

## Ephemerellidae (Insecta: Ephemeroptera) from Hong Kong, China, with Descriptions of Two New Species

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### ABSTRACT

Four species of Ephemerellidae are recorded from Hong Kong, China in this paper, including two new species: *Serratella albostriata* sp. n., *Teloganodes tristis* (Hagen), *Torleya arenosa* sp. n., and *Uracanthella rufa* (Imanishi). Descriptions of all new species are based on imagoes and larvae.

KEYWORDS: Ephemeroptera, Ephemerellidae, *Serratella albostriata*, *Torleya arenosa*, new species, Hong Kong.

### INTRODUCTION

The family Ephemerellidae is represented in Hong Kong by the genera *Serratella*, *Torleya*, *Teloganodes* and *Uracanthella* based on the classification published by Allen (1980, 1984). Until now, the generic placements of species of *Serratella*, *Torleya* and *Uracanthella* from Hong Kong were uncertain. They were initially assigned to *Ephemerella* T<sub>2</sub>, *Ephemerella* T<sub>1</sub>, and *Ephemerella* L<sub>3</sub> respectively (Dudgeon, 1982, 1984; Hubbard, 1986), thence to *Serratella* T<sub>2</sub>, *Ephemerellina* T<sub>1</sub>, and *Serratella* L<sub>2</sub> (Dudgeon, 1990, 1992), and finally to *Uracanthella* sp., *Torleya* sp., and *Serratella* sp. (Dudgeon, 1999). In the past two years, we have made extensive collections including rearing and light trapping all over Hong Kong and examined many specimens of Ephemerellidae. In the present paper, we report upon four species including two new species of *Serratella* and *Torleya*. Identifications of most adults included in this study were confirmed by rearing from larvae in the laboratory.

Abbreviations used for deposition of types are as follows: the insect collection of the South China Agricultural University, Guangzhou, P. R. China (SCAU); Department of Ecology & Biodiversity, The University of Hong Kong (HKU); the insect collection of the Agriculture and Fisheries Department of Hong Kong Government (AFDHK); the collection of Florida A & M University, Tallahassee, Florida (FAMU); and, Purdue Entomological Research Collection, West Lafayette, Indiana (PERC).

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*Serratella albostriata* sp. n. (Figs. 1–12)

*Ephemerella* T<sub>2</sub>: Dudgeon, 1982: 225; Hubbard, 1986: 249.

*Serratella* T<sub>2</sub>: Dudgeon, 1990: 225.

*Uracanthella* sp. : Dudgeon, 1999: 270, Fig. 4.55.

*Male imago* (in alcohol, reared from larvae). Length: body ca 4.5 mm, forewings 4.5–5.0 mm. Upper portion of compound eye orange or reddish-orange, lower portion black. Antennae smoky. Head yellowish-brown with small reddish-brown maculae. Thorax yellowish-brown; wings hyaline, basal portion tinted with brown, primary longitudinal veins light yellow, crossveins and intercalaries pale. Legs pale, each femur with a reddish-brown apical macula. Length of segments of forelegs (mm): femur 1.0, tibia 2.2, tarsal segments 0.12, 0.47, 0.50, 0.25, and 0.12; hind femur slightly shorter than tibia, tarsus very short, about  $\frac{1}{4}$  length of tibia. Abdominal tergites 1–6 light reddish-brown (light-trapped specimens pale) and translucent with paired sublateral light purple maculae; abdominal segments 7–10 yellowish-brown and opaque; tergites 2–8 each with dark brown maculae near pleural fold. Genitalia as in Fig. 2, grayish white. Caudal filaments pale with purplish-black annulations at apex of each segment.

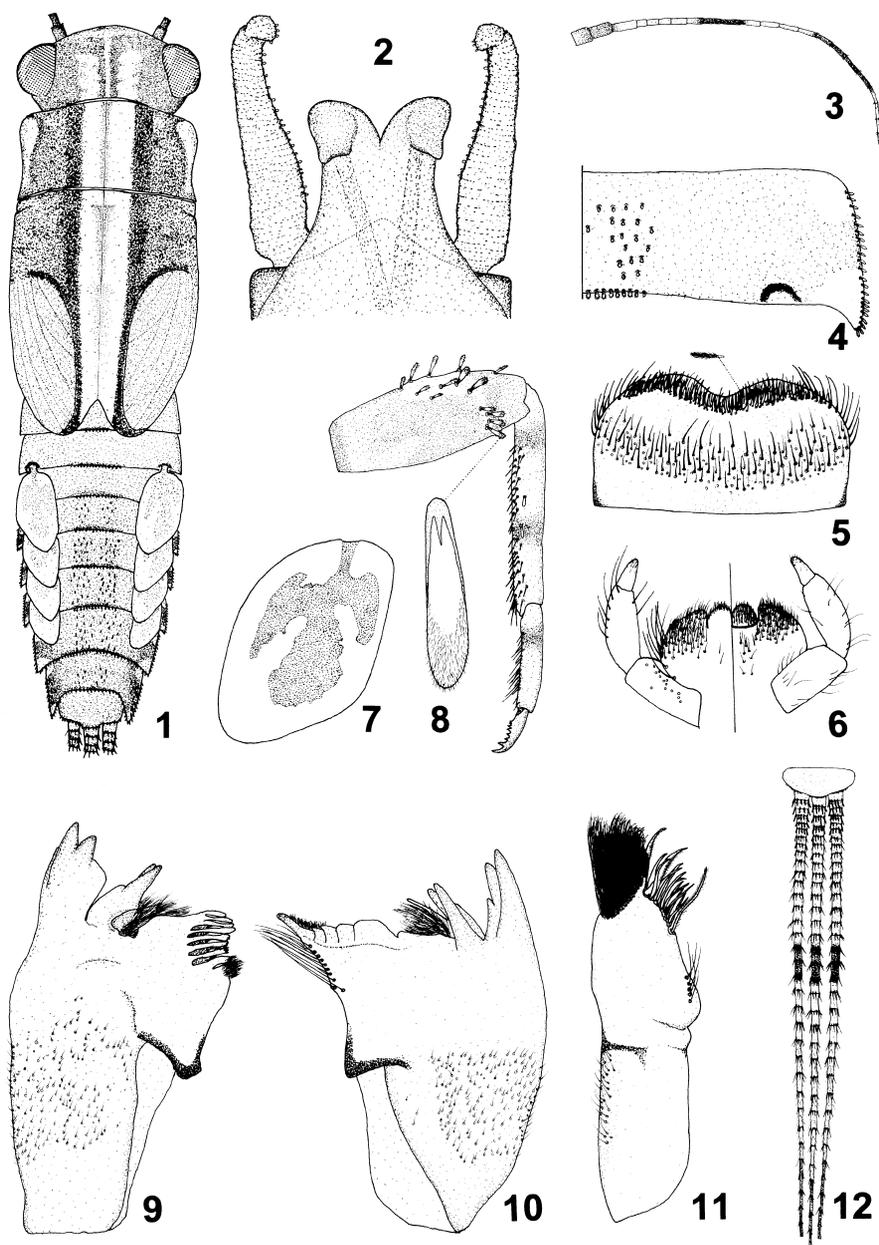
*Female imago* (in alcohol, reared from larvae). Length: body 5.0–6.0 mm, forewings 5.5–6.5 mm. Head, thorax and abdomen darker brown than in male. Wings hyaline; longitudinal veins and intercalaries brown, crossveins pale. Other characters as in male except for usual sexual differences.

*Mature larva* (Fig. 1). Length: female body 4.0–5.5 mm, caudal filaments 3.0–4.0 mm; male body 3.5–4.5 mm, caudal filaments 2.0–3.0 mm. General color reddish-brown to dark brown, and with a wide, pale medial longitudinal stripe along vertex of head and thoracic nota.

*Head.* Head without tubercles or projections. Antennae (Fig. 3) long and slender, about 1.5 times longer than width of head. Labrum (Fig. 5) nearly rectangular, about 2.0 times wider than long, and small compared to head capsule (across the compound eyes) or about 2.6–2.8 times width of labrum. Mandibles as in Figures 9 and 10, incisors short and blunt. Maxillary palpi absent (Fig. 11). Labium as in Figure 6, labial palpi 3-segmented, segment 1 as long as segment 2, segment 3 small.

*Thorax.* Thoracic nota reddish-brown to dark brown with a pale medial longitudinal stripe, pronotum with pale lateral margins. Fore femora (Fig. 8) pale brown with variable light markings, tibiae yellowish-brown with brown bands basally and medially, tarsi yellowish-brown with brown bands basally; femora with a transversal row of 5–7 stout long clavate setae near subapical area, and others distributed irregularly on posterior side and along posterior margin; claws with 6–7 denticles, apical one much larger than others.

*Abdomen.* Tergites without dorsal tubercles. Abdomen uniform reddish-brown to dark brown apart from pale antero- and posterolateral angles of each segment



Figs. 1–12. *Serratella albostrata* sp. n.: Fig. 1. head, thorax and abdomen of larva, dorsal view; Fig. 2. male genitalia, dorsal view; Fig. 3. antenna; Fig. 4. abdominal tergite 6; Fig. 5. labrum, dorsal view; Fig. 6. labium, a: dorsal view, b: ventral view; Fig. 7. gill III, Fig. 8. foreleg, Fig. 9. left mandible; Fig. 10. right mandible; Fig. 11. maxilla; Fig. 12. caudal filaments. Figs. 1 and 3-12 are of the mature larva.

(Figs. 1, 4); abdominal segments 4–9 each with posterolateral projections and elliptic scale-like setae laterally; posterior margins of tergites 2–10 with elliptic scale-like setae (on tergites 2–7 the setae only on middle of margins), similar setae also present on surface of tergites 5–9 (Fig. 4). Imbricated gills (Fig. 1) on segments 3–7, gills III–VI alike (Fig. 7), gills VII very small. Caudal filaments pale yellowish-brown with dark brown bands medially and terminally (Fig. 12); each segment with whorled spines, and sparse intersegmental setae on subapical segments.

*Material examined.* Holotype: male imago (in alcohol, reared from larva), CHINA, Hong Kong, Hok Tau, 18-X-1998, Xiaoli Tong, in SCAU. Paratypes, CHINA, HONG KONG: 4 larvae, same data as holotype, in SCAU; 2 male imagoes (one genitalia on slide), 1 ♂ subimago (light-trapped specimen), Tai Po Kau, 10-VIII-1983, David Dudgeon, in HKU; 3 ♂ imagoes (light-trapped specimen), Tai Tso Stream, Tai Mo Shan, 10-IX-1987, David Dudgeon, 1 in FAMU, 1 in PERC, and 1 in SCAU; 2 larvae, Tai Po Kau, 12-XI-1996, Xiaoli Tong, in AFDHK; 1 larva, Shing Mun, 25-VI-1997, Xiaoli Tong, in HKU; 1 ♂ imago (reared from larva, genitalia on slide), Shing Mun (nr. The Bridge), 19-IX-1997, Xiaoli Tong, in SCAU; 1 ♀ imago (reared from larva), Lam Tsuen River (nr. Tong Ming Tsuen), 19-IX-1997, Xiaoli Tong, in AFDHK; 4 larvae, Lam Tsuen River (nr. Ma Po Mei), 7-X-1997, Xiaoli Tong, in SCAU; 1 ♀ imago (reared from larva), Lam Tsuen River (nr. The Channel, upper Pak Ngau Shek), 16-X-1997, Xiaoli Tong, in HKU; 1 larva, Lam Tsuen River (nr. Channel, upper Pak Ngau Shek), 22-X-1997, Xiaoli Tong, in HKU; 1 larva, Chuen Lung, 20-I-1998, Xiaoli Tong, in HKU; 2 ♂ imagoes (light trapping specimens, genitalia on slides), Tai Po Kau, 9-V-1998, Xiaoli Tong, in SCAU; 1 larva, Lam Tsuen River (nr. Ma Po Mei), 21-V-1998, Xiaoli Tong, in HKU; 2 larvae, Tai Po Kau, 14-X-1998, Xiaoli Tong, in SCAU; 3 larvae, Hou Tau, 18-X-1998, Xiaoli Tong, in SCAU; 4 larvae, Pak Ngau Shek, 8-I-1999, Xiaoli Tong, 2 in FAMU, 2 in PERC.

*Etymology:* *albostrata* is from the Latin words: *albus* meaning white and *striatus* meaning stripe.

*Distribution:* Hong Kong (China).

*Remarks.* The male imago of *Serratella albostrata* sp. n. can be easily distinguished from all known species of *Serratella* by the unique male genitalia. The larvae of this new species resemble *Serratella subsolana* from Afghanistan (Allen, 1973: Fig. 1), but can be distinguished from the latter by the following characters: (1) maxillary palpi absent; (2) fore femora with a row of stout long clavate setae near the subapical area; (3) abdominal tergites without paired submedian elevated ridges; and (4) caudal filaments light yellowish-brown with dark brown bands on the median and apex. The larvae of the new species are also similar to those of *Uracanthella rufa* in legs, claws, abdominal tergites, gills and caudal filaments, but this new species can be easily differentiated from *U. rufa* in larvae by the head, mouthparts and color pattern on the abdominal segments.

*Biology.* Larvae are usually found in moderately rapid to swift streams with sediments of mixed stones and sands. They are most common in deeply shaded riffles containing accumulations of leaf litter. Larvae often bend the caudal filaments forward over the abdomen and they are poor swimmers, moving by undulatory movements of the abdomen. When not walking, they often raise the body up and down in a "push-up" action.

***Teloganodes tristis* (Hagen) (Figs. 13–19)**

*Cloe tristis* Hagen, 1858: 476.

*Leptophlebia tristis*: Hagen, 1873: 394.

*Teloganodes tristis*: Eaton, 1882: 208; Ulmer, 1939: 512; 1940: 627

*Teloganodes* sp.: Dudgeon, 1990: 225; 1999: 274 & Fig. 4.53.

*Mature larva.* Body length *ca* 5.0 mm. General color greyish-yellow with black color patterns. Head capsule with long simple setae along lateral margin posterior to antennal bases (Fig. 14); labrum (Fig. 13) small, head capsule about 3.6 times of width of labrum; mandibles as in Figure 17; maxillary palpi reduced to tiny bud (Fig. 16); labium small and short with less than 1/3 length of maxilla, with well developed postmentum (Fig. 18). Legs with flat and greatly expanded femora (Figs. 15, 19); fore femora with well developed, setose transverse ridge near base of dorsal surface (Fig. 15); mid legs similar to hind legs in color pattern and other characteristics (Fig. 19); tarsal claws with 5 denticles. Abdominal tergites 1–10 each with midposterior tubercle. Gills present on segments 2–5, first pair of gills largest and operculate. Terminal filament absent.

*Material examined:* 1 larva, Tai Po Kau Forest Stream, Hong Kong, 29-III-1997, Maria Salas, in SCAU. 1 larva, Tai Po Kau Forest Stream, 20-IX-1986, David Dudgeon, in HKU.

*Distribution:* Sri Lanka; Java; Sumatra; Philippines; China (Hong Kong).

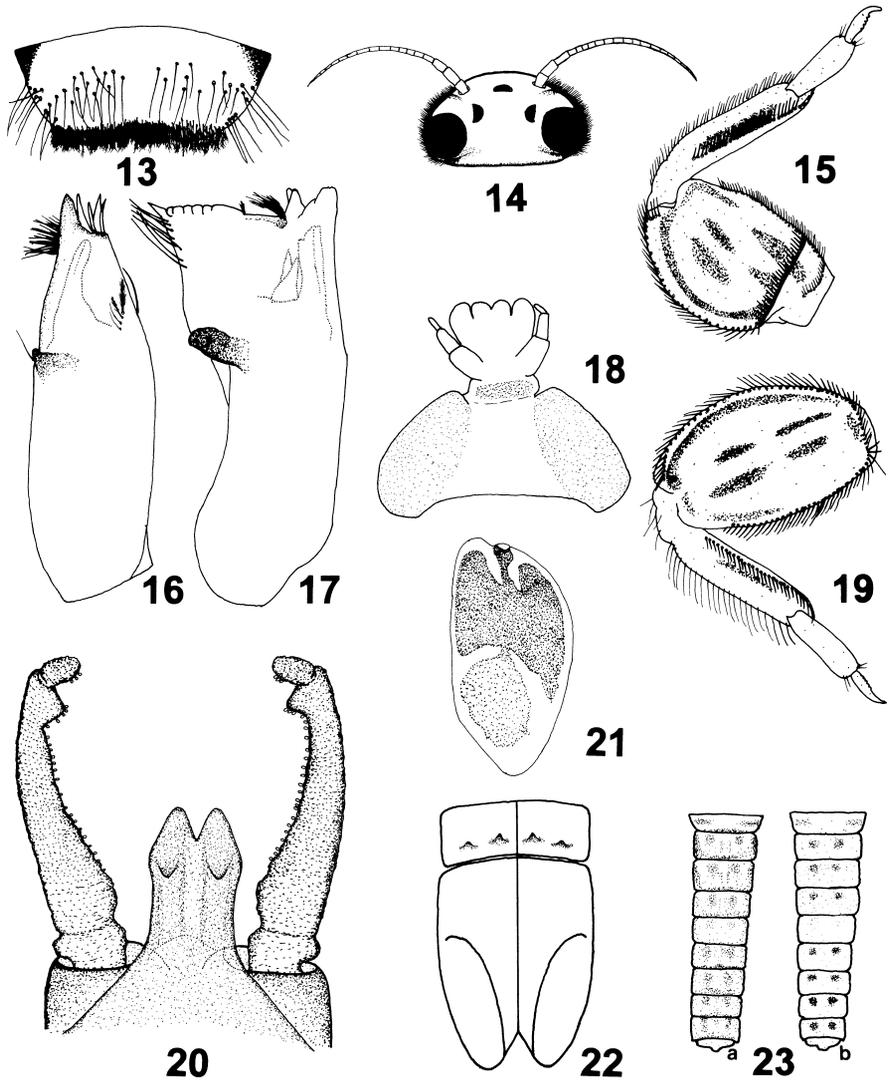
***Torleya arenosa* sp. n. (Figs. 20–31)**

*Ephemerella* T<sub>1</sub>: Dudgeon, 1982: 225; Hubbard, 1986: 249.

*Ephemerellina* T<sub>1</sub>: Dudgeon, 1990: 225.

*Male imago.* (in alcohol reared from larvae). Length: body 4.5–5.0 mm, forewings 4.0–5.0 mm. Upper portion of compound eye light yellow-brown or greyish-red, lower portion black. Antennae light brown. Thorax brown; wings hyaline, basal portion light brown, forewings with small serrations and short, simple setae marginally; primary longitudinal veins and intercalaries light yellow, crossveins white. Legs pale, each femur with single brown macula apically. Length of segments of forelegs (mm): femur 0.9, tibia 2.3, tarsal segments 0.05, 0.55, 0.45, 0.27, and 0.15. Abdominal segments light purple-brown and translucent except segments 7–10 opaque; tergites 2–9 each with paired submedian purplish-brown spots (Fig. 23a). Genitalia as in Fig. 20, second segment of genital forceps swollen apically; penes with short apical lobes and a median notch; penis lobes each with a small subapical projection. Caudal filaments pale, without annulations or bands.

*Female imago* (in alcohol reared from larvae). Length: body 4.0–4.5 mm, forewings 5.0–5.6 mm. Head, thorax and abdomen yellowish-brown. Wings hyaline,



Figs. 13–19. *Teloganodes tristis* (Hagen), mature larva: Fig. 13. labrum, dorsal view; Fig. 14. head; Fig. 15. foreleg; Fig. 16. maxilla; Fig. 17. right mandible; Fig. 18. labium and postmentum, ventral view; Fig. 19. mid leg.

Figs. 20–23. *Torleya arenosa* sp. n.: Fig. 20. male genitalia, dorsal view; Fig. 21. gill III; Fig. 22. thoracic nota of larva, showing tubercles on prothoracic notum; Fig. 23. abdominal tergites of imago, a: male imago; b: female imago.

longitudinal veins and intercalaries light brown, crossveins pale. Legs pale, each femur with macula apically. Abdominal segments yellowish-brown; tergites 2–9 each with paired submedian dark brown spots, spots on tergite V usually indistinct (Fig. 23b). Other characters as in male except for usual sexual differences.

*Mature larva.* Length: female body 3.5–5.0 mm, caudal filaments 1.5–2.0 mm; male body 3.0–4.0 mm, caudal filaments ca 1.5 mm. Body covered with numerous hairs. Thoracic nota and abdominal tergites 1–9 yellow or yellowish-brown with irregular purplish-brown maculae. Head and thoracic nota of female larva pale yellowish-brown with purplish-brown spots; abdominal tergites 1–9 pale yellow to light yellowish-brown each with paired submedian purplish brown spots, tergite 5 usually light yellow without submedian spots, with purplish-brown markings laterally. Larva body usually covered with numerous fine hairs.

*Head.* Light yellowish-brown with irregular dark brown maculae between eyes and without tubercles. Antennae light brown. Labrum small (head capsule about 3.6–4.2 times width of labrum), semicircular and dark brown on posterolateral corners; anterior margin with shallow concavity medially. Mandibles as in Figures 27 and 28, incisors short and blunt, outer margins of mandibles nearly straight. Maxillary palpi absent (Fig. 29). Labium (Fig. 24) light yellow, labial palpi 3-segmented, segment 1 longer and wider than segment 2, segment 3 light brown, shorter than segment 2.

*Thorax.* Nota light brown with irregular dark brown streaks, forewing pads dark. Paired knob-like submedian and sublateral tubercles near posterior margin of prothoracic notum (Fig. 22), sublateral tubercles small and less-developed. Fore femora (Fig. 25) pale with light brown apically, tibiae light yellowish-brown with basal half brown; tarsi with brown bands basally and apically, claws pale with dark brown apically; fore femora with row of long stout clavate setae submedially, tibiae with 3–4 long stout clavate setae ventrally, tarsus with a row of acute setae ventrally; claws with 2 groups of denticles (Fig. 26); apical group with 4 acute and long denticles, gradually larger apically; basal group with 4 small blunt denticles. Mid and hind femora pale with dark macula apically, dorsal and ventral margins with long stout setae and fine hairs, other features same as in forelegs.

*Abdomen.* Abdominal segments 4–9 each with posterolateral projections, with long elliptic scale-like setae laterally; posterior margin of tergites 4–7 each with 2 small tubercles (Fig. 31); posterior margin of sternum 9 of female convex, male with 2 concavities submedially. Gills present on abdominal segments 3–7, gills III (Fig. 21) largest covering most parts of succeeding gills. Caudal filaments pale yellow with 1–3 brown annulations with whorls of long acute setae at apex of each segment.

*Material examined.* Holotype: male imago (in alcohol, reared from larva), CHINA, Hong Kong, Lantau Island, Sam A Shui Tsuen, 27-XI-1997, Xiaoli Tong, in SCAU. Paratypes (in alcohol), CHINA, HONG KONG: 1♂ 2♀ imagoes (reared from larvae, male genitalia on slide), locality and date as holotype, in SCAU; 1♂ imago (light-trapped specimen), Tai Po Kau, 10-VIII-1983, David Dudgeon, in HKU; 4♂ imagoes (light-trapped specimens, 1♂ genitalia on slide), Tai Tso Stream, Tai Mo Shan, 10-IX-1987, David Dudgeon, 1 in FAMU, 1 in PERC, and 2 in SCAU; 1 larva, Tai Po Kau, 12-XI-1996, Xiaoli Tong, in AFDHK; 7 larvae, Wang Shan Keuk, 21-XI-1996, Xiaoli Tong, 4 in FAMU, 3 in PERC; 3 larvae, Sam Tsuen, nr. Tai O Road, Lantau, 18-XII-1996, Xiaoli Tong, in SCAU; 1 larva, Shing Mun, 26-IX-1997, Maria L. Salas, in HKU; 1 larva, Tan Shan River, nr. Ng Uk, 18-III-1998, Xiaoli Tong, in HKU; 1♀ imago (reared from larva), Bride's Pool, 29-III-1998, Xiaoli Tong, in SCAU; 2♂ imagoes (reared from larvae), Wang Shan Keuk, 29-III-1998, Xiaoli Tong, in SCAU; 1 larva, Ng Tung Chai, 26-V-1998, Xiaoli Tong, in SCAU; 1 larva, Mui Tsz

Lam, Ma On Shan, 4-XI-1998, Xiaoli Tong, in HKU; 2 larvae, Tai Po Kau, 2-II-1999, Xiaoli Tong, in SCAU.

*Etymology.* From the Latin word *arenosus* meaning sandy.

*Distribution:* Hong Kong (China).

*Remarks.* The male imago of *Torleya arenosa* sp. n. resembles *T. mikhaili* Tiunova (1995) in appearance, but can be distinguished from the latter by (1) the second segment of genital forceps swollen apically; and (2) the colour patterns of the abdomen. The larva of *T. arenosa* sp. n. resembles that of *Torleya glareosa* Kang & Yang (1995) in mouthparts, fore legs and gills, but can be distinguished from the latter by the following characters: (1) the lateral margins of mandibles with many long, fine setae; (2) prothoracic notum with 2 pairs of knob-like tubercles near the posterior margin; (3) tarsal claws with 2 groups of denticles, each group containing 4 denticles; (4) posterior margins of abdominal tergites IV-VII each with 2 small acute tubercles; and (5) abdominal tergites II-VIII each with a pair of submedian round dark maculae.

*Biology.* Larvae are usually found in shallow, fairly rapid to rapid streams of small to moderate size, especially in riffles with coarse sand and gravel substrate. They are most common in shaded parts of the streams. They are awkward swimmers. The bodies of larvae are always covered by silt trapped by fine setae.

### *Uracanthella rufa* (Imanishi)

*Ephemerella rufa* Imanishi, 1937: 37; Imanishi, 1940: 208.

*Ephemerella lenoki* Tshernova, 1952: 275. Synonymized by Tshernova et al., 1986.

*Uracanthella lenoki* (Tshernova): Belov, 1979: 577. Synonymized by Tshernova et al., 1986.

*Uracanthella markevitchi* Belov, 1979: 577. Synonymized by Tshernova et al., 1986.

*Ephemerella* (*Serratella*) *rufa* Imanishi: Gose, 1980: 366; Yoon & Kim, 1981: 39.

*Ephemerella* L<sub>3</sub>: Dudgeon, 1984: 210; Hubbard, 1986: 250.

*Ephemerella* (*Uracanthella*) *rufa* Imanishi: Tshernova et al., 1986: 138.

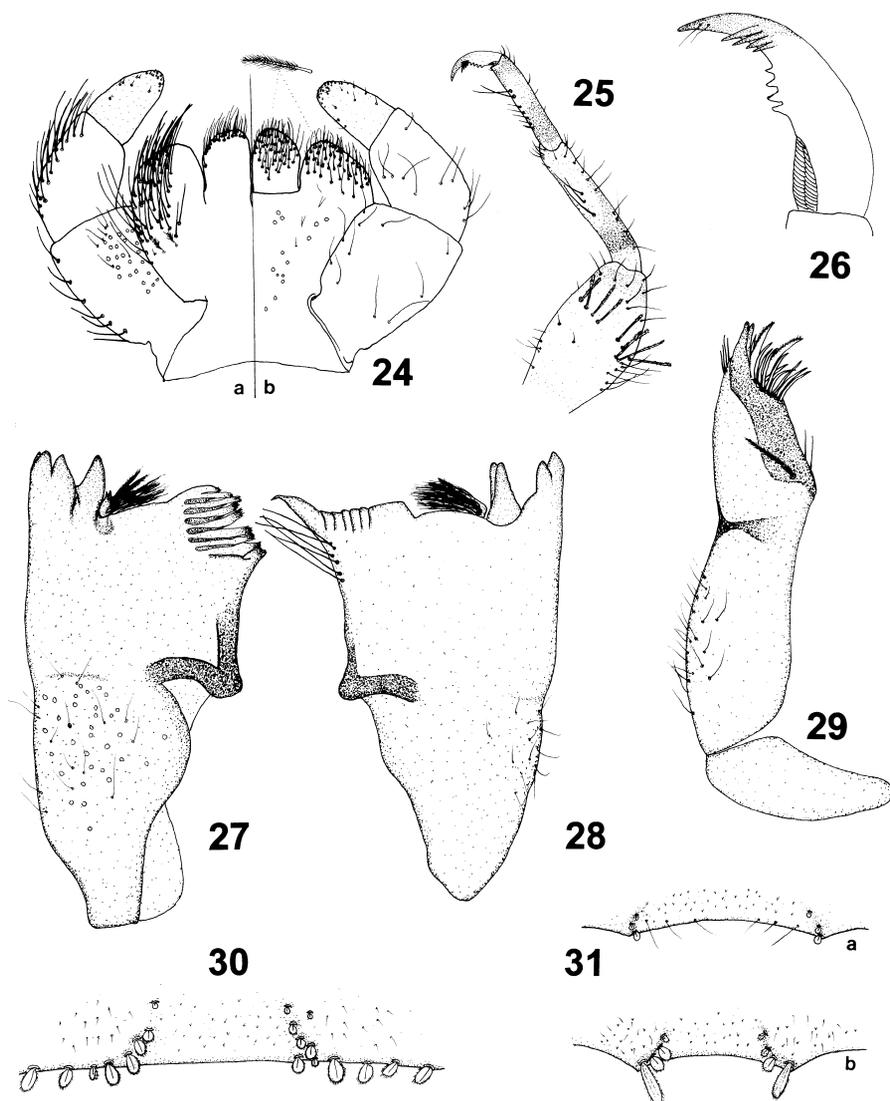
*Serratella rufa* (Imanishi): Ishiwata, 1987: 29; Yoon & Bae, 1988: 32; Zhou et al., 1997: 125.

*Serratella* L<sub>2</sub>: Dudgeon, 1990: 225.

*Ephemerella yixingensis* Wu & Gui, 1993: 72. Synonymized by Zhou et al., 1997.

*Uracanthella rufa* (Imanishi): Bae et al., 1994: 37.

The genus *Uracanthella* was established by Belov (1979) based on the type species *Ephemerella lenoki* Tshernova, 1952. *Uracanthella* shares many characters with the genus *Serratella*. The adults of *Uracanthella* are indistinguishable from those of *Serratella*, but the larvae of *Uracanthella* can be easily separated from *Serratella* by their unique mouthpart structures, e.g., long incisors of mandibles, shape of maxillae and canine teeth reduced on galea-lacinia. *Uracanthella rufa* is uncommon in Hong Kong streams, but it is widespread in Mainland China (Zhou et al., 1997).



Figs. 24–31. *Torleya arenosa* sp. n., mature larva: Fig. 24. labium, a: dorsal view, b: ventral view; Fig. 25. foreleg; Fig. 26. tarsal claw of foreleg; Fig. 27. left mandible; Fig. 28. right mandible; Fig. 29. maxilla; Fig. 30. middle portion of posterior margin of abdominal tergite 8; Fig. 31. middle portion of posterior margin of tergites 4 (a) and 7 (b).

*Material examined*: 5 larvae, Lam Tsuen River at Tong Ming Tsuen, Hong Kong, China, 20-IX-1978, David Dudgeon, 2 in HKU, 3 in SCAU.

*Distribution*: Russia; Korea; Japan; China: Jilin, Beijing, Gansu, Shaanxi, Henan, Anhui, Jiangsu, Sichuan, Yunnan, Zhejiang, Fujian, Hunan, Jiangxi, Hong Kong.

## ACKNOWLEDGMENTS

We thank Prof. Y. J. Bae (Seoul Women's University, Korea) for the gift of *Uracanthella rufa* and for sending important references, and for offering useful suggestions; we also thank Dr. T. Soldán (Institute of Entomology, Academy of Sciences, Czech Republic) for the gift of many mayfly specimens including *Torleya major* and useful references. Special thanks also to Dr. Maria Salas for the specimen of *Teloganodes tristis*.

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