

***Baetis jaervii* sp. n. (Ephemeroptera: Baetidae) from northern Europe**

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Savolainen, E. 2009: *Baetis jaervii* sp. n. (Ephemeroptera: Baetidae) from northern Europe. — Entomol. Fennica 20: 182–185.

Baetis jaervii sp. n. is described and illustrated. The history and relationships of this taxon to related species are elucidated on the basis of literature and determinations of genetic distance and mtDNA barcodes. *B. jaervii* is the only representative of the *B. vernus* group found in northern Europe, the nymphs of which live in lakes. The population from northern Finland earlier assigned to *Baetis tracheatus* should be transferred to represent *B. jaervii*.

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Received 26 October 2007, accepted 26 June 2008

1. Introduction

Baetis macani was originally described from a pond 800 m a.s.l. from the alpine zone of Mount Saana in Finnish Lapland (Kimmins 1957, Macan 1957). Savolainen & Saaristo (1981) pointed out that the taxon called *B. macani* Kimmins has two forms of nymphs in Finland. One form lives in lotic waters and has narrow gills with invisible tracheae and the other form lives in lentic waters and has wider gills with conspicuous tracheae. Ingrid Müller-Liebenau, an authority of *Baetis* taxonomy, assigned both the lotic and the lentic form to *B. macani* (Müller-Liebenau 1969, pers. comm.), a practice followed by Bauernfeind & Humpesch (2001) and Jacob (2003).

In her review of northern European mayflies, Engblom (1996) called the form with broader gills living in lentic waters, recognized by Savolainen & Saaristo (1981), *B. macani* Kimmins, while she called the form with narrow gills and invisible tracheae living in lotic waters *B. bundyae* Lehmkuhl (1973). *B. bundyae* was de-

scribed from tundra ponds in arctic Canada.

Savolainen *et al.* (2007) measured the reproductive isolation between *Baetis* species living in northernmost Europe using allele frequencies of loci coding for enzymes. This result was confirmed using the CO1 gene of mtDNA (Ståhls & Savolainen, 2007).

It became apparent that the nymph form with narrow gills and invisible tracheae living in lotic waters is reproductively isolated from the form with broader gills and conspicuous tracheae living in lentic waters. The latter taxon is morphologically and genetically uniform, while the former may consist of two cryptic taxa, one of which seems to be conspecific with *B. bundyae* Lehmkuhl (Ståhls & Savolainen 2007). Molecular techniques have shown cryptic species in *B. rhodani* (Williams *et al.* 2006) and in *B. vernus* as well (Ståhls & Savolainen 2007).

The main point is that *B. macani sensu* Engblom (1996) must be a new species. Table 1 reviews the names used for the above taxa in the literature referred here.

Table 1. Names used in literature of the species discussed in this paper.

Lotic, nymphs have narrow gills	Lentic, nymphs have broad gills
<i>macani</i> (Kimmins 1957)	other form (Savolainen & Saaristo 1981)
<i>macani</i> (Müller-Liebenau 1969, Bauernefeind & Humpesch 2001, Jacob 2003)	<i>macani</i> (Müller-Liebenau 1969, Bauernefeind & Humpesch 2001, Jacob 2003)
<i>bundyae</i> (Engblom 1996)	<i>macani</i> (Engblom 1996)
<i>macani</i> (Savolainen et al. 2007, Ståhls & Savolainen 2007)	new species (Savolainen et al. 2007, Ståhls & Savolainen 2007)

2. *Baetis jaervii* sp. n.

Description. Larva, (Holotype): External morphology that of a typical *Baetis* larva. Coloration light brown all over. A pale median band extends from head to abdominal tergites. Lateral pale spots of varying shape on both sides of dorsum of thorax. Oblong pale spots on both sides of abdominal tergum. First apical tooth of mandible 3 x broader than the second tooth (Fig. 1). Gills long and broad; length extending over two abdominal segments; tracheae branching, highly conspicuous. Body length 7.5 mm, length of cerci 6 mm.

Adult male (paratype No. 1): Overall colouration very pale. Head and thorax light brown. Legs and cerci almost white, abdominal segments 1 through 6 very light, translucent, abdominal segments 7 through 10 slightly brownish. Forceps very light, almost white. Truncate process of forceps base (see Müller-Liebenau 1969) small,

unpigmented. The first segment conical, narrowing smoothly towards the apex. Terminal segment of forceps 1.5 times longer than broad (Fig. 2). Turbinate eyes pale, cream coloured, form as in *B. vernus*. Body length 7.5 mm, length of cerci 13 mm.

Type material. Holotype: larva, Finland, Lkoc, Muonio, Lake Törmäslommol, N 67°56'59", E 24°0'13", 26.VII.2006, leg. E. Savolainen. Paratype No. 1: adult male, Finland, Tb, Vesanto, Lake Keitele, N 62°55'47", E 26°4'45", 27.VII.1991, leg. E. Savolainen. Paratype No. 2: six larvae from locality of holotype, 26.VII.2006, leg. E. Savolainen. Paratype No. 3: five larvae from locality of paratype No. 1, 30.VII.2004, leg. E. Savolainen. Paratype No. 4: eight larvae, Finland, Sb, Lake Kallavesi, N 62°53'47", E 27°36'56", 27.VII.2004, leg. E. Savolainen. Paratype No. 5: 22 larvae, Finland, Lkoc, Muonio, Lake Särkijärvi, N 67°54'28", E 23°55'36", 11.VIII.2004, leg. E. Savolainen. Paratype No. 6: 23 lar-

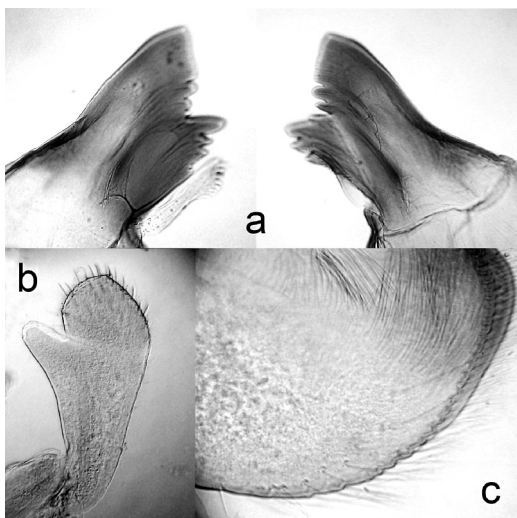


Fig. 1. *Baetis jaervii* sp. n. larva, paratype No. 7. – a. Mandibles. – b. Labial palp. – c. Labrum.

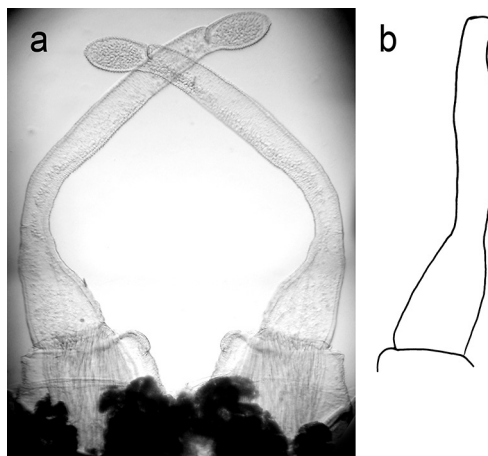


Fig. 2. *Baetis jaervii* sp. n. – a. Male forceps, paratype No. 8, photographed from below. – b. Male forceps, imago, paratype No. 1, lateral aspect of segments 1 and 2.

vae, Finland, Lkoc, Kittilä, river Jeesiöjoki, N 67° 39'24", E 25°32'43", 25.VII.2005, leg. E. Savolainen. Paratype No. 7: two larvae from the locality of paratype No. 1, 21.VII.1978, leg. E. Savolainen, embedded in euparal. Paratype No. 8: adult male from locality of paratype No. 1, 10.VIII.1968, leg. E. Savolainen, embedded in euparal.

All types are stored at coll. Kuopio Natural History Museum, Kuopio, Finland. With the exception of paratypes number 1, 7 and 8, parallel samples were made of all type specimens that were typed for mtDNA. These specimens are stored at coll. Finnish Museum of Natural History, Helsinki, Finland. The DNA barcodes are available at the EMBL Nucleotide Sequence Database with Accession Nos. AM4945594-AM4946688. Only two clearly related sequences were found within this material (Stähls & Savolainen 2007); in a similar fashion, morphological variation among paratypes was negligible.

Bionomy. Nymphs live in sedge belts or individual sedge tussocks along the shores of lakes. The environment is relatively poor in dissolved oxygen. The males swarm vertically in late July and early August 1–5 m above meadowlike shore vegetation.

Distribution. Found (as *B. macani*) in Denmark, Finland, Norway and Sweden (Engblom 1996); Degerman *et al.* (1994) give the distribution in Sweden. In Finland found from 61 ° N to 69.20 ° N.

Etymology. *Jaervii* is given to honor Dr. T.H. Järvi, a vendace biologist active in the lake region of Central Finland. It has a secondary meaning as well: the word for “lake”, the nymph habitat, is in Finnish *järvi*.

Diagnosis. *Baetis jaervii* sp. n. belongs to the *vernus* group (Müller-Liebenau 1969). Externally the nymph resembles that of *B. tracheatus*, but the number of setae in the front margin of labrum are different: *B. jaervii* sp. n. has 1+4 setae or more, while *B. tracheatus* has 1+2–3 (cf. Müller-Liebenau 1969, Bauernfeind & Humpesch 2001). The apical tooth of the first mandible is very broad in both *B. jaervii* sp. n. and *B. tracheatus*, up to 3 times or more broad than the second tooth. The corresponding apical tooth of *B. macani* is only slightly broader than the second one. The gills are relatively broader than the ones

of *B. macani*, provided with conspicuous, branched tracheae; in *B. macani* the tracheae are opaque with, at most, one central trachea visible. The pigmentation of larva may be variable, so that spots are not visible. The tracheae of young larvae may be narrow but the tracheae are always well visible. The uncorrected pairwise divergence between *B. jaervii* and *B. macani* at COI sequences was 13.1–14.4% (Stähls & Savolainen 2007).

The adults of *B. jaervii* sp. n. differ from the ones of *B. tracheatus* in the colour and shape of forceps and in the size and colour of eyes. The eyes of *B. jaervii* are pale and cream coloured. The first segment of forceps and forceps base are dark, the first segment of the forceps narrows smoothly between the base and apex, while in *B. tracheatus* the first segment is asymmetric and narrows abruptly; the eyes are small and ochre yellow in *B. tracheatus* (cf. Müller-Liebenau 1969 and Bauernfeind & Humpesch 2001). The nymph biotopes of *B. tracheatus* and *B. jaervii* sp. n. differ: the former lives in flowing and the latter in standing waters.

3. Discussion

As mentioned in the introduction, there has been constant confusion in the application of the name *B. macani*, even within a single paper. The nymph mandibles shown in Fig. 76 on p. 115 in Müller-Liebenau (1969) for *B. macani* are evidently the ones of *B. jaervii* sp. n.; likewise Morihara & McCafferty (1979) show in Fig. 5 the mandibles of *B. jaervii* sp. n. and state that they are the ones of *B. macani macani*, while their mandibles of *B. macani bundyae* (Fig. 6) agree exactly with the ones of *B. macani* Kimmins. Engblom (1996) shows in Fig. 40a the nymph mandibles of *B. jaervii* sp. n. as the ones of *B. macani*, while she uses the name *B. bundyae* for *B. macani*.

B. bundyae has been found in flowing water in arctic Canada (e.g. Cobb & Flannagan 1980, Harper & Harper 1997, Giberson *et al.* 2007); it has an extensive distribution extending south along the Rocky Mountains. Morihara & McCafferty (1979) pointed out that the morphological characters of *B. bundyae* Lehmkuhl overlapped with the ones of *B. macani* Kimmins and placed it as a subspecies of *B. macani* Kimmins.

McCafferty (1994) reversed, however, this opinion and re-established *B. bundyae* as a *bona species*. Ståhls and Savolainen (2007) used barcodes to demonstrate that *B. macani/bundyae* is made up of two related forms, one of which is found both in North America and Europe, while the other has been found in Europe only.

In Finnish entomological literature, males of *B. jaervii* sp. n. have been incorrectly assigned to *B. scambus* (Müller-Liebenau & Savolainen 1975). The males of *B. jaervii* sp. n. resemble the ones of *B. scambus*. The turbinate eyes of *B. scambus* are, however, sepia brown and the overall colouration is darker brown.

Savolainen & Saura (1996) reported *B. tracheatus* from the eutrophic, slowly flowing, river Jeesiöjoki in Kittilä in Lapland. The individuals taken from slowly flowing water differ slightly in morphology from the ones in standing water. Savolainen *et al.* (2007) and Ståhls & Savolainen (2007) have shown, using genetic distance and mtDNA barcodes, that the samples assigned to *B. tracheatus* from Lapland are conspecific with *B. jaervii* sp. n.

Acknowledgements. I thank Dr. Anssi Saura for a collaboration extending for four decades, including this study. Dr. Gunilla Ståhls has collaborated in barcoding the *Baetis vernus* group that has been an invaluable help in this species designation. Dr. Pertti Renvall has introduced me to the principles of taxonomy and encouraged me; Mr. Jukka Tuononen has made the photographs. Dr. Ilari Sääksjärvi has suggested several improvements to the manuscript that I gratefully acknowledge. I also wish to thank Dr. Donna Giberson for helpful comments. The Finnish Ministry of Environment has given financial support within a project involved in mapping threatened animal species in Finland.

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