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First Checklist of Stoneflies (Insecta: Plecoptera) of Bulgaria, with Application of the IUCN Red List Criteria at the National Level

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Abstract: The first list of the species-group taxa of stoneflies (Plecoptera) of Bulgaria is presented based on literature and supplemented by unpublished data of the present authors. This survey includes 103 species and six subspecies, belonging to 23 genera and seven families. Three taxa, *Brachyptera beali beali* (Navás, 1923), *Protonemura rauschi* Theischinger, 1975 and *Isoperla chius* Zwick, 1978, are new for the country. At present, 31 of the stoneflies recorded in Bulgaria are endemic and c. 68% of them are Balkan endemics. The inclusion in Red Data Lists of threatened species of the Plecoptera is essential for the protection of rare and endemic species and for the preservation of their habitats. In order to achieve that, their conservation status has been assessed. One species is considered Extinct (EX), two – Regionally Extinct (RE) from the country, two – Possibly Extinct (PE), 22 – Critically Endangered (CR), nine – Endangered (EN) and 21 – Vulnerable (VU).

Key words: Plecoptera, taxon list, endemic species, conservation status, first country records, Bulgaria

Introduction

Studies on stoneflies in Bulgaria are being carried out for more than 170 years. The first literature data appeared in the middle of the 19th century (Pictet 1841), followed in the late 19th and early 20th centuries by papers by Klapálek (1895, 1913) and Schoenemund (1926). Later on, Navás (1929) described seven new species and Buresch (1936) reported 19 stoneflies from Bulgaria, some of which were reported under synonymous names later. The second wave of studies was initiated during the early 1960s and 1970s by Raušer (1962, 1963, 1965, 1966), Aubert (1964), Braasch (1969, 1970, 1972), Joost (1970), Sowa (1970) and Braasch & Joost (1971a, 1971b, 1971c, 1972, 1973, 1975, 1976, 1977). They carried out an enormous amount of faunistic and taxonomic research. The first more detailed paper on Bulgarian stoneflies was published by Raušer (1962) and contained 29 species. Subsequently, Braasch & Joost (1971a) expanded it to 73 species. As the final result of their research, Braasch and Joost described 16 new species of Plecoptera from Bulgaria and reported further 41 species that were new for the country.

Ecological observations, together with new faunistic records about Bulgarian stoneflies, were initiated by Bulgarian scientists during the 2nd half of the 20th century (Russev 1959, 1961, 1962, 1966a, 1966b, 1967, 1977, 1979, Russev & Janeva 1975, Uzunov et al. 1981, Russev et al. 1984, Janeva & Russev 1985, Kovachev & Uzunov 1986, Janeva 1987, Janeva & Russev 1989, Russev et al. 1991, Janeva et al. 1997, Vidinova et al. 2000, Yaneva et al. 2001, Vidinova et al. 2006, Sakelarieva et al. 2008, Vidinova et al. 2008, Tyufekchieva et

al. 2013, Varadinova et al. 2013). Other contributions to the knowledge of Bulgarian Plecoptera were given in papers by Kumanski (2004) and Tyufekchieva et al. (2011), both studying the biodiversity of the Eastern and Western Rhodopes. In Bulgaria's Biological Diversity book, the rich collection of Bulgarian stoneflies was identified by K. Kumanski and based on his results Gueorgiev et al. (1998) increased their species number to 96. They belonged to 22 genera and seven families, including a total of 24 endemic species. Hubenov et al. (2000a, b) presented new faunistic records for the Central Balkan and Rila National Parks, mentioning 99 and 101 Bulgarian stonefly species, respectively.

The third phase of research on stoneflies started in the last decade as a result of a next generation of publications. Murányi (2007) has reported *Leuctra mortoni feheri* Murányi, 2007 as a subspecies new for science, based on materials collected by the author from the Rila Mountains. Graf & Bálint (2010) also described one new species from Bulgaria, *Leuctra hansmalickyi* Graf, 2010. Later, Tyufekchieva et al. (2013) briefly discussed 107 stoneflies species, focusing mainly on the distribution and conservation significance of species of Taeniopterygidae. Finally, in a study of stoneflies from the Vrachanska Planina Mountains Tyufekchieva et al. (2016) have reported 108 species from the country. However, the data are fragmentary and do not present information on species diversity and conservation status of the Plecoptera for the whole territory of Bulgaria.

Materials and Methods

The list of the species-group taxa of stoneflies of Bulgaria is based on 522 benthic samples processed between 1995 and 2011 by the first author. These have been supplemented by unpublished and literature data, published between 1841 and 2016. Overall, this contribution includes more than 27,600 specimens from c. 1200 samples collected from 360 localities.

Nomenclature and systematic arrangements follow Muranyi (2008) and DeWalt et al. (2018). The present checklist comprises the following data: valid taxon name, synonyms, all other names used for the species when recorded in Bulgaria and remarks. New country records are given for some rare species. They include the name of the water body, elevation (m a.s.l.), GPS coordinates or UTM code number (see below), date in the format day/ month/ year, number and life cycle stage of the examined material and name(s) of collector(s). Remarks include data on endemism. The endemics are divided in Balkan (found in more than one Balkan country), Bulgarian (found in Bulgaria only), regional (found in more than one locality of a certain region) and local (known only from one locality) following Hubenov (2007).

We present an up-to-date assessment of the conservation status of stoneflies in Bulgaria, using the internationally accepted Red List guidelines developed by the International Union for Conservation of Nature (IUCN 2017). The procedure for assessing taxa at a regional level differs from that at a global level and is summarised in the Guidelines for Application of IUCN Red List Criteria at Regional and National Levels (IUCN 2012b).

The Bulgarian stoneflies have been assessed using criteria B, D1 and D2, owing to the nature of the available data. The species distribution and the geographic coordinates are provided through using the cartographic system based on UTM grid and the Bulgarian UTM Directory computer programme (Michev 1999). The size of each locality is usually equal to UTM grid cell 10 x 10 km.

The taxa of the Plecoptera have been classified in the following categories: Extinct (EX); Regionally Extinct (RE); Possibly Extinct (PE); Critically Endangered (CR); Endangered (EN); Vulnerable (VU); Nearly Threatened (NT); Least Concern (LC); Data Deficient (DD); Not Evaluated (NE). The IUCN Red List Categories abbreviations used in the text were based on the IUCN Red List Categories and Criteria (IUCN 2012a).

Abbreviations of collectors: BR=Boris Russev†, JK=Jenő Kontschán, DM=Dávid Murányi, TS=Teodora Stoyanova, TSz=Tímea Szederjesi, VT=Violeta Tyufekchieva, YV=Yanka Vidinova.

Results

List of the species-group taxa

This first stonefly checklist comprises 109 species-group taxa (103 species and six subspecies). Three species, *Brachyptera beali beali* (Navás, 1923), *Protonemura rauschi* Theischinger, 1975 and *Isoperla chius* Zwick, 1978, are new to the Bulgarian fauna.

The genus *Leuctra* has the largest number of species and subspecies – 23 (21.1%). Other genera are presented as follows: *Protonemura* – 15, *Nemoura* – 12, *Isoperla* – 11, *Brachyptera* – 8, *Rhabdiopteryx* – 5; *Taeniopteryx*, *Chloroperla* and *Perla* – 4; *Capnia*, *Amphinemura*, *Perlodes* and *Siphonoperla* – 3; *Dinocras* – 2 and the remaining nine genera *Oemopteryx*, *Zwicknia, Capnopsis*, *Nemurella*, *Arcynopteryx*, *Isogenus*, *Besdolus*, *Bulgaroperla* and *Marthamea* – with one species.

Family Taeniopterygidae Klapálek, 1905

The general distribution and ecology of the family Taeniopterygidae was compiled and discussed by Tyufekchieva et al. (2013).

Genus *Taeniopteryx* Pictet, 1841

Taeniopteryx auberti Kis & Sowa, 1964

Taeniopteryx hubaulti Aubert, 1946

Taeniopteryx nebulosa (Linnaeus, 1758)

Taeniopteryx schoenemundi (Mertens, 1923)

Genus *Brachyptera* Newport, 1851

Brachyptera beali beali (Navás, 1923)

New Bulgarian record: Luda River, above Rakitna Village, Pirin Mts., 706 m a.s.l., N41°50.58.51' E23°11.07.97', 23.04.2009, 1 larva, leg. TS.

Remarks: Balkan endemic; first record for Bulgaria. In stone and gravel (mesolithal) habitats, as well as inundated higher vegetation in metarhithral of Luda River. Found in oligosaprobic conditions (S_R = 74.00). The species seems to be very rare in Bulgaria. Known from Pirin Mts. but with a limited distribution, reflecting the habitat preferences of this species in South-Eastern Europe. An overview of the taxonomy, synonymy, distribution and ecology of *B. beali beali* is presented by Karaouzas et al. (2016).

Brachyptera braueri (Klapálek, 1900)

= *Taeniopteryx braueri* in Buresch (1936)

Remarks: The distribution of many species in Bulgaria is still based on old data from more than 40 years ago. According to Tyufekchieva et al. (2013), *B. braueri* probably does not occur in Bulgaria. Its presence or absence in the fauna of Bulgaria needs further confirmation.

Brachyptera bulgarica Raušer, 1962

Brachyptera helenica Aubert, 1956

Remarks: Balkan endemic.

Brachyptera risi (Morton, 1896)

Brachyptera seticornis (Klapálek, 1902)

Brachyptera thracica Raušer, 1965

Remarks: Bulgarian endemic; local, known only from Rhodope Mts.

Brachyptera zwicki Braasch & Joost, 1971

Genus *Rhabdiopteryx* Klapálek, 1902

Rhabdiopteryx alpina Kühtreiber, 1934

Remarks: Confirmed records of *R. alpina* are restricted to the Alps (Vinçon & Murányi 2009) and Bulgarian records likely refer to *R. harperi* Vinçon & Murányi, 2009.

Rhabdiopteryx hamulata (Klapálek, 1902)

Rhabdiopteryx navicula Theischinger, 1974

Rhabdiopteryx neglecta (Albarda, 1889)

Rhabdiopteryx triangularis Braasch & Joost, 1972

Remarks: Balkan endemic.

Genus *Oemopteryx* Klapálek, 1902

Oemopteryx loewii (Albarda, 1889)

Family Capniidae Klapálek, 1905

Genus *Zwicknia* Murányi, 2014

Zwicknia bifrons (Newman, 1838)

= *Capnia bifrons* in publications before Murányi et al. (2014)

Remarks: Specific identity of Bulgarian *Zwicknia* must be confirmed.

Genus *Capnia* Pictet, 1841

Capnia nigra (Pictet, 1833)

Remarks: Reported for the first time for Bulgaria from the Iskar River (1 ♀, 04.1917) by Braasch & Joost (1971a) and its presence in Bulgaria must be confirmed. *Capnia nigra* is a very widespread species, found also in Greece and Albania and from Morocco to Japan.

Capnia vidua vidua Klapálek, 1904

Remarks: Braasch & Joost (1975) reported *C. vidua* without subspecific identity. However, the presence of the nominotypical subspecies in Bulgaria needs to be confirmed.

Capnia vidua rilensis Raušer, 1962

Genus *Capnopsis* Morton, 1896

Capnopsis schilleri balcanica Zwick, 1984

= *Capnopsis schilleri* in Braasch & Joost (1971a, 1971b, 1975).

Remarks: Balkan endemic.

Family Leuctridae Klapálek, 1905

Genus *Leuctra* Stephens, 1835

Leuctra albida Kempny, 1899

Leuctra balcanica Raušer, 1965

Remarks: Balkan endemic.

Leuctra bronislawi Sowa, 1970

Leuctra cingulata Kempny, 1899

New distribution data: Kyustendil Province, Osogovska Planina Mts., open brook at Osogovo hut, 1625 m a.s.l., N42°11.791' E22°37.409', 23.10.2013, 1 female, leg. JK, DM, TSz.

Remarks: Mentioned by Klapálek (1913) from Rila Mts. but no additional records were published and the specimen does not exist in the collection of the National Museum Prague. Our data confirm the Bulgarian occurrence of this widespread European species.

Leuctra digitata Kempny, 1899

Leuctra fusca fusca (Linnaeus, 1758)

Leuctra hansmalickyi Graf & Bálint, 2010

Remarks: Bulgarian endemic; local, known only from Rila Mts.

Leuctra helenae Braasch, 1972

Remarks: Bulgarian endemic; local, known only from Central Balkan Mts.

Leuctra hippopus Kempny, 1899

Leuctra hirsuta Bogoescu & Tabacaru, 1960

= *Leuctra evae* in Raušer (1962)

Remarks: Balkan endemic.

Leuctra inermis Kempny, 1899

Leuctra joosti Braasch, 1970

Remarks: Balkan endemic.

Leuctra kumanskii Braasch & Joost, 1977

Remarks: Bulgarian endemic; local, known only from Pirin Mts.

Leuctra major Brinck, 1949

Leuctra marani Raušer, 1965
Remarks: Balkan endemic.
Leuctra mortoni mortoni Kempny, 1899
Remarks: Braasch (1972) reported *L. mortoni* from the Stara Planina, Rila and Pirin Mountains. Later, the subspecies *L. mortoni feheri* was described on the basis of specimens from northern Albania and the Rila Mountains (Murányi 2007). Thus, the populations in the Rila and Pirin Mts. likely belong to this southern subspecies, while the subspecific identity of the population from the Stara Planina Mts. needs to be confirmed.
Leuctra mortoni feheri Murányi, 2007
Remarks: *Balkan endemic.*
Leucta nigra (Olivier, 1811)
Leuctra prima Kempny, 1899
Leuctra pseudohippopus Raušer, 1965
Remarks: Balkan endemic.
Leuctra pseudosignifera Aubert, 1954
Remarks: Braasch & Joost (1971a, 1971c, 1975) reported it and the closely related *L. prima* from several Bulgarian localities. Early-spring emerging species of the *prima* group were revised a decade ago (Vinçon & Murányi 2007) but no Bulgarian specimens were studied. Therefore, the identity of the Bulgarian populations needs to be confirmed.
Leuctra rosinae Kempny, 1900
Leuctra quadrimaculata Kis, 1963

Family Nemouridae Newman, 1853
Genus *Amphinemura* Ris, 1902
Amphinemura borealis (Morton, 1894)
Remarks: With a single record from Bulgaria (Russev 1967). Very rare also in the Carpathians.
Amphinemura standfussi (Ris, 1902)
Amphinemura triangularis (Ris, 1902)

Genus *Protonemura* Kempny, 1898
Protonemura auberti Illies, 1954
Protonemura autumnalis Raušer, 1956
Protonemura beaumonti (Aubert, 1956)
Remarks: Recorded by Braasch & Joost (1971c, 1975) from the Strandzha and the Stara Planina Mts. These specimens most probably refer to *P. rauschi,* since *P. beaumonti* is an endemic species of the Peloponnese but was reported from several other parts of the Balkans prior to the description of *P. rauschi* (Karaouzas et al. 2016).
Protonemura brevistyla (Ris, 1902)
Protonemura hrabei Raušer, 1956
Protonemura illiesi Kis, 1963
Remarks: Balkan endemic.
Protonemura intricata intricata (Ris, 1902)
Protonemura mattheyi (Aubert, 1956)
Remarks: Balkan endemic.
Protonemura meyeri (Pictet, 1841)
Protonemura montana Kimmins, 1941
Protonemura nitida (Pictet, 1835)
Protonemura praecox praecox (Morton, 1894)
Protonemura rauschi Theischinger, 1975
New Bulgarian record: Haskovo Province, Malko Gradishte Village, brook in mixed forest south of the village, 435 m a.s.l., N41°44.235' E25°58.801', 29.05.2012, 2 male, 3 females, 1 male larva, leg. JK, DM, TSz.
Remarks: Balkan endemic. First record for Bulgaria, though those of *P. beaumonti* most probably also refer to this species. In small torrents and brooks, mainly in forested areas of low and medium-high elevations.
Protonemura strandschaensis Braasch & Joost, 1972
Remarks: Balkan endemic.
Protonemura tarda Braasch, 1972
Remarks: Bulgarian endemic.

Genus *Nemoura* Latreille, 1796
Nemoura avicularis Morton, 1894
Nemoura braaschi Joost, 1970
Remarks: Balkan endemic.
Nemoura bulgarica Raušer, 1962
= *Nemoura kownackorum* in Sowa (1970)
Remarks: Bulgarian endemic.
Nemoura cambrica Stephens, 1836
Nemoura cinerea cinerea (Retzius, 1783)
= *Nemoura variegata* in Buresch (1936)
Nemoura flexuosa Aubert, 1949
Nemoura longicauda Kis, 1964
Nemoura marginata Pictet, 1835
Nemoura pirinensis Raušer, 1962
Remarks: Bulgarian endemic.
Nemoura pygmaea Braasch & Joost, 1972
Remarks: Bulgarian endemic.
Nemoura subtilis Klapálek, 1895
Nemoura uncinata Despax, 1934
= *Nemoura fulviceps* in Russev (1961); Braasch & Joost (1971a, 1971b, 1975); Kumanski (1997); Hubenov et al. (2000b); Tyufekchieva et al. (2011)

Genus *Nemurella* Kempny, 1898
Nemurella pictetii Klapálek, 1900

Family Perlodidae Klapálek, 1909
Genus *Arcynopteryx* Klapálek, 1904
Arcynopteryx dichroa (McLachlan, 1872)
= *Arcynopteryx compacta* in Buresch (1936); Braasch & Joost (1971a; 1972); Kumanski (1997); Hubenov et al. (2000a, 2000b); Vidinova et al. (2000)
New distribution data: outflow of Sulzata Lake, Rila Mts., 2535 m a.s.l., FM87, 07.10.2001, 2 larvae, leg. YV; outflow of Okoto Lake, Rila Mts., 2440 m a.s.l., FM87, 07.10.2001, 12 larvae, leg. YV.

Genus *Isogenus* Newman, 1833
Isogenus nubecula Newman, 1833

Genus *Besdolus* Ricker, 1952
Besdolus ventralis (Pictet, 1841)
= *Perla (Dictyopteryx) ventralis* in Pictet (1841)
= *Dictyogenus ventralis* in Braasch, Joost (1976); Gueorguiev et al. (1998)
New distribution data: outflow of Bubreka Lake, Rila Mts., 2282 m a.s.l., FM87, 21.07.1995, 2 larvae, leg.

YV; Belichka River, Belitsa Town, 850 m a.s.l., GM14, 31.10.1996, 1 larvae, leg. YV, VT; Trigradska River, 1300 m a.s.l., KG80, 01.11.1995, 1 larva, leg. YV, VT.

Remarks: Described from the 'monts Balkan', probably from Bulgarian territory (Zwick & Weinzierl 1995).

Genus *Perlodes* Banks, 1903

Perlodes dispar (Rambur, 1842)

Perlodes intricatus (Pictet, 1841)

= *Perlodes intricata* in Braasch & Joost (1971c, 1975) and Russev & Janeva (1975)

Perlodes microcephalus (Pictet, 1833)

= *Perlodes microcephala* in Braasch & Joost (1971a, 1971c, 1975)

Genus *Bulgaroperla* Raušer, 1966

Bulgaroperla mirabilis mirabilis Raušer, 1966

Remarks: Balkan endemic.

Genus *Isoperla* Banks, 1906

Isoperla auberti Raušer, 1965

Remarks: Bulgarian endemic.

Isoperla belai Illies, 1963

Isoperla buresi Raušer, 1962

Isoperla chius Zwick, 1978

New Bulgarian record: Haskovo Province, Madzhari Village, stream in bushy vegetation, south of the village, 240 m a.s.l., N41°39.423' E25°41.927', 29.05.2012, 4 male, 5 females, 1 larva, leg. JK, DM, TSz.

Remarks: First record for Bulgaria. In medium-sized to large streams at low to medium-high elevations. Hitherto reported from the Chios Island of Greece and from Western Turkey (Darilmaz et al. 2016).

Isoperla grammatica (Poda, 1761)

= *Chloroperla grammatica* in Buresch (1936)

= *Isoperla rufescens* in Buresch (1936)

Isoperla obscura (Zetterstedt, 1840)

Isoperla oxylepis balcanica Raušer, 1962

Remarks: Balkan endemic.

Isoperla oxylepis oxylepis (Despax, 1936)

Isoperla russevi Sowa, 1970

Remarks: Balkan endemic.

Isoperla submontana Raušer, 1965

Remarks: Balkan endemic.

Isoperla tripartita tripartita Illies, 1954

= *Isoperla tripartita graeca* in Raušer (1963), Braasch & Joost (1971c) and Kumanski (1997)

Family Chloroperlidae Okamoto, 1912

Genus *Chloroperla* Newman, 1836

Chloroperla brachyptera (Schoenemund, 1926)

Remarks: Bulgarian endemic.

Chloroperla kosarovi Braasch, 1969

Remarks: Balkan endemic.

Chloroperla russevi Braasch, 1969

Remarks: Balkan endemic.

Chloroperla tripunctata (Scopoli, 1763)

Genus *Siphonoperla* Zwick, 1967

Siphonoperla burmeisteri (Pictet, 1841)

Remarks: The single Bulgarian record (Braasch & Joost 1976) is the only one from the Balkans and needs confirmation.

Siphonoperla neglecta (Rostock, 1881)

= *Chloroperla neglecta* in Navás (1929); Braasch, Joost (1971a, 1971b); Kumanski (1997); Vidinova et al. (2000); Tyufekchieva et al. (2011)

New distribution data: Bistritsa River, 1500 m a.s.l., GM18, 11.05.1968, 5 larvae, leg. BR; Shirokolashka River, Shiroka Laka Village, Rhodope Mts., 1100 m a.s.l., KG91, 19.09.1984, 1 larvae, leg. BR.

Siphonoperla transsylvanica (Kis, 1963)

= *Chloroperla transsylvanica* in Braasch, Joost (1971a, 1971b)

= *Siphonoperla torrentium* in Gueorguiev et al. (1998)

Family Perlidae Latreille, 1802

Genus *Marthamea* Klapálek, 1907

Marthamea vitripennis (Burmeister, 1839)

Remarks: Previously recorded for the lithorheophilic coenosis of the Danube (Russev 1959), Maritsa (Russev 1967, Zwick 1984b) and Strouma Rivers (Zwick 1984b). The species has not been recorded in Bulgaria for more than 50 years.

Genus *Perla* Geoffroy, 1762

Perla abdominalis Burmeister, 1839

= *Perla burmeisteriana* in Braasch, Joost (1971a, 1971a b); Russev (1971, 1977); Janeva (1987); Russev et al. (1991); Hubenov et al. (2000b); Vidinova et al. (2000, 2006); Tyufekchieva et al. (2011).

Perla illiesi Braasch & Joost, 1973

Perla marginata (Panzer, 1799)

Remarks: According to Karaouzas et al. (2016), the previous Balkan records of *P. marginata* probably refer to *P. pallida* Guérin-Méneville, 1838 (Sivec, Stark 2002). Here we list the species as *P. marginata*. Detailed information on its distribution in Bulgaria is to be presented in a future contribution.

Perla pallida Guérin-Méneville, 1838

= *Perla bureschi* in Schoenemund (1926); Buresh (1936)

= *Perla pallida bureschi* in Braasch & Joost (1971b); Kumanski (1997)

= *Perla pallida dacica* in Braasch (1972); Vidinova et al. (2000)

Genus *Dinocras* Klapálek, 1907

Dinocras cephalotes (Curtis, 1827)

= *Perla cephalotes* in Buresch (1936)

Dinocras megacephala (Klapalek, 1907)

= *Dinocras klapaleki* in Russev (1967)

We have assessed the conservation status of the presented species (Table 1). Currently, among the 109 Bulgarian stonefly taxa that have been recorded, one species is Extinct (EX); two species are Regionally Extinct (RE) from the country; two - Possibly Extinct (PE); 22 - Critically Endangered (CR); nine - Endangered (EN); 21 - Vulnerable (VU); 18 - Least Concern (LC); 14 species are Near Threatened (NT); 17 species are classified as Data Deficient (DD) and three species are Not Evaluated (NE).

Table 1. Threatened stonefly species according to the IUCN categories and criteria (IUCN 2012a). Taxa are given in taxonomic order within each conservation status category. For abbreviations, see Materials and Methods.

Taxa	Category	Criterion
Oemopteryx loewii	EX	
Isoperla obscura	RE	
Marthamea vitripennis	RE	
Taeniopteryx nebulosa	PE	
Isogenus nubecula	PE	
Brachyptera helenica	CR	B1a
Brachyptera thracica	CR	D1
Brachyptera zwicki	CR	
Rhabdiopteryx alpina	CR	B1a, D1
Rhabdiopteryx hamulata	CR	D1
Rhabdiopteryx navicula	CR	B2a, D1
Rhabdiopteryx neglecta	CR	B1a, D1
Rhabdiopteryx triangularis	CR	
Leuctra bronislawi	CR	B2a
Leuctra helenae	CR	B1a, D1
Leuctra joosti	CR	D1
Leuctra kumanskii	CR	D1
Protonemura illiesi	CR	D1
Protonemura mattheyi	CR	D1
Protonemura strandschaensis	CR	B1a, D1
Nemoura avicularis	CR	D1
Nemoura pygmaea	CR	D1
Perlodes dispar	CR	B2a, D1
Bulgaroperla mirabilis mirabilis	CR	D1
Isoperla auberti	CR	D1
Isoperla oxylepis balcanica	CR	D1
Siphonoperla transsylvanica	CR	D1
Taeniopteryx auberti	EN	B1a
Taeniopteryx hubaulti	EN	
Brachyptera bulgarica	EN	D1
Capnia vidua rilensis	EN	D1
Capnopsis schilleri balcanica	EN	
Leuctra marani	EN	
Protonemura autumnalis	EN	D1
Protonemura tarda	EN	D1
Besdolus ventralis	EN	D1
Taeniopteryx schoenemundi	VU	D1,D2
Zwicknia bifrons	VU	
Leuctra albida	VU	
Leuctra hirsuta	VU	D1
Leuctra major	VU	
Leuctra quadrimaculata	VU	D1
Protonemura auberti	VU	B1a
Protonemura hrabei	VU	
Nemoura braaschi	VU	
Nemoura bulgarica	VU	D1
Nemoura flexuosa	VU	B1a
Nemoura subtilis	VU	
Nemurella pictetii	VU	B1a, D1
Arcynopteryx dichroa	VU	D1
Isoperla belai	VU	D1
Isoperla buresi	VU	
Isoperla submontana	VU	
Chloroperla tripunctata	VU	D1
Siphonoperla neglecta	VU	
Perla pallida	VU	
Dinocras cephalotes	VU	
Brachyptera risi	LC	
Brachyptera seticornis	LC	
Leuctra fusca fusca	LC	
Leuctra hippopus	LC	
Leuctra inermis	LC	
Leuctra nigra	LC	
Leuctra pseudosignifera	LC	
Amphinemura triangularis	LC	
Protonemura intricata intricata	LC	
Protonemura montana	LC	
Protonemura praecox praecox	LC	
Nemoura cinerea cinerea	LC	
Perlodes intricatus	LC	
Perlodes microcephalus	LC	
Isoperla grammatica	LC	
Perla abdominalis	LC	
Perla marginata	LC	
Dinocras megacephala	LC	
Leuctra mortoni mortoni	NT	
Leuctra prima	NT	
Leuctra pseudohippopus	NT	
Leuctra rosinae	NT	
Protonemura brevistyla	NT	
Protonemura meyeri	NT	
Protonemura nitida	NT	
Nemoura pirinensis	NT	
Nemoura uncinata	NT	
Isoperla oxylepis oxylepis	NT	
Isoperla tripartita tripartita	NT	
Chloroperla brachyptera	NT	
Chloroperla kosarovi	NT	
Chloroperla russevi	NT	
Brachyptera beali beali	DD	
Capnia vidua vidua	DD	
Leuctra balcanica	DD	
Leuctra cingulate	DD	
Leuctra digitata	DD	
Leuctra hansmalickyi	DD	
Leuctra mortoni feheri	DD	
Amphinemura borealis	DD	
Amphinemura standfussi	DD	
Protonemura beaumonti	DD	
Protonemura rauschi	DD	
Nemoura cambrica	DD	
Nemoura longicauda	DD	
Nemoura marginata	DD	
Isoperla chius	DD	
Isoperla russevi	DD	
Perla illiesi	DD	
Brachyptera braueri	NE	
Capnia nigra	NE	
Siphonoperla burmeisteri	NE	

Discussion

Based on our results, we could speculate that the stonefly fauna of Bulgaria is among the richest on the Balkan Peninsula. The number of species of the Plecoptera for Greece and Turkey are 78 and 117, respectively (Karaouzas et al. 2016, Darilmaz et al. 2016), whereas for the Republic of North Macedonia and Serbia – 100 (Murányi et al. 2014) and 90 (Petrović et al. 2014), respectively.

The order Plecoptera has a moderate level of endemism in Bulgaria. Currently, the checklist comprises 31 endemic stoneflies (28.44% of all Bulgarian stoneflies). Among the established endemic species and subspecies, the Balkan endemics are predominant. They include 19 species and two subspecies (67.7 % of all the endemics). Ten endemics are found only in Bulgaria: four of them (*B. thracica*, *L. hansmalickyi*, *L. helenae* and *L. kumanskii*) are local endemics (12.90% of all the endemics) and six (19.35% of all the endemics) – regional endemics (*P. tarda*, *N. bulgarica*, *N. pirinensis*, *N. pygmaea*, *I. auberti* and *Ch. brachyptera*). Most of the endemic stoneflies in Bulgaria are representatives of the families Leuctridae and Nemouridae.

Moreover, stoneflies are among the most significant biological components in running waters (Zwick 2000) and, at the same time, one of the most endangered groups of insects (Fochetti & Tierno de Figueroa 2006). Since the first manuscript that presented information on the conservation status of Bulgarian stoneflies (Tyufekchieva et al. 2013), available information on this topic in Bulgaria has increased with the inclusion of several species in the Faunistic Diversity of the Vrachanski Balkan Nature Park (Tyufekchieva et al. 2016).

As pointed out in IUCN (2012a), all taxa listed as Vulnerable, Endangered, Critically Endangered are defined as threatened. Therefore, at present almost 50 % of the Bulgarian stoneflies are considered threatened (see Table 1). Overall, this is applicable for all European stoneflies: 63 % of the taxa likely belong to one or more IUCN categories (Red List categories).

In addition, for 21 of the species we have observed decrease in the area of their distribution over the last 20 years, probably due to destruction of their preferred habitats. Some new sampling has provided evidence that even in suitable habitats, the species are highly localised and restricted. Consequently, these species have been classified as Vulnerable. Nine taxa qualify as Endangered. There are particular threats to these species due to their small or fragmented populations and the specific habitats they inhabit. Twenty-two stoneflies are strongly restricted in one or a few isolated localities in Bulgaria and, therefore, they are assessed as Critically Endangered.

The last records of *M. vitripennis* and *I. obscura* date back to 1965 (Russev 1967). Russev (1966a) reported *I. obscura* for the first time for Bulgaria from the Maritsa River (Plovdiv and Dimitrovgrad Towns, 23-24.04.1955). Some of its known localities possibly have been incorrectly reported by Russev & Janeva (1975) because of confusion with other species. The only data available about the presence of *O. loewii* in Bulgaria date back to the middle of the last century. Therefore, we consider these species (*O. loewii, I. obscura* and *M. vitripennis*) as Extinct or Regionally Extinct in Bulgaria. Additionally, *T. nebulosa* and *I. nubecula* have not been recorded for several decades. These species can be assessed as Possibly Extinct. It is quite likely that the species still exist, but no studies have been performed to verify their occurrence in the country.

Similar is the situation in other European countries. For instance, *I. nubecula* and *I. obscura* are Regionally Extinct for the Italian Alps (Fochetti et al. 1998) and the Czech Republic (Bojková & Soldán 2013). The Possibly Extinct (PE) *T. nebulosa* and the Vulnerable *T. schoenemundi* (Tyufekchieva et al. 2013) are Regionally Extinct in Switzerland (Lubini et al. 2012). According to Rauser (1992) and Zwick (1984a), *C. schileri* is likely to disappear from sites with lower elevation and will continue to exist only in mountainous rivers and streams, which has also been confirmed by our studies. This species has been assessed as Endangered (EN) for Bulgaria, similarly to Slovakia (Krno 1994). Furthermore, *M. vitripennis* is Regionally Extinct for Spain, France, Greece, Poland and Slovakia. *Oemopteryx loewii* is very probably globally extinct; the last data are the Bulgarian ones. All available specimens are females and the records are older than 100 years.

On the other hand, it is known that some of the stoneflies that have been considered extinct from Western and Central Europe during the 20th century (Zwick 1984b, 1992, 2004, Sivec 2002, Popijac 2008) are still being recorded from Hungary, Austria, Croatia and Slovakia (Kovacs & Ambrus 2001, Derka et al. 2002, Popijac & Sivec 2011).

All stoneflies with narrow ecological niches and distribution, as well as with specific requirements to their environments, might be extremely vulnerable and under the threat of disappearance (Brown et al. 2009). Nevertheless, currently no European stoneflies have been included in any Red Data Lists of threatened species (Fochetti & Tierno de Figueroa 2006). The present assessment of the conservation status of Bulgarian Plecoptera is the

first step towards the addition of stoneflies with high conservation importance in such lists. This could assist in the protection of the rare and endemic species, together with the preservation of their habitats.

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