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Michael D. Hubbard
Florida A&M University

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THE MAYFLY FAMILY BEHNINGIIDAE (EPHEMEROPTERA:
EPHEMEROIDEA): KEYS TO THE RECENT SPECIES
WITH A CATALOG OF THE FAMILY

Michael D. Hubbard¹

ABSTRACT

Keys to the known Recent species of the mayfly family Behningiidae are presented. Also included is a catalog of references to the genera and species of the Behningiidae, along with indications of described stages and geographical distributions.

The mayfly family Behningiidae is one of the smallest families of the Ephemeroptera. It comprises only four genera: the three Recent genera *Behningia* Motaş & Băcesco, *Dolania* Edmunds & Traver, and *Protobehningia* Tshernova, and the Jurassic fossil genus *Archaeobehningia* Tshernova. To date there are only seven described species in the family.

Although McCafferty (1991) recently elevated the Behningiidae to its own superfamily, he presented little data (McCafferty 1979, McCafferty & Edmunds 1976) to support his rationale and his arguments therefore remain unconvincing. I still consider the family to belong in the Ephemeroidea, and accordingly, following standard practice among mayfly workers, I have left it placed therein.

Keys to the known stages of the nymphs and imagoes of the Recent species of the Behningiidae are presented.

The catalog is intended to be a comprehensive, but certainly not exhaustive, listing of references in the scientific literature to all known species of the Behningiidae. Included with each species are indications of the geographic distributions listed in the scientific literature. Listed with the references to taxonomic papers are indications of the stage described or figured. Only selected taxonomic references are given for each genus.

This paper is one in a continuing series of catalogs of the Ephemeroptera (c.f. Hubbard & Pescador 1978, Hubbard & Peters 1978, Hubbard 1979, 1982a, 1982b, 1986, 1987, 1990, Hubbard & Savage 1981, Hubbard, Dominguez & Pescador 1992).

Family Behningiidae Tshernova, 1938
Behningiidae Tshernova, 1938, 1938:131.

¹Entomology / Center for Water Quality, Florida A&M University, Tallahassee, FL 32307.

Genus *Archaeobehningia* Tshernova

Archaeobehningia Tshernova, 1977, 1977:94; Soldán, 1979, 72:636; Kaludina, 1980, 178:229; Tshernova, 1980, 178:33; Landa & Soldán, 1985, 4:99; Hubbard, 1987, 129:61; Peters & Gillies, 1991, p:211.

Type-species: *Archaeobehningia edmundsi* Tshernova, original designation.

***Archaeobehningia edmundsi* Tshernova**

Archaeobehningia edmundsi Tshernova, 1977, 1977:95, fig. 2, pl. 10 fig. 2 (nymph); Sinitshenkova, 1985, 211:22; Hubbard, 1987, 129:62; Peters & Gillies, 1991, p:211.

Archaeobehningia [sic] *edmundsi*; Sinitshenkova, 1984, p:63.

Distribution: Jurassic of Russian Transbaikal (fossil).

Genus *Behningia* Lestage

Behningia Lestage, 1930, 69:436; Tshernova, 1938, 1938:131; Lestage, 1938, 78:315; Tshernova, 1940, 1:130; Bertrand, 1954, p:254; Edmunds & Traver, 1959, 52:46; Tshernova & Bajkova, 1960, 39:415; Landa, 1969, 18:295; McCafferty, 1975, 101:451; Soldán, 1979, 72:636; Landa & Soldán, 1985, 4:99; Peters & Peters, 1986, 69:246; Tshernova et al. 1986, 1:111; Peters & Gillies, 1991, p:211.

Type-species: *Behningia ulmeri* Lestage, monotypy.

***Behningia lestagei* Motaş & Băcesco**

Behningia lestagei Motaş & Băcesco, 1937, 24:27, fig. 1-2 (nymph); Lestage, 1938, 78:315 (nymph); Motaş & Băcesco, 1940, 26:78, figs. 1-4, pl. 1 (nymph); Demoulin, 1952, 28(21):1; Demoulin, 1955, 91:207; Keffermüller, 1957, 7:254; Edmunds & Traver, 1959, 52:46, fig. 13-23 (nymph); Poprawska, 1960, 4:160; Tshernova & Bajkova, 1960, 39:410; Keffermüller, 1963, 12:323; Brodsky, 1974, 53:296, fig. 1g (adult); Koss & Edmunds, 1974, 55:324, pl. 12 fig. 138-139 (egg); Peters & Peters, 1977, 62:409; Tshernova, 1977, 1977:95; Soldán, 1979, 72:636; Puthz, 1978, 2:263; Fink, Soldán, Peters & Peters, 1991, 69:1083.

[?] *Behningia lestagei*; Bertrand, 1954, p:254, fig. 123 (nymph).

Behningia lestagei ?; Keffermüller, 1959, 19(5):8, pl. 4-7, 9-12 (male, female, nymph); Keffermüller, 1960, 19(8):6; Peters & Peters, 1986, 69:245.

Behningia ulmeri; Landa, 1969, 18:295, pl. 28 (male, female, nymph).

Behningia ulmeri [partim]; Kluge, 1989, pl. 5 fig.3-4 (nymph).

Distribution: Moldavia, Poland, Czechoslovakia, Romania.

***Behningia tshernovae* Edmunds & Traver**

Behningia ulmeri (?); Tshernova, 1938, 1938:132, fig. 1-4 (male).

Behningia ulmeri [partim]; Tshernova, 1940, 1:133; Kluge, 1989, pl. 5 fig.3-4 (nymph).

Behningia ulmeri ?; Demoulin, 1952, 28(21):1, fig. 5 (male); Tshernova, 1952, 3:248, figs. 20-24 (nymph); Tshernova, 1958, 37:73.

Behningia ulmeri; Bertrand, 1954, p:254, fig. 124 (male).

Behningia tshernovae Edmunds & Traver, 1959, 52:47, fig. 23-30 (male, nymph); Landa, 1969, 18:297; Peters & Peters, 1977, 62:409; Tshernova,

1977, 1977:95; Tiunova, 1986, p:21; Tshernova et al. 1986, 1:111, fig. 48(1-4) (male).

Distribution: Eastern Russia.

***Behningia ulmeri* Lestage**

"Nov. gen., nov. sp. ?" Behning, 1924, 1:252, fig. 33-34 (nymph).

"Merkwürdige Ephemeriden-Nymphe" Ulmer, 1924, 7:3, fig. 1-6 (nymph).

Behningia ulmeri Lestage, 1930, 69:436; Motaş & Băcesco, 1937, 24:25 (nymph); Lestage, 1938, 78:315 (nymph); Motaş & Băcesco, 1940, 26:78 (nymph); Demoulin, 1952, 28(21):1; Demoulin, 1955, 91:207; Keffermüller, 1957, 7:254; Edmunds & Traver, 1959, 52:46, fig. 22; Tshernova & Bajkova, 1960, 39:410; Peters & Peters, 1977, 62:410; Tshernova, 1977, 1977:95; Soldán, 1979, 72:636; Puthz, 1978, 2:263; Peters & Gillies, 1991, fig. 9, 12-13 (male).

Behningia ulmeri [partim]; Tshernova, 1940, 1:133; Kluge, 1989, pl. 5 fig.3-4 (nymph).

Behningia ulmeri ?; Klyutschareva, 1963, Zoologicheskii Zhurnal 42:1604.

[not] *Behningia ulmeri*; Tshernova, 1938, 1938:132, fig. 1-4; Bertrand, 1954, p:254, fig. 124 (male); Bertrand, 1954, p:254; Landa, 1969, 18:295, pl. 28 (male, female, nymph).

[not] *Behningia ulmeri* ?; Demoulin, 1952, 28(21):1, fig. 5 (male); Tshernova, 1952, 3:248, figs. 20-24 (nymph); Tshernova, 1958, 37:73.

Distribution: Russia.

Genus *Dolania* Edmunds & Traver

Dolania Edmunds & Traver, 1959, 52:46; Tshernova & Bajkova, 1960, 39:415; McCafferty, 1975, 101:451; Edmunds, Jensen & Berner, 1976, p:274; Berner, 1977, 22(1):48; Peters & Peters, 1977, 62:409; Landa & Soldán, 1985, S4:99; Berner & Pescador, 1988, p:259; Peters & Gillies, 1991, p:211.

Type-species: *Dolania americana* Edmunds & Traver, original designation.

***Dolania americana* Edmunds & Traver**

Dolania americana Edmunds & Traver, 1959, 52:46, figs. 1-16, 31-32 (nymph); Tshernova & Bajkova, 1960, 39:414; Edmunds, 1962, 12(5):17; Schneider, 1966, 29:205; Peters & Jones, 1973, p:246; Koss & Edmunds, 1974, 55, pl. 12 fig. 140-141 (egg); McCafferty, 1975, 101:451, fig. 1 (nymph); Edmunds, Jensen & Berner, 1976, p:276, fig. 42, 197, 202, 204, 424 (male, female, nymph); Berner, 1977, 22(1):48; Peters & Peters, 1977, 62:409; Tshernova, 1977, 1977:95; Soldán, 1979, 72:636, fig. 1-15 (male, female, nymph); Tsui & Hubbard, 1979, 67:119; Finn & Herlong, 1980, 91:102; Harvey, Vannote & Sweeney, 1980, p:211; Dakin & Felder, 1981, 64:454; Peters, 1982, 6:28; Sweeney & Vannote, 1982, 36:811; Basha & Pescador, 1984, p:205; Benke et al., 1984, 54:43; Fink, 1986, p:1; Peters & Peters, 1986, 69:245, fig. 1-3 (male, female); Peters, Peters & Fink, 1987, 65:3177; Berner & Pescador, 1988, p:259, pl. 14, fig. 14 (male, female, nymph, egg); Fink & Yasui, 1988, 17:448, fig. 1-9 (sperm); Peters & Peters, 1988, 97(5):8, 3 figs (male); Kluge, 1989, pl. 5 fig. 2 (nymph); Jacobs, 1990, 101:219; Fink, Soldán, Peters & Peters, 1991, 69:1083, fig. 3a-g, 6a-j, 7a-d (nymph); Peters & Gillies, 1991, p: fig. 8, 10-11 (male); Sweeney & Funk, 1991, 13:17; Peters & Peters, (in press).

Distribution: United States (Florida, Georgia, Louisiana, North Carolina, South Carolina, Wisconsin-Minnesota).

***Dolania* sp.**

Dolania sp. nov.; Sweeney & Funk, 1991, 13:18.

Distribution: United States (Alabama).

Genus *Protobehningia* Tshernova

Protobehningia Tshernova in Tshernova & Bajkova, 1960, 39:411; Peters & Peters, 1977, 62:410; Soldán, 1979, 72:636; Landa & Soldán, 1985, 4:99; Tshernova et al., 1986, 1:111; Peters & Peters, 1986, 69:246; Peters & Gillies, 1991, p:207.

Type-species: *Protobehningia asiatica* Tshernova, original designation.

***Protobehningia asiatica* Tshernova**

Protobehningia asiatica Tshernova in Tshernova & Bajkova, 1960, 39:413, fig. 1-3 (nymph); Peters & Peters, 1977, 62:410; Tshernova, 1977, 1977:95; Tiunova, 1986, p:21; Tshernova et al., 1986, 1:111; Kluge, 1989, pl. 5 fig. 1 (nymph); Peters & Gillies, 1991, p:207, fig. 7 (nymph).

Distribution: Far Eastern Russia.

***Protobehningia merga* Peters & Gillies**

Protobehningia merga Peters & Gillies, 1991, p:208, fig. A, 1-6 (male, nymphal exuviae).

Distribution: Thailand.

Key to the imagos of Behningiidae

(portions adapted from Peters & Gillies 1991)

1. Vein CuA of fore wings not forked; length of penes 3/5 to 4/5 length of abdomen *Protobehningia* (*Protobehningia merga*)
- Vein CuA of fore wings forked; length of penes 1/4 length of abdomen or less 2
- 2(1). Longitudinal veins form geminate pairs in fore wings; length of forceps nearly as long as length of penes *Behningia*, 3
- Longitudinal veins evenly spaced in fore wings; length of forceps 1/2 length of penes. *Dolania americana*
- 3(2). One longitudinal intercalary vein in fork of CuA₁ of fore wings (see Edmunds and Traver, 1959, fig. 24) 4
- Two longitudinal intercalary veins in fork of CuA₁ of fore wings *Behningia ulmeri*
- 4(3). Intercalary reticulations along hind margin of fore wings *Behningia lestagei*
- No intercalary reticulations along hind margin of fore wings *Behningia tshernovae*

Key to the nymphs of Behningiidae

1. Tarsi of fore legs fused to tibiae; tibiae of hind legs not reduced *Protobehningia*, 5
- Tarsi of fore legs not fused to tibiae; tibiae of hind legs reduced 2
- 2(1). Labial palp III less than $\frac{4}{5}$ length of palp II; galea-lacina of maxilla ovoid *Behningia*, 3
- Labial palp III subequal to longer than palp II; galea-lacinea of maxilla not ovoid. *Dolania americana*
- 3(2). Labial palp II at least $\frac{2}{3}$ as long as palp III *Behningia ulmeri*
- Labial palp II less than $\frac{2}{3}$ as long as palp III 4
- 4(3). Labial palp I subequal in length to palp III; labial palp I more than twice as long as broad *Behningia tshernovae*
- Labial palp I about $\frac{1}{20}$ length of palp III; labial palp I less than twice as long as broad. *Behningia lestagei*
- 5(1). Glossae and paraglossae with few (<5) long stout setae on ventral surface *Protobehningia asiatica*
- Glossae and paraglossae with more than 20 long stout setae on ventral surface *Protobehningia merga*

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