holotype genitalia, one penis lobe was folded over. This distortion produced another view of the spinules near the apex (Fig. 8); the usual position is shown in Fig. 9. The fork of ICu, from CuA was a consistent character in the four-winged imagos and subimagos examined. The number of long spines on the dorsal surface of the third labial palpal segment varied from two to six in slide-mounted specimens.

The first publication on Courtallam mayflies was concerned with relative abundance, diversity, and life cycle patterns (Sivaramakrishnan and Job 1981). Manuscript names used during the course of this study were carefully edited from the text of this publication; however, the manuscript name *E. striganesansis* does appear in Table 1 (Sivaramakrishnan and Job 1981). The name *E. striganesansis* is a nomen nudum as it was inadvertently

published without any description, designation, or deposition of types.

Edmundsula lotica, sp. nov.
(Fig. 1-28)

Edmundsula striganesansis [nomen nudum]. Sivaramakrishnan and Job 1981: 110.

Male Imago (in alcohol). Upper portion of eyes dark reddish-brown, lower portion black. Head dark yellowish-brown. Antennae yellowish-brown, flagellum paler. Basal half of ocelli black, apical half white. Thorax brown, carinae darker, sutures paler; lateral areas of pronotum, pleura, and lateral margins of mesonotum dark brown. Legs yellowish-brown; coxae washed with dark brown; prothoracic femora with longitudinal, irregular dark brown streak; a wide, transverse dark brown band near middle of meso- and metathoracic femora; apex of all femora washed with dark brown; tibiae washed with dark brown at apex; tarsi and claws brownish-yellow. Wings (Fig. 2-5): longitudinal and cross veins dark brown to brown, faded near posterior margin of wings, especially in Cu-A area of forewings; cross veins in cells C and Sc and cross veins near forks of Rs, MA, and MP surrounded with dark brown maculae, maculae narrow near forks of veins Rs, MA, and MP; membrane hyaline, except pterostigmatic area translucent brown. Abdomen: brown, terga 8 to 10 washed with dark brown; a dark brown, transverse band on posterior margin of terga 1 to 9; sterna paler; spiracles dark brown, tracheae hyaline. Genitalia (Fig. 7-9): basal half of penes yellowish-brown, apical half light yellowish-brown; forceps yellowish-brown, washed with dark brown at the lateral edges. Caudal filaments light yellowish-brown, annulations at articulations blackish-brown.

Female Imago (in alcohol). Eyes black. Head brownish-yellow, washed with dark brown. Antennae yellowish-brown, flagellum paler. Basal half of ocelli black, apical half white. Thorax reddish-brown; pronotum yellowish-brown; other details of coloration as in male imago. Legs light yellowish-brown; other details of coloration and marks as in male imago. Wings: longitudinal and cross veins dark brown to brown, faded near posterior margin of wings, especially in Cu-A area of forewings; cross veins in cells C and Sc surrounded with dark brown maculae, maculae narrower than in male imago; membrane hyaline, except pterostigmatic area translucent brown. Abdomen dark brown; a darker brown, narrow, transverse band on posterior margin of terga 1 to 9; median pale yellow bar on terga 4 to 7; submedian paired pale yellow marks on terga 7 to 8. Caudal filaments light yellowish-brown, annulations at articulations blackish-brown.

Mature Nymph (in alcohol). Head: dorsum dark brown, carinae darker, sutures paler; venter pale. Antennae: scape and pedicel dark brown, flagellum paler. Thorax yellowish-brown, lateral mar-

gins washed with blackish-brown (Fig. 1). Legs light yellowish-brown; femora with median and apical dark markings; other details of coloration and marks as in male imago. Abdomen dark brown; narrow, transverse darker brown band on posterior margin of terga 1 to 9. Gills (Fig. 27-28): membrane gray; tracheae black. Caudal filaments light yellowish-brown, annulations at articulations blackish-brown.

Holotype Male Imago. INDIA: Tamil Nadu State, Main Falls Stream, Courtallam, 200 m, 22-XII-1977, K. G. Sivaramakrishnan. Allotype female imago, same data as for holotype. Paratypes: 1 male imago, 1 male subimago, same data as for holotype; 2 nymphs, same data as for holotype except 20-III-1978; 20 nymphs, same data as for holotype except 5-X-1981. All types are in alcohol. The nymph and imagos are associated by rearing. Holotype, allotype, and 7 nymphal paratypes are deposited in K. G. Sivaramakrishnan collection at Entomology Institute, Loyola College, Madras. One male imaginal paratype, 1 male subimaginal paratype, and 15 nymphal paratypes are deposited in the collection of Florida A&M University, Tallahassee.

Etymology. From adjective lotus, L., meaning washed, implying stream habitat.

Biology. The nymphs cling to the underside of boulders in quiet edges of streams where the boulders lie amidst sand and silt. They are poor swimmers. Gut contents included organic detritus and diatoms.

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