New records and distribution data of stoneflies (Insecta: Plecoptera) from the Western Balkans

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Introduction

Plecoptera, the world-wide distributed order of aquatic insects represent a significant ecological component of running water ecosystems (Fochetti & Tierno de Figueroa, 2008) and are known to be intolerant to pollution and variation in their environmental conditions (Fochetti & Tierno de Figueroa, 2006; Zwick, 1980).

They mostly live in cold regions and the distribution of most of the species is well defined, since nymphs prefer certain types of water and imagos are usually short distance flyers (Kriska, 2013).

Many physical and chemical characteristics of the environment directly affect the distribution, abundance and behavior of stoneflies, such as water temperature, oxygen content, current-substrate relationships, and nutrient composition and availability (Giller & Malmqvist, 1998; Lamberti & Moore, 1984; Moog, 2002; Ridl et al., 2018; Ward & Stanford, 1982).

Knowledge about the stoneflies fauna in Europe is not completed and until now are known 514 species, 38 genera and 7 families (GRAF et al., 2019).

The goal of this study was to contribute to the distribution patterns of stoneflies species in the Balkan Peninsula.

Material and Methods

Adult stonefly specimens were collected using entomological nets and hand picking. Collected samples were preserved in 80 % ethanol.

Sampling was carried out in forty localities in Kosovo, Albania, North Macedonia, Serbia and Montenegro over the years 2014, 2015, 2016, 2017 and 2018.

The sampling stations are located at different habitats and altitudes, basically from 398 m to 1545 m above sea level. Twenty-four of the sampling stations are located in Kosovo, one in Albania, seven in North Macedonia, seven in Serbia and one in Montenegro (Table 1).

Phenology and distribution data refer to the regional European monographies (Fochetti & Tierno De Figueroa 2008, Graf, et al., 2009; Kis, 1974; Lubini et al., 2012) and online databases (DeWalt et al., 2020).

All specimens were identified up to the species level. The collection is deposited at the Laboratory of Zoology of the Faculty of Natural and Mathematics Sciences, University of Prishtina, Republic of Kosovo

Tab. 1. Localities: KS-Kosovo; AL-Albania; MK-North Macedonia; SRB-Serbia; MN–Montenegro

Code	Sampling Stations	Latitude °N	Longitude °E	Altitude m
S1	Berisha Mountain, KS	42.544168	20.876845	707
S2	Berisha Mountain, KS	42.523249	20.868111	837
S3	Duboçak, KS	42.846075	20.750462	712
S4	Qyqavicë, KS	42.734769	20.924591	940
S5	Blinaj, KS	42.5185	20.9788	721
S6	Siqeve, KS	42.7369	21.2343	798
S7	Radavc, KS	42.738350	20.30675	575
S8	Dërmjak, KS	42.17264	21.31582	620
S9	Binçë, KS	42.29476	21.37150	570
S10	Lugu i Kopilaqës, KS	42.24605	21.43110	1400
S11	Korbliq, KS	42.229795	21.336078	730
S12	Viti, KS	42.30628	21.36202	520
S13	Shushte, KS	42.28113	21.35911	573
S14	Mjak, KS	42.25903	21.34335	625
S15	Debelldeh, KS	42.25454	21.40008	982
S16	Letnice, KS	42.28727	21.45736	625
S17	Samakove, KS	42.25360	21.34762	660
S18	Llapushnicë, KS	42.42533	21.55426	475
S19	Stanqiq, KS	42.25506	21.55029	836
S20	Zheger, KS	42.31572	21.53148	640
S21	Rugove (mbi kishe) KS	42.660351	20.261235	550
S22	Haxhaj, KS	42.708320	20.042711	1254
S23	Keqekoll, KS	42.739779	21.333917	726
S24	Mbi Zhegër, KS	42.29519	21.54584	660
S25	Qafshtame, AL	41.524446	19.901321	1154
S26	Tanushë, MK	42.23356	21.42733	1358
S27	Brodec III, MK	42.160165	21.448974	1400
S28	Brodec II, MK	42.150596	21.455415	1362
S29	Brodec I, MK	42.130803	21.429318	625
S30	Kozhuf. MK	41.191013	22.200732	1545
S31	Sveta voda, MK	41.155704	21.172624	845
S32	Sello Orebobej, MK, Manastiri Sv. Dimitrje	41.892656	21.402238	398
S33	Jastrebc M. cesma, SRB	43.398180	21.395490	997
S34	Svode-crna reka, SRB	42.796209	22.327014	1142
S35	Vlasinska reka, SRB	42.84145	22.82922	884
S36	Meqka Mahalla, (near Mosul), SRB	42.511615	22.249803	1282
S37	Villa Best (Vlasina lake), SRB	42.712575	22.325057	1237
S38	Cemernik, SRB	2.74115	22.29349	1445
S39	Tulare, SRB	42.79352	21.46824	535
S40	Çakorr, MN	42.684437	20.062970	1206

Results and Discussions

During this investigation we found 43 species belonging to 14 genera and 7 families of Plecoptera. The distribution of species within families is as follows: Nemouridae (16), Leuctridae (11), Perlodidae (6), Taeniopterygidae (4), Perlidae (3), Chloroperlidae (2), Capniidae (1). The highest number of specimens belongs to the following species: *Leuctra hirsuta* Bogescu & Tabacaru, 1960 (232 specimens), *Zwicknia* (*Capnia*) *bifrons* (Newman, 1838) (152 specimens), *Leuctra fusca* (Linnaeus, 1758) (107 specimens), while all other species were collected with lower numbers of individuals.

Twelve species were found each with one specimen only during this investigation: *Leuctra inermis* Kempny, 1899, *Leuctra* cf. *metsovonica* Aubert, 1956, *Leuctra prima* Kempny, 1899, *Leuctra* cf. *olympia* Aubert, 1956, *Nemoura asceta* Murányi, 2007, *Nemoura longicauda* Kis, 1964, *Nemoura marginata* Pictet, 1836, *Protonemura aestiva* Kis, 1965, *Protonemura nitida* (Pictet, 1836), *Protonemura praecox* (Morton, 1894), *Perlodes intricatus* (Pictet, 1841) and *Arcynopteryx compacta* (McLachlan, 1872).

Tab. 2. List of species

No	Species	Localities
1	*Zwicknia (Capnia) bifrons* (Newman, 1838)	S2, S3, S5, S6, S23
2	*Siphonoperla neglecta* (Rostock, 1881)	S30, S33
3	*Chloroperla tripunctata* (Scopoli, 1763	S33
4	*Leuctra bronislawi* Sowa, 1970	S8, S9, S10, S25, S29
5	*Leuctra cingulata* Kempny, 1899	S10, S26, S29
6	*Leuctra fusca* (Linnaeus, 1758)	S8, S9, S11, S12, S13, S14, S15, S16, S17, S25
7	*Leuctra hippopus* Kempny, 1899	S3, S10, S13, S15, S29
8	*Leuctra hirsuta* Bogescu & Tabacaru, 1960	S4, S8, S14, S19, S27, S28, S25, S29, S33,
9	*Leuctra inermis* Kempny, 1899	S30
10	*Leuctra* cf. *metsovonica* Aubert, 1956	S26
11	*Leuctra major* Brinck, 1949	S10, S20, S25
12	*Leuctra nigra* (Olivier, 1811)	S10, S26, S33
13	*Leuctra prima* Kempny, 1899	S27
14	*Leuctra* cf. *olympia* Aubert, 1956	S21
15	*Amphinemura triangularis* (Ris, 1902)	S11, S20, S29
16	*Amphinemura sulcicollis* (Stephens, 1836)	S3
17	*Nemoura asceta* Murányi, 2007	S33
18	*Nemoura anas* Murányi, 2007	S25
19	*Nemoura cinerea* (Retzius, 1783)	S19
20	*Nemoura flexuosa* Aubert, 1949	S29
21	*Nemoura longicauda* Kis, 1964	S26
22	*Nemoura* cf. *lucana* Nicolai & Fochetti, 1991	S16
23	*Nemoura marginata* Pictet, 1836	S31
24	*Nemoura uncinata* Despax, 1934	S10
25	*Nemurella pictetii* (Klapálek, 1900)	S10, S30
26	*Protonemura aestiva* Kis, 1965	S28
27	*Protonemura hrabei* Raušer, 1956	S10, S15, S22, S25, S26
28	*Protonemura intricata* (Ris, 1902)	S20, S24, S31
29	*Protonemura nitida* (Pictet, 1836)	S26
30	*Protonemura praecox* (Morton, 1894)	S15
31	*Perla burmeisteriana* Claassen, 1936	S11
32	*Perla marginata* (Panzer, 1799)	S35, S40
33	*Perla pallida* Guérin-Méneville, 1838	S18, S26, S40
34	*Isoperla albanica* Auberti, 1946	S33, S36, S37, S38, S40
35	*Isoperla belai* Illies, 1963	S11
36	*Isoperla gramatica* (Poda, 1761)	S11, S26
37	*Isoperla tripartita* Illies, 1954	S13, S22, S26, S30, S32, S34, S39
38	*Perlodes intricatus* (Pictet, 1841)	S40
39	*Arcynopteryx compacta* (McLachlan, 1872)	S7
40	*Brachyptera macedonica* Ikonomov, 1983	S1, S2, S15
41	*Brachyptera risi* (Morton, 1896)	S8, S29, S31
42	*Brachyptera seticornis* (Klapálek, 1902)	S8, S10, S21, S26, S40
43	*Taeniopteryx schoenemundi* Mertens, 1923	S6, S23

Four species are recorded for the first time from Kosovo (*Leuctra cingulata* Kempny, 1899, *Nemoura* cf. *lucana* Nicolai & Fochetti, 1991, *Nemoura uncinata* Despax, 1934 and *Brachyptera macedonica* Ikonomov, 1983), one is recorded for the first time from Serbia (*Nemoura asceta* Murányi, 2007) and one from Albania (*Leuctra major* Brinck, 1949).

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