

## Aquatic Insects of the Rivers of the Western Polar Urals (Russia)

OLGA LOSKUTOVA

Institute of Biology, Komi Science Centre, Russian Academy of Sciences, 28 Kommunisticheskaya Str., 167982, Syktyvkar, Komi, Russia; e-mail: loskutova@ib.komisc.ru

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**Abstract:** The fauna of aquatic insects of European North-East was studied. Geographical position of the Ural on the border of the Europe and Asia causes a great interest in the study of entomofauna of this region. Larvae of insects were obtained from the benthos and adults were collected from entomological samples by the author in 1993-1995, 1999 and 2002. Three different groups of aquatic insects were determined: mayflies (27 species), stoneflies (22 species) and caddisflies (34 species). Widespread and European species dominated in the fauna, however some Siberian species also occurred. During the study period, dipterans (chironomids and blackflies) formed more than half of total numbers of bottom invertebrates. However, caddisflies and mayflies often dominated in the biomass.

**Key words:** mayflies, stoneflies, caddisflies, Ural rivers, aquatic insects.

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### Introduction

The staff of Institute of Biology in July-September of 1955-1956 conducted earlier hydrobiological studies in the Polar Urals. Popova (1959, 1962) has published the results of this work. The long-term benthos studies in the Kozhim River (1982–1987), associated with mineral extraction were revealed in the articles by Shubina and Loskutova (1991, 1992, 1994). There are no literature data on the benthos of the Vangyr River. However, there present few data on invertebrate fauna of the B. Synya basin (Chernova, 1941; Popova, 1962; Shubina, Estafiev, 1998; Shubina, 2002) and the Kara basin (Shubina, Shubin, 2003).

### Methods

The study area comprises the territory of the Komi Republic and the Nenets Autonomous District (Figure 1). We studied benthic insects of the large rivers of the Polar Urals attributed to the Usa River basin in July-August of 1993-1995 and 2002 – the Kosju, the Kozhim, the Vangyr, the Bolshaya Synya. The author performed hydrobiological research in the Kara River in 1999. All studied rivers begin from the Ural Ridges. They have rocky banks, boulder or

pebble bottom, high speed and low temperature (9-14<sup>0</sup>C in July) in their upper and middle reaches. They turn into terrain rivers only in lower reaches.

The Kosju, Vangyr and Bolshaya Synya rivers were studied from source to mouth. On the Kozhim River, hydrobiological studies were conducted from the mouth of Durnaya River (70 km from the mouth) and in sub-mouth part (near railway bridge). Benthos of the Kara River was studied in upper and middle reaches.

Samples were taken by use of hydrobiological scraper. At the same time imagines of aquatic insects were caught by entomological scoop net. The collection of imagines included about 850 specimens. Some larvae from the 185 hydrobiological samples were determined.

We estimated species composition of caddisflies, mayflies and stoneflies as the most representative groups of bottom fauna of the Ural rivers falling into the Pechora River, using the keys of Ivanov, Grigorenko (2001), Kluge (1997), Lillehammer (1988), Zhiltzova, Teslenko (1997) and Zhiltzova (2003).

### Results

The benthos of all studied rivers dominated by the larvae of aquatic insects – dipterans

(blackflies, chironomids), mayflies, stoneflies and caddisflies. These groups formed in total 77.7 - 99.4 % of the total number and 62.8 - 99.7 % of the total biomass of the benthos (Table 1). In the Kosju River mouth Popova (1962) also mentioned dragonfly larvae.

The fauna consisted mainly of rheophilic cold-preferring species (Table 2). Thus, mayflies of the Kosju River and its tributaries were dominated by *Baetis lapponicus* and *B. rhodani* (40 % of total mayflies), *Cinygma lyriformis* (12.4 %), *Ecdyonurus joernensis* (5.0 %). 71.5 % of caddisflies were juveniles and 18.5% of them were pupae of *Apatania crymophila*. *Rhyacophila nubila* and *Mystrophora* sp. were rare. Stoneflies of *Arcynopteryx compacta* and *Capnia* juv. were dominated both by number and frequency. *Elmis aenea* and *Oulimnius tuberculatus* were the commonest beetles.

Caddisflies contributed a large part of the biomass of the benthos of the Synya River. Larvae formed 37.4% and pupae 10% of the total benthos biomass. Most caddisflies species were in the upper reaches of the river. Biomass in the upper courses was dominated by *Arctopsyche ladogensis* and *R. nubila*, in the middle reaches by *Hydropsyche nevae*. Considerable number of boulders in the middle reaches was inhabited by *Brachycentrus subnubilus*. Numerous emergences of caddisflies *Potamophylax latipennis*, *P. cingulatus* and *R. nubila* occurred during our studies in upper courses. Some species (*Polycentropus flavomaculatus*, *Hagenella clathrata*, *Apatania stigmatella*, *Glossosoma intermedium*, *Plectrocnemia conspersa*) were identified as imago. The role of stoneflies in the benthos is low in summer, although they were

widespread in streams with low orders. Dominating forms in the upper courses of the Bolshaya Synya were mature larvae of genus *Leuctra*. Simultaneously we registered also single male imagoes of *L. digitata*. Apparently, the larvae belong to the abundant genus *Leuctra* (*L. fusca* and *L. digitata*), which flies out in August-October in the Pechora tributaries. A lot of egg-laying females of *Amphinemura borealis* were registered during the study period. The benthos of lower and middle reaches dominated by young larvae *Capnia*. Mayflies *Ephemerella aurivillii* were abundant in the upper reaches, less abundant were adult insects *Siphonurus lacustris*, *S. alternatus*, *Heptagenia sulphurea* and *Parametetus chelifer*. The benthos of the Synya River dominated by the larvae of *Baetis fuscatus*, *B. feles*, *H. sulphurea* and *E. aurivillii*. Among other insects, wide spread larvae and imagines *Elmidae* can be mentioned.

Mayfly's larvae dominated in the benthos of the Kara River (49.1% of number and 70.3 % of benthos biomass). Nymphs of *B. lapponicus* revealed high number (up to 4000 individuals/m<sup>2</sup>). In littoral, stones were completely covered by sub-imago and imago of this species. *B. lapponicus* was especially numerous in small brooks flowing into the Kara river. *B. fuscatus*, *B. vernus* and young *Ephemerella* larvae were also numerous, the number of *Metretopus borealis* was high on overgrows boulders. Among stoneflies, we found larvae *A. compacta*, as well as young larvae *Capniidae* and *Leuctridae*. Caddisflies had less considerable proportion in the benthos of upper reaches. In middle reaches, *Micrasema* sp. and *P. latipennis* were common.

Table 1. Contribution of aquatic insects in the studied rivers: 1 – share in number (%); 2 – share in biomass (%).

Part of watershed of studied Rivers	Mayflies		Stoneflies		Caddisflies		Blackflies		Chironomids	
	1	2	1	2	1	2	1	2	1	2
<b>Kosju</b>										
Upper	6.2	17.5	1.3	1.4	8.8	33.7	2.0	3.9	72.1	36.5
Middle	9.0	9.1	1.3	0.6	1.0	2.4	74.9	81	12.6	3.5
Lower	0.5	1.3	0.2	0.6	9.1	3.8	0.1	0.2	85.9	12.1
<b>Vangyr</b>										
Upper	14.1	11.3	0.8	0.2	1.4	17.1	25.3	57.4	41.2	11.6

Middle	8.4	13.0	0.9	0.9	3.8	15.9	7.9	19.8	75	23.4
Lower	18.5	18.5	0.9	0.4	0.7	12.7	39.6	58.9	37.4	8.8
<b>Kozhim</b>										
Middle	2.9	2.4	0.2	0.5	2.1	13.4	42.1	73.8	52.1	9.6
Lower	2.6	5.9	0.9	2.8	29.8	27.9	1.3	3.3	59.3	49.6
<b>Bolshaya Synya</b>										
Upper	14.2	14.3	1.5	1.0	1.0	47.4	9.1	21.4	57.8	10.2
Middle	2.5	11.1	0.5	0.2	2.4	14.0	0.1	<0.1	72.2	37.5
Lower	1.8	14.3	0.2	0.2	0.1	0.2	0.2	0.4	81.5	60.2
<b>Kara</b>										
Upper	49.1	70.3	27.5	6.0	1.3	0.9	5.0	19.8	13.5	2.4
Middle	13.3	27.9	0.5	0.2	3.0	15.6	-	-	78.5	48.7

Table 2. Composition and distribution of aquatic insects in the rivers of the Western Polar Urals:

Legends: (+) – data from literature sources (Chernova, 1941; Popova, 1959, 1962; Zhiltzova, Loskutova, 1986; Shubina, Loskutova, 1994; Shubina, 2003); + - species found in benthos samples; \* - species identified by adults.

Family, species	Tributaries of the Pechora, various level				Kara
	Kosyu	Kozhim	Vangyr	B.Synya	
1	2	3	4	5	6
<b>Ephemeroptera</b>					
Ameletidae					
<i>Ameletus inopinatus</i> Eaton	+	(+)	+	(+)	-
Siphonuridae					
<i>Siphonurus alternatus</i> Say	(+)	(+)	-	+*	(+)
<i>Siphonurus lacustris</i> Eaton	-	-	-	+*	-
<i>Parameletus chelifera</i> Bengtsson	-	(+)	-	(+)*	-
<i>Parameletus</i> sp.	-	(+)	-	-	-
Metretopodidae					
<i>Metretopus borealis</i> (Eaton)	-	(+)	-	(+)	(+)
Baetidae					
<i>Centroptilum</i> sp.	(+)	-	-	-	-
<i>Baetis muticus</i> (L.)	+	-	+	(+)	-
<i>B. niger</i> (L.)	-	+	-	-	-
<i>B. lapponicus</i> (Bengtsson)	+	(+)	+	(+)	+
<i>B. rhodani</i> (Pictet)	+	(+)	+	-	-
<i>B. fuscatus</i> (L.)	+	(+)	+	+	+
<i>B. scambus</i> Eaton	-	(+)	-	-	-
<i>B. feles</i> Kluge	-	-	-	+	+
<i>B. vernus</i> Curtis	-	(+)	+	(+)	(+)
<i>Procloeon bifidum</i> Bengtsson	-	-	-	(+)	-
Heptageniidae					
<i>Ecdyonurus joernensis</i> Bengtsson	+	(+)	+	(+)	(+)
<i>H. sulphurea</i> Muller	+	-	+	(+)*	-
<i>Heptagenia dalecarlica</i> Bengtsson	+	(+)	+	(+)	-
<i>H. flava</i> Rostock	(+)	(+)	-	-	-
<i>Heptagenia</i> sp., juv.	-	-	-	-	+
<i>Cinygma lyriformis</i> McDunnough	+	(+)	+	-	-

Table 2. Continued

1	2	3	4	5	6
Leptophlebiidae					
<i>Paraleptophlebia weneri</i> (Ulmer)	+	-	-	-	-
<i>Leptophlebia</i> sp., juv.	-	-	-	-	+
Ephemerellidae					
<i>Ephemerella aurivillii</i> Bengtsson	-	(+)	+	+*	(+)
<i>E. ignita</i> (Poda)	(+)	-	-	(+)	-
<i>E. mucronata</i> (Bengtsson)	-	(+)	+	(+)	-
<i>Ephemerella</i> sp., juv.	+	(+)	+	-	-
Caenidae					
<i>Caenis rivulorum</i> Eaton	-	(+)	+	+	-
<i>Brachycercus</i> sp.	(+)	-	-	-	-
<b>Plecoptera</b>					
Perlodidae					
<i>Acynopteryx compacta</i> (McLachlan)	+	(+)	+	-	+
<i>Diura bicaudata</i> L.	-	(+)	-	-	-
<i>D. nanseni</i> (Kempny)	+	(+)	+	+	+*
<i>Isoperla grammatica</i> (Poda)	+	-	+	-	-
<i>I. obscura</i> (Zetterstedt)	+	(+)	+	-	+*
Chloroperlidae					
<i>Siphonoperla burmeisteri</i> (Pictet)	-	-	-	+*	-
<i>Xanthoperla apicalis</i> (Newman)	+	-	-	-	-
Taeniopterygidae					
<i>Taeniopteryx nebulosa</i> (L.)	+	(+)	-	+	-
Nemouridae					
<i>Amphinemura borealis</i> (Morton)	+	(+)	+	+*	+
<i>A. standfussi</i> Ris	-	(+)	-	-	-
<i>Nemoura arctica</i> Esben- Petersen	-	(+)	-	-	*
<i>N. cinerea</i> (Retzius)	-	(+)	-	-	-
<i>N. sahlbergi</i> Morton	-	(+)	-	-	-
<i>Nemurella pictetii</i> Klapalek	+	(+)	+	-	-
<i>Protonemura</i> sp.	-	-	+	-	-
Capniidae					
<i>Capnia atra</i> Morton	-	(+)	-	-	-
<i>C. pygmaea</i> Zetterstedt	-	(+)	-	-	-
<i>C. vidua</i> Klapalek	+	(+)	-	-	-
<i>Capnia</i> sp., juv.	-	-	-	+	+
<i>Mesocapnia variabilis</i> (Klapalek)	-	(+)	-	-	*
Leuctridae					
<i>Leuctra digitata</i> Kempny	+	(+)	-	+	-
<i>L. fusca</i> L.	+	(+)	-	-	-
<i>L. hippopus</i> Kempny	+	(+)	+	+	-
<b>Trichoptera</b>					
Rhyacophilidae					
<i>Rhyacophila fasciata</i> Hagen	-	(+)	+	-	-
<i>R. nubila</i> Zetterstedt	+	(+)	+	+*	-
<i>Rhyacophila</i> sp.	+	+	+	+	-

Table 2. Continued

	1	2	3	4	5	6
Glossosomatidae						
<i>Glossosoma intermedium</i> Klapalek		-	-	-	+#	-
<i>Mystrophora altaica</i> Martynov		+	(+)	+	-	-
<i>Mystrophora</i> sp.		+	+	+	+	+
Hydroptilidae						
<i>Hydroptila</i> sp.		-	(+)	-	+	-
Psychomyiidae						
<i>Psychomyia pusilla</i> (Fabricius)		-	-	-	+	-
Polycentropodidae						
<i>Plectrocnemia conspersa</i> (Curtis)		-	-	-	*	-
<i>Polycentropus flavomaculatus</i> Pictet		+	-	+	+	-
Arctopsychidae						
<i>Arctopsyche ladogensis</i> (Kolenati)		+	(+)	+	+	+
Hydropsychidae						
<i>Hydropsyche nevae</i> (Kolenati)		+	+	-	+	-
Phryganeidae						
<i>Hagenella clathrata</i> Kolenati		-	-	-	*	-
<i>Phryganea bipunctata</i> (Retzius)		+	-	-	-	-
<i>P. grandis</i> L.		(+)	-	-	-	-
Leptoceridae						
<i>Athripsodes bilineatus</i> Linnaeus		-	-	+	+	-
<i>Ceraclea annulicornis</i> (Stephens)		+	(+)	+	-	-
<i>C. fulva</i> Rambur		(+)	-	-	-	-
Brachycentridae						
<i>Brachycentrus subnubilus</i> Curtis		+	(+)	+	+	-
<i>Micrasema</i> sp.		-	(+)	-	-	+
Lepidostomatidae						
<i>Lepidostoma hirtum</i> Fabricius		(+)	(+)	-	+	-
Apataniidae						
<i>Apatania crymophila</i> McLachlan		+	(+)	+	-	-
<i>A. majuscula</i> McLachlan		-	(+)	-	-	-
<i>Apatania stigmatella</i> (Zetterstedt)		-	-	-	*	-
<i>Apatania</i> sp.		+	(+)	+	+	+
Beraeidae						
<i>Beraeodes minutus</i> L.		+	-	-	-	-
Limnephilidae						
<i>Anabolia laevis</i> Zetterstedt		(+)	-	-	-	-
<i>Anisogamodes flavipunctatus</i> Martynov		-	(+)	-	-	-
<i>Asynarchus lapponicus</i> Zetterstedt		-	(+)	+	-	-
<i>Dicosmoecus palatus</i> (McLachlan)		-	-	-	-	*
<i>Grammotaulius nigropunctatus</i> Retzius		(+)	-	-	-	-
<i>Grammotaulius</i> sp.		-	-	+	-	-
<i>Halesus</i> sp.		-	+	-	-	-
<i>Limnephilus borealis</i> (Zetterstedt)		-	-	-	+	-
<i>L. extricatus</i> McLachlan		-	-	-	+#	+
<i>L. rhombicus</i> L.		(+)	-	-	-	-
<i>Limnephilus</i> sp.		+	(+)	+	-	-
<i>Potamophylax cingulatus</i> Stephens		-	-	-	*	-
<i>P. latipennis</i> (Curtis)		+	(+)	+	+#	(+)

## Conclusions

Faunal investigation of aquatic insects in the Polar Ural River revealed the presence of 83 species from 3 orders: mayflies (27 species), stoneflies (22 species) and caddisflies (34 species). 21 species are new for the Polar Ural River. Widespread and European species dominated in the fauna, however some Siberian species also occurred. 9 species have northern European populations and widely occur in Siberia. These are *Baetis feles*, *Cinygma lyriformis* (Ephemeroptera), *Mesocapnia variabilis* (Plecoptera), *Arctopsyche ladogensis*, *Hydropsyche nevae*, *Dicosmoecus palatus*, *Apatania crymophila*, *A. stigmatella*, *Mystrophora altaica* (Trichoptera).

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