

## THE FAMILY BAETIDAE FROM JAPAN

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### Abstract

A revised list of the family Baetidae (Ephemeroptera) from Japan is presented including 11 genera and 39 species with a valid name. Baetid genera that occur in Japan are *Acentrella* Bengtsson, *Alainites* Waltz and McCafferty, *Baetiella* Uéno, *Baetis* Leach, *Centroptilum* Eaton, *Cloeon* Leach, *Labiobaetis* Novikova and Kluge, *Nigrobaetis* Novikova and Kluge, *Procloeon* Bengtsson, *Promatsumura* Hubbard and *Tenuibaetis* Kang and Yang.

Key words: Baetidae; genera; species; Japan.

### Introduction

The family Baetidae occurs throughout the world except for New Zealand (Edmunds et al. 1976). To date, about 40 genera have been established (Lugo-Ortiz and McCafferty 1999) and more than 500 species are described in this family (Dudgeon 1999).

Concerning Baetidae from Japan, 27 species were described by Takahashi (1924), Matsumura (1931), Uéno (1931a, 1969), Imanishi (1937) and Gose (1965, 1980a, b, c). New records of 9 species from Japan were provided by Matsumura (1904), Takahashi (1929), Horasawa (1931), Uéno (1931b, 1969), Kobayashi (1992), Nakasone et al. (1998), Ishiwata (2000) and Fujitani et al. (2004). Kobayashi (1987) and Fujitani (2002) distinguished 13 species and two species as nymphs, respectively, and gave them alphabetical provisional names.

Ishiwata (2001a) provided a checklist of Ephemeroptera in Japan, in which Baetidae included 38 species with a valid name belonging to 7 genera: *Acentrella* Bengtsson, *Baetiella* Uéno, *Baetis* Leach, *Centroptilum* Eaton, *Cloeon* Leach, *Procloeon* Bengtsson and *Matsumuracloeon* Hubbard. Fujitani et al. (2003a, b) showed the occurrence of the following genera in Japan: *Nigrobaetis* Novikova and Kluge, *Alainites* Waltz and McCafferty, *Labiobaetis* Novikova and Kluge and *Tenuibaetis* Kang and Yang, which Fujitani et al. (2003a) raised from subgenus. They also transferred 14 species originally described in *Baetis* to these genera (Fujitani et al. 2003a, b). Herein, a revised checklist of Baetidae from Japan is provided. I include 39 species with a valid name belonging to 11 genera. I also provide notes on the species given alphabetical provisional names by Kobayashi (1987) and Fujitani (2002). In synonymic list of the species originally described from regions except Japan, I cited the original descriptions in addition to the papers

and reports referring to material or descriptions from Japan. Omission of sex or life stages indicates that the cited papers and reports only recorded the species.

### Family Baetidae

Genus *Nigrobaetis* Novikova and Kluge, 1987

*Baetis* Leach, 1815: Müller-Liebenau, 1969, 1 (the *niger* group, the *gracilis* group in part); Müller-Liebenau, 1974, 163 (the *niger* group, the *gracilis* group).

*Baetis* (*Nigrobaetis*) Kazlauskas, 1972, 337 nom. nud., in Waltz et al., 1994, 34; Novikova and Kluge, 1987, 8 (type species: *Ephemera niger* Linné 1761, by original designation); Novikova and Kluge, 1994, 623 (in part).

*Nigrobaetis*: Waltz et al., 1994, 34; Waltz and McCafferty, 1997, 138; Fujitani et al., 2003a, 122; Fujitani et al., 2003b, 128.

*Baetis* (*Margobaetis*) Kang and Yang, in Kang et al., 1994, 11 [type species: *Baetis* (*Margobaetis*) *mundus* Chang and Yang, 1994, by original designation].

*Nigrobaetis chocoratus* (Gose, 1980)

*Baetis chocoratus* Gose, 1980a, 79, nymph; Gose, 1985, 21, nymph; Kobayashi, 1987, 54, nymph; Yamasaki, 1987, 85; Kobayashi, 1989, 62; Tanida (ed.), 1991, 14, nymph; Ishiwata, 2001a, 66, nymph; Ishiwata, 2001b, 180; Ishiwata, 2002, 14.

*Baetis* (*Nigrobaetis*) *chocoratus*: Novikova and Kluge, 1994, 628, nymph.

*Alainites chocoratus*: Waltz and McCafferty, 1997, 135.

*Nigrobaetis chocoratus*: Fujitani, 2002, 114; Fujitani et al., 2003a, 123; Fujitani et al., 2003b, 128.

*Nigrobaetis sacishimensis* (Uéno, 1969)

*Baetis sacishimensis* Uéno, 1969, 222, male; Gose, 1980b, 122, male; Ishiwata, 2001a, 67; Ishiwata and Kobayashi, 2003, 306, male.

*Alainites sacishimensis*: Waltz et al., 1994, 34, male.

*Nigrobaetis sacishimensis*: Fujitani et al., 2003a, 123; Fujitani et al., 2003b, 128.

In Japan, *Nigrobaetis* sp. D, *Nigrobaetis* sp. I, *Nigrobaetis* sp. N and *Nigrobaetis* sp. P were originally distinguished in nymph and only given alphabetical provisional names in *Baetis* by Kobayashi (1987). They were transferred to *Nigrobaetis* by Fujitani et al. (2003b).

Genus *Alainites* Waltz and McCafferty, 1994

*Baetis* Leach, 1815: Müller-Liebenau, 1969, 174 (the *gracilis* group in part); Müller-Liebenau, 1974, 34 (the *muticus* group).

*Baetis* (*Nigrobaetis*): Novikova and Kluge, 1994, 623 (in part).

- Alainites* Waltz and McCafferty, in Waltz et al., 1994, 34 (type species: *Baetis muticus* Linnaeus, 1758, by original designation); Waltz and McCafferty, 1997, 13; Fujitani et al., 2003a, 124; Fujitani et al., 2003b, 128.
- Baetis (Acerbaetis)* Kang and Yang, in Kang et al., 1994, 35 [type species: *Baetis (Acerbaetis) clivosus* Chang and Yang, 1994, by original designation].
- Alainites atagonis* (Imanishi, 1937)  
*Baetis atagonis* Imanishi, 1937, 337, male, female; Gose, 1980b, 122, male; Ishiwata, 2001a, 66.  
*Alainites atagonis*: Waltz and McCafferty, 1997, 135; Fujitani et al., 2003a, 124; Fujitani et al., 2003b, 128.
- Alainites florens* (Imanishi, 1937)  
*Baetis florens* Imanishi, 1937, 336, male; Gose, 1980a, 79, nymph; Gose, 1980b, 122, male; Gose, 1985, 20, nymph; Ishiwata, 2001a, 66.  
*Baetis (Nigrobaetis) florens*: Novikova and Kluge, 1994, 628, male, nymph.  
*Alainites florens*: Waltz and McCafferty, 1997, 135; Fujitani et al., 2003a, 124; Fujitani et al., 2003b, 128.
- Alainites muticus* (Linnaeus, 1758)  
*Baetis pumilus* (Burmeister, 1839): Horasawa, 1931, 121, male.  
*Baetis muticus* (Linnaeus, 1758): Ishiwata, 2001a, 67.  
*Alainites muticus*: Waltz et al., 1994, 34, list.
- Alainites yoshinensis* (Gose, 1980)  
*Baetis yoshinensis* Gose, 1980a, 79, nymph; Gose, 1980b, 122, male; Gose, 1985, 21, nymph; Kobayashi, 1987, 54, nymph; Yamasaki, 1987, 86; Kobayashi, 1989, 61; Kuranishi and Kuhara, 1994, 1212; Ishiwata, 2001a, 68; Ishiwata, 2001b, 180, male, nymph; Ishiwata, 2002, 15; Ishiwata and Kobayashi, 2003, 304, male, nymph.  
*Baetis (Nigrobaetis) yoshinensis*: Novikova and Kluge, 1994, 629, male, nymph.
- Alainites yoshinoensis* [!]: Waltz and McCafferty, 1997, 135.  
*Alainites yoshinensis*: Fujitani, 2002, 114; Fujitani et al., 2003a, 124; Fujitani et al., 2003b, 128.
- Genus *Labiobaetis* Novikova and Kluge, 1987  
*Baetis* Leach, 1815: Müller-Liebenau, 1969, 150 (the *atrebatinus* group); Edmunds Jr. et al., 1976, 158 (in part); Morihara and McCafferty, 1979, 137 (in part) (the *propinquus* group); Müller-Liebenau, 1984, 253 (the *molawiensis* group); Waltz and McCafferty, 1990, 775 (in part).  
*Baetis (Labiobaetis)* Novikova and Kluge, 1987, 8 (type species: *Baetis atrebatinus* Eaton, 1870, by original designation).  
*Baetis (Mullerbaetis)* Kang and Yang, in Kang et al., 1994, 32 [type species: *Baetis (Mullerbaetis) molawiensis* Müller-Liebenau, 1984, by original designation].

*Labiobaetis*: McCafferty and Waltz, 1995, 19; Gattolliat, 2001, 97; Fujitani et al., 2003a, 126; Fujitani et al., 2003b, 129; previously synonymized with *Pseudocloeon* Klapálek, 1905 by Lugo-Ortiz et al., 1999, 1 (in part).

In Japan, *Labiobaetis* sp. G and *Labiobaetis* sp. Q were originally distinguished in nymph and only given alphabetical provisional names in *Baetis* by Kobayashi (1987). They were transferred to *Labiobaetis* by Fujitani et al. (2003b).

Genus *Tenuibaetis* Kang and Yang, 1994

*Baetis* (*Tenuibaetis*) Kang and Yang, in Kang et al., 1994, 26 [type species: *Baetis* (*Tenuibaetis*) *pseudofrequentus* Müller-Liebenau, 1985, by original designation]; previously synonymized with *Baetiella* Uéno, 1931 by Waltz and McCafferty, 1997, 136.

*Tenuibaetis*: Fujitani et al., 2003a, 129; Fujitani et al., 2003b, 130.

*Tenuibaetis pseudofrequentus* (Müller-Liebenau, 1985)

*Baetis pseudofrequentus* Müller-Liebenau, 1985, 98, nymph; Kobayashi, 1987, 55, nymph; Kobayashi, 1989, 61; Ishiwata, 2001a, 67; Ishiwata and Kobayashi, 2003, 304, nymph.

*Baetiella pseudofrequentata*: Waltz and McCafferty, 1997, 136; Tong and Dudgeon, 2000, 144, male, female.

*Tenuibaetis pseudofrequentus*: Fujitani et al., 2003b, 131.

In Japan, *Tenuibaetis* sp. E and *Tenuibaetis* sp. H were originally distinguished in nymph and only given alphabetical provisional names in *Baetis* by Kobayashi (1987). They were transferred to *Tenuibaetis* by Fujitani et al. (2003b).

Genus *Baetis* Leach, 1815

*Baetis* Leach, 1815, 137 (type species: *Ephemera fuscata* Linnaeus, 1716, emended from *Ephemera bioculata* by Kimmins, 1964, 146); Müller-Liebenau, 1969, 1 (the *alpinus* group, the *lutheri* group, the *pavidus* group, the *rhodani* group, the *vernus* group, the *fuscatus* group, the *buceratus* group); Edmunds Jr. et al., 1976, 158 (in part); Morihara and McCafferty, 1980, 139 (the *rhodani* group, the *vernus* group, the *fuscatus* group, species not assignable to any species groups); Tshernova et al., 1986, 128 (in part); Waltz and McCafferty, 1997, 137 (the *rhodani* group, the *vernus* group, the *fuscatus* group, species having not been assigned to any species groups).

*Baetis* (*Baetis*): Novikova and Kluge, 1987, 8.

*Baetis acuminatus* Gose, 1980

*Baetis acuminatus* Gose, 1980b, 122, male; Ishiwata, 2001a, 66; Fujitani et al., 2003b, 131.

*Baetis bicaudatus* Dodds, 1923

- Baetis bicaudatus* Dodds 1923, 71, female, nymph; Ishiwata et al., 2000, 71, nymph; Ishiwata, 2001a, 66; Fujitani et al., 2003b, 131; Konno et al., 2003, 141; Konno, 2004, 21.
- Baetis* sp. L: Kobayashi, 1987, 54, nymph; Kobayashi, 1989, 59; Tanida (ed.), 1991, 1, nymph.
- Baetis celcus* Imanishi, 1937
- Baetis celcus* Imanishi, 1937, 335, male, female; Gose, 1980b, 122, male; Ishiwata, 2001a, 66; Fujitani et al., 2003b, 131.
- Baetis flexifemora* Gose, 1980
- Baetis flexifemora* Gose, 1980b, 122, male; Kobayashi, 1992, 19, male; Fujitani et al., 2003b, 131.
- Baetis frexifemora* [!]: Ishiwata, 2001a, 67; Ishiwata, 2002, 15.
- Baetis fuscatus* (Linnaeus, 1761)
- Ephemera fuscata* Linnaeus, 1761, 376, imago.
- Baetis bioculatus* (Linnaeus, 1758): Matsumura, 1904, 160, male; Matsumura, 1915, 37, male; Uéno, 1928, 50, nymph; Uéno, 1931b, 220; Uéno, 1935, 64, male, nymph.
- Baetis fuscatus*: Ishiwata, 2001a, 67.
- Baetis hyugensis* Gose, 1980
- Baetis hyugensis* Gose, 1980a, 79, nymph; Gose, 1980b, 122, male; Gose, 1985, 21, nymph; Ishiwata, 2001a, 67; Fujitani et al., 2003b, 131.
- Baetis iriomotensis* Gose, 1980
- Baetis* sp. (No. 1): Uéno, 1969, 224, female.
- Baetis iriomotensis* Gose, 1980b, 122, female; Ishiwata, 2001a, 67, list; Fujitani et al., 2003b, 131.
- Baetis sahoensis* Gose, 1980
- Baetis sahoensis* Gose, 1980a, 79, nymph; Gose, 1980b, 122, male; Gose, 1985, 21, nymph; Kobayashi, 1987, 54, nymph; Yamasaki, 1987, 85; Kobayashi, 1989, 59; Tanida (ed.), 1991, 1, nymph; Kuranishi and Kuhara, 1994, 1212; Ishiwata, 2001a, 67; Ishiwata, 2001b, 180, nymph; Ishiwata, 2002, 15; Fujitani, 2002, 114; Fujitani et al., 2003b, 131.
- Baetis shinanonis* Uéno, 1931
- Baetis shinanonis* Uéno, 1931a, 93, male, female; Uéno, 1935, 64, nymph; Ishiwata, 2001a, 67.
- Baetis taiwanensis* Müller-Liebenau, 1985
- Baetis taiwanensis* Müller-Liebenau, 1985, 94, nymph; Fujitani et al., 2004, 40, male, female, male subimago, female subimago, nymph.
- Baetis* sp. S1: Fujitani, 2002, 114.
- Baetis takamiensis* Gose, 1980
- Baetis takamiensis* Gose, 1980a, 79, nymph; Gose, 1980b, 122, male; Gose, 1985, 79, nymph; Ishiwata, 2001a, 67; Fujitani et al., 2003b, 131.
- Baetis thermicus* Uéno, 1931

*Baetis thermicus* Uéno, 1931b, 92, male, female; Imanishi, 1937, 333, male, female; Imanishi, 1940, 219, nymph; Uéno, 1950, 130, male; Gose, 1962, 18, nymph; Gose, 1980b, 79, male; Kobayashi, 1987, 55, nymph; Yamasaki, 1987, 86; Kobayashi, 1989, 59; Tanida (ed.), 1991, 1, nymph; Kuranishi and Kuhara, 1994, 1212; Ishiwata, 2001a, 67; Ishiwata, 2001b, 180, male, nymph; Fujitani, 2002, 114; Ishiwata, 2002, 15; Ishiwata and Kobayashi, 2003, 304, male, nymph; Fujitani et al., 2003b, 131.

*Baetis totsukawaensis* Gose, 1980

*Baetis totsukawensis*, Gose, 1980a, 79, nymph; Gose, 1980b, 122, male; Gose, 1985, 21, nymph; Ishiwata, 2001a, 67.

*Baetis tsushimensis* Gose, 1980

*Baetis tsushimensis* Gose, 1980a, 79, nymph; Gose, 1980b, 122, male; Gose, 1985, 21, nymph; Ishiwata, 2001a, 67; Fujitani et al., 2003b, 131.

*Baetis uenoi* Gose, 1980

*Baetis* sp. (No. 2): Ueno, 1969, 224, female.

*Baetis uenoi* Gose, 1980b, 122, female; Ishiwata, 2001a, 68; Fujitani et al., 2003b, 131.

*Baetis yamatoensis* Gose, 1965

*Baetis yamatoensis* Gose, 1965, 218, male; Gose, 1973, 1; Gose, 1980a, 79, nymph; Gose, 1980b, 122, male; Gose, 1985, 21, nymph; Ishiwata, 2001a, 68; Fujitani et al., 2003b, 131.

In Japan, *Baetis* sp. F, *Baetis* sp. J, *Baetis* sp. M and *Baetis* sp. O were originally distinguished in nymph and only given alphabetical provisional names by Kobayashi (1987) and *Baetis* sp. M1 by Fujitani (2002).

#### Genus *Acentrella* Bengtsson, 1912

*Acentrella* Bengtsson, 1912, 110 (type species: *Acentrella lapponicus* Bengtsson, 1912, by original designation); Bogoescu and Tabacaru, 1957, 483; Waltz and McCafferty, 1987, 559; McCafferty and Waltz, 1990, 774; Park et al., 1996, 56; Ishiwata, 2001a, 65; Ishiwata, 2001b, 178; Ishiwata, 2002, 14.

*Baetis* Leach, 1815: Edmunds Jr. and Traver, 1954, 238 (in part); Grandi, 1957, 119; Müller-Liebenau, 1965, 111 (in part); Müller-Liebenau, 1969, 81 (the *lapponicus* group); Edmunds Jr. et al., 1976, 158 (in part); Morihara and McCafferty, 1980, 139 (the *lapponicus* group).

*Baetis* (*Acentrella*): Novikova and Kluge, 1987, 16.

*Acentrella gnom* (Kluge, 1983)

*Pseudocloeon gnom* Kluge, 1983, 74, male, female, nymph.

*Acentrella gnom*: Waltz and McCafferty, 1987, 560; Kobayashi, 1992, 18, nymph; Ishiwata, 2000, 75, nymph; Ishiwata, 2001a, 65; Ishiwata, 2001b, 179, nymph; Ishiwata, 2002, 14.

- Acentrella lata* (Müller-Liebenau, 1985)  
*Pseudocloeon latum* Müller-Liebenau, 1985, 100, nymph; Nakasone et al., 1998, 166.  
*Acentrella lata*: Ishiwata, 2001a, 65; Ishiwata and Kobayashi, 2003, 304, nymph.  
*Acentrella sibirica* (Kazlauskas, 1963)  
*Pseudocloeon sibiricum* Kazlauskas, 1963, 319, nymph.  
*Acentrella sibirica*: Ishiwata, 2000, 75, nymph; Ishiwata, 2001a, 65; Ishiwata, 2002, 14.  
*Acentrella suzukiella* Matsumura, 1931  
*Acentrella suzukiella* Matsumura, 1931, 1471, male; Ishiwata, 2001a, 65.
- Genus *Baetiella* Uéno, 1931  
*Baetiella* Uéno, 1931b, 220 (type species: *Acentrella japonica* Imanishi, 1930, by original designation); Uéno, 1935, 65; Edmunds Jr. and Traver, 1954, 238; Waltz and McCafferty, 1987, 561; Park et al., 1996, 58; Waltz and McCafferty, 1997, 136 (in part); Ishiwata, 2001a, 65; Ishiwata, 2001b, 179; Ishiwata, 2002, 14.  
*Pseudocloeon* Matsumura, 1931, 1473 (type species not designated) (in part); Gose, 1980c, 211; Gose, 1985, 21.  
*Baetis* (*Baetiella*): Novikova and Kluge, 1987, 16.  
*Neobaetiella* Müller-Liebenau, 1985, 103 (type species: *Neobaetiella uenoi* Müller-Liebenau, 1985, by original designation).  
*Matsumuracloeon* Hubbard, 1989, 388 (type species: *Pseudocloeon aino* Matsumura, 1931a, by monotypy).  
*Baetiella japonica* (Imanishi, 1930)  
? *Acentrella* (sp. nov.): Uéno, 1928, 51, nymph.  
*Acentrella japonica* Imanishi, 1930, 263, male, female, male subimago, nymph.  
*Baetiella japonica*: Uéno, 1931b, 220, male, nymph; Uéno, 1935, 65, male; Imanishi, 1940, 226, nymph; Waltz and McCafferty, 1987, 563; Yamasaki, 1987, 85; Kuranishi and Kuhara, 1994, 1212; Ishiwata, 2001a, 65; Ishiwata, 2001b, 179, male, nymph; Ishiwata, 2002, 14.  
*Pseudocloeon aino* Matsumura, 1931, 1437, female.  
*Baetiella nose-gawaensis* Gose, 1965, 218, male.  
*Pseudocloeon japonica* [!]: Gose, 1980c, 211, male, nymph; Gose, 1985, 21, nymph.  
*Pseudocloeon japonicum*: Müller-Liebenau, 1985, 107, nymph.  
*Baetiella aino*: Waltz and McCafferty, 1987, 563.  
*Matsumuracloeon aino*: Hubbard, 1989, 388.  
*Baetiella bispinosa* (Gose, 1980)  
*Baetiella* sp. 1: Tanida, 1974, 162.  
*Pseudocloeon bispinosus* Gose, 1980c, 211, nymph.

*Baetiella bispinosa*: Waltz and McCafferty, 1987, 563; Tong and Dudgeon, 2000, 143, nymph; Ishiwata, 2001a, 65; Ishiwata and Kobayashi, 2003, 304, nymph.

Genus *Centroptilum* Eaton, 1869

*Centroptilum* Eaton, 1869, 131 (type species: *Ephemera luteola* Müller, 1776, by original designation): Gose, 1962, 18; Gose, 1980c, 212; Gose, 1985, 21; Tshernova et al., 1986, 120; Ishiwata, 2001a, 68; Ishiwata, 2001b, 181; Ishiwata, 2002, 15.

*Cloeon* (*Centroptilum*): Novikova and Kluge, 1994, 63.

*Centroptilum rotundum* Takahashi, 1929

*Centroptilum rotundum* Takahashi, 1929, 64, female; Uéno, 1931b, 220, male; Gose, 1980c, 212, nymph; Gose, 1985, 21; Ishiwata, 2001, 68.

Genus *Cloeon* Leach, 1815

*Cloeon* 1815, 137 (type species: *Ephemera diptera* Linnaeus, 1761, by original designation); Uéno, 1935, 64; Gose, 1962, 18; Gose, 1980b, 77; Gose, 1985, 21; Tshernova et al., 1986, 120; Ishiwata, 2001a, 68; Ishiwata, 2001b, 181; Ishiwata, 2002, 15.

*Cloeon* (*Cloeon*): Novikova and Kluge, 1994, 64.

*Cloeon dipterum* (Linnaeus, 1761)

*Ephemera diptera* Linnaeus, 1761, 377, imago.

*Cloeon dipterum*: Matsumura, 1904, 160, female; Uéno, 1935, 64, nymph; Gose, 1962, 18; Gose, 1980b, 77; Gose, 1985, 20, nymph; Ishiwata, 2001a, 68; Ishiwata, 2001b, 181; Ishiwata, 2002, 15.

*Cloeon kyotonis* Matsumura, 1931

*Cloeon kyotonis* Matsumura, 1931, 1472, female; Ishiwata, 2001a, 68.

*Cloeon maikonis* Takahashi, 1924

*Cloeon maikonis* Takahashi, 1924, 372; female; Ishiwata, 2001a, 68.

*Cloeon marginale* (Hagen, 1858)

*Cloe marginale* Hagen, 1858, 477, female subimago.

*Cloeon marginale*: Uéno, 1969, 226, male, female; Ishiwata, 2001a, 68.

*Cloeon okamotoi* Takahashi, 1924

*Cloeon okamotoi* Takahashi, 1924, 372, female; Ishiwata, 2001a, 68.

*Cloeon ryogokuense* Gose, 1980

*Cloeon ryogokuense* Gose, 1980b, 77; Gose, 1985, 21; Ishiwata, 2001a, 68; Ishiwata, 2002, 15.

*Cloeon tamagawanum* (Matsumura, 1931)

*Procloeon tamagawanum* Matsumura, 1931, 1472, male.

*Promatsumura tamagawanum*: Hubbard, 1988.

*Cloeon tamagawanum*: Ishiwata, 2001a, 68

Genus *Procloeon* Bengtsson, 1915

*Pseudocloeon* Bengtsson, 1914, 218 (type species: *Cloeon bifidum* Bengtsson, 1912 by original designation).



- Procloeon* Bengtsson, 1915, 34 (type species: *Cloeon bifidum* Bengtsson, 1912 by original designation): replacement name for *Pseudocloeon* Bengtsson, 1914; Tshernova et al., 1986, 120; Ishiwata, 2001a, 68; Ishiwata, 2001b, 181; Ishiwata, 2002, 16.
- Cloeon* (*Procloeon*): Novikova and Kluge, 1994, 74.
- Procloeon bimaculatum* (Eaton, 1885)
- Cloeon bimaculatum* Eaton, 1885, 182, male, female; Uéno, 1969, 226, female.
- Procloeon bimaculatum*: Ishiwata, 2001a, 69.
- Genus *Promatsumura* Hubbard, 1988
- Procloeon* Matsumura, 1931, 1473 (type species not designated).
- Promatsumura*: Hubbard, 1988, 240 (type species: *Procloeon nipponicum* Matsumura, 1931): replacement name for *Procloeon* Matsumura, 1931; Ishiwata, 2001a, 69.
- Promatsumura nipponicum* Matsumura, 1931
- Procloeon nipponicum* Matsumura, 1931, 1472, female.
- Promatsumura nipponicum*: Hubbard, 1988, 240; Ishiwata, 2001a, 69.

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### Literature Cited

- Bengtsson, S. 1912. Neue Ephemeriden aus Scherden. Entomologisk Tidskrift **33**:107–117 (in German).
- Bengtsson, S. 1914. Benerkungen über die nordischen Arten der Gattung *Cloëon* Leach. Entomologisk Tidskrift **35**:210–220 (in German).
- Bengtsson, S. 1915. Eine Namensänderung. Entomologisk Tidskrift **36**:34 (in German).

- Bogoescu, C., and I. Tabacaru. 1957. Etude comparée des nymphes d'*Acentrella* et de *Pseudocloeon*. Considération phylogénétiques concernant la famille Baëtidae (Ephemeroptera). *Beiträge zur Entomologie* 7:483–491 (in French).
- Dodds, G. S. 1923. Mayflies from Colorado. *Transactions of the American Entomological Society* 49:93–116.
- Dudgeon, D. 1999. *Tropical Asian streams*. Hong Kong University Press, Hong Kong.
- Eaton, A. E. 1869. On *Centroptilium*, a new genus of the Ephemeridae. *The Entomologist's Monthly Magazine* 6:131–132.
- Eaton, A. E. 1885. A revisional monograph of recent Ephemeridæ or mayflies. *The Transactions of the Linnean Society of London. Series 2. Zoology* 3:1–346.
- Edmunds Jr., G. F., and J. R. Traver. 1954. An outline of a reclassification of the Ephemeroptera. *Proceedings of the Entomological Society of Washington* 56:236–240.
- Edmunds Jr., G. F., S. L. Jensen, and L. Berner. 1976. *The mayflies of North and Central America*. University of Minnesota Press, Minneapolis, USA.
- Fujitani, T. 2002. Species composition and distribution patterns of *Baetis* and its related genera (Baetidae: Ephemeroptera) in a Japanese stream. *Hydrobiologia* 485:111–121.
- Fujitani, T., T. Hirowatari, and K. Tanida. 2003a. Genera and species of Baetidae in Japan: *Nigrobaetis*, *Alainites*, *Labiobaetis* and *Tenuibaetis* n. stat. (Ephemeroptera). *Limnology* 4:121–129.
- Fujitani, T., T. Hirowatari, and K. Tanida. 2003b. Nymphs of *Nigrobaetis*, *Alainites*, *Labiobaetis*, *Tenuibaetis* and *Baetis* from Japan (Ephemeroptera: Baetidae): diagnoses and keys for genera and species. Pages 127–133 in E. Gaino, editor. *Research Update on Ephemeroptera and Plecoptera*. Università di Perugia, Italy.
- Fujitani, T., T. Hirowatari, and K. Tanida. 2004. The first record of *Baetis taiwanensis* Müller-Liebenau from Japan, with description of imago and subimago (Ephemeroptera: Baetidae). *Entomological Science* 7:39–46.
- Gattolliat, J. L. 2001. Six new species of *Labiobaetis* Novikova & Kluge (Ephemeroptera: Baetidae) from Madagascar with comments on the validity of the genus. *Annales de Limnologie* 37:97–123.
- Gose, K. 1962. Ephemeroptera. Pages 6–24 in M. Tsuda, editor. *Aquatic Entomology*. Hokuryûkan Publisher, Tokyo (in Japanese.)
- Gose, K. 1965. Description of two new species of Baetidae from Japan (Ephemeroptera). *Kontyû* 33:218–220.
- Gose, K. 1973. Benthic community of Yoshino River, Japan. Study on Bioproductivity of Benthos in Yoshino River 5:1–7 (in Japanese).
- Gose, K. 1980a. The mayfly of Japanese 6. *Aquabiology* 2:76–79 (in Japanese).
- Gose, K. 1980b. The mayfly of Japanese 7. *Aquabiology* 2:122–123 (in Japanese).
- Gose, K. 1980c. The mayfly of Japanese 8. *Aquabiology* 2:286–288 (in Japanese).

- Gose, K. 1985. Ephemeroptera. Pages 7–32 in T. Kawai, editor. An Illustrated Book of Aquatic Insects of Japan. Tokai University Press, Tokyo (in Japanese).
- Grandi, M. 1957. Contributi allo studio degli Ephemeroidei Italiani. XXI. Intorno ai generi *Acentrella* Bgtssn. e *Baetis* Leach. Bollettino dell'Istituto di Entomologia della Università di Bologna **22**:119–124 (in Italian).
- Hagen, H. A. 1858. Synopsis der Neuroptera Ceylons. Verhandlungen des Zoologisch-botanischer Verein in Wien **8**:471–488 (in Latin).
- Horasawa, I. 1931. Short notes on Japanese Ephemeridae (2). Kontyû **5**:121–124 (in Japanese).
- Hubbard, M. D. 1988. *Promatsumura*, replace name for *Procloeon* Matsumura, 1931 (Ephemeroptera: Baetidae) with designation of type-species. Insecta Mundi **2**:240.
- Hubbard, M. D. 1989. *Matsumuracloeon*, a replacement name for *Pseudocloeon* Matsumura, 1931 (Ephemeroptera: Baetidae). Florida Entomologist **72**:388.
- Imanishi, K. 1930. Mayflies from Japanese torrents I. New mayflies of the genera *Acentrella* and *Ameletus*. Transactions of the Natural History Society of Formosa **20**:263–267.
- Imanishi, K. 1937. Mayflies from Japanese torrents VIII. Notes on the genera *Paraleptophlebia* and *Baetis*. Annotations Zoologicae Japonenses **16**:330–338.
- Imanishi, K. 1940. Ephemeroptera of Manchoukuo, Inner Mongolia, and Chôsen. Pages 169–263 in T. Kawamura, editor. Report of the Limnological Survey of Kwantung and Manchoukuo. Kyoto University Press (in Japanese).
- Ishiwata, S. 2000. Notes on mayflies in Kanagawa Prefecture. Natural History Report of Kanagawa Prefecture **21**:73–82 (in Japanese).
- Ishiwata, S. 2001a. A checklist of Japanese Ephemeroptera. Pages 55–84 in Y. J. Bae, editor. The 21st Century and Aquatic Entomology in East Asia. Proceedings of the 1st symposium of AESEA.
- Ishiwata, S. 2001b. Mayflies of Chiba Prefecture, Japan. Checklist, diagnoses and keys. Journal of the Natural History Museum and Institute, Chiba **6**:163–200 (in Japanese).
- Ishiwata, S. 2002. Mayflies of Kanagawa Prefecture, Japan. Kanagawa Chûho, **138**:1–46 (in Japanese).
- Ishiwata, S., and N. Kobayashi. 2003. Ephemeroptera. Pages 296–331 in M. Nishida, N. Shikatani, and S. Shokita, editors. The Flora and Fauna of Inland Waters in the Ryukyu Islands. Tokai University Press, Tokyo (in Japanese).
- Ishiwata, S., T. M. Tiunova, and R. B. Kuranishi. 2000. The mayflies (Insecta: Ephemeroptera) collected from the Kamchatka Peninsula and the North Kuril Islands in 1996–1997. Pages 67–75 in T. Komai, editor. Results of Recent Research on Northeast Asian Biota, Natural History Research, Special Issue.
- Kang, S. C., H. C. Chang, and C. T. Yang. 1994. A revision of the genus *Baetis* in Taiwan (Ephemeroptera, Baetidae). Journal of Taiwan Museum **47**:9–44.
- Kazlauskas, R. 1963. New and little-known mayflies (Ephemeroptera) from the USSR. Entomological Review **42**:582–589 (in Russian).

- Kazlauskas, R. 1972. Neues über das System der Eintagfliegen der Familie Baetidae (Ephemeroptera). Pages 337–338 in XIII International Congress of Entomology Moscow, 2–9 August, 1968 Proceedings (in German).
- Kimmins, D. E. 1964. *Baetis* [Leach, 1815] (Insecta, Ephemeroptera): proposed designation of a type-species under the plenary powers. Z. N. (S). 1620. *Bulletins of Zoological Nomenclature* **21**:146–147.
- Kluge, N. J. 1983. New and little known mayflies of the family Baetidae (Ephemeroptera) from the Primorye. *Entomologiceskoe obozrenie* **61**:65–79 (in Russian).
- Kobayashi, N. 1987. *Baetis* species as biological indices of water quality. Pages 41–52 in M. Yasuno, and T. Iwakuma, editors. Proceedings of Symposium “Problem and Perspective of Aquatic Biological Index”. National Institute of Environmental Studies, Tokyo (in Japanese).
- Kobayashi, N. 1989. Genus *Baetis*, with consideration to their systematic relationships and distribution patterns. Pages 53–67 in A. Shibatani and K. Tanida, editors. Recent Progress in Aquatic Entomology in Japan, With Special Reference to Speciation and “*Sumiwake*”. Tôkai University Press, Tokyo, Japan (in Japanese).
- Kobayashi, N. 1992. Ephemeroptera. Pages 18–24 in H. Moriya, editor. Benthic Fauna of Sagami-hara City. Sagami-hara City Government (in Japanese).
- Konno, Y. 2004. Lotic aquatic insects in the Azusagawa River, in the Kamikochi Valley of Chubu Sangaku National Park. *Japanese Journal of Limnology* **65**:21–26 (in Japanese).
- Konno, Y., H. Nishimoto, H. Maruyama, T. Torii, and S. Ishiwata. 2003. Lotic aquatic insects in the alpine zone of Daisetsuzan National Park, Hokkaido. *Japanese Journal of Limnology* **64**:141–144 (in Japanese).
- Kuranishi, R., and N. Kuhara. 1994. Benthic fauna of Akan National Park. The Nature of Akan National Park, 1993. V. Fauna of Akan National Park. Maeda Ippo Foundation, Japan (in Japanese).
- Leach, E. A. 1815. Entomology. Brewster’s Edinburgh Encyclopedia, **9**:57–172.
- Linnaeus, C. 1761. Fauna Suecia. Edition II. No. 1476 (in Latin).
- Lugo-Ortiz, C. R., and W. P. McCafferty. 1999. Global diversity of the mayfly family Baetidae (Ephemeroptera): a generic perspective. *Trends in Entomology* **2**:45–54.
- Lugo-Ortiz, C. R., W. P. McCafferty, and R. D. Waltz. 1999. Definition and reorganization of the genus *Pseudocloeon* (Ephemeroptera: Baetidae) with new species description and combinations. *Transactions of the American Entomological Society* **125**:1–37.
- Matsumura, S. 1904. Guide to 1,000 species of insects from Japan Empire. Keiseisha Shoten, Tokyo (in Japanese).
- Matsumura, S. 1915. Insect taxonomy. Volume 1. Keiseisha Publisher, Tokyo (in Japanese).

- Matsumura, S. 1931. 6000 illustrated insects of Japan Empire. Tôko Shoin, Tokyo (in Japanese).
- McCafferty, W. P., and R. D. Waltz. 1990. Revisionary synopsis of the Baetidae (Ephemeroptera) of North and Middle America. *Transaction of the American Entomological Society* **116**:769–799.
- McCafferty, W. P., and R. D. Waltz. 1995. *Labiobaetis* (Ephemeroptera: Baetidae): new status, new North American species, and related new genus. *Entomological News* **106**:19–28.
- Morihara, D. K., and W. P. McCafferty. 1979. Systematics of the *propinquus* group of Baetis species (Ephemeroptera: Baetidae). *Annals of the Entomological Society of America* **72**:130–135.
- Morihara, D. K., and W. P. McCafferty. 1980. The *Baetis* larvae of North America (Ephemeroptera: Baetidae). *Transactions American Entomological Society* **105**:139–221.
- Müller-Liebenau, I. 1965. Revision der von Simon Bengtsson aufgestellten *Baetis*-Arten (Ephemeroptera). *Opuscula entomologica* **30**:79–123 (in German).
- Müller-Liebenau, I. 1969. Revision of European species of the genus *Baetis* Leach, 1815 (Insecta, Ephemeroptera). *Gewässer und Abwässer* **48/49**:1–214 (in German).
- Müller-Liebenau, I. 1974. Baetidae from southern part of France, Spain and Portugal (Insecta, Ephemeroptera). *Gewässer und Abwässer* **53/54**:7–42 (in German).
- Müller-Liebenau, I. 1984. New genera and species of the family Baetidae from West-Malaysia (River Gombak) (Insecta: Ephemeroptera). *Spixiana* **7**:253–284.
- Müller-Liebenau, I. 1985. *Baetis* from Taiwan with remarks on *Baetiella* Ueno, 1931 (Insecta, Ephemeroptera). *Archiv für Hydrobiologie* **104**:93–110.
- Nakasone, K., H. Mitsumoto, M. Yonamine, T. Kishimoto, E. Higa, and T. Omija. 1998. Studies on suspended material content in sediment and benthic macro-invertebrate fauna of river in U. S. military base. *Annual report of Okinawa Prefectural Institute of Health and Environment news* **12**:161–167 (in Japanese).
- Novikova, E. A., and N. Y. Kluge. 1987. Systematics of the genus *Baetis* (Ephemeroptera: Baetidae) with description of a new species from Middle Asia. *Vestnik Zoologii* **1987**:8–19 (in Russian).
- Novikova, E. A., and N. Y. Kluge. 1994. Mayflies of the subgenus *Nigrobaetis* (Ephemeroptera, Baetidae, *Baetis* Leach, 1815). *Entomologiceskoe obozrenie* **73**:623–644 (in Russian).
- Park, S. Y., Y. J. Bae, and I. B. Yoon. 1996. Revision of the Baetidae (Ephemeroptera) of Korea (1). Historical review, *Acentrella* Bengtsson and *Baetiella* Uéno. *Entomological Research Bulletin* (Korean Entomological Institute, Korea University) **22**:55–66.
- Takahashi, Y. 1924. Some new species of mayflies from Japan. *Zoological magazine* **36**:377–380 (in Japanese).
- Takahashi, Y. 1929. A new Japanese may-fly, *Centroptilium rotundum* n. sp. *Lansania* **1**:63–64 (in Japanese, with English description).

- Tanida, K. 1974. Preliminary reports on the aquatic insects of the Ryukyus with some ecological remarks I. Ecological Study on Natural Conservation of the Ryukyu Islands **1**:161–174 (in Japanese).
- Tanida, K., editor. 1991. Aquatic Insects of Shiga Prefecture, Japan. Shingakusha Publisher, Kyoto (in Japanese).
- Tong, X., and D. Dudgeon. 2000. *Baetiella* (Ephemeroptera: Baetidae) in Hong Kong, with description of a new species. Entomological News **143**:111–118.
- Tshernova, O. A., N. J. Kluge, N. D. Sintshenkova, and B. B. Belov. 1986. Order Ephemeroptera. Pages 99–142 in P. A. Lehr, editor. Identification of Insects of Far East USSR. Vol. 1. Leningrad Press, Leningrad (in Russian).
- Uéno, M. 1928. Some Japanese mayfly nymphs. Memoirs of the college of science, Kyoto Imperial University, Series B. **4**:19–63.
- Uéno, M. 1931a. Einige neue Ephemeroptera und Plecoptera aus Mittel-Japan. Annotations Zoologicae Japonenses **13**:91–99 (in German).
- Uéno, M. 1931b. Contribution to the knowledge of Japanese Ephemeroptera. Annotation Zoologicae Japonense **16**:189–231.
- Uéno, M. 1935. Reports on benthic fauna of Minami-Azumi region, with special attention to Azusagawa River. Pages 9–116 in D. Miyadi, editor. Benthic Fauna and Kamikôchi Valley and Azusagawa River. Iwanami Publisher, Tokyo (in Japanese).
- Uéno, M. 1950. Ephemeroptera. Pages 120–130 in T. Ishii et al., editors. Illustrated Book of Insects of Japan. Hokuryûkan Publisher, Tokyo (in Japanese).
- Uéno, M. 1969. Mayflies (Ephemeroptera) from various regions of Southeast Asia. Oriental Insects **2**:221–228.
- Waltz, R. D., and W. P. McCafferty. 1987. Systematics of *Pseudocloeon*, *Acentrella*, *Baetiella*, and *Liebebiella*, new genus (Ephemeroptera: Baetidae). Journal of New York Entomological Society **95**:553–568.
- Waltz, R. D., and W. P. McCafferty. 1990. Revisionary synopsis of the Baetidae (Ephemeroptera) of North and Middle America. Transaction of American Entomological Society **116**:769–799.
- Waltz, R. D., and W. P. McCafferty. 1997. New generic synonymies in Baetidae (Ephemeroptera). Entomological News **108**:134–140.
- Waltz, R. D., W. P. McCafferty, and A. Thomas. 1994. Systematics of *Alainites* n. gen., *Dipheter*, *Indobaetis*, *Nigrobaetis* n. stat., and *Takobia* n. stat. (Ephemeroptera, Baetidae). Bulletin de la Société d'histoire Naturelle de Toulouse **130**:33–36.
- Yamasaki, T. 1987. Mayflies of Tamagawa River system and their distribution. Pages 81–120 in R. Ishikawa, T. Yamasaki, J. Kojima and S. Uchida, editors. Analytic Studies on the Distribution of Some Insect-Groups in the Tamagawa River System and Its Upper Reaches. Tokyû Foundation for Better Environment, Tokyo (in Japanese).