New synonymy and new data on the distribution of the mayflies from Korea and the Russian Far East (Ephemeroptera)

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Introduction

About one hundred and fifty species of mayflies occur in the Far East of Russia which is close to two thirds of all known Northeast Asian mayflies (Tshernova et al., 1986; Bae, 1997). Tshernova, Bajkova, Sinitshenkova, Kluge, and Tiunova mainly contributed to the knowledge of mayfly fauna of the Far East of Russia. On the other hand, sixty-six species of mayflies have been reported from Korea since Imanishi (1940) (Bae et al., 1994; Bae, 1997). The North Korean mayfly fauna has been thoroughly investigated recently (Braasch & Soldan, 1988; Bae & Soldan, 1997; Bae & Andrikovics, 1997).

Although geographically adjacent, mayflies from Korea and the Far East of Russia have been scarcely treated together until 1980s because of the communication problems between those countries. For this study, we intensively examined type and non-type material from Korea and the Far East of Russia. We deal herein with new synonymy, taxonomic discussions on some problematic species, and new distributional data.

Material

Mayflies from the Far East of Russia (FE Russia), North Korea (N Korea), and South Korea (S Korea) were examined. For detailed information on type material deposited at Zoological Institute in St.Petersburg (ZIN), see Kluge (1995). For numerous non-type specimens (many of them reared) deposited at St.Petersburg State University (SPBU), see various Kluge's previous papers. For type and non-type material deposited at Seoul Women's University (SWU), see Bae at al. (1994) and Bae's various previous papers.
Taxonomic account

Family **BAETIDAE**

**Baetis (Baetis) fuscatus** (Linnaeus, 1761)

*Baetis* nla: Imanishi, 1940: 221 (larva; N Korea, Japan, Manchuria); Yoon & Bae, 1988a: 111 (S Korea).

*Baetis fuscatus* (L.): Müller-Liebenau, 1969: 128 (larva, imago; Europe); Kluge, 1980: 562 (Siberia); Tshernova et al., 1986: 133 (imago; FE Russia); Bae & Soldan, 1997 (N Korea).


**Material examined.** Numerous larvae, imagines, and imagines reared from larvae (Europe, Siberia, FE Russia, N Korea, S Korea; SPbU, SWU).

Imanishi (1940) described larvae of this species as "*Baetis nla*" from North Korea, Japan, and Manchuria. Since then, there have been many faunistic studies in Korea listing this species under the arbitrary name "*Baetis nla*" which refers to any *fuscatus*-type baetid (see Yoon & Bae, 1988a). This is a transpalearctic species known from Europe to East Asia. The form distributed in Siberia and the Far East differs from that of Europe by orange colour of turban eyes of male imago (Kluge, 1980). It is a very common species in the Far East of Russia and in Korea occurring from upper to down stream areas, sometimes in polluted streams.

**Baetis (Nigrobaetis) muticus** (Linnaeus, 1758)


*Baetis* KUa: Yoon & Bae, 1988a: 111 (S Korea).

*Baetis (Nigrobaetis) muticus* (L.): Novikova & Kluge, 1987: 10; Novikova & Kluge, 1994: 635 (larva, imago; Europe, East Kazakhstan); Kluge, 1997: 190 (larva); Bae & Soldan, 1997 (N Korea).

*Alainites muticus* (L.): Waltz et al., 1994: 34 (Europe).

**Material examined.** Numerous larvae, imagines, and imagines reared from larvae from Europe, the Urals and Caucasus, one larva from Eastern Kazakhstan (SPbU). *Baetis* KUa: Yoon & Bae, 1988 (N Korea, S Korea; SWU).

This species has been known from Korea as "*Baetis KUa*" since Yoon & Bae (1988a). Based on examination of a good series of larval material from Europe and Asia, we determine this species as *Baetis (Nigrobaetis) muticus*. Formerly the easternmost point of recorded distribution of *B. (N.) muticus* was Eastern Kazakhstan (Novikova & Kluge, 1994).

Waltz et al. (1994) suggested a new classification for selected baetid groups, in which the genus *Alainites* Waltz & McCafferty, 1994 was established with the type species *Ephemera mutica* Linnaeus, 1758 (wrongly spelled as "*Baetis muticus* L., 1758"). According to our investigation (Novikova & Kluge, 1994), the type species of *Alainites* is undoubtedly congeneric with the type species of *Takobia* Novikova & Kluge, 1987, and both can be placed in the subgenus (or genus) *Nigrobaetis* Kazlauskas in Novikova & Kluge, 1987 (see Kluge, 1997: 189).

Family **HEPTAGENIIDAE**

**Ecdyonurus (Afghanurus) bajkovicus** Kluge, 1986

*Paracinygmula zhiltzowae* Bajkova, 1975: 56 (nom. praecoc.) (larva; FE Russia).


*Ecdyonurus* KUa: Yoon & Bae, 1984: 14 (larva; S Korea) (associated with *E. bajkovicus* Kluge by Bae et al., 1994).

*Ecdyonurus bajkovicus* Kluge in Tshernova et al., 1986: 117 (nomen novum pro *Paracinygmula zhiltzowae* Bajkova) (imago; FE Russia); Kluge, 1988: 300; Kluge, 1995: 19 (type deposition).

*Nixe subspinosus* Braasch & Soldan, 1988: 25 (imago; N Korea), syn. n.

*Ecdyonurus subspinosus* (Braasch & Soldan): Bae et al., 1994: 40 (S Korea).

*Ecdyonurus (Afghanurus) bajkovicus* Kluge: Kluge, 1997: 200 (larva; FE Russia).

**Material examined.** Holotype and paratypes (larvae) of *Paracinygmula zhiltzowae* Bajkova, 1975 = *Ecdyonurus bajkovicus* Kluge, 1986 (FE Russia; ZIN). Larvae, imagines and imagines reared from larvae (FE Russia, N Korea, S Korea; SPbU, SWU).

This species was originally described from larvae from the Far East of Russia (Bajkova, 1975) and Korea (Yoon & Bae, 1984). The adults were reared from larvae from the Far East of Russia and described by Kluge (1983). Soldan, on the other hand, collected the adult of the same species from North Korea in 1986 and described it under the name *Nixe subspinosus* Braasch & Soldan, 1988. Soldan also collected larvae and reared adults of *N. subspinosus* from North Korea (see Bae & Soldan, 1997).

This species was placed in the genus *Paracinygmula*, *Ecdyonurus*, or *Nixe*. The type species of *Paracinygmula* Bajkova, 1975 and the type species of *Nixe* Flowers, 1980 are undoubtedly congeneric with the type species of *Afghanurus* Demoulin, 1964.
(Kluge, 1988), and all of them can be placed in the genus *Ecdyonurus* Eaton, 1868 s.1.

**Ecdyonurus** (Afghanurus) joernensis Bengtsson, 1909

*Ecdyonurus joernensis* Bengtsson, 1909: 19 (female imago; Europe).

*Heptagenia mongolica* Bajkova & Varychanova, 1978: 111 (larva; Mongolia).

*Heptagenia dentata* Braasch, 1979: 69 (imago; Mongolia).


*Ecdyonurus* KUB: Yoon & Bae, 1984: 14 (larva; S Korea).


*Ecdyonurus (Afghanurus) joernensis* Bengtsson: Kluge, 1997: 200 (larva; Scandinavia, Russia, Mongolia).

**Material examined.** Numerous larvae, imagines and imagines reared from larvae (Europe, the Urals, Siberia, Mongolia, FE Russia, S Korea; SPbU, SWU).

This is a transpalearctic species occurring from Europe to East Asia. On its systematic position see discussion above, under *Ecdyonurus (Afghanurus) bajkova*; the usage of the generic name *Heptagenia* for this species is undoubtedly wrong.

**Epeorus curvatulus** Matsumura, 1931

*Epeorus curvatulus* Matsumura, 1931: 1477 (Japan); Imanishi, 1934: 392 (imago, larva; Japan); Imanishi, 1940: 250 (larva; N Korea, S Korea, Manchuria); Braasch & Soldan, 1988: 27 (N Korea); Kluge, 1997: 205 (larva).


*Epeorus* (s. str.) *anatolii* Sinitshenkova, 1981: 814 (larva; FE Russia); syn. n.; Kluge, 1995: 19 (type deposition).

*Epeorus rautianii* Sinitshenkova, 1982: 52 (larva, imago; Siberia) (synonymized with *E. anatolii* by Tshernova, 1987: 7); Tshernova et al., 1986: 117 (imago; Siberia); Kluge, 1995: 27 (type deposition).

**Material examined.** Larvae and imagines (S Korea, FE Russia; SWU, SPbU). Holotype (larva) of *E. anatolii* Sinitshenkova, 1981 (FE Russia; ZIN). Paratypes (larvae, imagines and imagines reared from larvae) of *E. rautianii* Sinitshenkova, 1982 (Siberia; ZIN).

In the original description of the subgenus Belovius Tshernova, 1981, this taxon was characterized by imaginal features only; a number of unrelated species of which important larval characters were unknown were placed there, *E. curvatulus* among them. Sinitshenkova (1981) gave a diagnosis of the subgenus Belovius based on larval characters: each of tergaliae of the pairs II-VII has a wide proximal lobe separated from remainder of tergalia by posterior costa. With this diagnosis, Belovius became a natural taxon. According to this diagnosis, *E. curvatulus* must be placed not in Belovius, as each tergalia of *E. curvatulus* has the posterior costa on its posterior margin. Based on this character, Sinitshenkova described *E. anatolii* as belonging not to Belovius, but to the subgenus Epeorus s. str.

**Epeorus** (Iron) aesculus Imanishi, 1934

*Epeorus aesculus* Imanishi, 1934: 384 (imago, larva partim; Japan); Imanishi, 1940: 250 (larva; N Korea).

*Iron aesculus* (Imanishi): Sinitshenkova, 1978: 50 (larva, imago; FE Russia); Tshernova et al., 1986: 120 (imago; FE Russia).


*Iron koreanicus* Braasch & Soldan, 1988: 25 (larva; N Korea), syn. n.

**Material examined.** Larvae, imagines and imagines reared from larvae (FE Russia, N Korea, S Korea; SPbU, SWU).

Originally *E. aesculus* was described from imagines and two forms of larvae tentatively attributed to this species (Imanishi, 1934). Sinitshenkova (1978) redescribed imagines and true larvae of *E. aesculus*, and distinguished it from *Iron maculatus* Tshernova, 1949. Kluge & TiuNova (1989) gave an additional description of this species. Soldan (pers. comm.) recently agreed that *Iron koreanicus* is conspecific with Kluge & TiuNova’s (1989) concept of *E. (I.) aesculus*.

**Family EPHEMERELLIDAE**

**Ephemerella** (Cincticostella) levandivovae Tshernova, 1952

*Ephemerella levandivovae* Tshernova, 1952: 274 (larva, FE Russia).

*Ephemerella orientalis* Tshernova, 1952: 279 (imago; FE Russia) (synonymy established by Tshernova et al., 1986: 138).

*Ephemerella* (Cincticostella) levandivovae Tshernova: Allen, 1971: 516 (larva, FE Russia); Tshernova et
al., 1986: 138 (imago; FE Russia); Kluge, 1995: 41 (type deposition).

*Ephemera (Cincticostella) castanea* Allen, 1971: 514 (larva; S Korea), syn. n.
*Cincticostella castanea* (Allen): Yoon & Bae, 1988b: 29 (larva, imago; S Korea).

Material examined. Lectotype and paralectotypes (larvae) of *Ephemera levanidovae* Tshernova, 1952 (FE Russia; ZIN). Larvae, imagines, and imagines reared from larvae (FE Russia, S Korea; SPbU, SWU).

We recognize this synonymy based on a good series of reared material of *E. (C.) levanidovae* and *E. (C.) castanea* from the type localities in the Far East of Russia and in Korea respectively. This species commonly occurs in clean mountain streams.

**Ephemera (Drunella) solida** Bajkova, 1980

*Ephemera trispina* na: Imanishi, 1940: 193 (larva; N Korea).
*Ephemera solida* Bajkova, 1980: 796 (larva; FE Russia).
*Ephemera (Drunella) solida* (Bajkova): Tshernova et al., 1986: 140 (imago; FE Russia); Kluge, 1997: 210 (larva; FE Russia).

Material examined. Larvae, imagines, and imagines reared from larvae (FE Russia, N Korea, S Korea; SPbU, SWU).

Previously the species described by Imanishi (1940) under arbitrary name “*Ephemera trispina na*” was incorrectly associated with *Ephemera triacantha* by Tshernova (1952). *E. (D.) solida* is distinguished from *E. (D.) triacantha* by the presence of stout setae on fore femora, lack of a longitudinal ridge on fore femora, and distinct colour pattern on thorax and abdomen. Previously, this species has been frequently misidentified as *E. (D.) triacantha* in faunistic studies in Korea.

**Ephemera (Drunella) triacantha** Tshernova, 1949

*Ephemera trispina* na: Imanishi, 1940: 194 (larva; N Korea).
*Ephemera triacantha* Tshernova, 1949: 151 (larva; Altai).
*Ephemera (Drunella) triacantha* (Tshernova): Edmonds, 1959: 546; Tshernova et al., 1986: 139 (imago; FE Russia); Kluge, 1997: 210 (larva; FE Russia).

*Ephemera (Drunella) trispina* Ueno: Yoon & Kim, 1981: 37 (S Korea).
*Drunella triacantha* (Tshernova): Yoon & Bae, 1988a: 166 (larva, imago; S Korea).

Material examined. Larvae, imagines, and imagines reared from larvae (FE Russia, N Korea, S Korea; PSU, SWU). Lectotype and paralectotype (larvae) of *E. tenax* Tshernova, 1952 (FE Russia; ZIN). See discussion under *E. (D.) solida*, above.

**Ephemera (Ephemera) dentata** Bajkova, 1967

*Ephemera dentata* Bajkova, 1967: 331 (larva; FE Russia); Kluge, 1995: 40 (type deposition).
*Ephemera (Ephemera) keijoensis* Allen, 1971: 526 (larva; S Korea), syn. n.
*Ephemera (Ephemera) dentata* Bajkova: Kluge, 1997: 212 (larva; FE Russia).

Material examined. Holotype (larva) of *E. dentata* Bajkova, 1967 (FE Russia; ZIN). Larvae (FE Russia; SPbU) and imagines reared from larvae (S Korea; SWU).

Based on the examination of type material of *E. dentata* and a good series of reared material of *E. (E.) keijoensis* from the type locality (Seoul, Korea), we established the above synonymy.

**Ephemera (Ephemera) kozhovi** Bajkova, 1967

*Ephemera kozhovi* na: Imanishi, 1940: 202 (larva; N Korea) (associated with *E. notofascia* by Yoon & Bae, 1988b).
*Ephemera kozhovi* Bajkova, 1967: 327 (larva, imago; FE Russia); Kluge, 1995: 40.
*Ephemera (Ephemera) kozhovi* Bajkova: Tshernova et al., 1986: 138 (imago; FE Russia); Kluge, 1997: 212 (larva; FE Russia).
*Ephemera notofascia* Yoon & Bae, 1988b: 34 (larva; S Korea), syn. n.

Material examined. Holotype and paratypes (imagines and larvae) of *E. kozhovi* Bajkova, 1967 (FE Russia; ZIN). Holotype and paratypes (larvae) of *E. notofascia* Yoon & Bae, 1988 (S Korea; SWU). Larvae, imagines and imagines reared from larvae (FE Russia, S Korea; SPbU, SWU).

We establish the above synonymy by comparison of the type specimens of both species.

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References


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