

NEW AND LITTLE KNOWN EPHEMERELLIDAE FROM SOUTHERN ASIA, AFRICA AND MADAGASCAR (Ephemeroptera)

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Abstract: The nominal genus *Lithogloea* Barnard is synonymized with *Ephemerellina* Lestage and the reasons for the synonymy are discussed. The nymphs and probable males of *Ephemerellina crassi*, n. sp., are described and the nymphs of another species are described but not named. *Ephemerella sinensis* Hsu is transferred to the genus *Ephemerellina*, thus *Ephemerellina* now contains five named species, *E. barnardi* Lestage, the type species (S. Africa), *E. harrisoni* (Barnard), n. comb. (S. Africa), *E. penicillata* (Barnard), n. comb. (S. Africa), *E. crassi*, n. sp. (S. Africa) and *E. sinensis* (Hsu), n. comb. (China).

The species of *Ephemerella* Walsh from the Himalayan Region are reviewed. *Ephemerella coheri*, n. sp., is named from Nepal and a new subgenus, *Crinitella*, is established for it. The subgenus *Drunella* Needham is represented in this area by *E. (D.) gilliesi*, n. sp. (Nepal), *E. (D.) uenoi*, n. sp. (Nepal), *E. (D.) traversae*, n. sp. (Kashmir) and *E. (D.) submontanus* Brodsky (Kansu Province, China), which was previously unassigned to subgenus. The heretofore European subgenus *Torleya* Lestage is represented in Nepal by *E. (T.) nepalica*, n. sp., and *E. sven-hedini* Ulmer (S. Kansu, China) is tentatively retained in the subgenus *Ephemerella* s. str.

A description is presented of a single subimago male from Madagascar of the heretofore Holarctic subgenus *Eurylophella* Tiensuu of *Ephemerella*, but the species is not named as the authors have reservations concerning the authenticity of the record.

The family Ephemerellidae is presently known in the Ethiopian Realm by the S. African genera *Lithogloea* Barnard with two species, and the monotypic *Ephemerellina* Lestage. We are adding further diversity to the *Ephemerellina-Lithogloea* complex by describing a fourth and transferring a fifth species from the genus *Ephemerella* Walsh. Representatives of the family Ephemerellidae heretofore have not been reported from Madagascar and we are describing, but not naming, a male subimago of the genus *Ephemerella* from this island.

The Holarctic genus *Ephemerella* is diverse in Asia with several subgenera being represented. In the present paper, we are reviewing the species found in the Himalayan Region, naming several new species and establishing a new subgenus.

Only five of the more than 100 known species of *Ephemerella* have been described from the Himalayan Region. Brodsky (1930) described *E. submontanus* from Kazakhstan, and Ulmer (1936) named *E. sven-hedini* from S. Kansu Province, China. *Ephemerella sven-*

1. The research on which this report is based was supported by grants from the National Science Foundation.

hedini is, at present, tentatively placed in the subgenus *Ephemerella* s. str. Walsh, and *E. submontana* is herein assigned to the subgenus *Drunella* Needham. Traver (1939) described a single nymph from N. India, and Uéno (1953) described a nymphal specimen from Nepal. Both of these species belong to the subgenus *Drunella*, and we are providing names for them. We are also describing an additional species in the subgenus *Drunella*, one in *Torleya*, and a third species for which we are establishing a new subgenus.

Acknowledgments: We are grateful to E. I. Coher (Waltham, Mass. formerly with World Health Organization) and M. T. Gillies (East African Institute of Malaria) for the gift of valuable specimens from Nepal. We also thank C. R. Crass (Natal Parks, Game and Fish Preservation Board), J. R. Traver (University of Massachusetts) and H. H. Ross and L. K. Gloyd (Illinois State Natural History Survey) for the loan of specimens from S. Africa, India and Madagascar respectively. We are appreciative of Masuzu Uéno (Otsu Hydrobiological Station, Japan) for permission to name a species which he had described earlier. We also thank Steve L. Jensen who drew the figures under the supervision of the authors.

Genus *Ephemerellina* Lestage

Barnard (1932) distinguished the genus *Ephemerellina* Lestage from *Lithogloea* Barnard by genitalic and fore leg characters in the male imago and by the position of the gills in the nymphal stage. The males of *Ephemerellina* have more slender penes and relatively longer foretibiae than *Lithogloea*, while the nymph lacks the vestigial gills found on segment one of *Lithogloea*.

The characteristics of the species which we now include in the *Ephemerellina-Lithogloea* complex indicate that these characters are not sufficient for the recognition of two separate genera. Furthermore, as discussed below in the species accounts, the combination of characters in the adults and the association of nymphs and adults make it virtually impossible to apply these names with confidence at even the subgeneric level. Therefore, we regard *Lithogloea* as a synonym of *Ephemerellina*. The name *Lithogloea* may prove to be applicable at the subgeneric level when the adults and nymphs of all the species, especially *E. barnardi*, the type species of *Ephemerellina*, are positively associated by rearing. The nymphs of *Ephemerellina harrisoni* Barnard, n. comb., and *E. penicillata* Barnard, n. comb., are already associated with the adults by rearing.

Ephemerellina crassi Allen and Edmunds, n. sp. Figs. 2-8.

Male Imago (in alcohol): Upper portion of eyes pale, lower portion black. Head and thorax chocolate brown; legs yellowish brown; forefemora less than 1/2 as long as foretibiae, foretarsi longer than foretibiae, relative lengths of segments as follows: femur=1.3; tibia=2.8; tarsus 1=0.1, tarsus 2=1.0; tarsus 3=0.9; tarsus 4=0.8; tarsus 5=0.3; tarsal claws similar on fore legs, both blunt, dissimilar on mid and hind legs, 1 hooked and 1 blunt; wings translucent, venation pale. Abdominal segments 1-5 pale, yellowish brown, translucent, segments 6-10 light brown, terga 9-10 with narrow dark brown anterior margins. Genital forceps 3-segmented, segments 1-2 nearly subequal, segment 3 short, penes fused except at apex and penis lobes expanded laterally (fig. 8), bases of penal brace dark brown. Caudal filaments pale. Length: body 6-7 mm; forewing 6.0-6.5.

Mature Nymph: General color brown. Head without tubercles; labrum emarginate

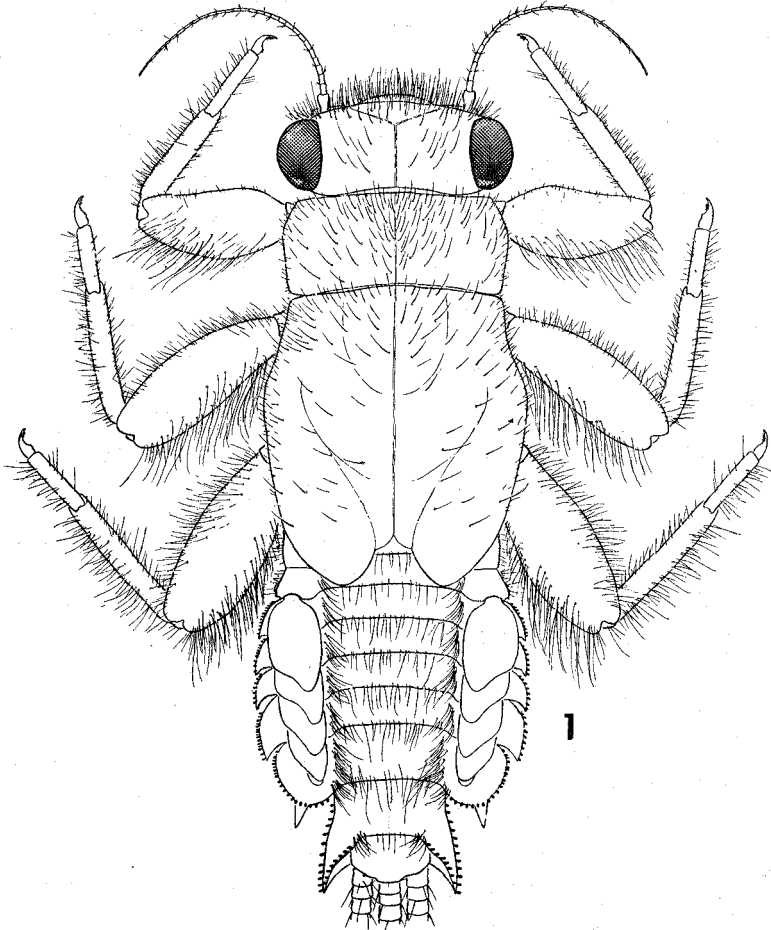
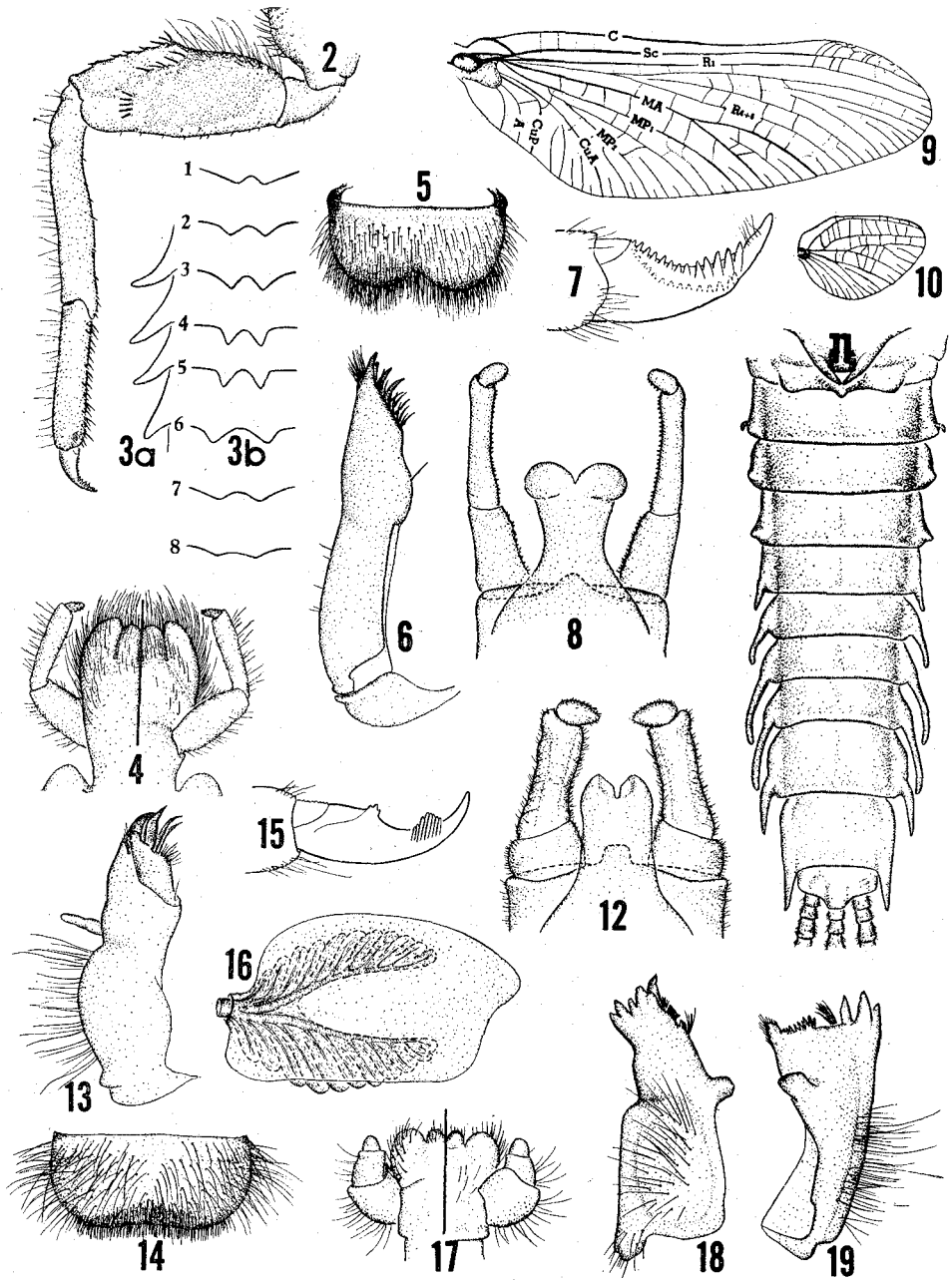


Fig. 1. *Ephemerella (Crinitella) coheri* (holotype), mature ♀ nymph, dorsal view.

medially (fig. 5); maxillae without palpi (fig. 6); labium and its palpi elongate (fig. 4). Pronotum without distinct tubercles, but with several low raised areas along posterior and lateral margins, mesonotum with raised areas near wingpad bases; legs brown, femora with dark brown markings; forefemora and tarsi with short spines arranged as in fig. 2; tarsal claws with a double row of denticles, each row with 6-10 denticles (fig. 7). Abdominal terga 1-8 with somewhat variable paired submedian tubercles, tubercles blunt and round on terga 1-3, longer and more acute on terga 4-5, decreasing in length on terga 6-8, tubercles often barely discernible on tergum 8; segments 3-6 of these tubercles raised almost perpendicularly from plane of terga (fig. 3a, b); tracheal gills on segments 1-5, gills rudimentary on segment 1, lamellate on segments 2-5; abdominal sterna brown with darker submedian longitudinal dashes originating at anterior margin of each segment, but not attaining rear margin. Caudal filaments with whorls of short spines at apex of each segment, sparsely setaceous basally, setae longer distally. Length: body 7-8 mm; caudal filaments 5-6.



Figs. 2-8. *Ephemrellina crassi*: 2, right nymphal fore leg; 3a, lateral view of tubercles on terga 3-6; 3b, posterior margins of abdominal terga 1-8; 4, labium; 5, labrum; 6, maxilla; 7, tarsal claw; 8, ♂ genitalia, dorsal view. Figs. 9-12. *Ephemerella (Eurylophella)* sp., ♂ subimago: 9, forewing; 10, hind wing; 11, abdomen, dorsal view; 12, ♂ genitalia, dorsal view. Figs. 13-19. *Ephemerella (Crinitella) coheri*: 13, maxilla; 14, labrum; 15, tarsal claw; 16, gill, segment 3; 17, labium; 18, left mandible; 19, right mandible.

The imagoes are all somewhat decomposed and in only fair condition; the colors of fresh specimens may be more vivid.

Holotype. ♂ nymph, Great Berg River, French Hoek Forest Reserve, S. Africa, 20. XI. 1950, A. D. Harrison (University of Utah); paratypes: 3 ♂ imagoes, Great Berg River, French Hoek Forest Reserve, S. Africa, 20. XI. 1950, A. D. Harrison, 1 at University of Utah, 1 at Institute for Water Research, Pretoria, S. Africa, and 1 at British Museum (Nat. Hist.); 38 ♀ and 8 ♂ nymphs, Great Berg River, French Hoek Forest Reserve, S. Africa, 21. XI. 1950, A. D. Harrison, deposited in same institutions as adults and also at Institut Royal des Sciences Naturelles de Belgique.

The ♂ imago of *E. crassi* has fore legs typical of *Ephemerellina*, but the form of the penes does not conform with either *Ephemerellina* or *Lithogloea*. The nymphal stage, however, would be assignable to the nominal genus *Lithogloea* as it possesses a vestigial gill on segment 1. The ♂ imago and nymph of *Ephemerellina crassi* have not been positively associated and the association of these stages appears doubtful on the basis of Barnards (1932) characterization of these "genera." However, since both the nymphal and adult stages were collected in and near the same stream on successive days, this association is probably correct. The problem will be clarified only when the nymphs are associated by rearing. The ♂ imago of *E. crassi* may be distinguished from the adult ♂♂ of the other species of *Ephemerellina* by the form of the penes. The nymph of *E. crassi* is distinct as it is the only known species in the genus with paired submedian abdominal tubercles, and may be further distinguished from *E. harrisoni* and *E. penicillata* by the arrangement of spines on the forefemora and by the dentition on the tarsal claws.

***Ephemerellina sinensis* (Hsu) n. comb.**

Ephemerella sinensis H., 1936, Peking Nat. Hist. Bull.: 325, 2 figs.

This species was described in the genus *Ephemerella*, but both the form of the genital forceps and the presence of 3 caudal filaments indicates it to be referable to *Ephemerellina*. The measurements of the fore leg would make this species referable to the nominal genus *Lithogloea* Barnard. The genus *Ephemerellina* heretofore has been known only from S. Africa and the above transfer extends the range of this genus to Kiangsi Province in southern China.

***Ephemerellina* sp. Figs. 37-45.**

Mature Nymph: General color light brown. Head without tubercles; labrum only narrowly emarginate and more than 2× as long as broad at median line (fig. 44); maxilla without palpus (fig. 45); left mandible and labium as in figs. 42-43. Thorax without tubercles; legs with small spines (figs. 37-39); tarsal claws with 6-9 denticles. Abdominal terga with median tubercles on segments 1-8 (fig. 40); tracheal gills on segments 2-6 only, gill on segment 2 as in fig. 41; posterolateral projections on segments 3-9 (fig. 40); abdominal terga light brown and without distinct markings; abdominal sterna light brown and without distinct markings. Caudal filaments with whorls of spines at apex of each segment. Length: body 11-12 mm; caudal filaments 14-15.

Specimens examined: 3 ♀ nymphs, Upper Berg River, western Cape Province, S. Africa, 21. XI. 1950, A. D. Harrison, in collection of the University of Utah, and Institute for Water Research, Pretoria, S. Africa.

Although it is quite likely that these nymphs represent an undescribed species, we do not consider it advisable to name them until they are reared to the adult, or until it is established with certainty that the nymph tentatively associated with *E. barnardi* is actually that species.

Genus *Ephemerella* Walsh

A single ♂ subimago from Madagascar in the collection of the Illinois Natural History Survey (Urbana, Illinois) is clearly a species of the genus *Ephemerella*, and seems referable to the subgenus *Eurylophella* Tiensuu on the basis of many characters. The well-developed posterolateral projections on abdominal segments 4-9, the form of the penes and genital forceps, the presence of a tubercle between the bases of the genital forceps, and the wing venation are all typical of *Eurylophella*. Several features of the subimago suggest that the nymph is *Eurylophella*-like. The nymphs of *Eurylophella* have vestigial thread-like gills on segment 1, and gills on segments 4-7. Abdominal segments 5-7 are shortened as an adaptation to bring gills on these segments under the semi-operculate gills of segment 4. The subimago from Madagascar has a small projection on each side of abdominal segment 1 that appears to be a remnant of a vestigial gill, pale depressions on each side of segments 4-7 that are apparently remnants of gill insertions, and abdominal segments 5-7 are shortened.

The subgenus *Eurylophella* is most diverse in boreal eastern N. America with 1 species extending as far south as Florida; a single species also occurs along the Pacific Coast of the United States and 2 other species are found from Lake Ladoga, Karelian A. S. S. R., south to Poland. Although the distribution of *Eurylophella* outside N. America could be much more extensive than is now known, the occurrence of this subgenus in Madagascar would appear anomalous. We have considered the possibility that the specimen is of N. American origin and was mistakenly placed with the Madagascar material; however, the specimen possesses characters which appear to distinguish it from the known N. American species. The hind wings are only about 1/4 as long as the forewings in the Madagascar specimen, while in most N. American species they are usually more nearly 1/3 the length of the forewings, although in some of the smaller species the hindwings approach being as short as 1/4 the length of the forewings. In those N. American species where we have available subimagoes in alcohol, abdominal segment 9 is about 1.5× as long as the 8th, while in the Madagascar specimen the 9th is about 1.2× as long as the 8th.

Because of the possibility that this specimen is not from Madagascar, we consider it inadvisable to name it at this time. It does not seem reasonable, however, to ignore the specimen on the assumption that an error was made in labeling.

Ephemerella (*Eurylophella*) sp. Figs. 9-12.

Male Subimago (in alcohol): Upper portion of eyes pale orange, lower portion gray. Prothorax brown, area around median suture of pronotum pale; posterior margin of pronotum with a median tubercle; mesothorax brown; scutum, scutellum and pleural area pale and translucent; wing opaque, tinged with grayish brown (fig. 9); legs brown, distal end of tibiae and tarsal segments narrowly ringed with dark brown; relative lengths of tarsal segments are: tarsus 1=0.2, tarsus 2=1.0, tarsus 3=0.8, tarsus 4=0.7, and tarsus 5=0.6. Abdominal terga light brown; abdominal segments 4-9 with fleshy posterolateral pro-

jections (fig. 11); abdominal sterna brown, lighter than terga. Genital forceps 3-segmented, segment 2 long, segments 1 & 3 short; penes fused except at apex (fig. 12). Caudal filaments light brown and clothed with minute spines. Length: body 6.5 mm; forewing 7.

Specimen Examined: ♂ subimago, Batafo, Tananarive Prov., Madagascar, VII. 1949, R. Paulian (Illinois State Natural History Survey).

Crititella Allen and Edmunds, n. subgen.

The subgenus *Crititella* is characterized by the following morphological features.

Head, thorax and abdomen without paired dorsal submedian tubercles. Body and appendages hairy (fig. 1). Left mandible with a small molar surface and an exceedingly well-developed anterior articulating condyle (fig. 18); maxillae with small unsegmented palpi (fig. 13); labium with short glossae, paraglossae and palpi (fig. 17). Tarsal claws with a palisade of long denticles (fig. 15). Abdomen with imbricated gills on segments 3-7; abdominal terga expanded laterally on segments 3-9 (fig. 1). Caudal filaments with long hair-like spines and long setae.

Type species: *Ephemerella* (*Crititella*) *coheri* Allen and Edmunds, n. sp.

Crititella is most similar to the subgenus *Serratella* Edmunds. Both subgenera possess tracheal gills on abdominal segments 3-7, reduced maxillary palpi and whorls of spines on the apices of the segments of the caudal filaments. *Crititella* differs from *Serratella* and all other subgenera in the genus *Ephemerella* by the uniquely asymmetrical mandibles (figs. 18 & 19) with a reduced molar surface and a large anterior articulating condyle on the left one, and by the peculiar shortened labium (fig. 17). It possesses long hairs on the head, thorax, abdomen and legs (fig. 1) similar to the species in the subgenus *Dannella* Edmunds, but the tarsal claws (fig. 15) are unique in the genus.

Ephemerella (*Crititella*) *coheri* Allen and Edmunds, n. sp. Figs. 1, 13-19.

Mature Nymph: Color unicolorous light yellowish brown. Head with long, fine, pale hair on anterior and dorsal surfaces. Thorax and legs with long hairs as in fig. 1; tarsal claws with a palisade of long denticles and a single tridentate projection (fig. 15). Abdominal terga 3-7 with imbricated tracheal gills (figs. 1 & 16); abdominal terga with long hair on posterior margin of segments 1-9, a row of long hair on terga 3-8 mediad of the gills; segments 4-9 with posterolateral projections, segment 8 with a narrow acute posterior projection, posterolateral projection on segment 9 extends posterolaterally beyond margin of segment 10; lateral margins of segments 4-8 with short heavy spicules, spicules on segment 8 pass over acute posterior projection and along posterior margin of segment forming a half-circle, spicules on segment 9 along lateral and inner margin of posterolateral projections; abdominal sterna without markings or hair. Caudal filaments light brown, and with long hair-like spines on apex of each segment, with setae beginning near base of each filament. Length: body 5.5-6.5 mm; caudal filaments 3-4.

Holotype. ♀ nymph, Pelung (1950 m), Nepal, 17. IV. 1957, E. I. Coher (University of Utah); paratopotypes: 5 ♂ and 3 ♀ nymphs, 1 nymph in each of the following collections: Canadian National Collection, California Academy of Sciences, the British Museum (Nat. Hist.), University of Florida, Bishop Museum and Institut Royal des Sciences Naturelles de Belgique; 2 nymphs are deposited in the University of Utah collection.

***Ephemerella (Drunella) submontana* Brodsky**

Ephemerella submontanus Brod., 1930, Abt. Syst. Zool. Jahrb. **59**: 683.—Uéno, 1953, Fauna & Flora Res. Soc. **1**: 303

Ephemerella submontana was described from 2 ♂ subimagoes and 3 ♀ subnagoes. Brodsky (1930) characterized this species on color plus the relationship of the length of the forewing to the length of the body (10 mm and 14 mm) in the ♀ subimago. Edmunds (1957) considered the subgeneric placement as uncertain. We now consider this species to belong to the subgenus *Drunella* because of the form of the genitalia of the subimago ♂♂, the size of the ♂ and ♀ subimagoes, and because the nymphal stage associated with this species by Brodsky (*op. cit.*) has tubercles on the ventral (leading) edge of the forefemora.

***Ephemerella (Drunella) gilliesi* Allen and Edmunds, n. sp. Figs. 32–36.**

Mature Nymph: Color light brown with variable dark brown markings. Head with very small, blunt paired occipital tubercles (fig. 34). Thorax light brown with variable dark brown ornate markings on pronotum and mesonotum, longitudinal veins and base of developing wing brown; prothorax with a very small, rounded, anterior median tubercle and small, round, paired posterior submedian tubercles; mesonotum with a round, single median tubercle between bases of wing pads; legs light brown, femora usually with indistinct medium brown transverse band near middle, subbasally and subapically, distal and proximal ends of tibiae and tarsi medium brown; apex of hind femora with a distinctive apical projection (fig. 33); tarsal claws with 2–4 denticles (fig. 35), medium brown at apex. Abdomen light brown; abdominal terga with stout paired submedian tubercles on segments 2–10, tubercles small on segment 2, increasing in length to segment 9, tubercles small on segment 10 (fig. 36); abdominal sterna pale brown. Caudal filaments brown, with whorls of small spines at the apex of each segment. Length: body 10–11 mm; caudal filaments 8–9.

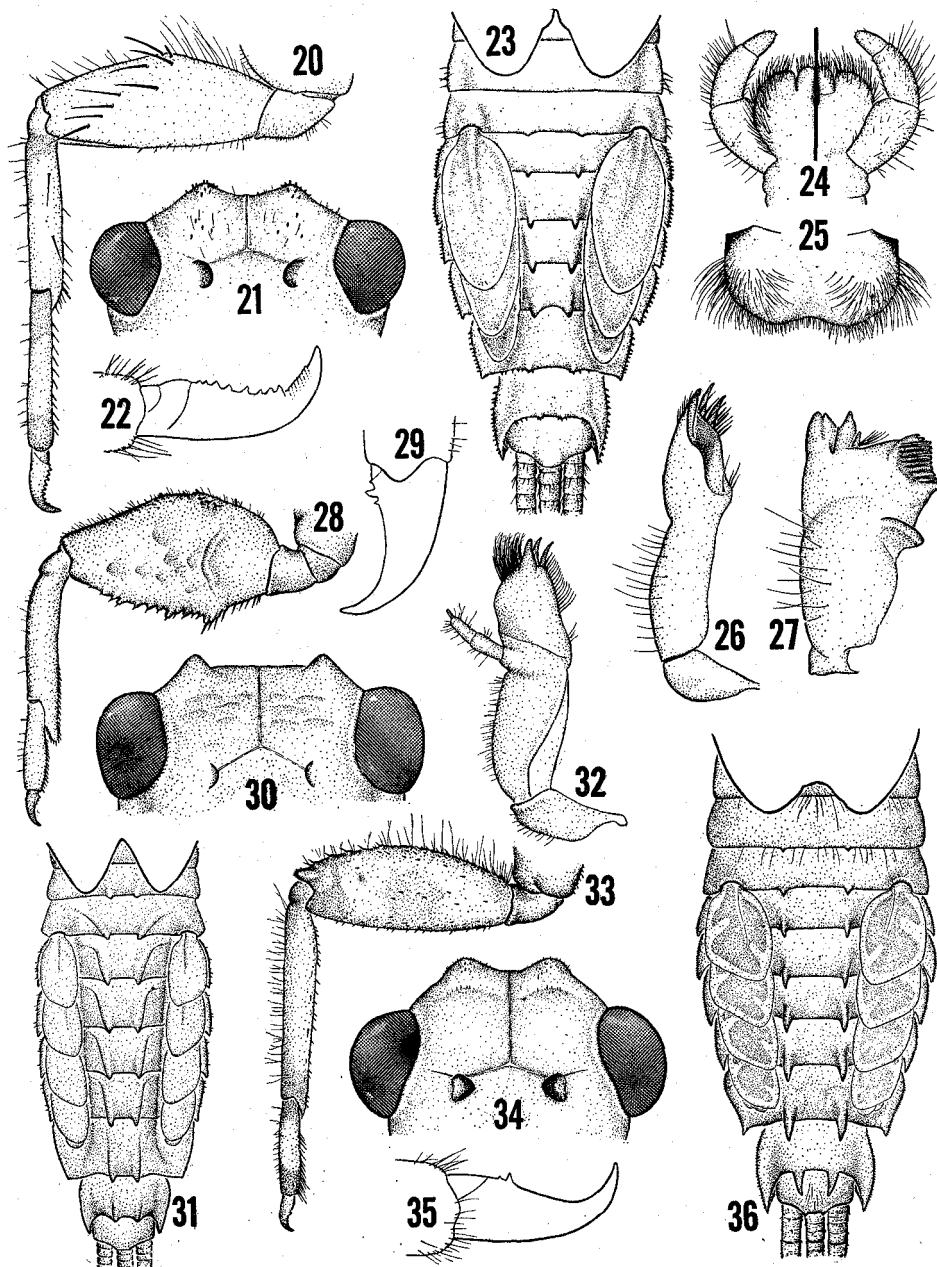
Holotype. ♀ nymph, Choban Gorge, Katmandu, Nepal, 20. XII. 1960, M. T. Gillies, (University of Utah); paratopotypes, 2 ♀ nymphs, 1 in the British Museum (Nat. Hist.) and 1 in the University of Utah Collection.

Ephemerella gilliesi appears to be most closely related to *E. uenoi*, n. sp. The nymphs of both these species resemble those of the *grandis* group in lacking tubercles on the ventral (leading) edge of the forefemora, but the tubercles of the head, thorax and abdomen do not have the extreme development characteristic of the *grandis* group. The robust body form, reduced number of denticles on the tarsal claws, and the well-developed abdominal tubercles on these 2 species are all characteristic of species of the subgenus *Drunella*. *Ephemerella gilliesi* and *E. uenoi* are the only Asian species of *Drunella* that lack tubercles on the leading edge of the femora. *E. gilliesi* is readily distinguishable by having only 1 distinct mesonotal tubercle, while *E. uenoi* has 5. These species also differ in the shape of their abdominal tubercles.

***Ephemerella (Drunella) uenoi* Allen and Edmunds, n. sp.**

Ephemerella sp. Uéno, 1953, Fauna & Flora Res. Soc. **1**: 302, 8 figs.

This species was described but not named by Uéno (1953) from a single nymph collected by the Japanese Himalayan Expedition in Nepal in 1952. This nymph is morpho-



Figs. 20-27. *Ephemerella (Torleya) nepalica*, nymph: 20, right fore leg; 21, vertex of head, front view; 22, tarsal claw; 23, abdomen, dorsal view; 24, labium; 25, labrum; 26, maxilla; 27, left mandible. Figs. 28-31. *Ephemerella (Drunella) traversae*, nymph: 28, right fore leg; 29, tarsal claw; 30, vertex of head, front view; 31, abdomen, dorsal view. Figs. 32-36. *Ephemerella (Drunella) gilliesi*, nymph: 32, maxilla; 33, right nymphal hind leg; 34, vertex of head, front view; 35, tarsal claw; 36, abdomen, dorsal view.

logically distinct from all known species in the subgenus *Drunella* and we take pleasure in naming it for the describer, Masuzo Uéno.

Nymph (immature): General color olivaceous brown. Head with 3 pairs of blunt tubercles; genae expanded but without lateral projections; a blunt median ocellar tubercle. Thorax with tubercles; pronotum with 5 knob-like tubercles; mesonotum with 5 blunt tubercles; legs pale; forefemora without tubercles on ventral (leading) edge; tarsal claws with 3-4 denticles. Abdominal terga with well-developed paired submedian tubercles on segments 3-9; posterolateral projections on segments 3-9. Caudal filaments pale. (Diagnosis extracted from Uéno's description, 1953.) Length: body 8.5 mm; caudal filaments 9.0.

Holotype. Nymph described and figured by Uéno (1953: 302-303, plate I) collected from a stream through paddy fields between Batar Bazar and a ford of Tadi Khola, 700 m, Nepal, 13. XII. 1952, K. Imanishi.

Ephemerella uenoi may be distinguished from *E. gilliesi* and all other known species in the subgenus *Drunella* by the number and arrangement of the dorsal tubercles on the head, thorax and abdomen as stated in the discussion under *E. gilliesi*. Uéno (*op. cit.*) states in this description that this species possesses paired dorsal abdominal tubercles on segments 3-9 and illustrated it as such in fig. 8 of his publication; however, in the figure of the whole nymph in this same paper he shows paired dorsal abdominal tubercles on segments 2-9.

***Ephemerella* (*Drunella*) *traverae* Allen and Edmunds, n. sp. Figs. 28-31.**

Nymph (immature): General color brown. Head with a broad, round frontal shelf and very short frontoclypeal projections; genae expanded but without lateral projections; a blunt median ocellar tubercle and small paired occipital tubercles (fig. 30). Thorax without tubercles; legs brown; forefemora with tubercles on ventral (leading) edge (fig. 28); tarsal claws with 1-3 denticles (fig. 29). Abdominal terga with well-developed paired submedian tubercles on segments 2-9 as in fig. 31; abdominal sterna light brown and sparsely setaceous. Length: body 7 mm; caudal filaments missing.

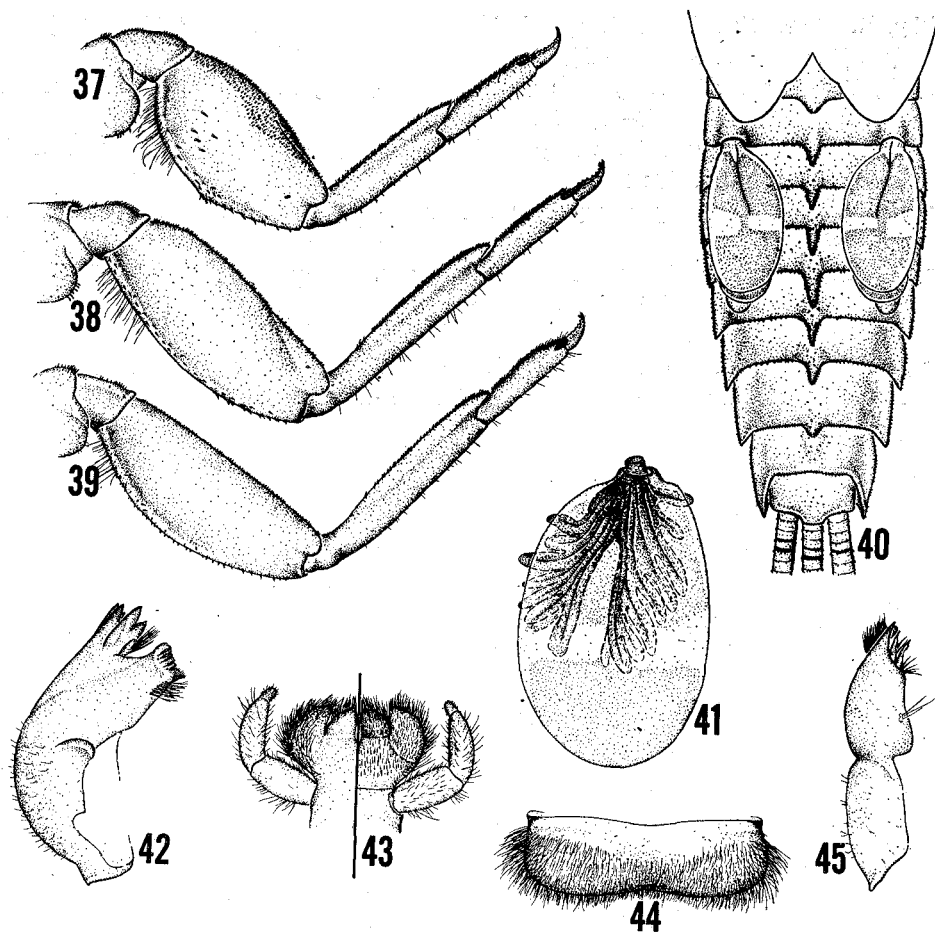
Holotype. ♀ nymph, L 11, Stream E of Nurla, Kashmir, India, 31.V.1933, G. E. Hutchinson (Yale N. India Expedition), in private collection of Jay R. Traver, Amherst, Massachusetts.

Ephemerella traverae is apparently a species of *walkeri* group of the subgenus *Drunella* and may be distinguished from all other known species in the subgenus by possessing a combination of paired occipital tubercles and a broad rounded frontal shelf and by the paired dorsal abdominal tubercles.

***Ephemerella* (*Torleya*) *nepalica* Allen and Edmunds, n. sp. Figs. 20-27.**

Mature Nymph: Color unicolorous light brown. Head with small paired occipital tubercles (fig. 21); maxillae without palpi (fig. 26); left mandible as in fig. 27. Prothorax with paired smoothly rounded submedian and sublateral tubercles. Legs with long hair and spines (fig. 20); femora shaded with darker brown near base and a faint transverse band sometimes visible beyond middle, tibia shaded with darker brown basally, tarsi shaded with darker brown in basal 1/2, with still darker apical band, claws medium brown

apically, darker leg markings may be obsolescent or lacking; tarsal claws with 6-8 denticles (fig. 22). Abdominal terga 3-7 with semi-operculate tracheal gills; abdominal terga 3-9 with paired submedian tubercles, tubercles well-developed on terga 4-7, small on terga 3 and 8-9, apex of tubercles darker brown than general body color (fig. 23); abdominal sterna without markings or hair. Caudal filaments light brown with narrow dark brown basal bands and with whorls of long slender spines at apex of each segment, in well-marked specimens, light brown segments alternate with pale ones. Length: body 6.5-7.5 mm; caudal filaments 4-5.



Figs. 37-45. *Ephemerellina* sp., nymph: 37-39, right legs; 40, abdomen; 41, gill, segment 2; 42, left mandible; 43, labium; 44, labrum; 45, maxilla.

Holotype. ♀ nymph, Pelung, 1950 m, Nepal, 17. IV. 1957, E. I. Coher, (University of Utah); paratopotypes, 4 ♂ and 10 ♀ nymphs, 1 ♀ nymph will be deposited in each of the following collections: Canadian National Collection, the California Academy of Sciences, the British Museum (Nat. Hist.), the University of Florida, Bishop Museum, and Institut

Royal des Sciences Naturelles de Belgique; 4 ♂ and 4 ♀ nymphs in the University of Utah collection.

Ephemerella nepalica is herein placed in the subgenus *Torleya* as it has semi-operculate gills on segments 3-7, and long hair-like spines on the terminal filaments, characters which distinguish the nymphal stage of *Torleya* from the subgenus *Serratella*. It differs from the known species of *Torleya* in having paired occipital and abdominal tubercles and in lacking maxillary palpi.

LITERATURE CITED

- Brodsky, K. 1930. Zur Kenntnis mittelasiatischen Ephemeropteren, I (Imagines). Abt. Syst. Zool. Jahrb. **59**: 681-720, 42 figs.
- Edmunds, G. F., Jr. 1959. Subgeneric groups in the mayfly family Ephemerellidae. Ann. Ent. Soc. Amer. **52**: 543-47, 9 figs.
- Hsu, Yin-Chi. 1936. New Chinese mayflies from Kiangsi Province (Ephemeroptera). Peking Nat. Hist. Bull. **10**: 319-26.
- Traver, J. R. 1939. Himalayan mayflies (Ephemeroptera). Ann. Mag. Nat. Hist. ser. 11, **4**: 32-56.
- Uéno, M. 1953. Fauna and flora of Nepal Himalaya. Scientific results of the Japanese expeditions to Nepal Himalaya. Fauna and Flora Res. Soc., Kyoto Univ., Kyoto, Japan **1**: 301-16, 10 pls.
- Ulmer, G. 1936. Schwedisch-chinesische wissenschaftliche Expedition nach den nordwestlichen Provinzen Chinas. Arkiv Zool. **27 A**: 1-6.