



## STONEFLIES (INSECTA, PLECOPTERA) OF KABARDA-BALKARIAN REPUBLIC (THE CENTRAL CAUCASUS)

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### ABSTRACT

In this study 17 stonefly species are reported for the Kabarda-Balkarian Republic, The Central Caucasus. Distributions and ecological notes are presented for each species and the significance of stonefly distributions to local water quality is discussed.

**Keywords:** Stoneflies, Plecoptera, river and spring streams, Kabarda-Balkarian Republic, The Central Caucasus

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### INTRODUCTION

Stoneflies are one of the most ancient insect groups with incomplete metamorphosis. The larvae occur in streams and glacial springs with cold and clean water and the adults inhabit the terrestrial environment, but their lives usually last for only a few days. Many species of stoneflies are known to be endemics of various geographic zones (Kutikova & Starobogatov 1977; Zhiltzova & Teslenko 1997; Zhiltzova & Cherchesova 2003; Teslenko & Zhiltzova 2009).

Plecoptera, like Diptera (Chironomidae, Simuliidae), Trichoptera, and Ephemeroptera, are widely distributed in streams. Although the list of Caucasian stoneflies is relatively well known (Kasymov 1972; Kutikova & Starobogatov 1977; Minoraskiy 1984; Cherchesova 2004; Cherchesova & Zhiltzova 2006), there are still many questions concerning the biology, ecology and morphology particularly of the larval stage of these insects. In this study an annotated list of the Kabarda-Balkarian

stoneflies is given.

### MATERIALS AND METHODS

The samples were collected from glacial rivers (Malka, Baksan, Chegem, Cherek, Uruch, Terek) and their tributaries (Zolka, Nalchik, Shalushka, Kamenka, Kenzhe, Urvan' etc.) between 1987 and 2011. The collection includes 1500 samples containing approximately 5500 larval and adult stoneflies. The identification of species was made with help of appropriate reference works (Kutikova & Starobogatov 1977; Zhiltzova & Teslenko 1997), including those written especially for the Caucasian zone (Cherchesova & Zhiltzova 2006; Teslenko & Zhiltzova 2009). The specimens were processed using a MBS-1 binocular microscope. Live larvae were frequently used because the necessary features can be more readily seen on live specimens. Larvae that could not be identified were dissected and their extremities and mouthparts were used for making permanent preparations.

## RESULTS

Based on our results, it is established that there are at least 17 species of stoneflies in the Kabarda-Balkarian republic. They occur primarily in small spring rivers near the foothills (the surroundings of Nalchik-city, rivers: Nalchik, Shalushka, Kenzhe, Kamenka, Beshenka, Belaya etc). The list of stoneflies of the Kabarda-Balkarian republic (KBR) is given below together with maps showing distribution of each family.

**Family Perlidae** in Kabarda-Balkarian republic is represented by 3 genera and 4 species (Fig. 1).

### 1. *Perla caucasica* Guerin 1838

**Distribution.** This is the most widespread species in KBR where it occurs at elevations up to 1000-1500 m above sea level. The predaceous larvae feed on

Diamesinae and Orthocladiinae.

### 2. *Perla pallida* Guerin 1838

**Distribution.** A common species found in spring rivers in the foothills (the surroundings of Nalchik-city, 450-650 m above sea level).

### 3. *Agnatina senilis* (Klapálek 1921)

**Distribution.** A common species collected in the rivers Baksanyonok, Deya, Baksan, Malka, Nalchik (Cherchesova & Zhiltzova 2006) and glacial rivers (the lower reaches of Nalchik, Shalushka, Kenzhe, etc.) from plain to foothills up to 600-650 m above sea level.

### 4. *Paragnetina transoxanica* (Klapálek 1921)

**Distribution.** Found only in the river Kenzhe (near village Kenzhe, in a forest zone, 600-650 m above sea level), however, in this river it is common.

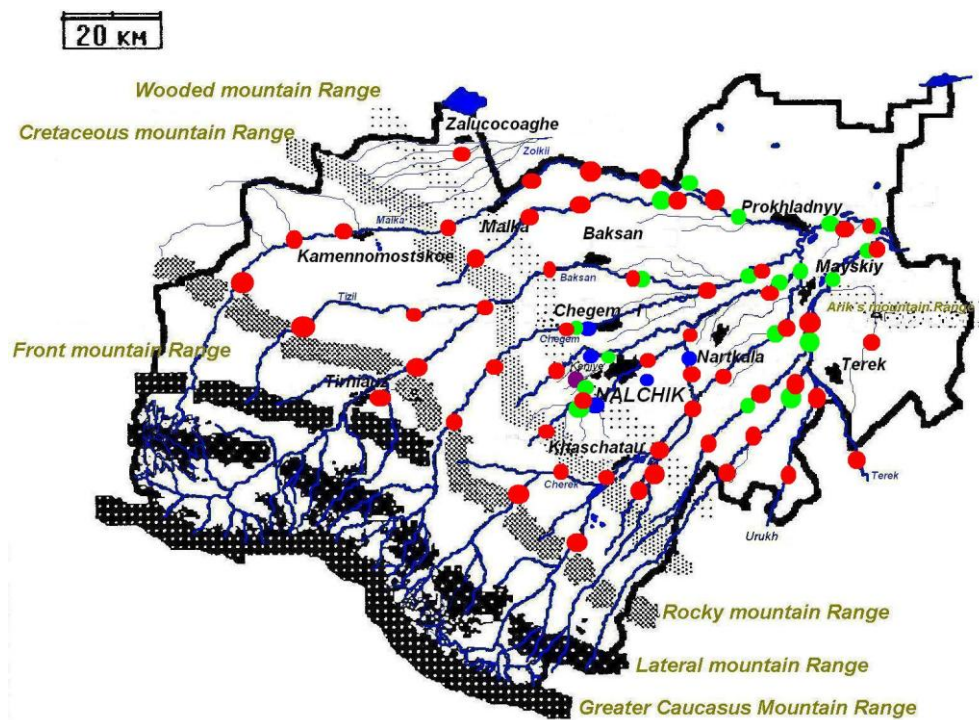


Fig. 1. Distribution of the stonefly family Perlidae (topographical basis by: A.V. Kuptsova): ■ *Perla caucasica* Guerin-Meneville; ■ *Perla pallida* Guerin-Meneville; ■ *Agnatina senilis* (Klapalek); ■ *Paragnetina spinulifera* (Zhiltzova).

**Family Perlodidae** is represented by 2 species, widely distributed in the republic (Fig. 2).

### 5. *Perlodes microcephalus* (Pictet 1833)

**Distribution.** A typical and widely distributed

species for KBR, especially in small foothill rivers in the deciduous forest zone.

6. *Isoperla bithynica* (Kempy 1908).

**Distribution.** The most common and abundant

species of family Perlodidae, found almost everywhere in KBR. Predaceous larvae feed on larvae and pupae of the chironomid, *Diamesa insignipes*.

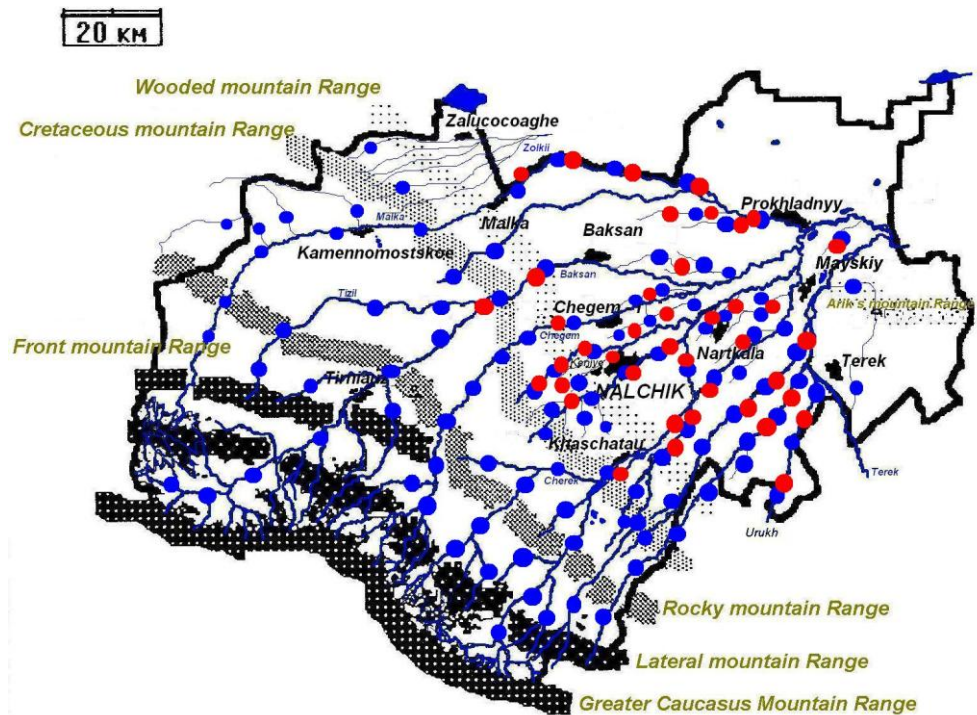


Fig. 2. Distribution of the stonefly family Perlodidae (topographical basis by: A.V. Kuptsova): ■ *Perlodes microcephalus* (Pictet); ■ *Isoperla bithynica* (Kempny).

**Family Chloroperlidae** in KBR is represented by 2 genera and 2 species that have limited natural habitat (Fig. 3).

7. *Pontoperla katherinae* Balynsky 1950

**Distribution.** The preimago stage of development is common among the benthos of glacial streams and spring rivers of foothill and mountain zones of KBR, but at 500 m below sea level larvae of this species were not found. In the foothill and mountain zone frequently associated with detrital materials in spring and summer, we found 17-45 specimens per square meter. The average weight of mature larvae (length 7-8 mm) is 6.3-7.1 mg. The larvae are concentrated near the water and substrate interface, on stones washed by water. Most were found in streams with well developed riparian forests

(Yakimov et al 2011b).

8. *Chloroperla* sp. (perhaps *C. zhiltzovae* Zwick 1967).

**Distribution.** Found rarely in the surroundings of Nalchik-city in the spring rivers Nalchik, Shalushka, Kenzhe and Kamenka.

**Family Taeniopterygidae** is represented by 2 genera and 3 species (Fig. 4).

9. *Taeniopteryx nebulosa* (Linnaeus 1758)

**Distribution.** In previous works (Zhiltzova & Tesleko 1997; Cherchesova & Zhiltzova 2006) the authors wrote that *T. nebulosa* was found in the Kabarda-Balkarian republic and Northern Osetiya, but in our expedition it could only be found in very low numbers in the streams surrounding Nalchik-city.

10. *Taeniopteryx caucasica* Zhiltzova 1981



**Distribution.** It is widely distributed in KBR where it occurs primarily in the upper reaches of glacial and

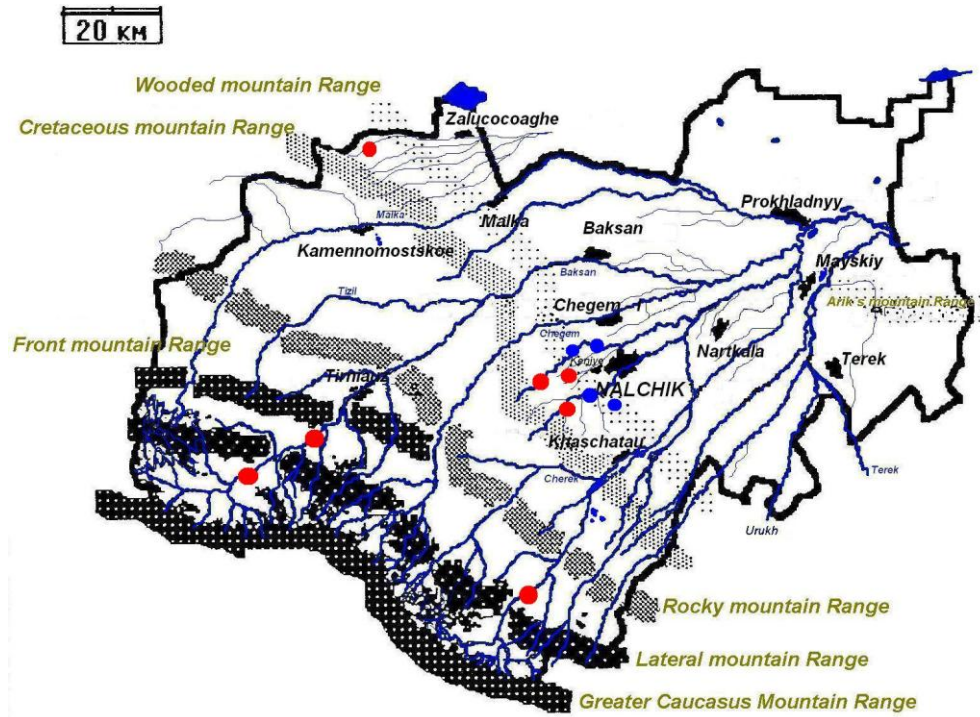


Fig. 3. Distribution of the stonefly family Chloroperlidae (topographical basis by: A.V. Kuptsova):  
■ *Pontoperla katherinae* Balynsky; ■ *Chloroperla* sp.

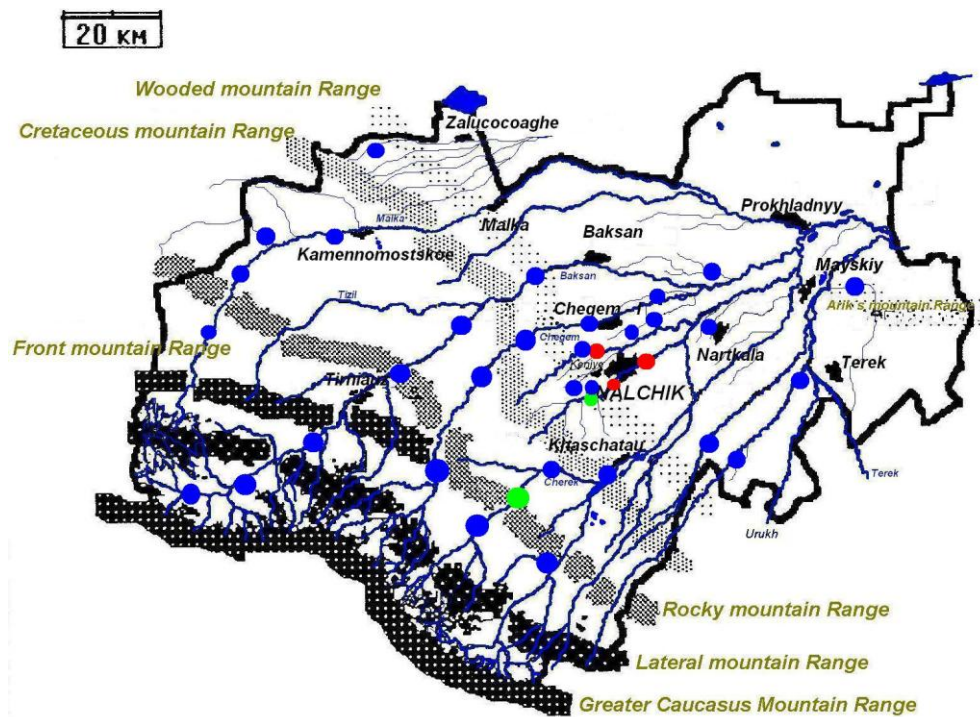


Fig. 4. Distribution of the stonefly family Taeniopterygidae (topographical basis by: A.V. Kuptsova):

■ *Taeniopteryx nebulosa* (Linnaeus); ■ *Taeniopteryx caucasica* Zhiltzova; ■ *Brachyptera transcaucasica* Zhiltzova. spring rivers. The high density of larvae, up to 150 individuals per square meter, leads to mass emergence and flight of adults in February and early March.

11. *Brachyptera transcaucasica* Zhiltzova 1956

**Distribution.** This rare species was found in only two locations, the upper reaches of Cherek Bezenngiyskiy (the surroundings of village Karasuu) and the upper reaches of Nalchik.

**Family Nemouridae** is represented by 3 genera and 3 species (Fig. 5).

12. *Amphinemura trialetica* Zhiltzova 1957

**Distribution.** This species was found at three sites, the glacial river Uruch (near village Staryi Uruch),

the river Kamenka (near villages Shalushka and Yanikoy) and the upper reaches of Nalchik-river. In these places it is common with densities sometimes in the 55-75 individuals per square meter range.

13. *Protonemura aculeata* Theischinger 1975

**Distribution.** The species is widely distributed in the foothills and in the mountains of KBR (in the plains it is replaced by another species) (Yakimov et al. 2011a). The larvae of this genus are the most widely distributed in the benthos, but they are quite sensitive to chemical and organic pollution.

14. *Nemoura cinerea* (Retzius 1783)

**Distribution.** Found only in the Nalchik-river (in Nalchik-city).

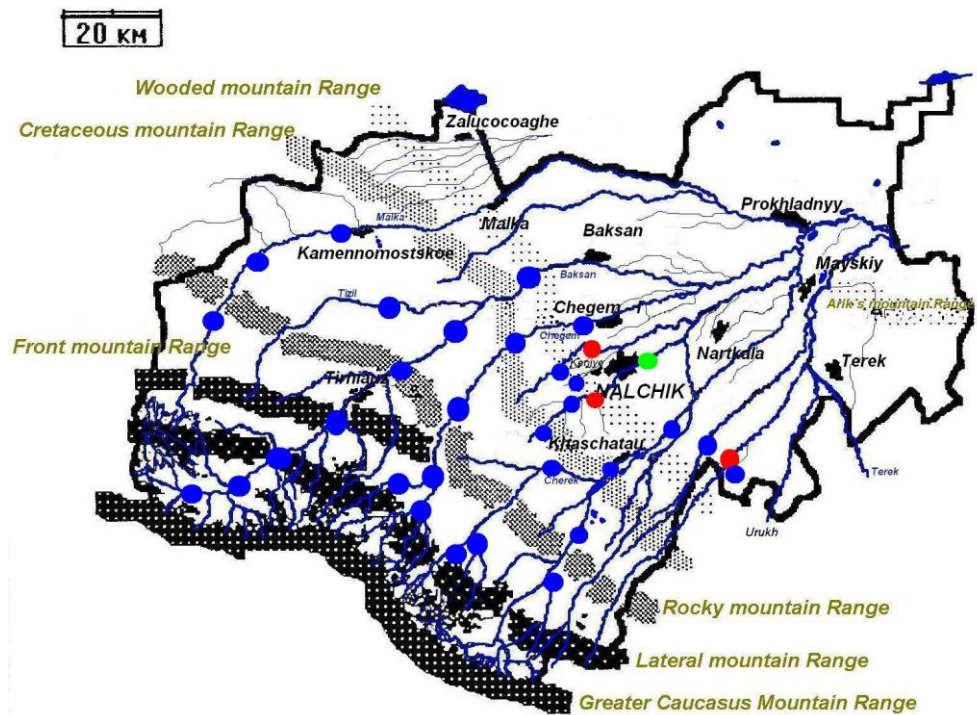


Fig. 5. Distribution of the stonefly family Nemouridae (topographical basis by: A.V. Kuptsova):

■ *Amphinemura trialetica* Zhiltzova; ■ *Protonemura aculeata* Theischinger; ■ *Nemoura cinerea* (Retzius).

**Family Capniidae** is represented by 1 genus and 1 species (Fig.6).

15. *Capnia nigra* (Pictet 1833)

**Distribution.** This species was found in small numbers from the rivers Zolka Bolshaya (the surroundings of village Svetlovodskoe), Nalchik-city,

Shalushka, Kenzhe, Kamenka (the surroundings of Nalchik-city).

**Family Leuctridae** is represented in Kabarda-Balkarian republic by 1 genus and 2 species (Fig. 7).

16. *Leuctra fusca* (Linnaeus 1758)

**Distribution.** Widely distributed in the foothills. In



spring rivers it can be found in densities of 45 individuals per m<sup>2</sup>. Often it is found among fall leaf packs.  
17. *Leuctra hippopus* (Kempny 1899)

**Distribution.** Like the previous species, it is widely distributed in the foothill zone and is found in similar habitat.

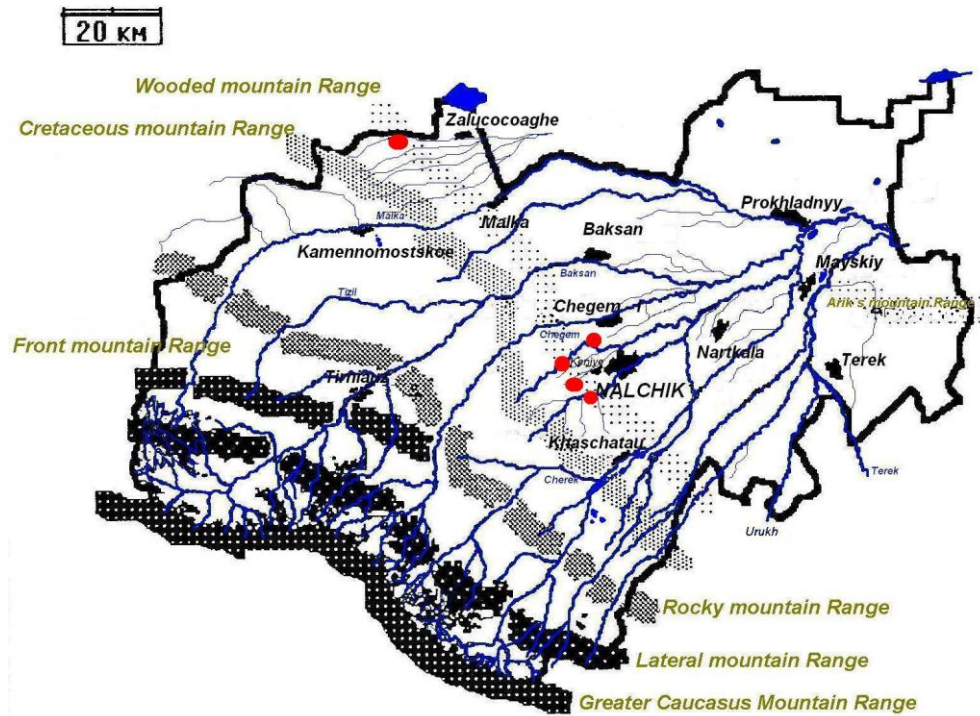


Fig. 6. Distribution of the stonefly *Capnia nigra* (Pictet) (topographical basis by: A.V. Kuptsova).

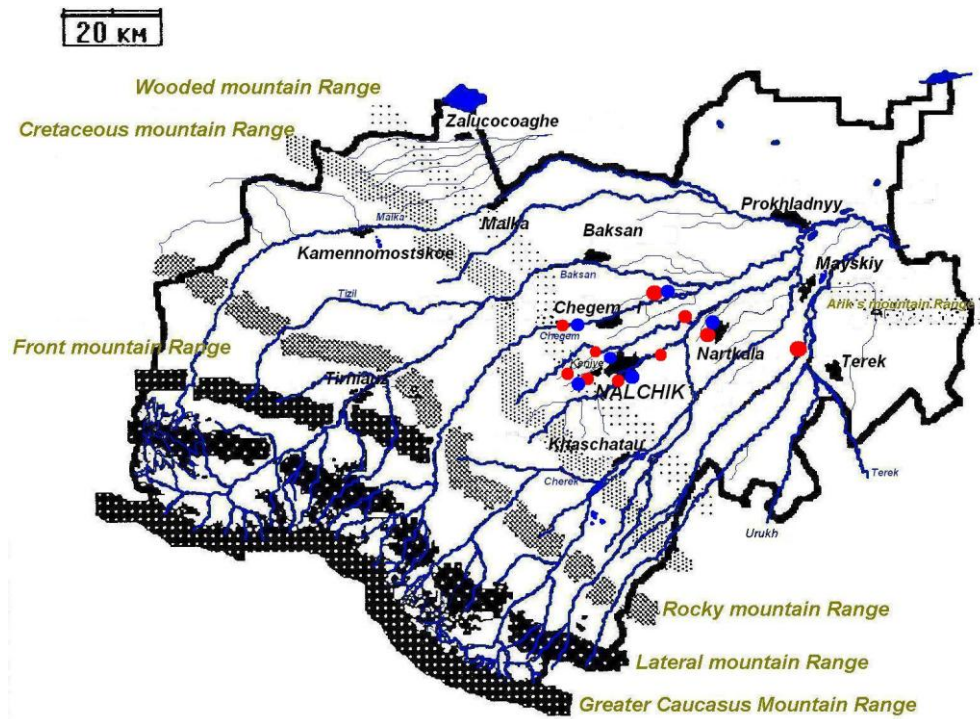



Fig. 7. Distribution of the stonefly family Leuctridae (topographical basis by: A.V. Kuptsova): ■ *Leuctra*

*fusca* (Linnaeus);  *Leuctra hippopus* (Kempny).

## DISCUSSION

During this study the following 17 species of stoneflies were found in smaller rivers of the Kabarda-Balkarian republic:

*Perla caucasica* Guerin 1838  
*Perla pallida* Guerin 1838  
*Agnetina senilis* (Klapálek 1921)  
*Paragnetina transoxanica* (Klapálek 1921)  
*Perlodes microcephalus* (Pictet 1833)  
*Isoperla bithynica* (Kempny 1908)  
*Chloroperla* sp. (perhaps *C. zhiltzovae* Zwick 1967)  
*Pontoperla katherinae* Balinsky 1950  
*Taeniopteryx nebulosa* (Linnaeus 1758)  
*Taeniopteryx caucasica* Zhiltzova 1981  
*Brachyptera transcaucasica* Zhiltzova 1956  
*Amphinemura trialetica* Zhiltzova 1957  
*Protonemura aculeata* Theischinger 1975  
*Nemoura cinerea* (Retzius 1783)  
*Capnia nigra* (Pictet 1833)  
*Leuctra fusca* (Linnaeus 1758)  
*Leuctra hippopus* Kempny 1899

More than half of these species are regional endemics (*Pontoperla katherina*, *Taeniopteryx caucasica*) and subendemics (*Perlodes microcephalus*, *Isoperla bithynica*, *Chloroperla* sp., *Amphinemura trialetica*, *Protonemura aculeata*). Mediterranean species (*Perla pallida* and *Brachyptera transcaucasica*) and widely distributed Eurasian species (*Nemoura cinerea*, *Capnia nigra*, *Leuctra fusca* and *Leuctra hippopus*) comprise most of the remainder. *Taeniopteryx nebulosa* is a transpalearctic species found in the streams of Eurasia and Northern Africa (Kutikova & Starobogatov 1977; Zhiltzova & Teslenko 1997; Teslenko & Zhiltzova 2009).

The calculation of the coefficient of community relationship (Zhakkar's coefficient) did not reveal major differences between streams in the surroundings of Nalchik-city. In study streams, especially in the middle and upper reaches, all species of stoneflies co-occur and the coefficient of relationship varied from 80 to 100%. This is also true for the entire length of the rivers Kenzhe and Kamenka, and for the upper reach of rivers Shalushka and Nalchik, and likely reflects the small anthropogenic influence at these sites. The exception to this rule is *Brachyptera transcaucasica* which occurs

in the upper reach of Nalchik-river and in the glacial river Uruch. In glacial rivers we generally found only 5-7 species of stoneflies, and in the benthos fauna of the lower reaches they almost vanish. This may be related to the occurrence of alcohol-fractures that pollute the water.

One of the objectives of our research was to evaluate the quality of surface water of small rivers using the method of biological indication (biomonitoring with help of the stoneflies). In our study the majority of stoneflies were found in the upper reaches of rivers, where the quality of water is within the xeno- and oligosaprobic zone (0.05-1.5 units). In regional stonefly communities larvae of *Protonemura* and *Taeniopteryx* predominate whereas the others are rare. This is likely related to their individual ecological requirements and biological features.

Within Nalchik-city in the small rivers Nalchik and Shalushka we observed a deterioration of water quality as xeno- and oligosaprobic streams changed to moderately polluted and polluted. In such rivers (betamezosaprobic zone) we found only *Perla caucasica*, which is able to live in extremely polluted environments. The decreasing of quantity (from about 100 to 15) and diversity of the stoneflies (from 10-15 species to 1) is suggested by our results to coincide with polluting of the rivers. This pollution changes the water quality from I – II class (xeno- and oligosaprobic) to III – IV class (beta- and alphamezasaprobic). It should be pointed out that in the 1990's the middle and upper reaches of Nalchik-river we found almost all known regional species of stoneflies.

In our study we also attempt to designate the main biocenote links. For example, we discovered (for the first time in science) that *Isoperla bithynica* is a predator. In its gut we found the fragments and the whole larvae of the chironomid, *Diamesa insignipes* (inside two *Isoperla* we found 6 and 8 larvae, respectively of *Diamesa*). We think the larger larvae of *Perla caucasica* are also predators, because they consumed at least some small invertebrates – Simuliidae, Chironomidae, Ephemeroptera etc, but the question of food specialization requires additional study.

Small and medium stoneflies (*Pontoperla*

*katherinae*, *Protonemura aculeata*, *Amphinemura trialetica*, *Taeniopteryx nebulosa*, *Taeniopteryx caucasica*, *Brachyptera transcaucasica*, *Chloroperla* sp., *Nemoura cinerea*, *Capnia nigra*, *Leuctra fusca* and *Leuctra hippopus*) probably eat detritus. This is suggested by the occurrence of the larvae of these stoneflies in wet fall leaves, among the dust of rotten wood, in aquatic moss, or on the remains of brown trout (*Protonemura aculeata* and *Leuctra fusca* from Beshenka-river).

The larvae of stoneflies are considered one of the most important foods of river fish, and the adults are the food for spiders, other insects, lizards, amphibians, birds and for, perhaps, mammals.

The given list of the stoneflies for the territory is not final. The further research of this group of amphibiotic insects will more precisely show the composition of the stoneflies and also will increase the knowledge about features of biology and ecology of these animals in the Kabarda-Balkarian Republic.

## ACKNOWLEDGMENTS

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