

MAYFLIES FROM JAPANESE TORRENTS
VII. NOTES ON THE GENUS *EPHEMERELLA*¹

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This paper deals with the genus *Ephemerella* of the family Ephemerellidae. Descriptions are given of four new species and also of three species, the male imagines of which are reported here for the first time.

There may be some more species belonging to the genus *Ephemerella* in the Kyoto district and in the Northern Japanese Alps which I am acquainted with only in their nymphal stages but exclude them from this paper, for I have not yet ascertained their imagines. I will report on these nymphs in another paper.

It seems to me that Dr. Uéno² consents to transfer *Ephemerella nigra* Uéno to the genus *Chitonophora* by the suggestion of Dr. E. Schoenemund. But my experience in rearing made the matter so clear that the imago of *Ephemerella nigra* does not show any characteristics of the genus *Chitonophora*. I hesitate for the present to recognize the validity of the genus *Chitonophora* with American authorities³.

I wish to express my sincere thanks to Prof. T. Kawamura and Dr. M. Uéno of the Otsu Hydrobiological Station, Kyoto Imperial University, to Prof. Dr. C. Harukawa and Dr. M. Tokunaga of the Entomological Laboratory, Kyoto Imperial University for their constant encouragement and useful suggestions.

1. *Ephemerella basalis* n. sp.

This species seems to be closely allied to *E. trispina* Uéno but differs from it in type of genitalia.

¹ Contribution from the Otsu Hydrobiological Station, Kyoto Imperial University. Contributions from the Entomological Laboratory, Kyoto Imperial University, No. 61.

² Uéno, M. 1931. Contributions to the knowledge of Japanese Ephemeroptera. Ann. Zool. Jap., vol. 13, p. 224.

³ Needham, J. G., Traver, J. R. and Y. Hsu. 1935. The biology of mayflies with a systematic account of North American species, p. 565.

Measurement:	Male	Female
Body, length	13.0-15.0 mm	13.0-16.0 mm
Fore wing, length	15.0-18.0	17.5-22.0
Cercus, length	13.0-16.5	14.5-17.0

Description. Male:—General colour brownish; head and thorax blackish brown; pleural sutures paler. Eyes greyish, the small basal portion darker than the large distal portion. Fore legs brownish, middle and hind legs yellowish to yellowish brown except for coxae and tarsi which are brownish; in the fore leg, tibia not longer than femur, tarsal joints rank 2, 3, 4, 5, 1; in the hind leg, femur a little longer than tibia, tibia:tarsus=5:2; all legs without any marking. Wings hyaline, veins brownish; basal portion of the fore wing and the entire hind wing tinged with brown. Abdomen reddish brown; each segment with a paler band on its posterior margin, which appears pruinose in some posterior segments and is relatively narrower than in *E. trispina*; postero-lateral corners of segment 8 extended and produced into large blunt, flattened spines; those of segment 9 produced into long sharp spines. Forceps brownish, similar to those of *E. trispina*; second joint stoutest and longest, and strongly bowed inwards with a deep constriction near the middle; third joint at least four times as long as wide. Penis-lobes also brownish, united and swollen basally but separated apically by a shallow cleft; in the lateral view they strongly curved upward. Cerci and median caudal filament dark brownish at the bases, becoming pale at the tips.

Female:—Similar to the male. General colour brownish. Head and thorax brownish, not so blackish as in the male; eyes dark greyish; breadth of the anterior margin of the prothorax not broader than the breadth of the head. Wings hyaline; in the fore wing cells c and sc tinted with faint brown; veins brownish; basal portion of the fore wing and the hind wing not tinted with brown as in the male. Abdomen reddish brown but paler than in the male; postero-lateral corners of segments 8 and 9 extended into spines as in the male; paler bands on the abdominal segments as well as pleural sutures usually appearing pruinose; sternites 8 and 9 also appearing pruinose; sternite 9 prolonged but not notched on its posterior margin.

Subimago:—Similar to the imago; general colour pale yellowish, especially in the female subimago. Wings subhyaline; veins brownish, bordered with the similar colour. In the male penis-lobes not curved upward as in the imago. Length of cercus, male 10.0-11.0 mm, female 13.0 mm.

Nymph:—Similar to the nymph of *E. trispina*, but in this species size larger and coloration darker than in *E. trispina*, and easily distinguishable from it by the number of frontal horns. General colour brownish; head with two prominent frontal horns (while in *E. trispina* head with three frontal horns); frontal margin of the head not rounded as in *E. trispina* but produced into two spines; mouth-parts similar to those of *E. trispina*. Femora flattened; fore femur armed with a number of strong teeth on its anterior margin and fore tibia with a long spine at its distal end as in *E. trispina*. Gills present on the abdominal segments 3-7 as in *E. trispina*, but the paired spinules on the posterior margin of the abdominal tergites 2-8 almost rudimentary in this species; cerci and median caudal filament fringed with hairs as in *E. trispina*. Lengths of cerci and median caudal filament 6.0-8.5 mm.

A nymph reported by Dr. M. Uéno* under the name of *Ephemerella* (?) *tuberculata* Morgan is probably the nymph of this species.

Holotype:—Male.

Allotype:—Female.

Paratypes:—Males and females.

Type locality:—Kibune, Kyoto; specimens: alcoholic; types obtained on April-May, 1931, by rearing nymphs.

The emergence of imago of this species in the Kyoto district from the end of April to the beginning of May, about one month earlier than that of *E. trispina* in the same district; in the Japanese Alps it takes place in the beginning of June at Gamada (ca 1100 mtr.), namely one month later than that in the Kyoto district, while the emergence of *E. trispina* at Kashima (ca 1000 mtr.) and Kamikôchi (ca 1500 mtr.) takes place in September, namely at least three month or more later than that in the Kyoto district.

Specimens collected from the Japanese Alps always somewhat darker in colour than those from the Kyoto district.

2. *Ephemerella longicaudata* Uéno, 1928

Ephemerella longicaudata Uéno: 1928. Mem. Coll. Sci., Kyoto Imp. Univ., Ser. B. 4, p. 42. (Description of nymph)

Measurement:	Male	Female
Body, length	13.5-15.0 mm	15.5 mm
Fore wing, length	13.0-16.0	17.0
Cercus, length	17.0-18.0	16.0

* Uéno, 1928. Mem. Coll. Sci., Kyoto Imp. Univ., Ser. B. 4, p. 45; pl. 10, fig. 10.

Description. Male:—General colour brownish; head and thorax dark brownish to dull brownish; pleural sutures paler. Eyes greyish. Fore legs brownish, middle and hind legs yellowish brown; in the fore leg tibia subequal in length to femur or slightly longer than it, tarsal joints rank 3, 2, 4, 5, 1; in the hind leg femur and tibia subequal, tibia: tarsus $\doteq 5:2$; all legs without any distinct marking. Wings hyaline, veins pale yellowish to brownish; cells c and sc tinted with faint yellowish brown; scutellum with a caudal projection and a pair of membranous caudal lamellae, each of which carries a small caudal prolongation in some specimens. Abdomen brownish, somewhat darker along the side, but in general, paler in colour than in *E. basalis* and without paler bands; each of the tergites 1-9 with a pale mid-dorsal streak which is narrower in the anterior segments; each of the tergites 1-5 also with faint traces of two pale, narrow submedian streaks; tergites 8-10 appearing pruinose; each of the postero-lateral corners of tergites 4-7 with a small tubercle; each of the postero-lateral corners of tergites 8-9 produced into a spine but not so conspicuous as in *E. basalis*; sternites dull brownish, each of them with a paler median streak in some specimens; posterior margin of each of the sternites 1-7 and the greater part of each of the sternites 8-9 appearing pruinose. Forceps brownish, second joint bowed inwards with a constriction but it is shallower than in *E. basalis*; third joint short, scarcely longer than wide; penis-lobes brownish; cerci and median caudal filament brownish, paler distally; median caudal filament 1.0-1.5 mm longer than cercus.

Female:—Similar to the male. General colour dull brownish, eyes smaller than those of the female of *E. basalis*; breadth of the anterior margin of the prothorax not broader than the breadth of the head. Caudal prolongation of the scutellum usually longer than in the male, about one third of the caudal prolongation of the scutellar lamellae in some specimens; postero-lateral corners of the tergites 4-7 with small tubercles and those of the tergites 8-9 with spines as in the male.

Subimago:—Similar to the imago; breadth of the anterior margin of the prothorax broader than the breadth of the head. Wings subhyaline; veins brownish; caudal prolongation of the scutellum very long, nearly as equal to the caudal prolongation of the scutellar lamellae; tubercles on the postero-lateral corners of the tergites 4-7 also a little longer than in the imago. Length of cercus 14.0 mm in the female.

Nymph;—For detailed description, see Uéno 1928.

The emergence of imago takes place in March and April in the Kyoto district. Types deposited in the Otsu Hydrobiological Station were collected from Lake Biwa on Mar. 21, 1918. The oldest specimens in my collection dated back on Apr. 17, 1932.

3. *Ephemerella nigra* Uéno, 1928

Ephemerella nigra Uéno: 1928. Mem. Coll. Sci., Kyoto Imp. Univ., Ser. B. 4, p. 44. (Description of nymph)

Ephemerella nigra Uéno: Horazawa, 1931. Konchû, vol. 5, p. 31. (Descriptions of subimago and female imago)

Measurement:	Male	Female
Body, length	8.5-11.5 mm	9.0-12.0 mm
Fore wing, length	10.0-11.5	10.0-13.0
Cercus, length	10.5-12.5	7.0-13.0

Description. Male:—General colour brownish; head and thorax above chestnut-brown. Fore legs brownish, middle and hind legs pale yellowish except for tarsi which are smoky brown; in the fore leg tibia about two times as long as femur, tarsal joints rank 2, 3, 4, 5, 1; in the hind leg femur slightly shorter than tibia, tibia:tarsus=5:2. Wings hyaline; median axillary membrane brownish; humeral brace-vein whitish; longitudinal veins yellowish at their bases, brownish towards the tips; veins in the anal angle of the fore wing and all veins of the hind wing almost whitish; caudal prolongations of the scutellum and the scutellar lamellae present, but not so conspicuous as in *E. longicaudata*. Abdomen light chestnut-brown above, dull brownish beneath; each of the abdominal tergites with a pale mid-dorsal streak which is bordered with smoky brown; tergites 8-10 appearing pruinose; each of the postero-lateral corners of the tergites 4-7 with a tubercle or a rudimentary spine and each of the postero-lateral corners of the tergites 8-9 with a spine as in *E. longicaudata*, but these tubercles inconspicuous in some specimens; sternites without markings; sternites 7-9 appearing pruinose. Forceps and penis-lobes brownish, similar to those of *E. longicaudata*; cerci and median caudal filament blackish brown, subequal in length.

Female:—Similar to the male. General colour brownish. Wings hyaline, coloration of veins as in the male; caudal prolongations of the scutellum and the scutellar lamellae usually longer than in the male; legs pale yellowish to pale brownish. Abdomen above reddish brown to dull brownish, below paler; posterior margin of each segment

appearing pruinose; mid-dorsal pale streak obscure in some specimens; tubercles present on the postero-lateral corners of the segments 3-7 in some specimens, but they almost inconspicuous in other specimens; sternite 9 prolonged and its apex truncated or shallowly concaved.

Subimago (female):—Similar to the imago. General colour paler and duller than in the imago; breadth of the anterior margin of the prothorax usually broader than the breadth of the head. Wings subhyaline; veins brownish; cross veins bordered with dull brown; caudal prolongation of the scutellum very long, about two times as long as that of the scutellar lamellae, which is not longer than in the imago.

Nymph:—For detailed description, see Uéno 1928.

This species is very common in the Kyoto district and the emergence of imago takes place there in April and May. I have obtained many specimens of imagines by rearing nymphs since 1931. I have also collected them several times in their swarming which are observed in day-time, high above in the air of the valley.

4. *Ephemerella atagosana* n. sp.

This species is similar to *E. nigra*, but is considerably smaller than it and is distinguishable from it by the second joint of the forceps which is not bowed inward with a constriction.

Measurement:	Male	Female
Body, length	7.5 mm	6.0-6.5 mm
Fore wing, length	10.0	9.5-10.5

Description. Male:—General colour brownish; eyes greyish, basal portion distinctly darker. Thorax light chestnut-brown; legs pale brownish, without markings; tarsi not infuscated; in the fore leg, tibia slightly shorter than twice the length of femur, tarsal joints rank $2 \div 3$, 4, 5, 1; in the hind leg femur and tibia subequal, tibia:tarsus = 2:1. Wings hyaline, veins almost whitish; hind wing with a conspicuous blackish speckle at its base; caudal prolongation of the scutellar lamellae relatively long comparing with that of *E. nigra*, but caudal prolongation of the scutellum very short. Each of the abdominal tergites with a narrow, pale median streak, shaded with smoky brown along its lateral margin; postero-lateral corners of the tergites 8-9 produced into spines. Forceps and penis-lobes pale brownish; second joint of the forceps not strongly bowed inward with a constriction as in the

preceding species; third joint of the forceps scarcely longer than wide; cercus injured in the type specimens.

Female:—Similar to the male. General colour ochraceous. Wings hyaline, veins whitish, blackish speckle of the base of the hind wing and the caudal prolongation of the scutellar lamellae as in the male. Each of the abdominal tergites shaded with smoky brown on its postero-mesal portion; postero-lateral corners of tergites 8-9 produced into spines as in the male.

Nymph:—Unknown.

Holotype:—Male.

Allotype:—Female.

Paratopotypes:—Females.

Type locality:—Mt. Atago, Kyoto. Specimens: alcoholic; types collected by K. Imanishi, on May 31, 1931.

5. *Ephemerella rufa* n. sp.

This species is similar to *E. atagosana*, but differs from it in coloration and in type of genitalia.

Measurements:	Male	Female
Body, length	7.5-8.0 mm	7.0 mm
Fore wing, length	6.5-8.0	8.5
Cercus, length	7.0-8.0	9.5

Description. Male:—General colour reddish brown. Eyes reddish brown in the distal portion, greenish grey, brownish or blackish in the basal portion. Caudal end of the scutellum yellowish, without caudal prolongation. Legs pale yellowish; in the fore leg, tibia about two times as long as femur, tarsus about two-thirds or three-fourths as long as tibia, tarsal joints rank $2 \div 3$, 4, 5, 1; in the hind leg tibia a little longer than femur, tibia:tarsus $\div 5:2$; each of the middle and hind femora with a blackish speckle near the apical end of its inner side but it obscure in some specimens. Wings hyaline, costal and subcostal areas somewhat obscured; veins very faintly pale yellowish, cross veins whitish; caudal prolongation of the scutellar lamellae present. Each of the abdominal tergites 1-7 pale on its median portion, darker along the pleural fold; each of the tergites 1-5 narrowly infuscated on its posterior margin in some specimens; tergites 8-10 appearing pruinose; postero-lateral corners of the tergites 8-9 produced into flat spines, but those of the tergite 8 inconspicuous in some specimens. Each of the sternites 1-4 shaded with smoky brown

laterally; black stigmatic dash present; sternites 8-9 appearing pruinose. (Forceps and penis-lobes light yellowish brown; in the forceps, first joint and second joint fused into one joint which is not swollen apically; third joint scarcely longer than wide; each of the penis-lobes broadened on its distal end, with a recurved lateral spine on its outer side; cerci and median caudal filament yellowish, joinings blackish to brownish.

Female:—Similar to the male; eyes pale greenish or blackish; each of the abdominal tergites appearing pruinose on its posterior margin; each of the abdominal sternites shaded broadly with purplish brown along its lateral margin.

Nymph:—Unknown.

Holotype:—Male.

Allotype:—Female.

Paratypes:—Males and females.

Type locality:—Shimogamo, Kyoto. Specimens: alcoholic; collected by K. Imanishi; Holotype and some other male specimens collected on Apr. 29, 1937, in their swarming in the late evening. Allotype and some other male specimens collected on Aug. 18, 1933 in Kisofukushima, Nagano, by the electric light. Specimens collected on June 18, 1935 in the type locality, distinctly smaller, viz; length of body, male 6.0-6.5 mm, female 5.5-6.0 mm; length of fore wing, male 6.0 mm, female 6.5-7.5 mm; length of cercus, male 6.5 mm, female 5.0-6.0 mm.

6. *Ephemerella cryptomeria* n. sp.

(*Drundia*)

This species is smaller than any of the above-mentioned species and also distinguishable from those by the ratio of femur to tibia in the fore leg, which is 3:4 in this species.

Measurement:	Male
Body, length	5.5 mm
Fore wing, length	6.0
Cercus, length	8.5

Description. Male:—General colour brownish. Head brownish, eyes greyish. Thorax brownish, pleura paler, posterior margin of the scutellum bordered narrowly with blackish brown. Legs pale brownish; in the fore leg, tarsus paler in colour, femur with a inconspicuous darker marking near its apex, femur:tibia=3:4, tarsal joints rank 2, 3, 4, 5, 1; in the middle and hind legs tibia darker than femur and tarsus, each of the middle and hind femora with a darker fleck near its base;

in the hind leg, femur longer than tibia, tibia:tarsus=5:2. Wings hyaline, longitudinal veins almost whitish; a brownish stain at the base of the fore wing as in *E. nigra*; caudal prolongations of the scutellum and the scutellar lamellae absent. Abdominal segments 4-7 semi-translucent, washed with pale yellowish brown, paler along their posterior margins; tergites 1-3 shaded with smoky brown, each of the tergites 2-3 with a median dark stripe; tergite 8 yellowish brown, tergites 9 and 10 dark brownish; postero-lateral corners of the tergites 8-9 produced into spines; sternites 1 and 8 largely shaded with smoky brown: ganglionic area also smoky brown; sternite 9 dark brownish, sternite 10 brownish. Forceps brownish; second joint swollen on the inner apical margin but without a constriction; third joint paler in colour, more than three times as long as wide. Penis-lobes brownish, separated apically, each lobe rounded at its apex. Cerci and median caudal filament brownish, paler distally.

Female:—Unknown.

Nymph:—Unknown.

Holotype:—Male.

Type locality:—Kibune, Kyoto. Specimens: alcoholic; collected by K. Imanishi, on June 16, 1931.