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The caddisflies (Insecta, Trichoptera) of the Us river basin in the Western Sayan mountains, Russia

Ручейники (Insecta, Trichoptera) бассейна реки Ус, Западный Саян (Россия)

V.V. Zaika
В.В. Заика

Tuvinian Institute for Exploration of Natural Resources of Siberian Branch of the Russian Academy of Sciences, Internatsionalnaya Str. 117a, Tyva Republic, Kyzyl 667007 Russia; Tuvan State University, Lenina Str. 36, Tyva Republic, Kyzyl 667000 Russia. E-mail: odonta@mail.ru.
Тувинский институт комплексного освоения природных ресурсов СО РАН, ул. Интернациональная 117а, Республика Тыва, Кызыл 667007 Россия; Тувинский государственный университет, ул. Ленина 36, Республика Тыва, Кызыл 667000 Россия.

Ключевые слова: Trichoptera, фауна, бассейн р. Ус, Западный Саян.

Key words: Trichoptera, fauna, the Us river basin, Western Sayan.

Abstract. This study is based on the author's collection of data from the Us river basin between 2013 and 2023. The Us River is a right tributary of the Yenisei River, and the Aradanka and Koyard tributaries belong to the southern macroslope of the Western Sayan. The study covered 53 km of the river's total length of 236 km, primarily during the months of June to October. A total of 387 larvae, 316 male imagoes and 692 female imagoes belonging to 54 species were collected. The most common species found in all river sections were *Brachycentrus americanus* (Banks, 1899) and *Apatania stigmatella* (Zetterstedt, 1840). The *Glossoma ailtaicum* (Martynov, 1914) species were recorded as being widespread. A comparison of the species composition of the Nizhnyaya Buiba River and the Us River according to the Sorensen-Chekanovsky index showed an equality of 0.3. The similarity of the Us river's species composition with that of the Aradanka and Koyard rivers is lower, at 0.15 respectively. The Us River's species diversity similarity index with the rivers of the northern macroslope of the Western Sayan is 0.41, and with the Upper Yenisei it is 0.40.

Резюме. В основу данной работы положены сборы автора за период 2013–2023 гг. в бассейне реки Ус, являющейся правым притоком р. Енисей, с её притоками Араданка и Коярд, относящимися к южному макросклону Западного Саяна. Исследованиями охвачено 53 км из её общей длины в 236 км. Пробы отбирались в основном в июне–октябре. Было собрано 387 личинок, 108 домиков, 40 куколок, а также 316 имаго самцов и 692 самок, относящихся к 54 видам. Самыми распространёнными и многочисленными на всех участках рек, оказались *Brachycentrus americanus* (Banks, 1899) и *Apatania stigmatella* (Zetterstedt,1840). Высокая численность была зарегистрирована также у вида *Glossoma ailtaicum* (Martynov, 1914). Сходство видового состава р. Нижняя Буйба в целом и метаритрали р. Ус по индексу Соренсена-Чекановского равно 0,3, а сходство с гипоритралью рек Араданка и Коярд — 0,4 и 0,5 соответственно. В то же время сходство видового состава р. Ус с реками Араданка и Коярд гораздо меньше: по 0,15 для обеих рек. Индекс сходства видового разнообразия р. Ус с реками северного макросклона Западного Саяна равен 0,41, а с Верхним Енисеем — 0,4.

Introduction

Caddisflies (Trichoptera) are the third component of the most widespread group of amphibiotic insects in mountain rivers — the so-called EPT Indicator Complex: Ephemeroptera-Plecoptera-Trichoptera. Not only is their species composition a prerequisite for the existence of mountain stream ecosystems, it is also a useful subject for studying the biogeographical connections of the Altai-Sayan mountain area with other regions.

This paper examines the characteristics of caddisfly species diversity within the middle reaches of the Us River and its main tributaries: the Nizhnyaya Buiba, Aradanka and Koyard rivers. The 236 km-long Us River is a right tributary of the Yenisei River. Studies were carried out along a 53 km stretch. Previous publications have covered amphibiotic insects in this area, including stoneflies [Zaika, 2018a], mayflies [Zaika, 2023], and caddisflies [Zaika, 2018b]. This publication only mentions 26 species of adult caddisflies from the Us river metarithral zone. Only two species were found in the Buiba river: *Rhyacophila sibirica* MacLachlan, 1879 and *Dicosmoecus palatus* (MacLachlan, 1872), as detailed in S.G. Lepneva's publication [Lepneva, 1948]. S.V. Dragan's study of the caddisflies in the Ergaki Nature Park [Dragan, 2020] provides information on the species composition of the water bodies and tributaries of the Nizhnyaya Buiba River. However, he only mentions one species in the channel: *Rhyacophila* sp.

The species composition of caddisflies in the Us River and its metarithral tributaries has generally been poorly studied. The aim of this paper is therefore to address this gap in knowledge.

Physical-geographical characterization of the study area

A detailed general characterisation of the area was provided in the article on mayflies [Zaika, 2018].

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Sampling sites were distributed from the source of the Nizhnyaya Buiba River to its confluence with the Us River, and further downstream of this large river (Fig. 1). ***Site 1*** included the epirhythral part of the Nizhnyaya Buiba River, where constituent streams with widths of 1–2 m, depths of up to 0.2 m, and velocities of ~0.5 m/s come to the surface. The average elevation is 1411 m and the coordinates are: 52°49' N, 93°18' E, and its total length is 32 km. Sampling ***site 2*** belongs to the head of the Nizhnyaya Buiba River, where a metarithral has formed. The width is ~0.7 m, the depth is up to 0.8 m and the velocity is ~1.5 m/s. The elevation above sea level is 1243 m and the coordinates are: 52°48' N, 93°17' E. ***Site 3*** refers to the middle reaches of the Nizhnyaya Buiba River, which also belongs to the metarithral zone. The width is ~15 m, the depth is 0.5–0.8 m and the velocity is 1.5 m/s. The elevation above sea level is 1005 m and the coordinates are: 52°42' N, 93°25' E. ***Site 4*** is the hyporythral zone of the Nizhnyaya Buiba River, located 200 metres from its confluence with the Us River. The width is approximately 20 m, the depth is greater than 1 m and the velocity is greater than 1.5 m/s. Samples were taken near the left bank at depths of 0.5–0.8 m. Elevation above sea level: 1007 m. Coordinates: 52°40' N, 93°30' E. ***Site 5*** is the metarithral of the Us River, located 15 km below the confluence with the Nizhnyaya Buiba River (see Fig. 2). The width is 30–40 m, the depth is 0.5–1 m and the velocity is ~1 m/s. The elevation above sea level is 880 m and the coordinates are 52°34' N, 93°26' E. ***Site 6*** is the hyporythral of the Aradanka River, a typical mountain stream which is 36 km long. It is approximately 50 m wide, 0.5–0.7 m deep and has a velocity of ~1.5 m/s in the pre-mouth area. The bottom is covered with stones of various sizes. Sampling was undertaken 1.5 km upstream of the mouth (Fig. 3), where the elevation is 870 m above sea level and the coordinates are 52°33' N, 93°26' E. ***Site 7*** is located on the Us River near the left bank, 300 m above the mouth of the Koyard River. The width is 70 m and the depth is 0.2–0.3 m with a velocity of ~1 m/s. The elevation above sea level is 819 m and the coordinates are 52°29' N, 93°26' E. ***Site 8*** is located on the Koyard River, which is also a typical mountain stream with a length of 41 km. Samples were taken from the hyporithral part of the pre-mouth area, from a rocky bottom where the width is about 15 m, the depth is up to 0.5 m and the velocity is ~1 m/s. The elevation below sea level is 844 m and the coordinates are 52°29' N, 93°26' E. ***Site 9*** is a metarithral on the left bank of the Us River, 500 m below the mouth of the Koyard River and 90 m wide. The sample was taken from a depth of 0.8 m near the shore, where the velocity is ~1 m/s. The elevation below sea level is 819 m and the coordinates are 52°29' N, 93°26' E. ***Site 10*** is on the right bank of the Us river. The width is 25 m and the velocity is greater than 1 m/s. The coordinates are 52°16' N, 93°13' E and the elevation above sea level is 727 m. The sample was taken from a depth of 0.8 m.

Materials and methods

The present work is based on the author's collection data from the Us river basin from 2013 to 2023, primarily during the months of June to October. A total of 387 larvae, 108 cases and 40 pupae, as well as 316 male adults and 692 female adults belonging to 54 species, were collected. These materials were deposited in the Bioresource Collection of the Shared Research Facility 'Fauna of the Central Part of the Altai-Sayan Ecoregion' at the Tuvinian Institute for Exploration of Natural Resources of SB RAS.

The larvae were collected using the standard hydrobiological methods for mountain rivers [Levanidova, 1982; Rukovodstvo..., 1992]. Adult caddisflies were captured by mowing the coastal vegetation and collecting them in an ultraviolet trap (OSRAM HWL (MBFT) 250 W 225 V Brasil K698), with the screen positioned amongst the coastal bushes.

The larvae were identified using the monographs of V.D. Ivanov et al. [2001] and S.G. Lepneva [1964, 1966], while the adults were identified using the Insect Identifier Key of the Russian Far East [Key..., 1997], as well as the following publications: Nozaki, Minakava [2004], Schmid et al. [1993], Vshivkova [1986] and Waringer and Graf [2013].

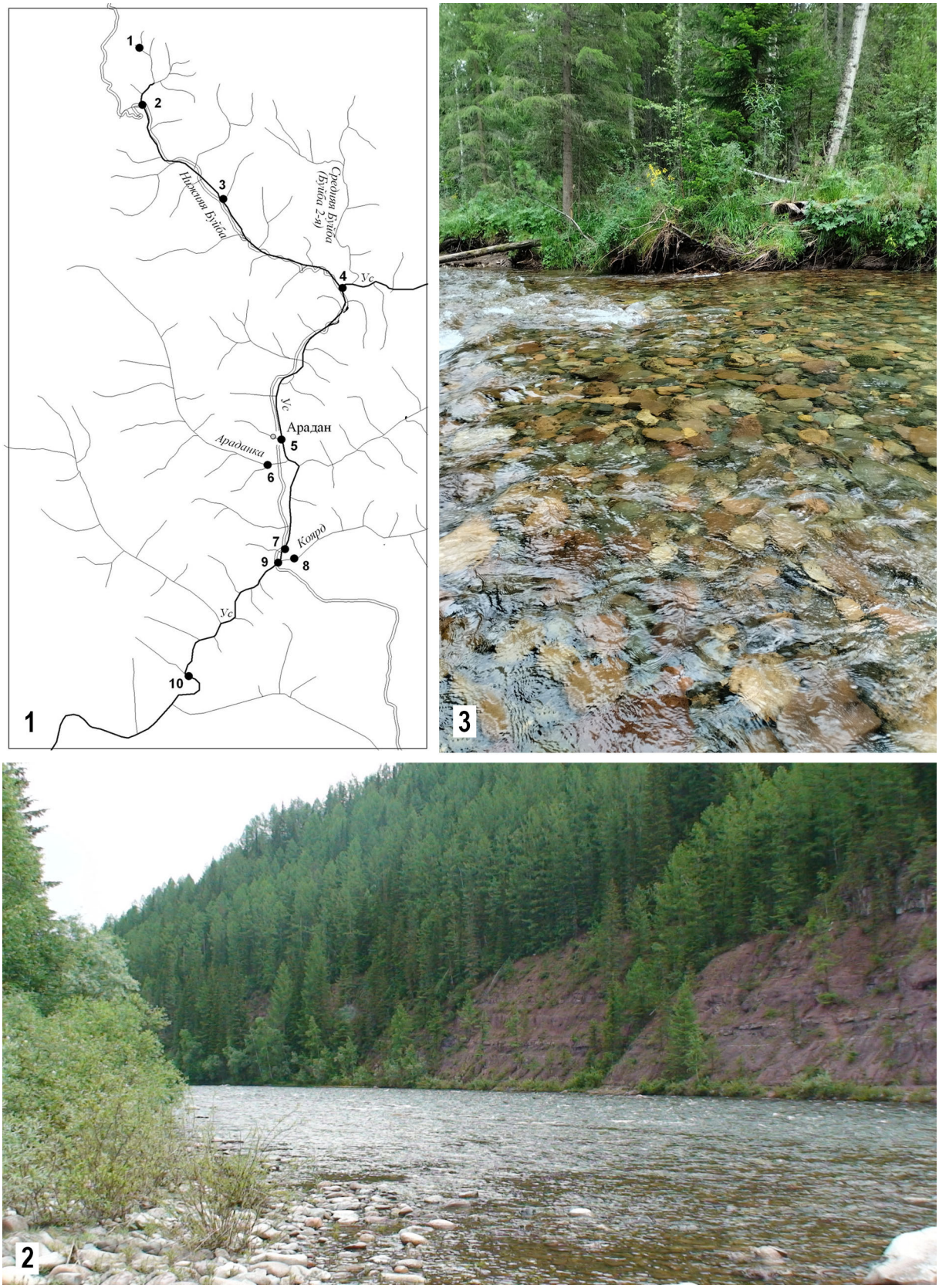
The Sorensen-Chekanovsky index [Pesenko, 1982] was used to compare the fauna of the studied regions, specific rivers and sampling sites. The caddis fly species used for comparison were listed in the following works: Zaika [2012] for the Eastern Sayan within the Upper Yenisei basin and Baturina [2015] for the northern macro-slope of the Western Sayan.

The present work is registered in ZooBank (www.zoobank.org) under urn:lsid:zoobank.org:pub:01B9A031-A670-4EC1-9012-34FD30374675

Results and discussion

A total of 55 caddis fly species belonging to 15 families were identified (Tables 1, 2) during a ten-year study of watercourses in the middle reaches of the Us river basin. Table 1 shows that the number of species is unevenly distributed among families. The Limnephilidae family has the highest number of species (16, or 29 %), followed by the Rhyacophilidae family (7, or 13 %), the Hydropsychidae and Glossosomatidae families (6, or 11 % each), the Apataniidae family (5, or 9 %), the Brachycentridae and Lepidostomatidae families (3, or 6 % each), and the Leptoctridae family (2, or 4 %). The remaining families have one species each.

Brachicentrus americanus and *Apatania stigmatella* were the most widespread and numerous species in all sections of the rivers. According to UV lamp light trap data at Point No. 5 carried out in summer in 2018 and 2022, the number of females and males of the first species was 283 and 106, respectively, and the number of the second species was 191 and 58, respectively. The *Glossoma ailtacum* species had a significantly smaller number of specimens (48 females and 18 males), and



Figs 1–3. The region of study and its habitats. 1 — map of the research area; 2 — metarithral of the Us river; 3 — hyporithral of the Aradanka river.

Рис. 1–3. Регион исследования и изученные местообитания. 1 — карта района исследований; 2 — метаритраль р. Ус; 3 — гипоритраль реки Араданка.

Table 1. Caddisfly in collections during 2013–2023
Таблица 1. Ручейники в общих сборах 2013–2023 гг

The number of specimens:	The Nizhnyaya Buiba	The Us (metarithral)	The Aradanka (hyporithral)	The Koyard (hyporithral)	Total number of copies in collections
larvae	59	213	96	19	387
cases	31	56	20	1	108
pupae	25	23	13	2	40
males	5	309		1	316
females	15	676			692
The number of species	16	55	8	8	

the number of other species ranged from one to tens of specimens.

Seven families are represented exclusively by rheophilic species, while the remaining families contain limnophilic species. It should be noted that some of these species are exclusively limnophilic because species from floodplain reservoirs and the basin's wetlands also flew into the UV lamp light trap. These species are marked with an asterisk in the species list. Regarding feeding types, predation on small benthos predominates in rheophilic species, while most other species are detritophagous, consuming litter, or phytophagous, consuming phytobenthos (including algophagous species) [Lepneva, 1949].

The earliest recorded breeding occurred in early June for *Brachycentrus americanus* and *Glossoma angaricum*, while the latest occurred during the last ten days of September for *Anisoptera obscurata*.

The predominance of species in the Limnephilidae family is explained by the fact that the largest number of species, 167, is found in the Limnephilidae family compared to other families in the Eastern Palaearctic. The second largest family is the Rhyacophilidae with 110 species [Moor, Ivanov, 2008]. In Siberia, these families are the leaders in terms of species numbers, with 159 and 49 species respectively [Ivanov, 2011]. They retain these leading positions in the surveyed watercourses, although the species numbers are an order of magnitude lower, which shows that further study of the territory is necessary.

Tables 1–2 show that the species composition of caddisflies in the Nizhnyaya Buiba and Us rivers is somewhat specific. Species such as *Micrasema gelidum*, *Limnephilus sparsus* and *Neophylax ussuricus* were only found in the Nizhnyaya Buiba. However, 30 species were only found in the Us River, namely: *Rhyacophila angulata, R. lata, Psychomyia flavida, Hydropsyche contubernalis, H. kozhantschikovi, H. pellucidula, Potamyia czekanovskii, Agapetus sp., Electragapetus sp.?, Glossoma angaricum, G. ussuricum, Hydroptila angulata, Phryganea bipunctata, Molannodes tinctus, Ceraclea excisa, Ceraclea annulicornis, Goerodes elongatus, Apatania crymophila, A. dalecarlica, Anabolia concentrica, Annitella obscurata, Asynarchus lapponicus, Halesus digitatus, Hydatophylax grammicus, H. nigrovittatus, Limnephilus rhombicus, L. sericeus, Phryganea bipunctata, Rhadicoleptus alpestris, Stenophylax lateralis*. The large number of species recorded in the Us River is explained by the fact that there was a stationary sampling point at one of the sampling sites on this river's metarithral. Species collection was carried out using a UV lamp throughout the caddisflies' flight period, revealing species that could not be detected by collecting larvae and mowing coastal vegetation at the stationary sampling point in other watercourses.

The Sorensen-Chekanovsky index values calculated for the metarithral species lists of the Us and Nizhnyaya Buiba rivers varied around 0.3 to evaluate their species diversity. Meanwhile, the similarity between the species composition of the Us river and that of the Aradanka and Koyard rivers is much smaller at 0.15. However, the similarity between the hyporihtral of the Nizhnyaya Buiba river and those of these rivers is 0.4 and 0.5 respectively. The species composition similarity between the Aradanka and Koyard rivers is 0.9, as their mouths are relatively close together. The Us river's low similarity with the aforementioned rivers can be explained by the differing conditions of their basins' formation.

The real interest lies in comparing the species diversity of caddisflies in the Us river basin, which is located on the southern macroslope of the Western Sayan, with the watercourses on the northern macroslope. The work of N.S. Baturina [2015] contains a list of caddisflies from the Kebezh river basin. This information enables us to evaluate the similarity between these two territories using the Sorensen-Chekanovsky index, which is equal to 0.41. The Us River is one of the largest right-bank tributaries of the Upper Yenisei; therefore, it is worthwhile to compare its biodiversity with that of the Upper Yenisei Basin, which comprises the Bolshoi and Malyi Yenisei rivers, located in Tuva [Zaika, 2012]. The similarity index is 0.40.

Conclusion

In summary, the analysis of the similarity of caddisfly faunas within the different basin systems of the Western Sayan confirms the previously made assumption that stoneflies and mayflies act as a barrier separating the river basins of the northern and southern

Table 2. Distribution of caddisfly species by family and river and their number in collections during 2013–2023
Таблица 2. Распределение ручейников по семействам, участкам рек и число их экземпляров в общих сборах 2013–2023 гг.

Family (number of species)	River Name				Total number of specimens in collections
	The Nizhnyaya Buiba	The Us (metarithral)	The Aradanka (hyporithral)	The Koyard (hyporithral)	
Rhyacophilidae (7)	*Rhyacophila kaltatica* Lev. et Schmid,1977, *R. impar* Martynov, 1914, *R. narvae* Navas, 1928, *R. sibirica* MacLachlan, 1879	*Rhyacophila angulata* Martynov, 1910, *R.kaltatica*, *R. impar*, *R. lata* Martynov, 1918, *R. narvae*, *R. sibirica*, *Rhyacophila* sp.	*R. sibirica*	*R. sibirica*	78 larvae 20♂♂, 24♀♀
Psychomyiidae (1)		*Psychomia flavida* Hagen, 1861?			1S
Arctopsychidae (1)	*Arctopsyche ladogensis* (Kolenati, 1859)				7 larvae 43♂♂, 3♀♀
Hydropsychidae (6)	*Hydropsyche newae* Kolenati,1858	*Hydropsyche contubernalis* MacLachlan, 1865, *H. kozhantschikovi* Martynov, 1924, *H. newae*, *H. pellucidula* (Curtis, 1834), Macronematinae?, *Potamyia czekanovskii* (Martynov, 1910)			12 larvae 1♂, 23♀♀
Glossosomatidae (1)	*Glossoma altaicum* (Martynov, 1914)	*Agapetus sp.*, *Electragapetus* sp.?, *G. altaicum*, *G. angaricum* (Levanidova, 1967), *G. intermedium* (Klapalek, 1892), *G. ussuricum* Martynov, 1934	*G. altaicum*	*G. altaicum*, *G intermedium*	57 larvae 23♂♂, 75♀♀
Hydroptilidae (1)		*Hydroptila angulata* Moseley, 1939			1S
Phryganeidae* (1)		*Phryganea bipunctata* Retz, 1783			2♂♂, 36♀♀
Molannidae (2)		*Molannodes tinctus* (Zetterstedt, 1840)			1♂
Leptoceridae (3)		*Ceraclea excisa* (Morton,1904), *C. annulicornis* (Stphens, 1836)			6♂♂, 1S
Brachycentridae (3)	*Brachycentrus americanus* (Banks, *B. subnubilus* Curtis, 1834), *Micrasema gelidum* MacLachlan, 1876	*B. americanus*, *B. subnubilus*, *Micrasema gelidum*	*B.americanus*	*B.americanus*	123 larvae 64 cases 27 pupae 118♂♂, 292♀♀
Lepidostomatidae (3)	*Goerodes albardanus* Ulmer, 1906, *Lepidostoma hirtum* Fabricius,1775	*G. albardanus*, *G. elongatus* Martynov, 1935, *Lepidostoma hirtum*	*G.albardanus*, *Lepidostoma hirtum*		77 larvae 2 cases 54♂♂, 28♀♀
Apataniidae (5)		*Apatania sp., A. crymophila MacLachlan, 1880, A. dalecarlica Forsslund, 1942, A. stigmatella* (Zetterstedt,1840)	*Allomyia sp.*	*Allomyia sajanensis* (Levanidova, 1967), *A. stigmatella*	29 larvae 20 cases 6 pupae 60♂♂, 193♀♀
Limnephilidae (16)	*Asynarchus amurensis* (Ulmer, 1905), *Dicosmoecus palatus* (MacLachlan, 1872), *Hydatophylax soldatovi* (Martynov, 1914), *Limnephilus sparsus* Curtis, 1834, Limnephilidae gen.	*Anabolia concentrica* (Zetterstedt, 1840), *Annitella obscurata* (MacLachlan, 1876), *Arctopora trimaculata* (Zetterstedt,1840), *Asynarchus amurensis*, *A. lapponicus* (Zetterstedt,1840), *Dicosmoecus palatus*, *Halesus digitatus* (von Paula Schrank, 1781), *H. tesselatus* (Rambur, 1842), *Hydatophylax grammicus* (MacLachlan, 1880), *H. soldatovi*, *H. nigrovittatus* (MacLachlan, 1872), *Limnephilus rhombicus* (Linnaeus,1758), *L. sericeus* (Say, 1824), Limnephilidae gen., *Rhadicoleptus alpestris* (Kolenati,1848), *Stenophylax lateralis* (Stephens, 1837)	*Arctopora trimaculata* (Zetterstedt,1840), *Asynarchus lapponicus*, *Dicosmoecus palatus*	*Dicosmoecus palatus*	84 larvae 15 cases 10 pupae 19♀♀, 19♂♂
Uenoidae (1)	*Neophylax ussuriensis* (Martynov, 1914)				1 larvae

macroslopes. Of particular interest is the possibility of another faunal barrier within the southernmost macroslope of the Western Sayan: the Kurtushubinsky ridge, which separates the Us river basin from the southern part of the Upper Yenisei basin.

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References

Baturina N. 2015. [Benthic invertebrates community of the watercourses of the North Altai and Western Sayan]. Diss... kand. biol. nauk. Novosibirsk. 200 p. [In Russian].

Dragan S.V. 2020. [Materials to the fauna of caddisflies (Insecta: Trichoptera) from streams and reservoirs of the Ergaki Natural Park (Western Sayan)] // Samara Journal of Science. Vol.9. No.3. P.54–57. [In Russian]. https://doi.org/10.17816/snv202093109

Ivanov V.D. 2011. Caddisflies of Russia: Fauna and biodiversity // Zoosymposia. No.5. P.171–209.

Ivanov V.D., Grigorenko V.N., Arefina T.I. 2001. Trichoptera // [Key to Freshwater invertebrates of Russia and adjacent lands]. Saint Peterburg: Nauka. P.8–72. [In Russian].

[Key to the insect of Russian Far East]. 1997. Trichoptera and Lepidoptera. Vol.5. Pt.1. Vladivostok: Dalnauka. P.10–206. [In Russian].

Lepneva S.G. 1948. [Larvae of caddisflies of the Yenisei river basin] // Izvestiya Biologo-geograficheskogo NII pri Irkutskom universitete. Vol.10. No.2. P.60–99. [In Russian].

Lepneva S.G. 1949. [Issues of ecological classification of caddisflies of watercources] // Entomologicheskoe Obozrenie. Vol.XXX. Nos 3–4. P.253–265. [In Russian].

Lepneva S.G. 1964. [Caddisflies. Larvae and pupae of Annulipalpia] // [Fauna of the USSR]. Vol.2. Pt.1. Moscow, Leningrad: Nauka. 565 p. [In Russian].

Lepneva S.G. 1966. [Caddisflies. Larvae and pupae of Integripalpia] // [Fauna of the USSR]. Vol.2. Pt.2. Moscow, Leningrad: Nauka. 563 p. [In Russian]

Levanidova I.M. 1982. Amfibioticheskie nasekomy`e gorny`x oblastej Dal`nego vostoka SSSR. Leningrad: Nauka. 214 p. [In Russian].

Moor F.C., Ivanov V.D. 2008. Global diversity of caddisflies (Trichoptera: Insecta) in freshwater // Hydrobiologia. Vol.595. P.393–407.

Nozaki T., Minakawa N. 2004. *Hydatophylax minor* sp. nov. (Trichoptera, Limnephilidae) from Hokkaido, Sakhalin and the South Kuril Islands // Biogeography. No.6. P.39–48.

Pesenko Yu.A. 1982. [Principles and methods of quantity analysis within faunal studies]. Moscow: Nauka. 287 p. [In Russian].

Rukovodstvo po gidrobiologicheskomu monitoringu presno-vodny`x e`kosistem, pod redakciej prof. V.A. Abakumova. 1992. Saint Petersburg: Gidrometeoizdat. 318 p. [In Russian].

Schmid F., Arefina T.I., Levanidova I.M. 1993. Contribution to the knowledge of the Rhyacophila (Trichoptera) of the sibirica group // Bulletin de L'institut Royal Des Sciences Naturelles de Belgique Entomologie. Vol.63. P.161–172.

Vshivkova T.S. 1986. [Caddisflies of family Glossomatidae Wall. (Trichoptera) of Far East of the USSR and sudfamily of Glossomatinae Wall.] // Donnye organizmy presnyh vod Dal`nego Vostoka. Vladivostok. P.58–75 [In Russian].

Waringer J., Graf W. 2013. Key and bibliography of the genera of European Trichoptera larvae // Zootaxa. Vol.3640. No.2. P.101–151. http://dx.doi.org/10.11646/zootaxa.3640.2

Zaika V.V. 2012. [Fauna and population of amfibiontic insects (Insecta, Ectognatha: Ephemeroptera, Plecoptera, Trichoptrera, Odonata) water flows of the Altai-Sayan mountain area]. Diss… doct. biol. nauk. Tomsk. 386 p. [In Russian].

Zaika V.V. 2018a. Stoneflies (Plecoptera) of the Us river basin of the Western Sayan // Euroasian Entomological Journal. Vol.17. No.1. P.18–25. [In Russian]. https://doi.org/10.15298/euroasentj.17.1.03

Zaika V.V. 2018b. [The caddis flies (Trichoptera) of the Us river basin of the Western Sayan] // Rucheiniki (Trichoptera) Rossii i sopredel'nych territorii: Materialy Vserossiiskogo nauchnogo seminara (s mezhdunarodnym uchastiem), posvyashchennogo 85-letiyu izvestnogo rossiiskogo trichopterologa Inny Ivanovny Kornouchovoi [Caddisflies (Trichoptera) of Russia and adjacent territories: Proceedings of the All-Russian scientific seminar (with international participation) dedicated to the 85th anniversary of the famous Russian trichopterologist Inna Ivanovna Kornoukhova]. Vladikavkaz: IPTC SOGU. P.47–51. [In Russian].

Zaika V.V. 2023. The mayflies (Ephemeroptera) of the Us river basinin the Western Sayan mountains, Russia // Euroasian Entomological Journal. Vol.22. No2. P.111–116. [In Russian]. https://doi.org/10.15298/euroasentj.22.02.11

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