

## Stoneflies (Plecoptera) of Northeast Asia and adjacent regions

### Веснянки (Plecoptera) Северо-Восточной Азии и сопредельных регионов

V.A. Teslenko\*, E.V. Khamenkova\*\*  
В.А. Тесленко\*, Е.В. Хаменкова\*\*

\* Federal Scientific Center of the East Asia Terrestrial Biodiversity FEB RAS, Prosp. 100-letiya Vladivostoka 159, Vladivostok 690022 Russia. E-mail: teslenko@biosoil.ru.

\*\* Федеральный научный центр биоразнообразия наземной биоты Восточной Азии ДВО РАН, пр. 100-летия Владивостока 159, Владивосток 690022 Россия.

\*\* Institute of the Biological Problems of the North FEB RAS, Portovaya Str. 18, Magadan 685000 Russia. E-mail: tauy@mail.ru.

\*\* Институт Биологических проблем Севера ДВО РАН, ул. Портовая 18, Магадан 685000 Россия.

**Key words:** species richness, Chukotka, Kamchatka, Magadanskaya Oblast, Yakutiya, Alaska, Yukon, Northwest Territories, Beringia.

**Ключевые слова:** видовое богатство, Чукотка, Магаданская область, Якутия, Аляска, Юкон, Северо-Западные территории, Берингия.

**Abstract.** The Northeast is a special region of the Asia, including the Chukotka, Yakutiya, Kamchatka and Magadanskaya Oblast, which along with Alaska (USA), Yukon and the Northwest Territories (Canada) were part of ancient Beringia in the past. Currently, a total of 156 stonefly species from 49 genera and 9 families with 61 species in the Asia and 104 species in American part are known for Beringia. Among them there are eight common species, *Capnia nearctica* Banks, 1918, *Eucapnopsis brevicauda* (Claassen, 1924), *Mesocapnia variabilis* (Klapálek, 1920), *Nemoura arctica* Esben-Petersen 1910, *Podmosta weberi* (Ricker, 1952), *Arcynopteryx dichroa* (McLachlan, 1872), *Diura bicaudata* (Linnaeus, 1758) and *Plumiperla diversa* (Frison, 1935), and 22 common genera, demonstrating important role of Beringia in intercontinental faunistic exchanges and in independent development of present West Nearctic and East Palearctic stonefly faunas. There are nine species, known to be endemic, namely: five American, *Mesocapnia bergi* (Ricker, 1965), *Podmosta weberi*, *Alaskaperla ovibovis* (Ricker, 1965), *Isoperla katmaiensis* Szczytko et Stewart, 1979 and *I. decolorata* (Walker, 1852), and four Asian species, *Capnia tshukotica* Zhiltzova et Levanidova, 1978, *C. levanidovae* Kawai, 1969, *C. kolymensis* Zhiltzova, 1979 and *C. kurnakovi* Zhiltzova, 1978. The species richness distribution in the Northeast Asia stonefly fauna corresponds to the general patterns and increases with the advancement from the Arctic deserts to the taiga zone and from the maritime monsoon climate to the continental one. The lowest species richness was noted in the tundra watercourses of the Chukotka, the greatest is in the streams and rivers of the taiga zone in the Magadanskaya Oblast. The richness of stonefly species in Kamchatka, located to the south, is poorer than the Magadanskaya Oblast due to paleogeographical events and volcanic activity of the Kamchatka-Koryak volcanogenic belt. The composition and similarity of regional faunas is briefly considered. The species *Paraleuctra cercia* (Okamoto, 1922) and *Plumiperla diversa* (Frison, 1935) are reported for Chukotka for the first time.

**Резюме.** Северо-Восток — особый регион Азии, включающий Чукотку, Республику Саха (Якутию), Камчатку и Магаданскую область, которые вместе с Аляской США,

Юконом и Северо-Западными территориями Канады в прошлом входили в состав древней Берингии. В настоящее время для Берингии известно 156 видов веснянок из 49 родов и 9 семейств, из них 61 вид в азиатской и 104 вида в американской части. Среди них восемь общих видов: *Capnia nearctica* Banks, 1918, *Eucapnopsis brevicauda* (Claassen, 1924), *Mesocapnia variabilis* (Klapálek, 1920), *Nemoura arctica* Esben-Petersen 1910, *Podmosta weberi* (Ricker, 1952), *Arcynopteryx dichroa* (McLachlan, 1872), *Diura bicaudata* (Linnaeus, 1758) и *Plumiperla diversa* (Frison, 1935), и 22 общих рода свидетельствуют о важной роли Берингии в межконтинентальном фаунистическом обмене и независимом развитии современной западно-неарктической и восточно-палеарктической фаун. Известно, что эндемичными являются девять видов: пять американских — *Mesocapnia bergi* (Ricker, 1965), *Podmosta weberi*, *Alaskaperla ovibovis* (Ricker, 1965), *Isoperla katmaiensis* Szczytko et Stewart, 1979 и *I. decolorata* (Walker, 1852), и четыре азиатских вида — *Capnia tshukotica* Zhiltzova et Levanidova, 1978, *C. levanidovae* Kawai, 1969, *C. kolymensis* Zhiltzova, 1979 и *C. kurnakovi* Zhiltzova, 1978. Распределение видового богатства фауны веснянок Северо-Восточной Азии соответствует общим закономерностям и увеличивается по мере продвижения от арктических пустынь к таёжной зоне и от морского муссонного климата к континентальному. Наименьшее видовое богатство отмечено в тундровых водотоках Чукотки, наибольшее — в ручьях и реках таёжной зоны Магаданской области. На Камчатке, расположенной южнее, видовое богатство веснянок меньше, чем в Магаданской области, что связано с палеогеографическими событиями и вулканической деятельностью Камчатско-Корякского вулканогенного пояса. Кратко рассмотрен состав и сходство региональных фаун. *Paraleuctra cercia* (Okamoto, 1922) и *Plumiperla diversa* (Frison, 1935) указываются для фауны Чукотки впервые.

## Introduction

Order Plecoptera numbers about 3900 species from 17 families worldwide [Newman et al., 2021; DeWalt et

al., 2023]. The majority of stoneflies are considered as cold adapted aquatic insect's habit mainly in the mountain streams and rivers of Boreal zone and declined to Arctic as well as to Tropical ones. This pattern is also observed in Northeast Asia with the advancement to the north. Formerly 139 species in 45 genera and 8 families are registered in the Russian Far East ranging from arctic deserts in the north to subtropics in the south. Of them 131 species are recognized in the south of Russian Far East in Amur River basin. In the north of the Far East, stonefly species diversity is much less, 56 species were recorded in Kamchatka and Magadanskaya Oblast, and only 16 species in Chukotka [Teslenko, 2009].

Stoneflies were first reported in the Northeast Asia in the end of 19-th century on fragmentary materials collected in the various expeditions. These collections contain only a few species: *Skwala compacta* (McLachlan, 1872) from Lena River, the Yakutian expedition by Alexander Chekanovsky, 1873; *Diura nanseni* (Kempny, 1900) collected by Alexander Bunge and Eduard Toll in tributary of the Yana River (Verkhoyansk), 1885; *Diura bicaudata* (Linnaeus, 1758) by Ivan Chersky in expedition to the Indiro-Kolyma Region (Verkhnekolymsk-Nizhnekolymsk), 1891; *Arcynopteryx dichroa* (McLachlan, 1872) by Mikhail Brusnev in the Russian polar expedition of 1901 in the Yana River down reaches; and *Arcynopteryx polaris* Klapálek, 1912 by Vladimir Popov in the Ayano-Nelkan expedition, 1903 [Zhiltzova, 1995]. Five stonefly species were briefly described by Longinos Navás [1930] on the materials of the Swedish expedition to Kamchatka in 1920–1922.

The most significant contribution to the knowledge of the stonefly fauna in Northeast Asia was made by Iya Levanidova. She was the first who initiate systematic and long-term research in Kamchatka in 1964–1969 [Levanidova, Nikolaeva, 1968; Levanidova, Kokhmenko, 1970; Levanidova 1970a, b; Zwick et al., 1971], Chukotka in 1972–1974 [Levanidova, Zhiltsova, 1976], and the Magadanskaya Oblast in the 1980s. Later in monograph except faunistics, ecology, and zoogeography, the importance of Beringia in the development of the fauna of the entire Eastern Palaearctic was determined [Levanidova, 1982].

In the Magadanskaya Oblast, Plecoptera fauna was investigated quite intensively in the early 70s and these researches is still mainly of a reconnaissance character. Important contribution was made by Lidiya Zhiltzova. She has been described a few new species after field trips to the upper Kolyma River basin [Zhiltsova, 1979, 1981; Zhiltsova, Levanidova, 1978; Zhiltsova, Zapekana-Dulkeit, 1986]. Additional information and new records were received from Chukotka and Magadanskaya Oblast other researches [Zasyapkina, 1975; Makarchenko et al., 1980; Arefina et al., 2003; Zasyapkina, Samochvalov, 2011]. Based on these data, several surveys devoted to the aquatic insect fauna of Northeast Asia were published [Zasyapkina et al., 1996; Zasyapkina, Ryabuchin, 2001; Ryabukhin, Zasyapkina, 2005]. Recently additional new records have also appeared in some publications

[Khamenkova et al., 2017; Teslenko, Khamenkova, 2017; Zasyapkina, 2018].

The stonefly fauna of Northeast Yakutiya, at the western boundary of Beringia, is still poorly understood and relevant literature is scarce [Zhiltzova, Levanidova, 1984; Zhiltzova, 1995; Reznik, 2005; Tiunova et al., 2009; Teslenko, 2011]. These data should be regarded as indicative, since special studies of the stonefly fauna in the Northeast Yakutiya have not been carried out.

The data on the stonefly fauna of the Eastern part of Beringia in the USA (Alaska), Canada (Yukon and Northwest Territories) were generalized in the monograph of the Yukon insects [Stewart, Ricker, 1997], while the first information was appeared after the publication by W. Ricker [1964]. A review of the fauna of Alaska and Western Canada has lately been published with an illustrated guide to species [Stewart, Oswood, 2006]. An updated synopsis of new and historical records of Plecoptera of the Arctic North Slope of Alaska [Kendrick, Huryn, 2014] and Canada's fauna diversity assessment including Northwest Territories were also recently presented [Kondratieff et al., 2019].

The purpose of this study was to summarize published and unpublished data on stonefly species richness in subregions of Northeast Asia that were parts of ancient Beringia. Since the series of Beringian land bridges stretched from the Lena River in Northeast Siberia through Alaska, Yukon to the Mackenzie River in Northwest Canada, a comparison with the stonefly richness of the American part of Beringia was also provided. All available data on Plecoptera of the Asian and American parts of Beringia are summarized here and composition of the regional faunas is also discussed.

## Material and methods

Present paper is based on the published and inventory data from the collections of the Federal Scientific Center of the East Asia Terrestrial Biodiversity (Vladivostok) in the Northeast Asia. Taxonomy and classification of Plecoptera mainly follows to the database Plecoptera Species File [DeWalt et al., 2023]. Distribution is described by 8 types constructing two groups: Holarctic and Palaearctic [Zhiltzova, Levanidova, 1984; Stewart, Ricker, 1997].

**Holarctic group:** 1. Holarctic species; 2. Amphipacific species inhabiting both sides of the Pacific Ocean in Asia and North America; 3. Transberingian species known only from areas of the ancient Bering land located on both sides of the Bering Strait. **Palaearctic group:** 4. Eastern Palaearctic species occurring east of Yenisei River; 5. Transpalaearctic species found across Palaearctic; 6. Palearctic species registering in Amur River basin on the south of Russian Far East, neighboring China, Korea, and Japan; 7. West Beringian species, confined only to Asian part of Beringia; 8. Endemic species that found only in a limited, restricted, and defined subregions of Northeast Asia and North America.

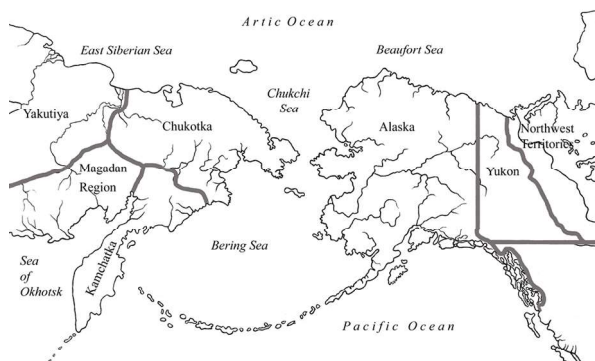


Fig. 1. Map-scheme of Beringia and its administrative regions.

Рис. 1. Карта-схема Берингии и входящих в её состав административных регионов.

To analyze faunal similarity in subregions a cluster analysis was performed using PAST software packages PALaeontological STatistics (version 1.57) [Hammer et al., 2006]. A measure of similarity was evaluated by Sørensen coefficient. The statistical significance of clusters was assessed using bootstrap analysis in 1000 repetitions.

An annotated list of Plecoptera species known from subregions of Northeast Asia, namely: Chukotka, Magadanskaya Oblast, Kamchatka, and Yakutiya and Table 1, Distribution of Plecoptera in Northeast Asia, Northwest America, and Arctic Europe are given in the Appendix 1 (p. 1–5).

## Results and Discussion

At present, the list of stoneflies in Chukotka includes 27 species from 15 genera and 7 families; the Pteronarcyidae family has not been found. In terms of species richness, the Capniidae (10 species, 5 of them from the genus *Capnia*) is dominated; the Chloroperlidae and Perlodidae families are presented with 6 species each; the other families comprise two or one species (Table 1). Despite the fact that the fauna of Chukotka is the poorest in the surveyed regions in Northeast Asia, it contains two endemic species *Capnia ishukotica* and *C. kurnakovi*.

Thirty-four species in twenty-one genera and eight families has been authentically recorded in Yakutiya. But, these data should be regarded as indicative, since they were mainly obtained during the study of the Lena River tributaries in the South Yakutiya. Unlike other regions, stoneflies of the Perlodidae family predominate, followed by Chloroperlidae and Capniidae. Yakutiya is the only one of the four regions of Northeast Asia where representatives of the Pteronarcyidae family have been found. Additionally *Capniella nodosa* and *Leuctra fusca* are absent in all other regions of Northeast Asia and Beringia.

Taking into account new records, Plecoptera list of the Magadanskaya Oblast located in the mountain-taiga belt, includes 53 species from 26 genera and 7 families and is distinguished by the greatest species diversity,

number of species is almost twice as high as the list of Chukchi tundra (Table 1). As in Chukotka, in the Magadanskaya Oblast, the Capniidae family (17 species) is predominated, the Perlodidae family contains 13 species, the Chloroperlidae 12 species, other families include from one to five species. Endemic species are *Capnia kurnakovi* and *C. kolymensis*. A distinctive feature of the fauna in the Magadanskaya Oblast is appearance of stoneflies with southeastern genesis [Zasyapkina, 2018], inhabiting the South of the Russian Far East. The relatively high species richness in Magadanskaya Oblast is apparently connected with the paleoclimatic conditions. It is assumed that the watercourses of the coast of the Sea of Okhotsk in the Magadanskaya Oblast were free from half-cover glaciations and acted as refuges for freshwater fauna during the Ice Age [Chereshnev, 1998].

Plecoptera list of Kamchatka is represented by 29 species from 18 genera and 6 families; the Pteronarcyidae and Perlidae families have not been registered. In contrast to Chukotka, Yakutiya, and the Magadanskaya Oblast, in the fauna of Kamchatka the Chloroperlidae (10) family is dominated, following by Capniidae (8), and Perlodidae (6), other families are contained by three to one species (Table 1). The originality of the Kamchatka fauna is determined by the only endemic *Capnia levanidovae*. According to our latest data the stonefly fauna of Kamchatka, located to the south, is poorer than Yakutiya and the Magadanskaya Oblast, it seems that due to long periods of isolated (peninsular) existence, marine transgressions, volcanic activity, mountain-valley glaciations, and the negative effect of melt waters [Levanidova, 1982].

Altogether, 61 stonefly species from 28 genera are known in Northeast Asia, or more than 40 % of the species known in the entire Russian Far East. The comment list includes eight stonefly families the family Pteronarcyidae contributed a single species. Three families, the Capniidae, Chloroperlidae, and Perlodidae contain about 80 % of all species found, and the winter stoneflies Capniidae differed in the largest species richness — 30 %. All endemic species are from *Capnia* genus. Apparently, Capniidae is one of the most advanced families in the development of permafrost; it is distinguished by the variability of morphological structures and biological adaptations, which make it possible to be among the most abundant in number of species and to adapt to various types of watercourses of low and high latitudes [Stewart, Ricker 1997]. The relatively low amount of Coarse Particulate Organic Matter in tundra arctic and subarctic streams and semivoltine (several-year) life cycle probably limit the presence and abundance of large shredders such as *Pteronarcys* [Stewart, Ricker, 1997]. The low diversity and abundance of herbivorous forage insects could be limiting to obligate predators such as Perlidae that also apparently have low cold-adaptive capacity in comparison with Perlodidae or Chloroperlidae. Chloroperlids and perlodids are usually facultative predators and have a flexible feeding strategy; with a lack of animal food, they easily switch to plant food and vice versa, while changing the feeding type and trophic

Table 1. Distribution of Plecoptera in Northeast Asia, Northwest America, and Arctic Europe  
 Таблица 1. Распределение веснянок на Северо-востоке Азии, Северо-западе Америки и в арктической Европе

Taxon		Magadan	Kamchatka	Yakutia	Alaska, Yukon, Northwest Territories	Finland
<i>Brachyptera risi</i> (Morton, 1896)						*
<i>Doddsia occidentalis</i> (Banks, 1900)					*	
<i>Rhabdiopteryx acuminata</i> Klapálek, 1905						*
<i>Taenionema japonicum</i> (Okamoto, 1922)	*	*	*	*		
<i>T. kincaidi</i> (Hoppe, 1938)					*	
<i>T. pacificum</i> (Banks, 1900)					*	
<i>T. pallidum</i> (Banks, 1902)					*	
<i>Taeniopteryx nebulosa</i> (Linnaeus, 1758)		*				*
<i>Arsapnia decepta</i> Banks, 1897					*	
<i>A. pileata</i> (Jewett, 1966)					*	
<i>Capnia ahngerii</i> Koponen, 1949		*				
<i>C. atra</i> Morton, 1896		*		*		*
<i>C. bargusina</i> Zapekina-Dulkeit, 1975		*				
<i>C. cheama</i> Ricker, 1965					*	
<i>C. coloradensis</i> Claassen, 1937					*	
<i>C. confusa</i> Claassen, 1936					*	
<i>C. elongata</i> Claassen, 1924					*	
<i>C. excavata</i> Claassen, 1924					*	
<i>C. gracilaria</i> Claassen, 1924					*	
<i>C. kolyensis</i> Zhiltzova, 1979		*				
<i>C. kurnakovi</i> Zhiltzova, 1978	*	*				
<i>C. apnia levanidovae</i> Kawai, 1969			*			
<i>C. melia</i> Frison, 1942					*	
<i>C. nana</i> Claassen, 1924					*	
<i>C. nearctica</i> Banks, 1918	*	*	*		*	
<i>C. nigra</i> (Pictet, 1833)	*	*	*	*		
<i>Capnia petila</i> Jewett, 1954					*	
<i>Capnia pygmaea</i> (Zetterstedt, 1840)	*	*	*			*
<i>Capnia rara</i> Zapekina-Dulkeit, 1970	*	*	*	*		
<i>C. tshukotica</i> Zhiltzova et Levanidova, 1978	*					
<i>C. vernalis</i> Newport, 1848					*	
<i>C. vidua</i> Klapálek, 1904						*
<i>Capniella nodosa</i> Klapálek, 1920				*		
<i>Capnopsis schilleri</i> (Rostock, 1892)						*
<i>Eucapnopsis brevicauda</i> (Claassen, 1924)	*	*			*	
<i>Isocapnia abbreviata</i> Frison, 1942					*	
<i>I. arcuata</i> Zhiltzova, 1975		*				
<i>I. crinita</i> (Needham et Claassen, 1925)					*	
<i>I. grandis</i> (Banks, 1907)					*	
<i>I. guentheri</i> (Joost, 1970)	*	*	*			
<i>I. integra</i> Hanson, 1943					*	
<i>I. kudia</i> Ricker, 1959		*				
<i>I. orientalis</i> Zhiltzova, 1975		*				
<i>I. spenceri</i> Ricker, 1943					*	
<i>I. vedderensis</i> (Ricker, 1943)					*	
<i>Mesocapnia autumnata</i> (Baumann et Gauvin, 1970)					*	
<i>M. bergi</i> (Ricker, 1965)					*	
<i>M. oenone</i> (Neave, 1929)					*	
<i>M. projecta</i> (Frison, 1937)					*	
<i>M. silvatica</i> Raušer, 1968	*	*	*	*		
<i>M. variabilis</i> (Klapálek, 1920)	*	*	*	*	*	
<i>Paracapnia leisteri</i> Zhiltzova et Potikha, 2005		*				
<i>Utacapnia columbiana</i> (Claassen, 1924)					*	

Table 1. (continuations)  
Таблица 1. (продолжение)

Taxon	Chukotka	Magadan	Kamchatka	Yakutia	Alaska, Yukon, Northwest Territories	Finland
<i>Despaxia augusta</i> (Banks, 1907)					*	
<i>Leuctra digitata</i> Kempny, 1899						*
<i>L. fusca</i> (Linnaeus, 1758)				*		*
<i>L. hippopus</i> Kempny, 1899						*
<i>L. nigra</i> (Olivier, 1811)						*
<i>Paraleuctra cercia</i> (Okamoto, 1922)	*	*	*			
<i>P. forcipata</i> (Frison, 1937)					*	
<i>P. occidentalis</i> (Banks, 1907)					*	
<i>P. projecta</i> (Frison, 1942)					*	
<i>P. vershina</i> (Gaufin et Ricker, 1974)					*	
<i>P. zapekinae</i> Zhiltzova, 1974		*				
<i>Perlomyia collaris</i> Banks, 1906					*	
<i>P. secunda</i> (Zapekina-Dulkeit, 1955)		*				
<i>P. utahensis</i> Needham et Claassen, 1925					*	
<i>Pomoleuctra purcellana</i> (Neave, 1934)					*	
<i>Amphinemura borealis</i> Morton, 1894						*
<i>A. linda</i> (Ricker, 1952)					*	
<i>A. palmeni</i> (Koponen, 1917)						*
<i>A. standfussi</i> Ris, 1902		*	*	*		*
<i>A. sulcicollis</i> (Stephens, 1836)						*
<i>Nemoura arctica</i> Esben-Petersen, 1910	*	*	*	*	*	*
<i>N. avicularis</i> Morton, 1894						*
<i>N. cinerea</i> (Retzius, 1783)						*
<i>N. dubitans</i> Morton, 1894						*
<i>N. flexuosa</i> Aubert, 1949						*
<i>N. normani</i> Ricker, 1952					*	
<i>N. sahlbergi</i> Morton, 1896					*	*
<i>N. sirotskii</i> Teslenko, 2018		*				
<i>N. viki</i> Lillehammer, 1972						*
<i>Nemurella pictetii</i> (Klapálek, 1900)						*
<i>Podmosta decepta</i> (Frison, 1942)					*	
<i>P. delicatula</i> (Claassen, 1923)					*	
<i>P. weberi</i> (Ricker, 1952)	*	*	*		*	
<i>Prostoia besametsa</i> (Ricker, 1952)					*	
<i>Protonemura intricata</i> (Ris, 1902)						*
<i>P. meyeri</i> (Pictet, 1841)						*
<i>Shipsa rotunda</i> (Claassen, 1923)					*	
<i>Soyedina</i> sp.					*	
<i>Visoka cataractae</i> (Neave, 1933)					*	
<i>Zapada cinctipes</i> (Banks, 1897)					*	
<i>Z. columbiana</i> (Claassen, 1923)					*	
<i>Z. frigida</i> (Claassen, 1923)					*	
<i>Z. haysi</i> (Ricker, 1952)					*	
<i>Z. oregonensis</i> (Claassen, 1923)					*	
<i>Z. quadribanchiata</i> (Zhiltzova, 1977)		*		*		
<i>Pteronarcella badia</i> (Hagen, 1874)					*	
<i>P. regularis</i> (Hagen, 1874)					*	
<i>Pteronarcys californica</i> Newport, 1848					*	
<i>P. dorsata</i> (Say, 1923)					*	
<i>P. reticulata</i> (Burmeister, 1839)				*		
<i>Arcynopteryx dichroa</i> (McLachlan, 1872)	*	*	*	*	*	*
<i>A. amurensis</i> Zhiltzova et Levanidova 1978		*				

Table 1. (continuations)  
Таблица 1. (продолжение)

Taxon	Chukotka	Magadan	Kamchatka	Yakutia	Alaska, Yukon, Northwest Territories	Finland
<i>Arcynopteryx polaris</i> Klapálek, 1912	*	*	*	*		
<i>Cascadoperla trictura</i> (Hoppe, 1938)					*	
<i>Cultus aestivates</i> (Needham et Claassen, 1925)					*	
<i>C. pilatus</i> (Frison, 1942)					*	
<i>Diura bicaudata</i> (Linnaeus, 1758)	*	*		*	*	*
<i>D. majuscula</i> (Klapálek, 1912)		*	*	*		
<i>D. knowltoni</i> (Frison, 1937)					*	
<i>D. nanseni</i> (Kempny, 1900)		*		*		*
<i>Isogenoides colubrinus</i> (Hagen, 1874)					*	
<i>I. zionensis</i> Hanson, 1949					*	
<i>Isogenus nubecula</i> Newman, 1833						*
<i>Isoperla chereshevi</i> Teslenko, 2017		*				
<i>I. decolorata</i> (Walker, 1852)					*	
<i>I. difformis</i> (Klapálek, 1909)						*
<i>I. eximia</i> Zapekina-Dulkeit, 1975		*		*		
<i>I. fusca</i> Needham et Claassen, 1925					*	
<i>I. grammica</i> (Poda, 1761)						*
<i>I. katmaiensis</i> Szczytko et Stewart, 1979					*	
<i>I. longiseta</i> Banks, 1906					*	
<i>I. obscura</i> (Zettstedt, 1840)	*	*	*	*		*
<i>I. petersoni</i> Needham et Christenson, 1927					*	
<i>I. sobria</i> (Hagen, 1874)					*	
<i>I. sordida</i> Banks, 1906					*	
<i>Kogotus nonus</i> (Needham et Claassen, 1925)					*	
<i>Megarcys ochracea</i> (Klapálek, 1912)		*		*		
<i>M. pseudochracea</i> Zhiltzova, 1977				*		
<i>M. signata</i> (Hagen, 1874)					*	
<i>Periodes dispar</i> (Rambur, 1842)						*
<i>Pictetiella asiatica</i> Zwick et Levanidova, 1971		*	*	*		
<i>P. zwicki</i> Zhiltzova, 1976	*	*				
<i>Skwala americana</i> (Klapálek, 1912)					*	
<i>S. compacta</i> (McLachlan, 1872)	*	*	*	*		
<i>Agneta brevipennis</i> (Navás, 1912)	*	*		*		
<i>A. extrema</i> (Navás, 1912)				*		
<i>Dinocras cephalotes</i> (Curtis, 1827)						*
<i>Hesperoperla pacifica</i> (Banks, 1900)					*	
<i>Kamimuria exilis</i> (McLachlan, 1872)				*		
<i>Alaskaperla longidentata</i> (Raušer, 1968)		*	*	*		
<i>A. ovibovis</i> (Ricker, 1965)					*	
<i>Alloperla delicata</i> Frison, 1935					*	
<i>A. fraterna</i> (Frison, 1935)					*	
<i>A. mediata</i> (Navás, 1925)		*	*	*		
<i>A. medveda</i> Ricker, 1952					*	
<i>A. rostellata</i> (Klapálek, 1923)	*	*	*	*		
<i>A. serrata</i> Needham et Claassen, 1925					*	
<i>A. severa</i> (Hagen, 1861)					*	
<i>A. telekojensis</i> Šámal, 1939		*		*		
<i>Haploperla brevis</i> (Banks, 1895)					*	
<i>H. lepnevae</i> Zhiltzova et Zwick, 1971		*	*	*		
<i>Isoptena serricornis</i> (Pictet, 1841)						*
<i>Paraperla frontalis</i> (Banks, 1902)					*	
<i>P. wilsoni</i> Ricker, 1965					*	
<i>Plumiperla diversa</i> (Frison, 1935)	*	*	*		*	

Table 1. (continuations)  
Таблица 1. (продолжение)

Taxon	Chukotka	Magadan	Kamchatka	Yakutia	Alaska, Yukon, Northwest Territories	Finland
<i>Siphonoperla burmeisteri</i> (Pictet, 1841)						*
<i>Suwallia decolorata</i> Zhiltzova et Levanidova, 1978		*				
<i>S. errata</i> Li et Li, 2021	*	*	*	*		
<i>S. forcipata</i> (Neave, 1929)					*	
<i>S. kerzhneri</i> Zhiltzova et Zwick, 1971	*	*	*	*		
<i>S. talajensis</i> Zhiltzova, 1976	*	*	*	*		
<i>S. autumn</i> (Hoppe, 1938)					*	
<i>S. dubia</i> (Frison, 1935)					*	
<i>S. lineosa</i> (Banks, 1918)					*	
<i>S. pallidula</i> (Banks, 1904)					*	
<i>S. starki</i> Alexander et Stewart, 1999					*	
<i>S. borealis</i> (Banks, 1895)					*	
<i>S. coloradensis</i> (Banks, 1898)					*	
<i>S. exquisita</i> (Frison, 1935)					*	
<i>S. fidelis</i> (Banks, 1920)					*	
<i>S. occident</i> (Frison, 1937)					*	
<i>S. oregonensis</i> (Frison, 1935)					*	
<i>S. pacifica</i> (Banks, 1895)					*	
<i>S. revelstoka</i> (Jewett, 1955)					*	
<i>Triznaka signata</i> (Banks, 1895)					*	
<i>Utaperla lepnevae</i> (Zhiltzova, 1970)	*	*	*			
<i>U. orientalis</i> Nelson et Hanson, 1969		*	*			
<i>U. sopladora</i> Ricker, 1952					*	
<i>Xanthoperla apicalis</i> (Newman, 1836)						*
<i>Kathroperla perdita</i> (Banks, 1920)					*	
Total:	27	53	29	34	104	37
	61					

level [Stewart, Ricker, 1997; Stewart, Oswood, 2006; Teslenko, 2006].

In any subregion of Northeast Asia, the widespread East Palaearctic species predominate, the species of the Holarctic group with the Holarctic, Amphipacific, and Transberingian distribution are present in Chukotka in greater relative abundance than in other sub regions. Stoneflies have open up the watercourses of the arctic deserts, tundra, forest-tundra, and taiga zone. On the whole, the distribution of species richness corresponds to the general patterns and increases with the advancement from the Arctic deserts to the taiga zone and from the maritime monsoon climate to the continental one [Whittaker, 1972]. The lowest species richness is noted in the tundra watercourses of the Chukotka and Kamchatka, the highest – in the streams and rivers of the taiga zone in the Magadanskaya Oblast. The fauna of Kamchatka, located to the south, is poorer than the Magadanskaya Oblast due to paleogeographycal events and present activity of the Okhotsk-Chukotka and Kamchatka-Koryak volcanogenic belts.

In the western part of Beringia (Alaska, Yukon, and North West Territories) on the American continent, the stonefly richness at the family, genera, and especially at the species levels is much higher than in the eastern part

in Northeast Asia and comprises 104 species from 43 genera and 9 families [Stewart, Ricker, 1997; Stewart, Oswood, 2006; Kendrick, Hurn, 2014; Kondratieff et al., 2019; DeWalt et al., 2023]. The family with single species represented in American Beringia is the Karthroperlidae (Table 1). The stonefly fauna is based on widespread western Nearctic species. West Beringian endemics include *Mesocapnia bergi*, *Podmosta weberi*, *Alaskaperla ovibovis*, *Isoperla katmaiensis*, and *Isoperla decolorata* [Stewart, Ricker, 1997; Stewart, Oswood, 2006].

Currently, a total of 156 species from 49 genera and 9 families have been recorded in the Asian and American parts of Beringia. The same three families, the Capniidae, Chloroperlidae, and Perlodidae contain more 70 % of all species known to occur. The winter stoneflies of Capniidae (28 %) are also distinguished in the greatest species richness. Both parts of Beringia account for 22 common genera, but there are actually more. The genera *Claassenia*, Wu, 1934, *Despaxia* Ricker, 1943, *Kathroperla* Banks, 1920, *Kogotus*, Ricker, 1942, *Sweltsa*, Ricker, 1943, *Pictetiella*, Illies, 1966, were not included in this number since their ranges are widely disjunctive on both coasts of the Pacific Ocean and go beyond the subregions of Beringia mentioned in the article. Although the pre-

Pleistocene origin of the extant Plecoptera fauna in the American part of Beringia is highly speculative but considered to be entirely Asiamerican [Stewart, Stark, 1988; Stewart, Ricker, 1997]. Except genera there are 8 common species: *Capnia nearctica*, *Eucapnopsis brevicauda*, *Mesocapnia variabilis*, *Nemoura arctica*, *Podmosta weberi*, *Plumiperla diversa*, *Arcynopteryx dichroa*, and *Diura bicaudata*. Their distribution patterns belong to Holarctic group, they are cold adapted, confinement to tundra landscapes, and, in all probability, could take part in trans-Beringian postglacial migrations across the Bering Land Bridge during the last glacial maximum of Pleistocene.

To assess the faunistic affinity in the sub regions of the Asian and American parts of Beringia, a cluster analysis was carried out using the Sørensen coefficient of faunal similarity (Fig. 2). The cluster contains two clades corresponding to faunal assemblages of Northeast Asia, Alaska, Yukon, and Northwest Territories. In the first faunal assemblage of the American part of Beringia, the faunas of Alaska and Yukon are the closest (similarity level 0.75, bootstrap 100 %), and have a low similarity level (0.38, bootstrap 100 %) with fauna of the Northwest Territories, where the lowest species richness registered due to harsh Arctic conditions [Kondratieff et al., 2019]. The second assemblage includes Northeast Asia fauna. A high level of the species affinity (0.75, bootstrap 80 %) is revealed for Chukotka and Kamchatka situated mainly in tundra zone, regional faunas in the Magadanskaya Oblast and Yakutiya which are a part of the North Okhotsk boreal taiga, forming their own branches at similarity levels 0.65 and 06 (bootstrap 67 % and 100 %, respectively). Both assemblages are distinctive and have a low similarity level (0.12, bootstrap value 100 %) possibly due to the small number of common species. All eight common species are Holarctic or Beringian and adapted to arctic and tundra environment, and had possibly opportunity for dispersal through the Bering Bridge during the last period in the Pleistocene. In addition to common species there are 22 common genera indicating the important role of the trans-Beringian biotic exchange which repeatedly took place in the Pliocene-Pleistocene, in the modern West Nearctic and East Palaearctic fauna formation and a relatively long periods of their independent development [Levanidova, 1982; Stewart, Stark, 2002; Stewart, Oswood, 2006; Teslenko, 2009]. It should also be accepted that the stonefly fauna affinity of Northeast Asia is insignificant but still more pronounced with North Europe than with Northwest America at the species level, but number of common genera, on the contrary, is more than three times less (7). Thus, in the well-documented fauna of Finland [Lillehammer, 1988] there are 10 common species (*Taeniopteryx nebulosa*, *Leuctra fusca*, *Capnia atra*, *Capnia pygmaea*, *Amphinemura standfussi*, *Nemoura arctica*, *Arcynopteryx dichroa*, *Diura bicaudata*, *Diura nansenii*, *Isoperla obscura*) with Northeast Asia which is more than a third of the stonefly species in Finland. In view of the limited relationship between European, Asian and American stonefly faunas during Pleistocene

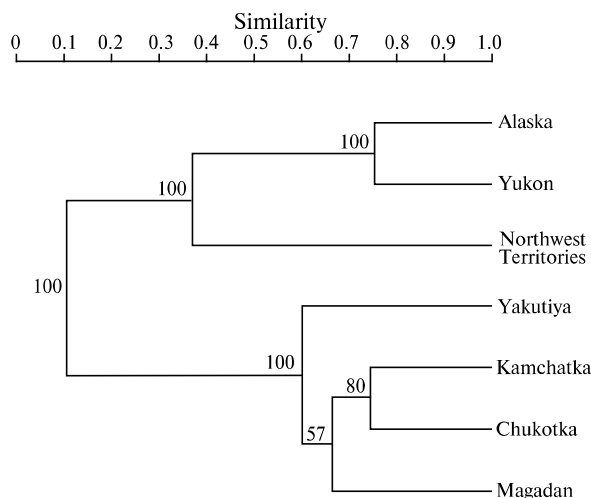


Fig. 2. The similarity of the species composition of the stonefly fauna of Beringia calculated by the method of paired group (UPGMA) (Sørensen coefficient, bootstrap 1000). Bootstrap values (%) are given at the base of the branches.

Рис. 2. Дендрограмма сходства видового состава фауны веснянок Берингии, рассчитанного методом парных групп (UPGMA, коэффициент Сёрсенена). В основании каждого кластера указаны бутстреп-значения (%).

glaciations, the faunistic intercontinental exchange was possible across the Polar Circle for these cold adapted species [Zwick, 1980].

Despite of a rather long period of research, the stonefly fauna of Northeast Asia is still insufficiently studied. The harsh climate and extreme inaccessibility limit our understanding of the faunal composition in the Yakutiya and numerous Chukotka Rivers. It is probable that in taiga streams and rivers hold more yet undiscovered species, than that in Arctic tundra zone.

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## References

- Arefina T.I., Ivanov P.Yu., Kocharina S.L., Lafer G.Sh., Makarchenko M.A., Teslenko V.A., Tiunova T.M., Khamenkova E.V. 2003. Fauna of aquatic insects of Taui River basin (Magadan Territory) // Vladimir Ya. Levanidov's Biennial Memorial Meetings. Vol.2. Vladivostok: Dalnauka. P.45–59. [In Russian].
- Chereshnev I.A. 1998. Biogeography of freshwater fish fauna in the Russian Far East. Vladivostok: Dalnauka. 130 p. [In Russian].
- DeWalt R.E., Maehr M.D., Neu-Becker U., Stueber G. 2023. Plecoptera Species File Online. Version 5.0/5.0. Available from: <http://plecoptera.speciesfile.org> (accessed 11 March 2023).
- Hammer Ø., Harper D.A.T., Ryan P.D. 2006. Paleontological statistics (Version 1.57). 78 p.
- Judson S.W., Nelson C.R. 2012. A guide to Mongolian stoneflies (Insecta: Plecoptera) // Zootaxa. Vol. 3541. No.1. P.1–118. <https://doi.org/10.11646/zootaxa.3541.1.1>.
- Kendrick M.R., Huryn A.D. 2014. The Plecoptera and Trichoptera of the Arctic North Slope of Alaska // Western North American Naturalist. Vol.74. No.3. P.275–285. <https://doi.org/10.3398/064.074.0303>.
- Khamenkova E.V., Teslenko V.A., Tiunova T.M. 2017. Distribution of the Macrobenthos Fauna in the Ola River basin, Northern Coast of



- the Sea of Okhotsk // Zoologicheskii Zhurnal. Vol.96. No.4. P.400–409. [In Russian]. <https://doi.org/10.1134/S0013873817030071>.
- Kondratieff B.C., DeWalt R.E., Verdone C.J. 2019. Plecoptera of Canada // Langor D.W., Sheffield C.S. (Eds): The Biota of Canada — A Biodiversity Assessment. Part 1: The Terrestrial Arthropods. ZooKeys. Vol.819. P.243–254. <https://doi.org/10.3897/zookeys.819.23535>.
- Levanidova I.M. 1970a. Ecologiya i zoogeografiya vesnyanok, podyonok i rucheinikov v rekah Kamchatki // Izvestiya TINRO. Vol.73. P.100–114. [In Russian].
- Levanidova I.M. 1970b. Vesnyanki Kamchatskogo Poluostrova (ecologicheskii i zoogeogeograficheskii obzor) // Izvestiya TINRO. Vol.78. P.203–224. [In Russian].
- Levanidova I.M. 1982. Amfibioticheskie nasekomye gornych oblastei Dal'nego Vostoka SSSR (faunistika, ecologiya, zoogeografiya Ephemeroptera, Plecoptera, Trichoptera). Leningrad: Nauka. 215 p. [In Russian].
- Levanidova I.M., Kokhmenko L.V. 1970. Kolichestvennyye charakteristiki bentosa v tekuchih vodoyomah Kamchatki // Izvestiya TINRO. Vol.73. P. 88–99. [In Russian].
- Levanidova I.M., Nikolaeva E.T. 1968. Bentostok v Kamchatskikh rekah // Izvestiya TINRO. Vol.64. P.291–300. [In Russian].
- Levanidova I.M., Zhiltzova L.A. 1976. Vesnyanki (Plecoptera) Chukotskogo Polyostrova // Presnovodnaya fauna Chukotskogo Polyostrova. Trudy Biologo-pochvennogo instituta DVNC AN SSSR. Vol.36. No.139. P.15–38. [In Russian].
- Lillehammer A. 1988. Stoneflies (Plecoptera) of Fennoscandia and Denmark // Fauna Entomologica Scandinavica. Vol.21. 165 p.
- Makarchenko E.A., Levanidova I.M., Zhiltzova L.A. 1980. Predvaritel'nye dannye po faune vodnykh bespozvonochnykh ostrova Vrangelya // Fauna presnykh vod Dal'nego Vostoka. Vladivostok: DVNC AN SSSR. P.3–12. [In Russian].
- Murányi D., Li W., Yang D. 2015. A new genus and species of winter stoneflies (Plecoptera: Capniidae) from Southwest China, with a commented checklist of the family in the Oriental Realm // Zootaxa. Vol.4059. No.2. P.371–382. <https://doi.org/10.11646/zootaxa.4059.2.8>.
- Navás R.P.L. 1930. Entomologische Ergebnisse der schwedischen Kamchatka Expedition 1920–1922. 23. Plecoptera // Arkiv för Zoologi. Vol.21A. P.1–8.
- Newman E.A., DeWalt R.E., Grubbs S.A. 2021. Plecoptera (Insecta) Diversity in Indiana: A Watershed-Based Analysis // Diversity. Vol.13. No.12. P.672. <https://doi.org/10.3390/d13120672>.
- Reznik I.V. 2005. Aquatic insect fauna of the rivers Chulman and Ungra (Aldan River basin, Southern Yakutiya) // Vladimir Ya. Levanidov's Biennial Memorial Meetings. Vol.3. Vladivostok: Dalnauka. P.334–337. [In Russian].
- Ricker W.E. 1964. Distribution of Canadian stoneflies // Gewässer und Abwässer. Vols 34/35. P.50–71.
- Ryabukhin A.S., Zasyapkina I.A. 2005. Terrestrial and freshwater insects of the Tauysk Bay coast // Biodiversity of the Tauysk Bay of the Sea of Okhotsk. Vladivostok: Dalnauka. P.290–478. [In Russian].
- Stewart K.W., Riker W.E. 1997. Stoneflies (Plecoptera) of the Yukon // Insects of the Yukon. Biological Survey of Canada (Terrestrial Arthropods). Ottawa, Ontario, Canada. P. 201–222.
- Stewart K.W., Stark B.P. 2002. Nymphs of North American Stonefly Genera (Plecoptera) 2nd edition. Columbus, Ohio: The Caddis Press. 510 p.
- Stewart K.W., Oswood M. 2006. The stoneflies (Plecoptera) of Alaska and Western Canada. Columbus, Ohio: The Caddis Press. 325 p.
- Teslenko V.A. 2006. Vesnyanki (Plecoptera) v ekosistemah rek Dal'nego Vostoka Rossii (fauna, biologiya, ecologiya). Avtoref. diss... doct. biol. nauk. Vladivostok. 43 p. [In Russian].
- Teslenko V.A. 2009. Stoneflies (Plecoptera) of the Russian Far East: diversity and zoogeography // International Perspectives in Mayfly and Stonefly Research. Proceedings of the 12th International Conference on Ephemeroptera and the 16th International Symposium on Plecoptera, Stuttgart 2008). Aquatic Insects. Vol.31. Suppl.1. P.693–706.
- Teslenko V.A. 2011. New records of stoneflies (Plecoptera) for Timpton River basin (the Southern Yakutiya) // Evrasiatskii Entomologicheskii Zhurnal (Euroasian Entomological Journal). Vol.10. No.3. P.385–389. [In Russian].
- Teslenko V.A., Khamenkova E.V. 2017. A new species of *Isoperla* Banks (Plecoptera: Perlodidae) from the northeast of the Russian Far East // Zootaxa. Vol.4300. No.2. P.238–244. <https://doi.org/10.11646/zootaxa.4300.2.5>.
- Tiunova T.M., Teslenko V.A., Reznik I.V. 2009. Mayflies (Ephemeroptera), stoneflies (Plecoptera) and caddis flies (Trichoptera) of the «Ungra» Nature Reserve (Aldan River basin, the Southern Yakutiya) // Evrasiatskii Entomologicheskii Zhurnal (Euroasian Entomological Journal). Vol.8. No.3. P.299–308. [In Russian].
- Whittaker R.H. 1972. Evolution and measurement of species diversity // Taxon. Vol.21. P.213–251.
- Zasyapkina I.A. 1975. Fauna rucheinikov, podyonok i vesnyanok Severo-Vostoka Asii i prilozhahchih territorii // Hydrobiologicheskoe issledovaniya vnutrennih vodoyomov Severo-Vostoka SSSR. Vladivostok: DVNC AN SSSR. P.139–166. [In Russian].
- Zasyapkina I.A. 2018. An annotated check-list of stoneflies (Insecta, Plecoptera) of the family Capniidae from the northern part of the Russian Far East // Evrasiatskii Entomologicheskii Zhurnal (Euroasian Entomological Journal). Vol.17. No.2. P.92–99. [In Russian]. <https://doi.org/10.15298/euroasentj.17.2.03>.
- Zasyapkina I.A., Ryabukhin A.S., Makarchenko E.A., Makarchenko M.A. 1996. Obzor amfibioticheskikh nasekomykh Severo-Vostoka Asii. Preprint. Magadan: SVNC DVO RAN. 116 p.
- Zasyapkina I.A., Rhyabukhin A.S. 2001. Amphibiotic Insects of the Northeast of Asia. Sofia, Moscow, Leiden: Pensoft & Backhuys. 183 p.
- Zasyapkina I.A., Samokhvalov V.L. 2011. Communities of bottom macroinvertebrates in the streams of Anadyr River basin // Izvestiya Samarskogo Nauchnogo Tsentra Rossiiskoy Akademii Nauk (Izvestia of Samara Scientific Center of the Russian Academy of Sciences). Vol.13. No.1. Iss.5. P.1092–1096. [In Russian].
- Zhiltzova L.A. 1979. Novye dannye po faune vesnyanok (Plecoptera) Severo-Vostoka SSSR // Systematika i ecologiya ryb kontinental'nykh vodoyomov Dal'nego Vostoka. Vladivostok: DVNC AN SSSR. P.62–69. [In Russian].
- Zhiltzova L.A. 1981. Novye vidy vesnyanok (Plecoptera) c Dal'nego Vostoka // Morfologiya i systematika nasekomykh Dal'nego Vostoka. Trudy Zoologicheskogo Instituta AN SSSR. Vol.92. L.: Zoologicheskii Institut AN SSR. P.3–7. [In Russian].
- Zhiltzova L.A. 1995. Catalog of type specimens in the collection of the Zoological Institute, Russian Academy of Sciences. Plecoptera. Sankt Petersburg: Zoological institute RAS. 38 p. [In Russian].
- Zhiltzova L.A., Levanidova I.M. 1978. Novye vidy vesnyanok (Plecoptera) s Dal'nego Vostoka // Novye vidy zhivotnykh. Trudy Zoologicheskogo Instituta AN SSSR. Vol.61. P.3–29. [In Russian].
- Zhiltzova L.A., Levanidova I.M. 1984. Annotirovannyi katalog vesnyanok (Plecoptera) Dal'nego Vostoka // Biologiya presnykh vod Dal'nego Vostoka. Vladivostok: DVNC AN SSSR. P.18–45. [In Russian].
- Zhiltzova L.A., Zapekina-Dulkeit Y.I. 1986. Plecoptera // Opredelitel nasekomykh Dal'nego Vostoka SSSR. Vol.1. Pervichnobeskrilye, drevnekrylye s nepolnym prevrashcheniem. Leningrad: Nauka. P.172–234. [In Russian].
- Zwick P. 1980. 7. Plecoptera (Steinfliegen) // Helmcke J.G., Starck D., Wermuth H. (Eds): Handbuch der Zoologie. Eine Naturgeschichte der Stämme des Tierreichs 4, 2. Ht.2. Tl.115. 115 s.
- Zwick P., Levanidova I.M., Zhiltzova L.A. 1971. On the fauna of Plecoptera from the Soviet Far East // Revue d'Entomologie de l'URSS (Entomologicheskoe Obozrenie). Vol.50. No.4. P.849–869. [In Russian].

**Appendix to the article:** Teslenko V.A., Khamenkova E.V. Stoneflies (Plecoptera) of Northeast Asia and adjacent regions (Euroasian Entomological Journal. 2023. Vol.22. No.4. P. 218–226)

**Приложение к статье:** Тесленко В.А., Хаменкова Е.В. Веснянки (Plecoptera) Северо-Восточной Азии и сопредельных регионов (Евразийский энтомологический журнал. 2023. Т.22. Вып.4. С.218–226)

**An annotated list of Plecoptera species known from Chukotka, Magadanskaya Oblast, Kamchatka, and Yakutiya**

**Capniidae**

*Capnia* Pictet, 1841

**Remarks.** *Capnia* is polyphyletic genus of small winter stoneflies with the Holarctic distribution comprising about 130 named species [DeWalt et al., 2023], of which 16 species are reported in the Russian Far East, of them 11 species found in Northeast Asia.

*Capnia ahngerii* Koponen, 1949

**Notes.** East Palaearctic, relatively rare, boreal species inhabits mainly in large rivers, is known from Altai Mountains to Magadanskaya Oblast.

*Capnia atra* Morton, 1896

**Notes.** Transpalaearctic, in Northeast Asia was recorded in the Magadanskaya Oblast in fast-flowing large rivers, small streams, and lakes.

*Capnia bargusina* Zapekina-Dulkeit, 1975

**Notes.** East Palaearctic relatively rare species. The local populations were recorded from Transbaikalia to the South of the Russian Far East; in Magadanskaya Oblast was found in large and small streams.

*Capnia kolymensis* Zhiltzova, 1981

**Notes.** West Beringian species was recorded exclusively in small mountain streams in the upper Kolyma river basin, Magadanskaya Oblast, considered as endemic of Northeast Asia.

*Capnia kurnakovi* Zhiltzova, 1978

**Notes.** West Beringian species was found in small mountain streams of Chukotka and Magadanskaya Oblast, considered as endemic species of Northeast Asia.

*Capnia levanidovae* Kawai, 1969

**Notes.** West Beringian species was registered in Kamchatka on the snow in the small mountain and foothill streams, less often in slow-flowing foothill rivers, considered as endemic of Northeast Asia.

*Capnia nearctica* Banks, 1918

**Notes.** Transberingian species, in Northeast Asia occurs in Chukotka, Magadanskaya Oblast, and Kamchatka in the rivers and lakes; in the East Beringia is considered a tundra species [Ricker, 1964] known from Alaska, Yukon, and Northwest Territories south to Ontario.

*Capnia nigra* (Pictet, 1833)

**Notes.** Transpalaearctic, abundant species inhabits the watercourses of the different types, in Northeast Asia recorded in Chukotka, Magadanskaya Oblast, Kamchatka, and Yakutiya.

*Capnia pygmaea* Zetterstedt, 1840

**Notes.** Transpalaearctic, boreal species, in Northeast Asia occurs sporadically in small populations in Chukotka, Magadanskaya Oblast, and Kamchatka in foothill and plain rivers.

*Capnia rara* Zapena-Dulkeit, 1970

**Notes.** East Palaearctic, rare species registered from Enisey river basin to the South of the Russian Far East; in Northeast Asia the species occurs in Chukotka, Magadanskaya Oblast, Kamchatka, and Yakutiya.

*Capnia tshukotica* Zhiltzova et Levanidova, 1976

**Notes.** West Beringian, large tundra species, known on female, possibly viviparous, inhabits lakes in Chukotka south to the Northern Koryak Highlands, considered as endemic of Northeast Asia.

*Capniella* Klapálek, 1920

**Remarks.** Endemic East Palaearctic genus contains four species in Siberia, the Russian Far East, Korea and China.

*Capniella nodosa* Klapálek, 1920

**Notes.** Inhabits East Siberia, the Russian Far East, and China; in Northeast Asia occurs in Yakutiya.

*Eucapnopsis* Okamoto, 1922

**Remarks.** East Palaearctic and Western Nearctic genus contains four valid species and 2 subspecies. Four species are Palaearctic and one of them is common for East Palaearctic and West Nearctic. Only one subspecies is known from the Oriental Realm [Murányi et al., 2015]. There are some problems with the identity, especially unsure distinction from Mongolian and Russian populations of *E. brevicauda* [Judson, Nelson, 2012].

*Eucapnopsis brevicauda* (Claassen, 1924)

**Notes.** Amphipacific, one of the smallest Capniidae species widely distributed along both coasts of the Pacific Ocean; in the Northeast Asia occurs in Chukotka and Magadanskaya Oblast in small mountain streams and rivers; in America inhabits Alaska, Yukon south to California and New Mexico.

*Isocapnia* Banks, 1938

**Remarks.** Holarctic genus includes 21 species, 12 species known from the Nearctic, nine species recognized from Palaearctic [DeWalt et al., 2023]. *Isocapnia* distributed in the West Nearctic from Alaska and Yukon north to California and New Mexico south; in the East Palaearctic eight out of nine species have been recorded. Nymphs are rarely collected due to their hyporheic habitat.

*Isocapnia arcuata* Zhiltzova, 1975

**Notes.** East Palaearctic species inhabits Russian Far East, in Northeast Asia occurs in Magadanskaya Oblast mostly in small, less often in large foothill rivers.

*Isocapnia guentheri* (Joost, 1970)

**Notes.** East Palaearctic common species known from Mongolia and Russia, including the Altai Mountains and Far East;

in Northeast Asia occurs in Chukotka, Magadanskaya Oblast, and Kamchatka, in streams, small and large foothill rivers.

*Isocapnia kudia* Ricker, 1959

**Notes.** East Palaearctic species distributed in Russia from Transbaikalia to Far East, in Northeast Asia registered in the Magadanskaya Oblast in foothill and mountain streams and rivers.

*Isocapnia orientalis* Zhiltzova, 1975

**Notes.** East Palaearctic rare species recorded in Northeast Asia in Magadanskaya Oblast in the mountain and foothill rivers.

*Mesocapnia* Raušer, 1968

**Remarks.** Holarctic genus includes 19 species, four species known from Palaearctic, only one species is common with the Nearctic.

*Mesocapnia silvatica* Raušer, 1968

**Notes.** East Palaearctic, arctomontane species inhabits tundra streams of the Arctic desert; wide spread in Mongolia, China, and Russia from Enisey River basin to Sakhalin Region; in Northeast Asia occurs in Chukotka, Magadanskaya Oblast, Kamchatka, and Yakutiya.

*Mesocapnia variabilis* (Klapálek, 1920)

**Notes.** Holarctic, arcto-boreal species wide spread in Northeast Asia in tundra streams of the Arctic desert in Chukotka, also in Magadanskaya Oblast, Kamchatka, and Yakutiya; known from East part of Beringia from Alaska and Yukon.

*Paracapnia* Hanson, 1946

**Remarks.** The genus includes 11 species registered in the East Nearctic and East Palaearctic where known from the North Siberia to Korea peninsula.

*Paracapnai leisteri* Zhiltzova et Potikha 2005

**Notes.** Palaearctic, rare species with distribution limited to small mountain streams and rivers of the Russian Far East, in Northeast Asia founds in Magadanskaya Oblast.

**Leuctridae**

*Leuctra* Stephens, 1836

**Remarks.** The Holarctic genus includes more than two hundred species known from North America, Europe, Asia, and northern Africa.

*Leuctra fusca* (Linnaeus, 1758)

**Notes.** Transpalearctic species with autumn emergence is known in Northeast Asia from Yakutiya. The species includes three subspecies, which subspecies occurs in Yakutiya is still unknown. *Leuctra fusca tergostyla* Wu, 1973 inhabits Russian Far East, China, and Korea.

*Paraleuctra* Hanson, 1914

**Remarks.** The genus contains 24 species with wide distribution in the East Palaearctic, Nearctic and Oriental Realms; 3 species inhabit the Russian Far East, two of them occur in the Northeast Asia.

*Paraleuctra cercia* (Okamoto, 1922)

**Material.** Chukotka, *Beringovskii* Distr.: 1♂, 6♀♀ — 40 km SSW of the village Beringovskii, 62°43' N, 178°55' E,

5.VII.2012, the Lakhtin River, on the willow, coll. A.V. Stekolshchikov; 1♂, 6♀♀ — ibidem, 28.VII.2012, shaking of the willow, coll. A.V. Stekolshchikov.

**Notes.** East Palaearctic: China, Korea, and Japan. In Northeast Asia the species was registered in Magadanskaya Oblast and Kamchatka in small mountain streams as well as in large rivers. In Chukotka the species is reported for the first time.

*Paraleuctra zapekinae* Zhiltzova, 1974

**Notes.** East Palaearctic, relatively rare species registered in Mongolia; in Russia distributed from Altai Mountains and the Yenisei River basin to the Sea of Okhotsk coast; in Northeast Asia occurs in Magadanskaya Oblast.

*Perlomyia* Banks, 1906

**Remarks.** The genus comprises 25 species in West Nearctic and East Palaearctic. Two species distributed from Alaska and Yukon south to California and New Mexico; seven species known in the Russian Far East, single species was found in Northeast Asia primarily in springs or spring-fed small streams.

*Perlomya secunda* (Zapekina-Dulkeit, 1955)

**Notes.** East Palaearctic, spring species has a wide range in temperate Asia from the Altai Mountains in the West, to the Kuril Isles and Sakhalin Island in the East, and Korea in the South. In Northeast Asia the species was noted in the Magadanskaya Oblast in small mountain streams.

**Nemouridae**

*Amphinemura* Ris, 1902

**Remarks.** Amphinemura is a large and widespread genus of stoneflies with about 200 species known from the Holarctic and Oriental Realms. Nearly half of these species inhabit East Palaearctic. There are 9 species in the Russian Far East; one species occurs in Northeast Asia.

*Amphinemura standfussi* (Ris, 1902)

**Notes.** Transpalearctic, subarctic, and boreal species with late summer emergence, widely distributed in large rivers and small streams, can be abundant in outlet of high latitude lakes. In Northeast Asia the species was recorded in Magadanskaya Oblast, Kamchatka, and Yakutiya.

*Nemoura* Latreille, 1796

**Remarks.** The most species-rich genus with more than 200 species recognized from the Holarctic and Oriental Realms. Approximately half of the *Nemoura* species occur in the East Palaearctic. Two species occur in Northeast Asia.

*Nemoura arctica* Esben-Petersen 1910

**Notes.** Holarctic, arctic, subarctic, a freeze-tolerant species easily adaptable to a variety of environmental conditions inhabits flowing streams, lakes, swampy areas with an inflow of groundwater. The species is widespread in Northeast Asia in Chukotka, Magadanskaya Oblast, Kamchatka, and Yakutiya as well as in Alaska, Yukon, and Northwest Territories.

*Nemoura sirotskii* Teslenko, 2018

**Notes.** East Palaearctic, relatively rare species with local populations is known from cold mountain stream and rivers in the Russian Far East from Amurskaya Oblast to the Sea of Okhotsk coast; in Northeast Asia was registered in Magadanskaya Oblast.

***Podmosta* Ricker, 1952**

**Remarks.** A small Trans-Pacific genus has seven valid West Nearctic species, one of them is known in Northeast Asia.

***Podmosta weberi* (Ricker, 1952)**

**Notes.** Transberingian species has widely disjunction on both sides of the Pacific Ocean in West Nearctic and East Palaearctic: in Northeast Asia occurs in Chukotka, Magadanskaya Oblast, and Kamchatka; in Alaska and Yukon the species inhabits small mountain streams at high elevations and small subarctic streams and considered as endemic. The species is also known from the northeast tributaries of the Baikal Lake.

***Zapada* Ricker, 1952**

**Remarks.** Nearctic and East Palaearctic genus with 12 species. *Ten species* that mostly live in cold streams are distributed across the mountains of the western USA. Two species inhabits Russian Far East south to Korea and China.

***Zapada quadrbranchiata* (Zhiltzova, 1977)**

**Notes.** East Palaearctic, registered in Northeast Asia in small mountain streams in the Magadanskaya Oblast and Yakutiya.

**Taeniopterygidae*****Taenionema* Banks, 1905**

**Remarks.** Holarctic genus with 14 species, 13 species known from Nearctic, the one species from East Palaearctic; inhabits small mountain streams at high elevations and small subarctic streams.

***Taenionema japonicum* (Matsumura, 1904)**

**Notes.** East Palaearctic, widely distributed, psychrophilic species is one of the dominant and common in the spring fauna; in Northeast Asia inhabits Chukotka, the Magadanskaya Oblast, Kamchatka, and Yakutiya.

***Taeniopteryx* Pictet, 1841**

**Remarks.** Holarctic genus includes 23 species distributed in Nearctic (11 species) and Palaearctic (12 species) in very diverse habitats ranging from fast cool or warm springs, rock or sand-bottomed streams, and sometimes even in intermittent streams. In Northeast Asia only one species.

***Taeniopteryx nebulosa* (Linnaeus, 1758)**

**Notes.** Transpalaearctic, in Northeast Asia is rare, recorded once in Ola River in Magadanskaya Oblast.

**Perlodidae*****Arcynopteryx* Klapálek, 1904**

**Remarks.** Holarctic genus comprises 5 species, which all occurs in East Palaearctic and only one species inhabits Nearctic. In Northeast Asia three species were recorded, they are psychrophilic, occurring in streams and high-elevation lakes.

***Arcynopteryx dichroa* (McLachlan, 1872)**

**Notes.** Holarctic, boreal-alpine species with distribution primarily in the northern latitudes, occurring in tundra streams, also in rivers, and in high-elevation lakes with stony shorelines. In Central and Southwest Europe has a disjunctive boreo-montane distribution with Pleistocene relict populations; widespread in Asia including Mongolia, Siberia, the Russian Far East, and Japan. In Northeast Asia inhabits Chukotka, Magadanskaya

Oblast, Kamchatka, and Yakutiya. *A. dichroa* is the only one of five species that occurs across Arctic region. *A. dichroa* recorded in Alaska, Yukon, Northwest Territories, and in other states of the United States and provinces of Canada on the north.

***Arcynopteryx amurensis*****Zhiltzova et Levanidovae, 1978**

**Notes.** East Palaearctic species, distribution is limited by cold streams and small rivers in Amurskaya Oblast and Khabarovskiy Krai in the Russian Far East; in Northeast Asia founds in the Magadanskaya Oblast.

***Arcynopteryx polaris* Klapálek, 1912**

**Notes.** East Palaearctic, widespread in Mongolia, China, Korea, and Russia. In Northeast Asia recorded in Chukotka, the Magadanskaya Oblast, Kamchatka, and Yakutiya. Arcto-boreal species inhabits oligotrophic lakes; limnocyrenes, fast and cold, mountain forested as well as tundra streams of the Arctic desert and near arctic thermal mineral springs.

***Diura* Billberg, 1758**

**Remarks.** Holarctic genus includes five species, four species inhabit Palaearctic, three species are in Northeast Asia two of them are common with Nearctic. Nymphs and adults occur in streams, small and large rivers, mountain lakes; they are mainly rare in collections.

***Diura bicaudata* (Linnaeus, 1758)**

**Notes.** The species with Holarctic distribution: in West Nearctic occurs in Alaska, Yukon as well as in Manitoba and Saskatchewan; in Northeast Asia is found in Chukotka, Magadanskaya Oblast and Yakutiya, mainly in rivers.

***Diura nanseni* (Kempny, 1900)**

**Notes.** Transpalaearctic. In East Palaearctic registered from Altai Mountains and Yenisey River to Lena River basin, in Northeast Asia spread in the Magadanskaya Oblast and Yakutiya.

***Diura majuscula* (Klapálek, 1912)**

**Notes.** East Palaearctic species with distribution from Amurskaya Oblast to Magadanskaya Oblast; in Northeast Asia found also in Kamchatka and Yakutiya in the foothill rivers and streams.

***Isoperla* Banks, 1906**

**Remarks.** Holarctic widespread genus includes about 200 species, more than 20 species are known from East Palaearctic, and 5 species from Northeast Asia.

***Isoperla chershevi* Teslenko, 2017**

**Notes.** West Beringian species known from Magadanskaya Oblast, in the Ola River and the Bol'shaya Garmanda River basins.

***Isoperla eximia* Zapekina-Dulkeit**

**Notes.** East Palaearctic species inhabits Mongolia, China and Russia from Altai and Sayan Mountains to the Sea of Okhotsk coast; in Northeast Asia occurs in Yakutiya and Magadanskaya Oblast.

***Isoperla obscura* (Zetterstedt, 1840)**

**Notes.** Transpalaearctic, in Northeast Asia is registered in Chukotka, Magadanskaya Oblast, and Yakutiya in large rivers and their tributaries.

**Megarcys** Klapálek, 1912

**Remarks.** West Nearctic and East Palaearctic genus contains eleven species, three species are in East Palaearctic.

*Megarcys ochracea* (Klapálek, 1912)

**Notes.** East Palaearctic occurs in Mongolia, from Altai Mountains to Russian Far East south to Korea and Japan; in Northeast Asia occurs in Magadanskaya Oblast and Yakutiya.

*Megarcys pseudochracea* Zhiltzova, 1977

**Notes.** East Palaearctic, from Amurskaya Oblast to the Sea of Okhotsk coast; in Northeast Asia was registered in Yakutiya.

**Pictetiella** Banks, 1947

**Remarks.** West Nearctic and East Palaearctic genus contains four species. Two species are recorded in East Palaearctic from Mongolia north to Northeastern Siberia, Far East, south to China, Japan and Korea.

*Pictetiella asiatica* Zwick et Levanidova, 1971

**Notes.** East Palaearctic, arcto-montane species spread from Altai and Sayan Mountains to the Sea of Okhotsk coast; in Northeast Asia occurs in Magadanskaya Oblast, Kamchatka (abundant), and Yakutiya; also known from Mongolia, China, and Korea. Stenothermic larvae live at different altitudes, counting plains; in the south occurs only in mountain streams.

*Pictetiella zwicki* Zhiltzova, 1976

**Notes.** West Beringian species, occurs in Chukotka near thermal mineral springs, and in Magadanskaya Oblast.

**Skwala** Ricker, 1943

**Remarks.** West Nearctic and East Palaearctic genus comprises 5 species. Three species are recorded in East Palaearctic from Mongolia north to Northeastern Siberia south to Japan.

*Skwala compacta* (McLachlan, 1872)

**Notes.** East Palaearctic abundant species inhabits large foothill rivers and small mountain rivers and streams. In Northeast Asia occurs in Chukotka, Magadanskaya Oblast, Kamchatka, and Yakutiya. The species also found in Mongolia, China, and Japan.

**Perlidae****Agnetina** Klapálek, 1907

**Remarks.** *Agnetina* is distributed in Holarctic and Oriental Realms currently includes more than 32 species, eight found in the East Palaearctic, two of them in the Russian Far East.

*Agnetina brevipennis* (Klapálek, 1921)

**Notes.** East Palaearctic species occurs in Mongolia and in Altai Mountains to the Russian Far East including Sakhalin Island; in Northeast Asia occurs in Chukotka, Magadanskaya Oblast and Yakutiya in mountain streams and rivers.

*Agnetina extrema* (Navás, 1912)

**Notes.** East Palaearctic species inhabits Mongolia and Siberia to the Russian Far East; in Northeast Asia registered in Yakutiya.

**Kamimuria** Klapálek, 1907

**Remarks.** *Kamimuria* is a genus widespread in the East Palaearctic and Oriental Realms including more than 80 species, about 60 species inhabit China.

*Kamimuria exilis* (McLachlan, 1872)

**Notes.** East Palaearctic species distributed from Mongolia to the Russian Far East; in Northeast Asia found in Yakutiya.

**Chloroperlidae****Alaskaperla** Stewart et DeWalt, 1991

**Remarks.** Transberingian genus has widely disjunction on both sides of the Pacific Ocean in West Nearctic and East Palaearctic contains 2 species; the first species is recorded in East Palaearctic from Mongolia north to the Russian Far East. The second inhabits in Alaska and is considered as East Beringian endemic.

*Alaskaperla longidentata* (Raušer, 1968)

**Notes.** East Palaearctic species spread from Mongolia to Russian Far East; in Northeast Asia known from Magadanskaya Oblast and Yakutiya. For Kamchatka is recorded for the first time.

**Alloperla** Banks, 1906

**Remarks.** East Palaearctic and Nearctic genus comprises more than 50 species; 14 species are known in East Palaearctic from Mongolia to Siberia, Russian Far East, China, Korea and Japan; only three of them are noted in Northeast Asia in the mountain and foothill streams.

*Alloperla mediata* (Navás, 1925)

**Notes.** East Palaearctic, distributed from Mongolia through Siberia, Russian Far East to China, Korea, and Japan; in Northeast Asia registered in the Magadanskaya Oblast, Kamchatka and Yakutiya.

*Alloperla rostellata* (Klapálek, 1923)

**Notes.** East Palaearctic with distribution from Mongolia through Siberia, Russian Far East to Korea; in Northeast Asia occurs in Chukotka, Magadanskaya Oblast, Kamchatka, and Yakutiya.

*Alloperla teleckojensis* Šámal, 1939

**Notes.** East Palaearctic, from Mongolia through Siberia to Russian Far East, in Northeast Asia inhabits Magadanskaya Oblast and Yakutiya.

**Haploperla** Navás, 1934

**Remarks.** *Haploperla* is established in the East Palaearctic, Nearctic, and Oriental Realms includes 15 species, 7 found in the East Palaearctic, in Northeast Asia known only one species.

*Haploperla lepnevae* Zhiltzova et Zwick

**Notes.** East Palaearctic occurs from Mongolia through Siberia to Russian Far East and China; in Northeast Asia reported in Magadanskaya Oblast, Kamchatka, and Yakutiya.

**Plumiperla** Surdick, 1985

**Remarks.** Transberingian genus has widely disjunction on both sides of the Pacific Ocean in West Nearctic and East Palaearctic, contains 2 species, one of them occurs in Northeast Asia.

*Plumiperla diversa* (Frison, 1935)

**Material:** Chukotka, *Beringovskii Distr.*: 1♂ — 40 km SSW of the village Beringovskii, 62°43'N 178°55'E, the Lakhtin River, forbs on the high river bank, 28.VII.2012, coll. A.V. Stekolshchikov.

**Notes.** Transberingian distribution, in West Nearctic known from Alaska and Yukon; in Northeast Asia registered in the

Magadanskaya Oblast and Kamchatka. Rare, occurs in small mountain streams as well as in large rivers. For Chukotka the species is reported for the first time.

***Suwallia* Ricker, 1943**

**Remarks.** Nearctic and East Palaearctic genus comprises 29 species; 14 are in East Palaearctic known in Mongolia, China, Japan, and Russian Far East; in Northeast Asia are four species.

***Suwallia decolorata* Zhiltzova et Levanidova, 1978**

**Notes.** East Palaearctic with distribution in China and the Russian Far East; in Northeast Asia is recorded in the Magadanskaya Oblast.

***Suwallia errata* Li et Li, 2021**

**Notes.** East Palearctic, abundant species widespread in the mountain and plain rivers, and streams from Mongolia to Russia, China, and Japan; in Northeast Asia registered in Chukotka, Magadanskaya Oblast, Kamchatka, and Yakutiya.

***Suwallia kerzhneri* Zhiltzova et Zwick, 1971**

**Notes.** East Palearctic with distribution from Mongolia to the Russian Far East; in Northeast Asia occurs in Chukotka, Magadanskaya Oblast, Kamchatka, and Yakutiya.

***Suwallia talalajensis* Zhiltzova, 1976**

**Notes.** East Palearctic species known from the Russian Far East and China; in Northeast Asia inhabits Chukotka, Magadanskaya Oblast, Kamchatka, and Yakutiya.

***Utaperla* Ricker, 1952**

**Remarks.** Nearctic and East Palaearctic genus includes 4 species; two species are in the East Palaearctic, both found in Northeast Asia.

***Utaperla lepnevae* (Zhiltzova, 1970)**

**Notes.** East Palaearctic species inhabits Russian Far East, in Northeast Asia found in Chukotka, Magadanskaya Oblast, and Kamchatka.

***Utaperla orientalis* Nelson et Hanson, 1969**

**Notes.** East Palaearctic species known from Russian Far East and China, in Northeast Asia occurs in Magadanskaya Oblast and Kamchatka.

**Pteronarcyidae**

***Pteronarcys* Newman, 1838.**

**Remarks.** Boreal Nearctic and East Palaearctic genus of giant stoneflies is represented by ten valid species, of which two species are East Palaearctic and known from Mongolia, Siberia, Russian Far East and Korea.

***Pteronarcys reticulata* Burmeister, 1839**

**Notes.** East Palaearctic species, in Northeast Asia is registered in Yakutiya, mainly in large foothill rivers in the upper and middle reaches.