

Subgeneric Classification of *Ephemera*^{1, 2}

(Ephemeroptera: Ephemeridae)

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The distinctive genus, *Ephemera* Linnaeus, is the oldest recognized, the largest in number of species, and the most widespread geographically of all the genera of Ephemeridae. It is primarily of Holarctic and Oriental distribution, and also known from the Ethiopian Region.

The name *Ephemera* was first established by Linnaeus (1758) to include all mayflies. After limiting the genus, Eaton (1868) designated *E. vulgata* L. as its type. Since being comprehensively redefined by Eaton (1883-88) *Ephemera* has maintained relatively stable taxonomic limitations. The ephemerid genera *Eatonica*, *Hexagenia*, and *Ichthyobotus* were originally based on species first described in *Ephemera*. Navas (1922) erected the genus *Nirvius*; subsequently, however, Lestage (1922) synonymized this name with *Ephemera*.

Demoulin (1955) erected the genus *Afromera* for three Ethiopian species, two of which had been originally described as *Ephemera*. McCafferty (1971) described an additional species of *Ephemera* from Africa and first presented evidence for doubting the generic status of *Afromera*. On the basis of a detailed review of all character distribution within the family, we herein designate *Afromera* as a synonym of *Ephemera*: *Ephemera* Linnaeus (= *Afromera* Demoulin **new synonymy**). We therefore presently recognize four described species of *Ephemera* in Africa including *Ephemera congolana* (Demoulin) **new combination**. The characters used by Demoulin to distinguish *Afromera*, namely the tarsal claws of the male fore legs, the posterior margin of the subgenital plate, and the anastomose venation of the wings, have all been found to be variable to inconsistent degrees on either an individual or specific level throughout *Ephemera*. Furthermore, there is no evidence from the larval stages that would support recognition of a separate genus.

The genus *Ephemera* can best be distinguished from other genera of Ephemeridae by the following characteristics. In both sexes of the

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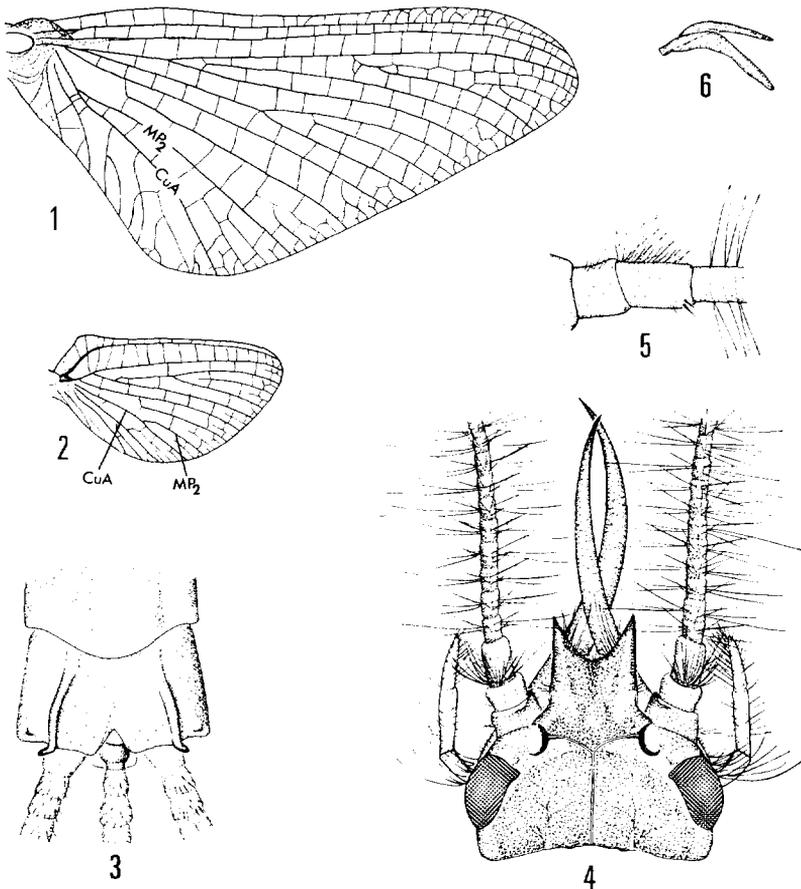


FIG. 1-6. *Ephemera (Ephemera)* spp. 1 and 2. Fore and hind wings, *E. supposita* Eaton. 3. Female terminal abdominal segments, ventral, *E. simulans* Walker. 4. Larval head, *E. supposita*. 5. Antennal base, *Ephemera* sp. 6. Gill 1, *E. sp.*

adults the median terminal filament is subequal in length to the cerci. Other characters common to both sexes are found in the wing venation. In the hind wings (Fig. 2) MP_2 is almost always attached basally to CuA ; and in the fore wings there are 3 or more veinlets extending from A_1 to the anal margin. Additionally, in the males the tarsal claws of the fore legs are never hooked and the genital forceps are 4-segmented.

Larval *Ephemera* can easily be differentiated from other larval ephemerids on the basis of the presence of (1) the non-spuriferous bifurcate frontal process, (2) long setae whorled over most of the length

of the antennal flagellae, (3) labial paraglossae which are not extended basally, and (4) the distally rounded tibiae of the fore legs.

The recent study of striking and unusual characteristics possessed by newly discovered larvae from Thailand, India, and South Africa has warranted a subgeneric classification of *Ephemera* as follows.

Subgenus EPHEMERA

(Figs. 1-6)

IMAGO. Length of male body, 10.0-20.0 mm.; fore wings, 8.0-17.0 mm. Length of female body, 12.0-25.0 mm.; fore wings, 10.0-22.0 mm. Fore wings almost always with MP_2 joining CuA at the basal curvature (Fig. 1). Hind wings usually over one third of length of fore wings; at least 1 longitudinal intercalary between R_2 and IR_3 (Fig. 2). Subanal plate of female with posterior margin variously convex (Fig. 3). Terminal abdominal sternum of female as in Figure 3, usually with posterolateral processes.

MATURE LARVA. Frontal process of head longer than wide, but always less than twice as long as wide (Fig. 4). Pedicels of antennae usually with at least 1 heavily sclerotized seta ventrally (Fig. 5). Mandibular tusks slender, circular in cross section, more than twice length of body of mandible; left tusk sometimes more curved, slightly longer, and usually crossing ventrally to right tusk. Labial palpi 3-segmented. Tibiae of prothoracic legs usually with somewhat indistinct comb of stout apical setae of posterodistal margin (similar to Fig. 21). Gill 1 with both forks similar in size (Fig. 6).

ETYMOLOGY.—*ephemeros*, Gr.: short lived.

TYPE SPECIES.—*Ephemera vulgata* Linnaeus, 1758, by subsequent designation (Eaton, 1868).

DISCUSSION. *Ephemera* s.s. is by far the largest and most widely distributed of the subgenera of *Ephemera*. It is cosmopolitan except for the Neotropical and Australian Regions. The character states discussed above when taken in combination will distinguish it from the known stages of the following subgenera.

Dicrephemera new subgenus

(Figs. 7-17)

IMAGO. Fore wings with MP_2 not joining CuA at basal curvature (Fig. 7). Hind wings less than one third of length of fore wings; no longitudinal intercalaries between R_2 and IR_3 (Fig. 8). Subanal plate of female with posterior margin straight (Fig. 9). Terminal abdominal sternum of female as in Figure 9, without posterolateral processes.

MATURE LARVA. Frontal process of head twice as long as wide (Fig. 10). Pedicels of antennae with no heavily sclerotized setae ventrally. Mandibular tusks atrophied (Fig. 11). Labial palpi with second and third segments appearing fused. Tibiae of prothoracic legs usually lacking comb of stout apical setae at posterodistal margin in posterior view (Fig. 12). Gill 1 with outer fork much larger than inner fork (Fig. 13).

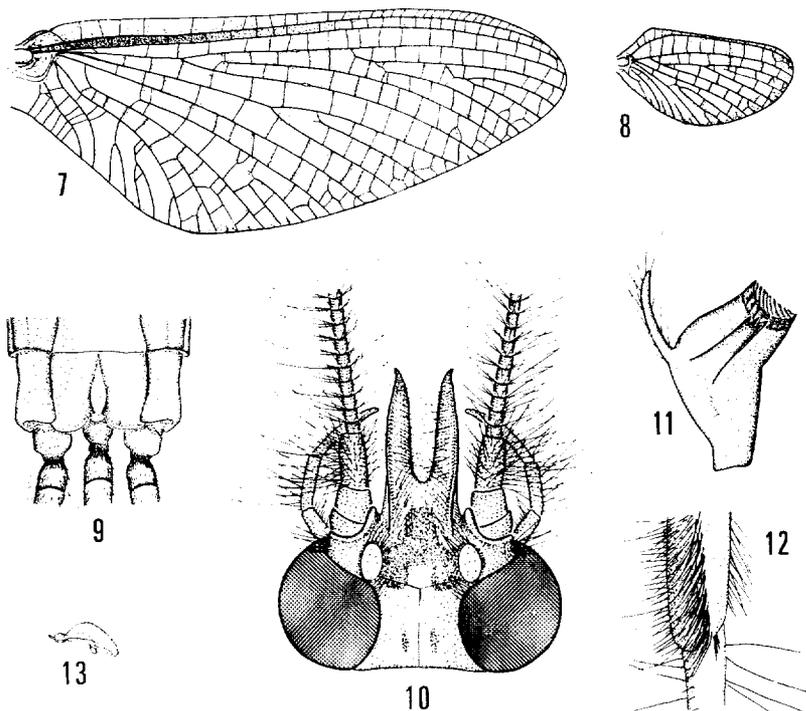
ETYMOLOGY.—*dicros*, Gr.: forked; *ephemeros*, Gr.; short lived.

TYPE SPECIES.—*Ephemerella siamensis* Uéno, 1969, p. 235; institutional custody of male holotype not indicated.

MALE IMAGO (in alcohol). Length: body 11–11.5 mm.; fore wings 10–10.5 mm. Head yellow dorsally, ivory anteriorly, dark brown between bases of ocelli, bases of lateral ocelli black. Antennae with basal segments ivory, terminal segments yellowish-brown to brown. Upper portion of compound eyes grayish-black, lower portion black. Prothorax brown dorsally, white laterally, usually with brown marking posterior to coxae ventrally. Mesothorax and metathorax cinnamon-brown, lateral sutures lighter. Femora of prothoracic legs ivory, tinged with brown apically, tibiae of prothoracic legs dark brown, tarsi light brownish-yellow, tinged with brown proximally. Meso- and metathoracic legs ivory. Wings hyaline, venation reddish-brown, crossveins very lightly margined with same tint. Fore wings with subcostal area shaded dark brown becoming lighter distally, MA fork shaded somewhat at origin. Hind wings smoky reddish-brown marginally. Abdominal terga (Fig. 14) ivory with markings as follows: tergites 3–9 each with pair of dark brown longitudinal markings, markings in tergites 3–7 progressively increasing in length and found almost entirely in anterior half of each segment, markings in tergites 8 and 9 extending nearly entire length of segments, tergite 9 also with thinner submedian longitudinal markings connected posteriorly to broader lateral markings. Abdominal sterna (Fig. 15) ivory with markings as follows: sternite 1 cinnamon-brown except for posterior margins, sternites 3–8 each with pair of thin longitudinal dark brown markings, increasing in length posteriorly, sternite 9 with broad marking covering entire segment posteriorly and tapering anteriorly. Genitalia (Fig. 16) with posterior margin of subgenital plate concave, penes broadly divergent and lobes rounded apically, covered ventrally for almost entire length by thin translucent membrane arising from subgenital plate, titillators short and rounded apically, often covered in ventral view by subgenital plate membrane. Caudal filaments brown.

FEMALE IMAGO (in alcohol). Length: body 10–12 mm.; fore wings 10–10.5 mm. Head dark brown dorsally. Femora of fore legs light brownish-yellow with smoky brown streak along outside margin, tibiae and tarsi of prothoracic legs light brownish-yellow, tibiae tinged with dark brown proximally. Wing venation light brownish-yellow, entire shading occurring in proximal half of subcostal area of fore wing. Abdominal terga variably marked (Fig. 17) but usually yellow with markings as follows: tergite 1 light cinnamon-brown, tergites 3–6 each with pair of broad longitudinal dark brown markings joined posteriorly and becoming faded at junction; tergites 7–9 marked with dark brown nearly throughout except for median stripe, pair of short submedian stripes, and sometimes anterior margin. Abdominal sterna without distinct markings. Caudal filaments pale with brown annulations at apex of proximal segments. Other characters as in male except for usual sexual differences.

MATURE LARVA (in alcohol). Length: body 16–19 mm.; caudal filaments 5–6.5 mm. Color patterns generally corresponding to adults, although usually lighter. Forks of frontal process (Fig. 10) slightly curved dorsally at apices, lateral margins only slightly rounded, dorsal surface covered with short golden setae for nearly entire length; eyes black; labrum slightly emarginate in median third. Pronotum with pair of small dark brown triangular shaped markings, with

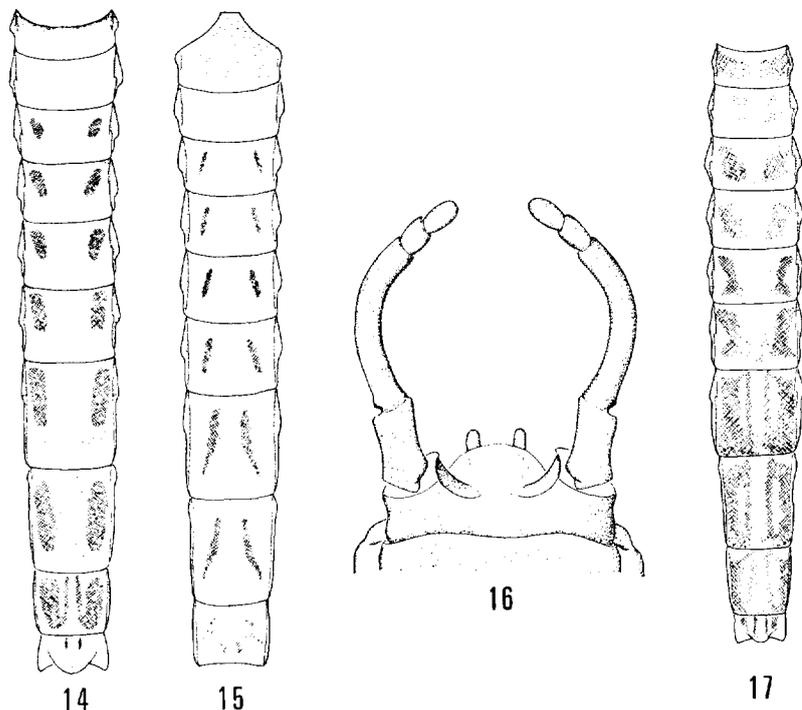


FIGS. 7-13. *Ephemera (Dicrephemer) siamensis* Uéno. 7 and 8. Fore and hind wings. 9. Female terminal abdominal segments, ventral. 10. Larval head. 11. Right larval mandible. 12. Parts of larval tibia and tarsus of left prothoracic leg, posterior. 13. Gill 1.

bases meeting at mid line of notum; legs generally ivory, with prothoracic legs tinged at joints with brown; tibial processes of metathoracic legs tinged with dark brown setae, appearing projected anteriorly due to revolvment of femora. Gills light yellowish-gray. Lateral setae along entire length of filaments, becoming shorter apically.

SPECIMENS EXAMINED. 19 male imagos, 14 male subimagos, 17 female imagos, 16 female subimagos, and 223 larvae as follows: Thailand, Chiangmai Province, Mae Ping, Chiangmai, 1000 feet; 9 November 1964 or 13 November 1964, W. L. and J. C. Peters, collectors. The majority of specimens housed at the University of Utah, Salt Lake City, and representatives deposited with the Laboratory of Aquatic Entomology, Florida A & M University, Tallahassee; Institut Royal des Sciences Naturelles, Brussels; British Museum (Natural History), London; and the Laboratory of Insect Diversity, Purdue University, West Lafayette, Indiana.

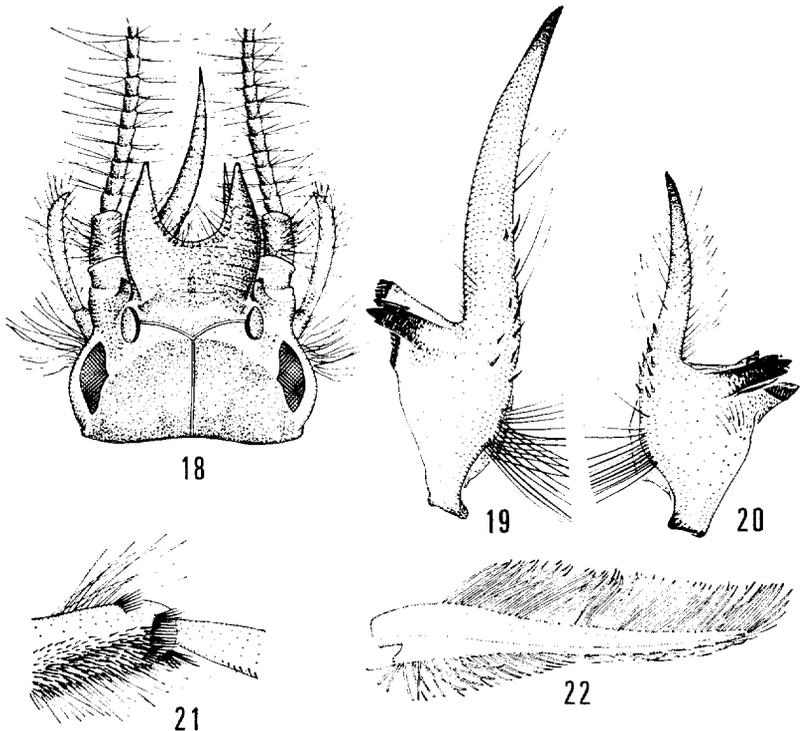
DISCUSSION. *Dicrephemer* presently includes only *E. siamensis* from Thailand; however, we have examined larval specimens from the



FIGS. 14-17. *Ephemera (Dicrephemer) siamensis* Uéno. 14. Male abdominal tergites. 15. Male abdominal sternites. 16. Male genitalia, ventral. 17. Female abdominal tergites.

Bhavani R., in India, and the Wilge R. in the eastern Transvaal, Republic of South Africa, which most assuredly represent undescribed species of *Dicrephemer*. The subgenus is based primarily on the very distinct larval stage, with the absence of well developed mandibular tusks being most diagnostic. The adults are rather weakly differentiated from those of *Ephemera* s.s., and all of the characters discussed must be used with caution. The possibility remains that as more of the larvae of little known *Ephemera* species from the Oriental and Ethiopian Regions are discovered they may prove to be *Dicrephemer*.

Many of the adults of *E. siamensis* were reared from the larvae by Dr. and Mrs. Peters in Thailand, therefore assuring a definite association. The adults of *E. siamensis* are redescribed because of the large series available to us in comparison to the small series upon which Uéno (1969) based his description. The larvae are described herein for the first time.



FIGS. 18-22. *Ephemera (Aethephemera) nadinae*, larva. 18. Head. 19 and 20. Left and right mandibles, lateral. 21. Parts of tibia and tarsus of left prothoracic leg, posterior. 22. Dorsal section of right gill 2.

Aethephemera new subgenus

(Figs. 18-22)

IMAGO. Unknown.

MATURE LARVA. Frontal process of head as long as wide (Fig. 18). Pedicels of antennae with no heavily sclerotized setae ventrally. Right mandibular tusk much reduced, less than three fifths of length of left tusk (Figs. 19 and 20). Labial palpi 3-segmented. Tibiae of prothoracic legs with comb of stout apical setae at posterodistal margin (Fig. 21). Gill 1 with both forks slender (similar to Fig. 6).

ETYMOLOGY.—*aethes*, Gr.: unusual; *ephemeros*, Gr.; short lived.

TYPE SPECIES.—*Ephemera (Aethephemera) nadinae* new species.

MATURE LARVA (in alcohol). Length: body 18.5-20.0 mm.; caudal filaments 6.9 mm. General color dark brown dorsally, brown ventrally, with golden setae and brown spurs. Frontal process of head golden brown, deeply concave anteriorly, lateral margins distinctly rounded, margin of concavity fringed dorsally with long golden setae (Fig. 18); eyes black; labrum emarginate only in median third.

Thoracic notum unicolorous brown; legs generally yellowish-brown, with femora of metathoracic legs darker; dorsal surface of tibiae of prothoracic legs entirely spuriferous; tibial processes of metathoracic legs with dense covering of golden-brown setae. Abdominal terga light brown with pale median and pair of submedian longitudinal markings bordered by dark brown; sterna brown with pair of dark brown submedian longitudinal maculae on segments 7, 8, and 9; gills grayish-purple; dorsal portion of gill 2 (Fig. 22) with inner margin produced ventrally at base; lateral setae along entire length of cerci, and along three fourths of length of terminal filament.

HOLOTYPE.—Mature female larva. South India, Kodaikanal grade, 1600 m.; 30 March 1962, E. S. Ross and D. Cavagnaro collectors. Deposited in the California Academy of Sciences, San Francisco. **Paratype.**—mature male larva (parts on slides) same data and deposition as holotype.

ETYMOLOGY.—*E. (A.) nadinae* is named in honor of the wife of W. P. McCafferty.

DISCUSSION. *Aethphemera* is presently known only from the larval stage, and is known only from India. The distinct subgenus, however, may prove to be more widespread as larvae become known.

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