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Stoneflies (Plecoptera, Insecta) from Sarnena Sredna Gora Mts

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Abstract. We recorded a total of nine species and four subspecies of stoneflies from eleven localities in the Sarnena Sredna Gora Mountains (Bulgaria). They belong to six families and eight genera of the order Plecoptera and represent 11.93% of the 109 stoneflies known up to now for Bulgaria. One of the registered species is endemic, while ten stoneflies have been found for the first time from the mountains.

Key words: Insecta, Plecoptera, new records, Bulgaria.

Introduction

There are only four published records of Plecoptera from the Sarnena Sredna Gora Mts. The first data on the stoneflies are reported by Braasch & Joost (1971). Summary data on the stonefly fauna of the Tundzha River are also reported in the studies of Russev *et al.* (1984) and Yaneva & Russev (1985). They found one species of the family Taeniopterygidae (Plecoptera) in the river. So far, only four species of stoneflies have been recorded from the study area. This scanty information is also included in the present paper.

The aim of this work is to present comprehensive data on faunistic composition of the species-group taxa of Plecoptera of the Sarnena Sredna Gora Mts and to divulge some patterns of the stonefly distribution from zoogeographical and conservation point of view.

Material and Methods

The present study summarises all information from the available literature up to now and gives new and recent unpublished faunistic data for the stoneflies from the Sarnena Sredna Gora Mts. The materials, six species and three subspecies of Plecoptera, were collected between July 2018 and May 2019. The list of stoneflies species was completed on the basis of available bibliographic data, mentioned above in the Introduction, and original data of the authors. All the material originated from 11 localities.

The collecting of the material was done using a hand-net with mesh size of 500 µm and through hand-collecting from stone, gravel and coarse sand substrata. Stoneflies larvae were separated from the other organisms, preserved in 80% ethanol and deposited in the collection of Institute of Biodiversity and Ecosystem Research (IBER), Bulgarian Academy of Sciences (BAS), Sofia, Bulgaria. The morphological examinations were carried out with a stereo-microscope. Nomenclature and systematic arrangements followed Murányi (2008) and DeWalt *et al.* (2020). The used criteria of IUCN were after Tyufekchieva *et al.* (2019).

Published records were presented according to the literature sources and UTM code numbers followed the Bulgarian UTM Directory computer programme (Michev 1999). New

data of individual records are listed in details, including the name of the water body, day, month and year, GPS coordinates, altitude and name(s) of collector(s).

Results

Check-list of stoneflies from the Sarnena Sredna Gora Mts

Order Plecoptera

Family Taeniopterygidae Klapálek, 1905
Genus *Taeniopteryx* Pictet, 1841
***Taeniopteryx schoenemundi* (Mertens, 1923)**

Literature data: Russev *et al.* (1984): 64 (MH01 - Tundzha River, above Zhrebchevo Reservoir, 28.10.1967; MH41 - Tundzha River, Slivenski Bani Resort, 13.10.1955); **Yaneva & Russev (1985)**: 20 (MH41 - Tundzha River, Slivenski Bani Resort, 15.11. 1981).

Distribution and ecology: Typical for inundated higher vegetation, stone and gravel substrata; found in colline, submontane and montane zones; inhabiting the epipotamal and hyporhitral along the Tundzha River (from 100 m to 320 m a.s.l.).

Family Leuctridae Klapalek, 1905
Genus *Leuctra* Stephens, 1835
***Leuctra fusca fusca* (Linnaeus, 1758)**

Material examined: Byala River, near Beguntsi Village, 24.08.2018, N42°32'34.9" E24°53'14.1", 317 m a.s.l., D. Gradinarov leg.; Turiyska River, 27.05.2019, N42°30'44.79" E25°12'17.71", 663 m a.s.l., Y. Vidinova, V. Evtimova leg.

Distribution and ecology: One of the most common stonefly species in Bulgaria with wide ecological spectrum. Prefers micro-, mesolithal and fine particulate organic matter. Recorded from all over Europe.

Remarks: New record for the Sarnena Sredna Gora Mts.

***Leuctra pseudosignifera* Aubert, 1954**

Material examined: Turiyska River, 27.05.2019, N42°30'44.79" E25°12'17.71", 663 m a.s.l., Y. Vidinova, V. Evtimova leg.

Distribution and ecology: The most common species of the genus in Bulgaria. Usual in lotic sections (between 50 and 2500 m a.s.l.) with gravel and stony bottoms. Larvae with preferences for moderate- to fast-flowing waters and less tolerant of lower oxygen concentrations unlike other species of the genus.

Remarks: New record for the Sarnena Sredna Gora Mts.

Family Nemouridae Newman, 1853
Genus *Protonemura* Kempny, 1898
***Protonemura auberti* Illies, 1954**

Material examined: Byala River, before Kurtovo Village, 27.05.2019, N42°35'45.74" E24°54'35.22", 415 m a.s.l., Y. Vidinova, V. Evtimova leg.

Distribution and ecology: Prefers lotic sections from 600 to 1800 m a.s.l. with psamal, stone and gravel substrata. Typical indicator of oligosaprobity inhabiting the rhitral.

Remarks: New record for the Sarnena Sredna Gora Mts.

***Protonemura intricata intricata* (Ris, 1902)**

Material examined: Turiyska River, 27.05.2019, N42°30'44.79" E25°12'17.71", 663 m a.s.l.; Rahmanliyska River, above Rozovets Village, 27.05.2019, N42°27'59.15" E25°07'37.08", 504 m a.s.l., Y. Vidinova, V. Evtimova leg.

Distribution and ecology: Found in crenal and rhithral, widely distributed in Bulgaria from 300 to 2500 m a.s.l. Prefers psamal, micro- and mesolithal mixed with fine organic matter and submerged plants.

Remarks: New record for the Sarnena Sredna Gora Mts.

***Protonemura meyeri* (Pictet, 1841)**

Material examined: Turiyska River, 27.05.2019, N42°30'44.79" E25°12'17.71", 663 m a.s.l., Y. Vidinova, V. Evtimova leg.

Distribution and ecology: Prefers micro-, mesolithal and submerged plants. Found in crenal and rhithral, distributed in Bulgaria from 580 to 2200 m a.s.l.

Remarks: New record for the Sarnena Sredna Gora Mts.

***Protonemura praecox praecox* (Morton, 1894)**

Material examined: Turiyska River, 27.05.2019, N42°30'44.79" E25°12'17.71", 663 m a.s.l., Y. Vidinova, V. Evtimova leg.

Distribution and ecology: Widespread, prefers rocky bottom (mesolithal) and fine particulate organic matter up to above 1800 m a.s.l. Common in montane rivers.

Remarks: New record for the Sarnena Sredna Gora Mts.

Genus *Nemoura* Latreille, 1796

***Nemoura cinerea cinerea* (Retzius, 1783)**

Literature data: Braasch & Joost (1971): 61 (MH42 - Tundzha River, before Sliven Town, 23.4.1970).

Material examined: Brook above Edrevo Village, 28.05.2019, N42°35'01.66" E25°48'49.56", 315 m a.s.l., Y. Vidinova, V. Evtimova leg.

Distribution and ecology: Usual in lotic river sections (from 60 up to 2500 m a.s.l.) with sandy, gravel and stony bottoms, as well as littoral zones of oligotrophic lakes. Larvae inhabit streams and rivers, from hypocrenal to epipotamal, and less tolerant of organic pollution unlike other species of the genus.

Remarks: New record for the Sarnena Sredna Gora Mts.

Family Perlodidae Klapálek, 1909

Genus *Isoperla* Banks, 1906

***Isoperla belai* Illies, 1963**

Literature data: Braasch & Joost (1971): 63 (MH42 - Tundzha River, before Sliven Town, 23.4.1970).

Distribution and ecology: Prefers micro- and mesolithal and macrophytes in the premontane, montane and subalpine rivers from 340 to 1500 m a.s.l. Balkan endemic species.

***Isoperla grammatica* (Poda, 1761)**

Material examined: Byala River, before Kurtovo Village, 27.05.2019, N42°35'45.74" E24°54'35.22", 415 m a.s.l.; Turiyska River, 27.05.2019, N42°30'44.79" E25°12'17.71", 663 m a.s.l.; Rahmanliyska River, above Rozovets Village, 27.05.2019, N42°27'59.15" E25°07'37.08", 504 m a.s.l.; Hanam Dere, above Dalboki Village, 28.05.2019, N42°29'16.24" E25°46'18.10", 288 m a.s.l.; Chuchura River, before Elhovo Town, 28.05.2019,

N42°34'08.20" E25°48'49.56", 350 m a.s.l.; Osmanska River, before Kazanka Village, 28.05.2019, N42°27'30.04" E25°24'38.20", 489 m a.s.l., all Y. Vidinova, V. Evtimova leg.

Distribution and ecology: The most common species in Bulgaria. Larvae with preferences for moderate- to fast-flowing waters. Usual in lotic sections (between 50 and 2000 m a.s.l.) with gravel and stony bottoms and rivers with particulate organic matter and psamal.

Remarks: New record for the Sarnena Sredna Gora Mts.

Family Chloroperlidae Okamoto, 1912
Genus *Siphonoperla* Zwick, 1967
***Siphonoperla neglecta* (Rostock, 1881)**

Literature data: Braasch & Joost (1971): 64 (MH42 - Tundzha River, before Sliven Town, 23.4.1970).

Distribution and ecology: Larvae are typically found in rhithral and hypocrenal of brooks and rivers between 300-2189 m a.s.l.. Mostly collected from submerged riparian vegetation or from gravel and stony habitats, usually in small number. Typical indicator of oligosaprobity.

Family Perlidae Latreille, 1802
Genus *Perla* Geoffroy, 1762
***Perla marginata* (Panzer, 1799)**

Material examined: Byala River, before Kurtovo Village, 27.05.2019, N42°35'45.74" E24°54'35.22", 415 m a.s.l., Y. Vidinova, V. Evtimova leg.; Turiyska River, 27.05.2019, N42°30'44.79" E25°12'17.71", 663 m a.s.l., Y. Vidinova, V. Evtimova leg.; Sredna Reka River, 4.5 km before Turiya Village, 22.07.2018, N42°31'45.1" E25°11'47.4", 572 m a.s.l., D. Gradinarov leg.

Distribution and ecology: Widespread, prefers rocky bottom (lithal) with woody debris, roots and logs (xylal) at 60 up to 2500 m a.s.l. Common in montane rivers. Sensitive to organic pollution.

Remarks: New record for the Sarnena Sredna Gora Mts.

Genus *Dinocras* Klapálek, 1907
***Dinocras megacephala* (Klapalek, 1907)**

Material examined: LH51 -Tundzha River, before Pavel Banya Town, 25.5.1981 (Unpublished data).

Distribution and ecology: Found in crenal and rhithral, widely distributed in Bulgaria from 196 to 2300 m a.s.l. Prefers psamal, micro- and mesolithal. Tolerates pollution up to β-mesosaprobic.

Remarks: New record for the Sarnena Sredna Gora Mts.

Faunistic and zoogeographical notes

Presently only 11 localities of stoneflies are known from the Sarnena Sredna Gora Mts., with a total of nine stonefly species and four subspecies recorded. They represent 11.93% of the 109 stoneflies currently known from Bulgaria. Of these 13 taxa, nine are new for the fauna of the mountains. The recorded taxa belong to six families and eight genera of the order Plecoptera. The family Nemouridae was the richest in taxa with two species and three subspecies, followed by Leuctridae, Perlidae and Perlodidae (with two species and subspecies each), Taeniopterygidae and Chloroperlidae (with one each).

According to their current distribution, the established stoneflies can be assigned to six zoogeographical categories, grouped into four zoogeographical complexes (Table 1).

Table 1. Species composition and zoogeographical characteristics of Plecoptera from the Sarnena Sredna Gora Mts.

Taxa	**Zoogeographical complexes**	**Zoogeographical categories**
Taeniopteryx shoenemundi (Mertens, 1923)	European	Mid-European
Leuctra fusca fusca (Linnaeus, 1758)	Holarctic	Palearctic
Leuctra pseudosignifera Aubert, 1954	European	Mid-and South-European
Protonemura auberti Illies, 1954	European	Mid-and South-European
Protonemura intricata intricata (Ris, 1902)	European	Mid-European
Protonemura meyeri (Pictet, 1841)	European	Pan-European
Protonemura praecox praecox (Morton, 1894)	European-Mediterranean	European-Anatolian
Nemoura cinerea cinerea (Retzius, 1783)	Holarctic	Palearctic
Isoperla belai Illies, 1963	Endemic	Balkan
Isoperla grammatica (Poda, 1761)	European	Pan-European
Siphonoperla neglecta (Rostock, 1881)	European	Mid-European
Perla marginata (Panzer, 1799)	European	Mid-and South-European
Dinocras megacephala (Klapálek, 1907)	European	Mid-and South-European

The **Holarctic species complex** includes only one zoogeographical category - Palearctic species, and is represented by two subspecies.

The **European species complex** is best represented and comprises eight species and one subspecies (69.23%) from three zoogeographical categories. Mid- and South- European species are dominant (four taxa), followed by Mid-European (three taxa) and Pan-European (two taxa).

The **European-Mediterranean species complex** includes one European-Anatolian subspecies (*P. praecox praecox*).

The **Endemic species complex** includes the Balkan endemic – *I. belai.*

Four species (*T. shoenemundi*, *P. auberti*, *I. belai* and *S.neglecta*) have been classified as Vulnerable (VU) according to the Red Data Lists of Threatened Species of Plecoptera in Bulgaria (Tyufekchieva *et al.* 2019).

Our results highlight the importance of new surveys in the Sarnena Gora Mts. region and the obtained data could be useful for the selection of conservation and protection measures within the studied area.

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