Subgeneric Classification of *Ephemera*¹, ²
(Ephemeroptera: Ephemeroidea)

W. P. McCafferty

*Department of Entomology, Purdue University, West Lafayette, Indiana 47907*

 AND

George F. Edmunds, Jr.

*Department of Biology, University of Utah, Salt Lake City, Utah 84112*

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 Ephemeroidea. 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 *Ichthybotus* were originally based on species first described in *Ephemera*. Navas (1922) erected the genus *Nirvia*; 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 Ephemeroidea by the following characteristics. In both sexes of the adults the median terminal filament is subequal. Other characters common to both sexes are for "..."
tation of *Ephemera*¹ ²
tera:Ephemeraidae)

McCAFFERTY
University, West Lafayette, Indiana 47907
F. EDMUNDS, JR.
of Utah, Salt Lake City, Utah 84112

*A* Linnaeus, is the oldest recognized, and the most widespread geographically ace. It is primarily of Holarctic and known from the Ethiopian Region.

established by Linnaeus (1758) to as the genus, Eaton (1868) designated be comprehensively redefined by maintained relatively stable taxonomic tra Eatonica, Hexagenia, and Ichthy-
species first described in *Ephemera*

*Ephemera*; subsequently, however, Lestage with *Ephemera*.

Genus *Afromera* for three Ethiopian an originally described as *Ephemera*.

additional species of *Ephemera* from see for doubting the generic status of fied review of all character distribution designate *Afromera* as a synonym of ¹ — *Afromera* Demoulin new synonym-

thesize four described species of *Ephemera* congolana (Demoulin) new combi-

Demoulin to distinguish *Afromera*, e fore legs, the posterior margin of the e venation of the wings, have all been ent degrees on either an individual or ¹. Furthermore, there is no evidence upport recognition of a separate genus. be distinguished from other genera of characteristics. In both sexes of the

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) MP₃ is almost always attached basally to CuA; and in the fore wings there are 3 or more veinlets extending from A₁ 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 ephemeralids 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 *Ephemerida* as follows.

**Subgenus Ephemerida**

(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 MP1 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 R1 and R2 (Fig. 2). Subinal plate of female with posterior margin variously convex (Fig. 3). Terminal abdominal sternum of female as in Figure 3, usually with posteriorlateral processes.

**Mature Larva.** Frontal process of head longer than wide, but always less than twice as long as wide (Fig. 4). Pedicel 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 postero-distal margin (similar to Fig. 21). Gill 1 with both forks similar in size (Fig. 6).

**Etymology.—** *ephemeroides*, Gr.: short lived.

**Type species.—** *Ephemerida vulgaris* Linnaeus, 1758, by subsequent designation (Eaton, 1868).

**Discussion.** *Ephemerida* s.s. is by far the largest and most widely distributed of the subgenera of *Ephemerida*. 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.

**Diephemerida** new subgenus

(Figs. 7-17)

**Imago.** Fore wings with MP1 not joining CuA at basal curvature (Fig. 7). Hind wings less than one third of length of fore wings; no longitudinal intercalaries between R1 and R2 (Fig. 8). Subinal 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 of postero-distal margin in posterior view (Fig. 12). Gill 1 with outer fork much larger than inner fork (Fig. 13).
Ectomy.—diros, Gr.: forked; ephemerous, Gr.: short lived.


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. Fensera 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 sternae (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 sternae 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 3-5.5 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

Lakes 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 revolvement 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. G. 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.** *Dicerophemera* presently includes only *E. siamensis* from Thailand; however, we have examined larval specimens from the

Bhavani R., in India, and the Wilge R. in the republic of South Africa, which most assuredly is another species of *Dicerophemera*. The subgenus is based upon a distinct larval stage, with the absence of ventral tusks being most diagnostic. The adults are readily separable from those of *Ephemera* s.s., and all of the above should be used with caution. The possibility remains that other, little known *Ephemera* species from the Oriental region are discovered they may prove to be *Dicerophemera*.

Many of the adults of *E. siamensis* were provided by Dr. and Mrs. Peters in Thailand, therefore acknowledgment. The adults of *E. siamensis* are redescribed from a series available to us in comparison to the description by Ueno (1969) based his description. The larva was described for the first time.

Bhavani R., in India, and the Wilge R. in the eastern Transvaal, Republic of South Africa, which most assuredly represent undescribed species of Dicrepidemera. 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 Dicrepidemera.

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.
Thoracic notum unicolorous brown; legs generally of metathoracic legs darker; dorsal surface of tibia spuriferous; tibial processes of metathoracic legs brown setae. Abdominal terga light brown with median longitudinal markings bordered by dark brown submedian longitudinal maculates of grayish-purple; dorsal portion of gill 2 (Fig. 22) ventrally at base; lateral setae along entire length of length of terminal filament.


**Etymology.**—E. (*A.*) nodinae is named in McCafferty.

**Discussion.** Aethephemera is presently known as stage, and is known only from India. The species may prove to be more widespread as larvae.

**Acknowledgments.**

We wish to express our gratitude to Mr. E. S. Ross Institute for Water Research, Pretoria, South Africa, with larval material from Africa. We also wish to thank Arwin Provonska, Laboratory of Insect Disease, for assisting in the preparation of figures.

**Literature Cited.**


Thoracic notum unicolorous brown; legs generally yellowish-brown, with femora of metathoracic legs darker; dorsal surface of tibiae of prothoracic legs entirely purerous; 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, 1800 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. Aethephemera 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.

Acknowledgments

We wish to express our gratitude to Mr. R. G. Noble of the National Institute for Water Research, Pretoria, South Africa, for providing us with larval material from Africa. We also wish to acknowledge Mr. Arwin Provonsha, Laboratory of Insect Diversity, Purdue University, for assisting in the preparation of figures.

Literature Cited


