NEW GENERIC SYNONYMIES IN BAETIDAE (EPHEMEROPTERA)[1]

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ABSTRACT: Several substantive errors in the classification of the family Baetidae have resulted from revisions of mayflies identified as *Baetis*. Revised synonymies of the valid genera *Alainites, Baetiella, Baetis, Diphetor, Labiobaetis, Nigrobaetis*, and *Takobia* are provided and include necessary new synonyms as follows: *Alainites* [= *Baetis (Acerbaetis)*, n. syn.]; *Baetiella* [= *Baetis (Tenuibaetis)*, n. syn.]; *Baetis sensu stricto* [= *Baetis (Tatubaetis)*, n. syn.]; *Labiobaetis* [= *Baetis (Mullerbaetis)*, n. syn.]; and *Nigrobaetis* [= *Baetis (Margobaetis)*, n. syn.]. Species name emendations include *Alainites atagonis*, n. comb., *Alainites clivosus*, n. comb., *Alainites chocoratus*, n. comb., *Alainites florens*, n. comb., *Alainites talasi*, n. comb., *Alainites yehi*, n. comb., *Alainites yoshinoensis*, n. comb.; *Baetiella ardua*, n. comb., *Baetiella inornata*, n. comb. (and corrected orthography), *Baetiella pseudofrequenta*, n. comb.; *Labiobaetis morus*, n. comb.; *Nigrobaetis facetus*, n. comb., *Nigrobaetis gombaki*, n. comb., *Nigrobaetis gracilentus*, n. comb., *Nigrobaetis mirabilis*, n. comb., *Nigrobaetis mundus*, n. comb., *Nigrobaetis numidicus*, n. comb., *Nigrobaetis taiwanensis*, n. comb., *Nigrobaetis terminus*, n. comb.; *Takobia acuticostalis*, n. comb., *Takobia kogistani*, n. comb., and *Takobia solangensis*, n. comb.

Kang *et al.* (1994) published five new subgenera and 13 new species of Baetidae from Taiwan that they placed in the genus *Baetis* Leach. Novikova and Kluge (1994) provided several new recombinations and descriptions of two new species within their concept of *Baetis (Nigrobaetis)*. *Baetis* has been the subject of other revisionary efforts that have included Müller-Liebenau (1970) (Europe); Morihara and McCafferty (1979a), Waltz and McCafferty (1987a), and McCafferty and Waltz (1990) (North America); Novikova and Kluge (1987) (Palearctic); and Waltz *et al.* (1994) and McCafferty and Waltz (1995) (world).

Possession of the villopore, located at the base of the larval femora was found by Waltz and McCafferty (1987a, 1987b) and McCafferty and Waltz (1990) to be a significant synapomorphy uniting a number of genera of Baetidae. This monophyletic grouping of genera is presently referred to as the *Baetis* complex (see e.g., Waltz *et al.* 1994, Lugo-Ortiz and McCafferty 1996) and includes *Acentrella* Bengtsson, *Baetiella* Uéno, *Baetis, Barbaetis* Waltz and McCafferty, *Cymulabaetis* McCafferty and Waltz, *Gratia* Thomas, *Heterocloeon* McDunnough, *Labiobaetis* Novikova and Kluge, *Liebebiella* Waltz and McCafferty, *Platybaetis* Müller-Liebenau, many (but not all) *Pseudocloeon sensu auctt.*, and *Tanzaniella* Gillies. In addition to having the unique villopore, all

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members of the *Baetis* complex have lost the plesiotypic cluster of bristles located between the incisors and mola of the mandibles. Species that were formerly classified in *Baetis,* but that are not members of the *Baetis* complex have obviously required reclassification into other genera, including some new genera. Highly distinctive and monophyletic lineages within the *Baetis* complex, many with species that were also once known as *Baetis,* have been recognized as the various genera listed above.

Kang *et al.* (1994) were evidently not aware of concepts and genus group names that were already established, beginning in 1987, for elements of the formerly broad and polyphyletic concept of *Baetis.* Thus, most species described from Taiwan, in various new subgenera of *Baetis,* by Kang *et al.* (1994) are actually members of other presently recognized genera. All subgenera described by Kang and Yang in Kang *et al.* (1994) are junior synonyms of nominal genera, including both *Baetis* complex and non-*Baetis* complex genera. Novikova and Kluge (1994) retained a highly conservative and polyphyletic concept of the genus *Baetis,* including a broad subgeneric grouping they identified as the subgenus *Nigrobaetis,* which incorporated elements of *Nigrobaetis s.str., Alainites* Waltz and McCafferty, *Diphetor* Waltz and McCafferty, and *Takobia* Novikova and Kluge. The bases of each of these genera were addressed by Waltz *et al.* (1994). Necessary corrections to the Kang *et al.* (1994) and Novikova and Kluge (1994) works by way of new generic synonymies and short discussions of the pertinent genera follow.

Alainites Waltz and McCafferty

Baetis gracilis group Müller-Liebenau, 1970:174, in part.
Baetis muticus group Müller-Liebenau, 1974:34.
Alainites Waltz and McCafferty, in Waltz *et al.,* 1994:34 [type, *Baetis muticus* Linn., 1758].
Baetis (Acerbaetis) Kang and Yang, in Kang *et al.,* 1994:35 [type, *Baetis clivosus* Chang and Yang, 1994], **n. syn.**
Baetis (Nigrobaetis) muticus group: Novikova and Kluge, 1994: 630.

Alainites was characterized by Waltz *et al.* (1994) and separated from other genera of the *Baetis* complex by tergal setae and armature characteristics previously discussed by Müller-Liebenau (1970) and by the apomorphic development of special paraproct prolongation (see Waltz *et al.,* 1994:34). Species included in *Acerbaetis* Kang and Yang possess all of these characteristics and clearly belong to *Alainites. Alainites atagonis* (Gose), **n. comb.,** *A. chocoratus* (Gose) **n. comb.,** *A. clivosus* (Chang and Yang), **n. comb.,** *A. florens* (Imanishi), **n. comb.,** *A. talasi* (Novikova and Kluge), **n. comb.,** *A. yehi* (Kang and Yang), **n. comb.,** and *A. yoshinoensis* (Gose), **n. comb.,** should be added to the list of *Alainites* species given by Waltz *et al.* (1994). Placement of *A. atagonis* is based

on adult morphology. *Alainites* is widely distributed throughout the Palearctic, the Mediterranean/northern Africa area, and parts of southeast and east Asia, including southern China and Taiwan.

Both the Kang *et al.* (1994) and the Waltz *et al.* (1994) papers bear December, 1994 publication dates. Based on International Commission of Zoological Nomenclature (ICZN) convention, the priority of names published with contemporaneous issue dates must be resolved on the basis of date of availability. The genus *Alainites* description in the Bulletin de la Société d'Histoire Naturelle de Toulouse, with an issue date of December, 1994 (which by ICZN convention is regarded as December 31, 1994), was distributed and met the criteria of availability on January 15, 1995, as confirmed by editors of the journal. This was prior to the verifiable availability date of April 15, 1995, for the *Acerbaetis* description in the Journal of the Taiwan Museum, with an issue date of December 31, 1994. This was confirmed by the Assistant Curator of the Taiwan Museum. The name *Alainites* therefore met the criteria of availability approximately three months prior to the date of availability of the name *Acerbaetis.* (see also Acknowledgments).

Baetiella Uéno

Baetiella Uéno 1931:220 [type, *Acentrella japonica* Imanishi, 1930].
Pseudocloeon Klapálek, in part: Bogoescu and Tabacaru, 1957:483.
Pseudocloeon (Baetiella): Kazlauskas, 1963:318 (English version pagination).
Neobaetiella Müller-Liebenau, 1985:103 [type, *Neobaetiella uenoi* Müller-Liebenau, 1985], synonymized by Waltz and McCafferty 1987b: 561.
Baetis (Baetiella): Novikova and Kluge, 1987:16.
Baetiella: Waltz and McCafferty, 1987b:561.
Baetis (Tenuibaetis) Kang and Yang, in Kang *et al.*, 1994:26 [type, *Baetis pseudofrequentus* Müller-Liebenau, 1985], **n. syn.**

The genus *Baetiella* was most recently characterized by Waltz and McCafferty (1987b) to include those species of the *Baetis* complex that have an elongate segment 2 and conical segment 3 of the labial palps, among other distinctive characteristics. Species placed in *Tenuibaetis* by Kang *et al.* (1994) possess the characteristics of *Baetiella.* Species included in the genus were listed by Waltz and McCafferty (1987b). *Baetiella ardua* (Kang and Yang), **n. comb.,** *B. inornata* (Kang and Yang), **n. comb.,** and *B. pseudofrequenta* (Müller-Liebenau), **n. comb.,** should be added to that list. The species name *Baetis (Tenuibaetis) inornaturs* Kang and Yang, was a *lapsis calami,* obvious from the etymology given for the species and figure citations accompanying the description (Kang *et al.* 1994). *Baetiella* is Palearctic and Oriental in distribution.

Baetis Leach

Baetis Leach, 1815:137 [type, *Ephemera fuscata* Linn., 1761].
Brachyphlebia Westwood, 1840:25 [type, *Ephemera fuscata* Linn., 1761].
Baetis (Tatubaetis) Kang and Yang, in Kang *et al.*, 1994:23 [type, *Baetis tatuensis* Müller-Liebenau, 1985], **n. syn.**

The genus *Baetis* is a member of the *Baetis* complex, and because *B. fuscatus* is the type species, the genus is most typified by the *B. fuscatus* species group (Müller-Liebenau 1970). *Baetis* also includes species of the *rhodani* and *vernus* groups in the Holarctic region (see Müller-Liebenau 1970 and Morihara and McCafferty 1979a) as well as possibly certain species from non-Holarctic parts of the world that have yet to be associated with any species groups. Based on body coloration, mouthpart characteristics (esp. of the labium and maxillae), tergal armature, and setation of the legs, *B. tatuensis* is clearly a member of the *B. fuscatus* group. *Baetis tatuensis* is therefore a member of *Baetis sensu stricto* and should not be placed in a separate subgenus *Tatubaetis* as was done by Kang *et al.* (1994). Species currently classified in *Baetis* from sub-Saharan Africa, South America, and Australia require additional study before they can be confirmed to be members of the genus. As a result, the only recently up to date and confirmed listing of *Baetis* species for a large geographic area is for North America (see McCafferty 1996).

Diphetor Waltz and McCafferty

Diphetor Waltz and McCafferty, 1987:669 [type, *Baetis hageni* Eaton, 1885].
Baetis (Nigrobaetis): Novikova and Kluge, 1994:627.

The distinctiveness of *Diphetor* from other described taxa was presented by Waltz *et al.* (1994). The genus is known from three species in North America and Algeria as listed by Waltz *et al.* (1994). The placement of species of *Diphetor* (a non- *Baetis* complex genus) in a subgenus of *Baetis* by Novikova and Kluge (1994) is untenable.

Labiobaetis Novikova and Kluge

Baetis atrebatinus group Müller-Liebenau, 1970:150.
Baetis propinquus group Morihara and McCafferty, 1979b:130.
Baetis molawinensis group Müller-Liebenau, 1984:260.
Baetis (Labiobaetis) Novikova and Kluge, 1987:13 [type, *Baetis atrebatinus* Eaton, 1870].
Labiobaetis: McCafferty and Waltz, 1995:20.
Baetis (Müllerbaetis) Kang and Yang, in Kang *et al.*, 1994:32 [type, *Baetis molawinensis* Müller-Liebenau, 1982], **n. syn.**

The genus *Labiobaetis is* a member of the *Baetis* complex of genera and was most recently characterized by McCafferty and Waltz (1995). Synapomorphies defining the genus include, among others, the excavate tip of the maxillary palps and usually the notched antennal segment 1. McCafferty and Waltz (1995) indicated that the Oriental *Baetis molawinensis* group, originally recognized by Müller- Liebenau (1984), clearly belonged to *Labiobaetis.* Kang *et al.* (1994) considered 11 previously described Oriental species in the subgenus *Müllerbaetis* (type, *B. molawinensis).* These are all species of *Labiobaetis* and were listed as such by McCafferty and Waltz (1995), along with all other species of the genus. The Taiwan species *L. morus* (Chang and Yang), **n. comb.,** should be added to the list of known species of this Holarctic and Oriental genus.

Nigrobaetis Novikova and Kluge

Baetis niger group Müller-Liebenau, 1970:163.
Baetis gracilis group Müller-Liebenau, 1970:174, in part.
Baetis (Nigrobaetis) Kazlauskas: Novikova and Kluge, 1987:8 [type, *Ephemera nigra* Linn., 1761].
Nigrobaetis Novikova and Kluge: Waltz, McCafferty and Thomas, 1994:34.
Baetis (Margobaetis) Kang and Yang, in Kang *et al.,* 1994:11 [type, *Baetis mundus* Chang and Yang, 1994], **n. syn.**
Baetis (Nigrobaetis): Novikova and Kluge, 1994: 627, in part.

Nigrobaetis is a non-*Baetis* complex genus that was most recently characterized by Waltz *et al.* (1994). Species from Taiwan assigned to *Margobaetis* by Kang *et al.* (1994) demonstrate *Nigrobaetis* generic characteristics, and thus, *Margobaetis* must be placed as a junior synonym of *Nigrobaetis.* The genus is known from the Holarctic and Oriental regions, and species included were listed by Waltz *et al.* (1994). To that list the following species should now be added: *N. facetus* (Chang and Yang), **n. comb.,** *N. gombaki* (Müller-Liebenau), **n. comb.,** *N. gracilentus* (Chang and Yang), **n. comb.,** *N. mirabilis* (Müller-Liebenau), **n. comb.,** *N. mundus* (Chang and Yang), **n. comb.,** *N. numidicus* (Soldán and Thomas), **n. comb.,** *N. taiwanensis* (Müller-Liebenau), **n. comb.,** and *N. terminus* (Chang and Yang), **n. comb.** Novikova and Kluge (1987,1994) incorrectly ascribed the name *Nigrobaetis* to Kazlauskas when in fact, by rules of nomenclature, they are recognized as the inadvertent authors of the genus group name. Novikova and Kluge (1994) also incorrectly placed species of *Diphetor* and certain species of *Alainites* and *Takobia* in *Nigrobaetis.* That concept is polyphyletic because it includes species of both the *Baetis* complex and non-*Baetis* complex. In any case, *Nigrobaetis* is not a subgenus of *Baetis.*

Takobia Novikova and Kluge

Baetis (Takobia) Novikova and Kluge 1987:10 [type, *Centroptilum maxillare* Braasch and Soldán, 1983].
Takobia: Waltz, McCafferty, and Thomas, 1994:35.
Baetis (Nigrobaetis) maxillaris group Novikova and Kluge, 1994:630.

The genus *Takobia* and its systematic status was discussed by Waltz *et al.* (1994). Novikova and Kluge (1994) regarded it as part of a subgenus *Nigrobaetis* of the genus *Baetis.* We regard *Takobia* as a distinct taxon at the genus level. Additional species to those listed by Waltz *et al.* (1994) include *Takobia acuticostalis* (Dubey), **n. comb.,** *T. kogistani* (Novikova and Kluge), **n. comb.,** and *T. solangensis* (Dubey), **n. comb.** The genus *Takobia* is known from Central Asia including the western Himalayas. The terminal segment of the male forceps is elongated and not spherical. This is a correction to the description of the male genitalia reported in Waltz *et al.* (1994) and should be noted.

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