

Stoneflies (Plecoptera) of the Javorníky Mts (Czech Republic)

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Abstract: The investigation of three streams in the Moravian part of the Javorníky Mts in 2003 and 2006–2009 brings the first records of Plecoptera in these mountains. A total of 28 species were found (30 % of the recent fauna of the Czech Republic), among which species of the upper parts of streams predominate. This result corresponds to the nature of the habitat on which researches have been carried out. One endangered species (*Leuctra cf. major*), two vulnerable species (*Dinocras cephalotes*, *Perla marginata*) and one near threatened species (*Leuctra quadrimaculata*) were recorded. Comparing the recorded species to those of the neighbouring mountains, it can be assumed that the fauna of stoneflies of the Javorníky Mts may contain more than 40 species and can form a continuous transition between the Moravskoslezské Beskydy Mts and the Bílé Karpaty Mts (including the Vizovická vrchovina Highlands).

Key words: Plecoptera, faunistics, Javorníky Mts, Carpathians, Moravia, Czech Republic

Introduction

Stoneflies (Plecoptera) are an important component of the fauna of the upper and middle parts of streams. Altogether 90 species of which 31 are listed in the Red List (historically 95 species of which five are extinct; Bojková & Soldán 2013) are recently known from the Czech Republic.

No survey dealing with the diversity of stoneflies of the Javorníky Mts has been published to date. Altogether 10 species of stoneflies were obtained in the hydrobiological survey of Razula NNR (Kroča 2003). Further investigation was carried out at two sites in the basin of the Kyčová brook in 2006–2009. Except for a remarkable record of *Leuctra quadrimaculata* Kis, 1963 (Kroča 2011), the data remained unpublished.

The aim of this study is the summarisation of all available records of stoneflies known from the Moravian part of the Javorníky Mts. New data on stoneflies of the Kyčová basin, based mostly on findings of adults, are presented. Furthermore, the material of stoneflies (both larvae and adults) from the Razula NNR was revised.

Material and methods

The geomorphological unit of the Javorníky Mts is located in the eastern Moravia, it is a part of the Outer Western Carpathians (subprovince), subsystem of the Moravian-Slovak Carpathians (Magurian flysch). From the nature conservation point of view, Kyčová stream and its tributary are located in the Beskydy PLA and Malá Hanzlůvka stream flows through the Razula National Nature Reserve (Tab 1 and Fig 1). The investigated sites are located in the upper sections of the streams representing hyporectal and epirhithral habitats.

The Inventory survey of Razula NNR was carried in 2003. Hydrobiological sampling was performed semiquantitatively (method Perla; Kokeš & Němejcová 2006) using a hand net (25 cm in diameter, 0.5 mm mesh size) and samples were fixed in 4% formaldehyde. Adults of stoneflies were collected by sweeping and fixed in 70% alcohol. The field work was carried out on the following dates: 19 April; 24 May; 7 June (only sweeping); 27 July and 18 September.

The investigation of Makyta and Malá Tisová was carried in 2006–2009 using the same sampling methods as in the Razula NNR. Sampling was conducted on the following dates: 23 May 2006; 16 August 2006; 30 October 2006; 12 February 2007; 16 April 2007; 6 August 2007; 8 October 2007 and 10 March 2008.

Adults of stoneflies were collected by Malaise traps installed above the streams from 13 March to 27 November 2007 and emptied every four to five weeks. Sweeping was carried out as a complementary method. The samples were fixed in 70% alcohol. All material was collected and determined by J. Kroča and it is deposited in the T. G. Masaryk Water Research Institute, p.r.i. in Brno (coll. J. Kroča, Plecoptera).

The nomenclature of stoneflies and conservation status of species in this paper follow Bojková & Soldán (2013). The distribution and ecological preferences are based on Graf *et al.* (2009). The sites are supplemented by grid references based on Zelený (1972) and Pruner & Míka (1996).

The following abbreviations are used: NNR – National Nature Reserve, PLA – Protected Landscape Area; MT – Malaise trap, HS – hydrobiological samples, SW – sweeping; EN – endangered species, VU – vulnerable species, NT – Near threatened species; L – larva, ♂ – male, ♀ – female.

Tab 1: Characteristics of studied localities

Locality	Quadrat	Altitude [m a. s. l.]	Stream	Coordinates
Razula NNR	6676	665 - 770	Malá Hanzlůvka	49°21'41.779''N 18°22'50.033''E
Makyta	6775	665	Kychová	49°16'33.266''N 18°10'44.574''E
Malá Tisová	6774	547	Kychová left tributary	49°16'29.188''N 18°8'38.537''E

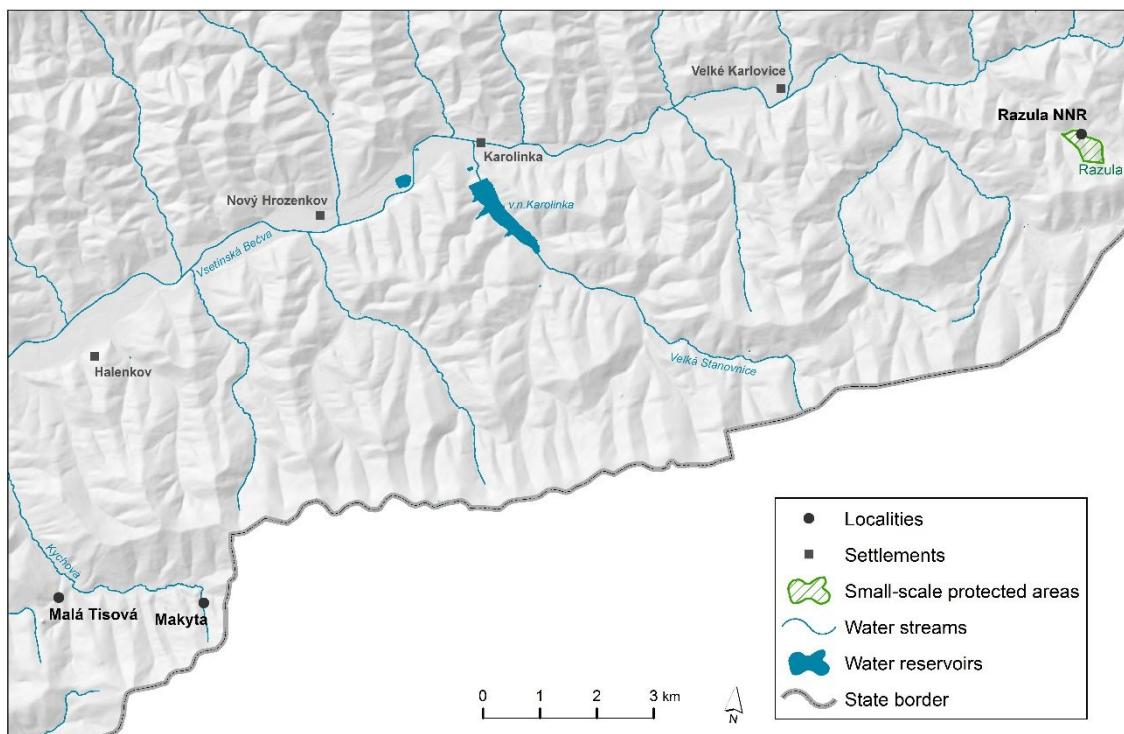


Fig 1: Map of localities.

Results

Dinocras cephalotes (Curtis, 1827) (VU)

Razula NNR, 24.v.2003, 3 L; 18.ix.2003, 2 L, both HS.

A European species common in fast-flowing mountain and submountain streams (usually metarhithral, hyporhithral) in the Czech Republic.

Distribution in the Outer Western Carpathians of the Czech Republic and Slovakia: Moravskoslezské Beskydy Mts (Zelinka 1950, Hrabě *et al.* 1954, 1958, Straškraba & Raušer 1954, Tuša 2001, Kroča 2002, 2013a) and Podbeskydská pahorkatina Upland (Straškraba & Raušer 1954, Hrabě *et al.* 1958, Chovancová 1992, Kroča 2002, 2013b).

Perla marginata (Panzer, 1799) (VU)

Razula NNR, 19.iv.2003, 5 L; 24.v.2003, 8 L; 27.vii.2003, 2 L; 18.ix.2003, 5 L, all HS, 7.vi.2003, 1 ♂ 3 ♀, SW.

A Western and Central European species occurring in similar habitats as *Dinocras cephalotes*.

Distribution in the Outer Western Carpathians of the Czech Republic and Slovakia: Bílé Karpaty Mts (Krno 1994, Krno & Horník 2007); Moravskoslezské Beskydy Mts (Zelinka 1950, Hrabě *et al.* 1954, 1958, Straškraba & Raušer 1954, Tuša 2001, Kroča 2002, 2013a) and Podbeskydská pahorkatina Upland (Straškraba & Raušer 1954, Hrabě *et al.* 1958, Kroča 2002, 2013b).

Diura bicaudata (Linnaeus, 1758)

Razula NNR, 19.iv.2003, 1 L; 18.ix.2003, 12 L, both HS, 24.v.2003, 1 ♀, SW. Makyta, 16.viii.2006, 14 L; 30.x.2006, 4 L; 12.ii.2007, 1 L; 6.viii.2007, 11 L; 8.x.2007, 2 L; 10.iii.2008, 2 L, all HS. Malá Tisová, 16.viii.2006, 1 L; 6.viii.2007, 1 L; 8.x.2007, 1 L, all HS.

A Holarctic species; in Europe, occurs in Fennoscandia, Alps, Hercynian mountains and Carpathian mountains. In the Czech Republic, it inhabits small streams of montane and submontane zones.

Distribution in the Outer Western Carpathians of the Czech Republic and Slovakia: Bílé Karpaty Mts (Krno 1994, Krno & Horník 2007, Bojková *et al.* 2012) and Moravskoslezské Beskydy Mts (Hrabě *et al.* 1958, Tuša 2001, Kroča 2002, 2012, 2013a).

Isoperla sudetica (Kolenati, 1860)

Razula NNR, 7.vi.2003, 1 ♂ 4 ♀, SW. Makyta, 14.v.–11.vi.2007, 10 ♂ 2 ♀; 11.vi.–9.vii.2007, 10 ♂, all MT. Malá Tisová, 16.iv.–14.v.2007, 1 ♂; 14.v.–11.vi.2007, 2 ♂ 3 ♀; 11.vi.–9.vii.2007, 5 ♂ 6 ♀, all MT.

A Central European species, common in the Czech Republic (including the Carpathian part). It occurs mainly in upper parts of the mountain streams (hypocrenal, epirhithral).

Distribution in the Outer Western Carpathians of the Czech Republic and Slovakia: Bílé Karpaty Mts (Krno 1994, Krno & Horník 2007, Bojková *et al.* 2012) and Moravskoslezské Beskydy Mts (Kroča 2012, 2013a).

Siphonoperla neglecta (Rostock, 1888)

Razula NNR, 24.v.2003, 1 ♂; 7.vi.2003, 3 ♂, SW. Makyta, 16.iv.–14.v.2007, 4 ♂; 14.v.–11.vi.2007, 8 ♂, all MT. Malá Tisová, 14.v.–11.vi.2007, 4 ♂, MT.

A Southern and Central European species occurring in small streams of mountains and submountain zones (hypocrenal, epirhithral).

Distribution in the Outer Western Carpathians of the Czech Republic and Slovakia: Bílé Karpaty Mts (Krno 1994, Krno & Horník 2007, Bojková *et al.* 2012); Moravskoslezské Beskydy Mts (Hrabě *et al.* 1954, Tuša 2001, Kroča 2002, 2012, 2013a) and very rare in the Podbeskydská pahorkatina Upland (Kroča 2013b).

Siphonoperla sp.

Razula NNR, 24.v.2003, 2 ♀; 7.vi.2003, 7 ♀, SW. Makyta, 16.iv.-14.v.2007, 1 ♀; 14.v.-11.vi.2007, 11 ♀; 11.vi.-9.vii.2007, 2 ♀, all MT. Malá Tisová, 14.v.-11.vi.2007, 10 ♀, MT.

The identification of females of the genus is ambiguous. Occurrence of females *Siphonoperla torrentium* is possible.

Brachyptera risi (Morton 1896)

Razula NNR, 24.v.2003, 1 ♀, SW. Makyta, 14.v.-11.vi.2007, 1 ♂ 1 ♀; 11.vi.-9.vii.2007, 1 ♀, all MT, 12.v.2008, 1 ♀, SW. Malá Tisová, 13.iii.-16.iv.2007, 1 ♂ 1 ♀; 16.iv.-14.v.2007, 4 ♂ 2 ♀; 14.v.-11.vi.2007, 1 ♂ 11 ♀; 11.vi.-9.vii.2007, 2 ♀, all MT.

A European species generally common in the Czech Republic (including the Carpathian part), especially in submontane and colline habitats (Bojková *et al.* 2011). It occurs from hypocrenal to hyporhithral parts.

Distribution in the Outer Western Carpathians of the Czech Republic and Slovakia: Bílé Karpaty Mts (Krno & Horník 2007, Bojková *et al.* 2012); Moravskoslezské Beskydy Mts (Hrabě *et al.* 1954, Tuša 2001, Kroča 2012, 2013a) and Podbeskydská pahorkatina Upland (Kroča 2013b).

Brachyptera seticornis (Klapalek 1902)

Makyta, 14.v.-11.vi.2007, 1 ♀, MT. Malá Tisová, 14.v.-11.vi.2007, 2 ♀, MT.

A Central and Southern European species, the most common and abundant species of the family Taeniopterygidae in the Czech Republic (including the Carpathian part). It occurs from hypocrenal to metarhithral parts of montane and submontane streams (Bojková *et al.* 2011).

Distribution in the Outer Western Carpathians of the Czech Republic and Slovakia: Bílé Karpaty Mts (Krno & Horník 2007, Bojková *et al.* 2012); Moravskoslezské Beskydy Mts (Hrabě *et al.* 1954, 1958, Straškraba & Raušer 1954, Tuša 2001, Kroča 2002, 2012, 2013a) and Podbeskydská pahorkatina Upland (Kroča 2013b).

Protonemura aestiva Kis, 1965

Makyta, 16.iv.-14.v.2007, 1 ♂; 14.v.-11.vi.2007, 8 ♂; 11.vi.-9.vii.2007, 8 ♂; 9.vii.-6.viii.2007, 6 ♂; 6.viii.-5.ix.2007, 2 ♂, all MT. Malá Tisová, 14.v.-11.vi.2007, 2 ♂; 11.vi.-9.vii.2007, 3 ♂; 9.vii.-6.viii.2007, 3 ♂; 6.viii.-5.ix.2007, 2 ♂; 5.ix.-8.x.2007, 1 ♂, all MT.

A Balkan-Carpathian species which is common and abundant in the montane and submontane springs and brooks.

Distribution in the Outer Western Carpathians of the Czech Republic and Slovakia: Bílé Karpaty Mts (Bojková & Špaček 2006, Bojková *et al.* 2012); Vizovická vrchovina Highland (Bojková *et al.* 2012) and Moravskoslezské Beskydy Mts (Bojková & Špaček 2006, Kroča 2012, 2013a).

Protonemura auberti Illies, 1954

Makyta, 14.v.-11.vi.2007, 1 ♂; 11.vi.-9.vii.2007, 1 ♂, all MT.

A Central European species which is common in the Czech Republic (especially in Bohemia) and occurs in similar habitats as *Protonemura aestiva*.

Distribution in the Outer Western Carpathians of the Czech Republic and Slovakia: Bílé Karpaty Mts (Krno 1994, Krno & Horník 2007, Bojková *et al.* 2012) and Moravskoslezské Beskydy Mts (Hrabě *et al.* 1954, Raušer 1956, Tuša 2001, Kroča 2012, 2013a).

***Protonemura* spp.**

Makyta, 14.v.–11.vi.2007, 4 ♀; 11.vi.–9.vii.2007, 7 ♀; 9.vii.–6.viii.2007, 10 ♀; 6.viii.–5.ix.2007, 4 ♀; 5.ix.–8.x.2007, 10 ♀, all MT. Malá Tisová, 11.vi.–9.vii.2007, 6 ♀; 9.vii.–6.viii.2007, 5 ♀; 6.viii.–5.ix.2007, 9 ♀; 5.ix.–8.x.2007, 10 ♀; 8.x.–4.xi.2007, 1 ♀, all MT.

The identification of females of species *P. auberti* and *P. aestiva* is ambiguous. The material cited above includes a mixture of females of this species.

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

Malá Tisová, 13.iii.–16.iv.2007, 1 ♂ 1 ♀, MT.

This species occurs in Southern, Central Europe and the British Isles. In the Czech Republic, it occurs in small streams (hypocrenal, epirhital) of montane and submontane zones.

Distribution in the Outer Western Carpathians of the Czech Republic and Slovakia: Bílé Karpaty Mts (Krno 1994, Krno & Horník 2007, Bojková *et al.* 2012) and Moravskoslezské Beskydy Mts (Raušer 1956, Hrabě *et al.* 1954, 1958, Kroča 2013a).

***Nemoura cambrica* Stephens, 1836**

Razula NNR, 24.v.2003, 6 ♂; 7.vi.2003, 4 ♂, both SW. Makyta, 16.iv.–14.v.2007, 49 ♂; 14.v.–11.vi.2007, 41 ♂; 11.vi.–9.vii.2007, 11 ♂; 9.vii.–6.viii.2007, 3 ♂, all MT, 12.v.2008, 6 ♂ SW. Malá Tisová, 16.iv.–14.v.2007, 123 ♂; 14.v.–11.vi.2007, 62 ♂; 11.vi.–9.vii.2007, 5 ♂, all MT, 12.v.2008, 2 ♂, SW.

A European species common in running waters from montane to planar zones in the Czech Republic.

Distribution in the Outer Western Carpathians of the Czech Republic and Slovakia: Bílé Karpaty Mts (Krno 1994, Krno & Horník 2007, Bojková *et al.* 2012); Vizovická vrchovina Highland (Bojková *et al.* 2012); Moravskoslezské Beskydy Mts (Hrabě *et al.* 1954, Tuša 2001, Kroča 2002, 2012, 2013a) and Podbeskydská pahorkatina Upland (Kroča 2013b).

***Nemoura carpathica* Illies, 1963**

Makyta, 13.iii.–16.iv.2007, 1 ♂; 16.iv.–14.v.2007, 10 ♂; 14.v.–11.vi.2007, 2 ♂, all MT, 16.iv.2007, 1 ♂, SW. Malá Tisová, 16.iv.–14.v.2007, 1 ♂, MT.

A Carpathian-Anatolian species which occurs from eucrenal to epirhital sections of streams in the montane zone in the Czech Republic.

Distribution in the Outer Western Carpathians of the Czech Republic and Slovakia: Bílé Karpaty Mts (Bojková & Špaček 2006, Bojková *et al.* 2012) and Moravskoslezské Beskydy Mts (Bojková & Špaček 2006, Kroča 2012, 2013a).

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

Makyta, 9.vii.–6.viii.2007, 1 ♂, MT.

A Euro-Siberian species, generally very common and ubiquitous, inhabiting both running and standing waters.

Distribution in the Outer Western Carpathians of the Czech Republic and Slovakia: Bílé Karpaty Mts (Krno 1994, Krno & Horník 2007, Bojková *et al.* 2012); Vizovická vrchovina Highland (Bojková *et al.* 2012); Moravskoslezské Beskydy Mts (Hrabě *et al.* 1954, Straškraba & Raušer 1954, Tuša 2001, Kroča 2012, 2013a) and Podbeskydská pahorkatina Upland (Kroča 2013b).

***Nemoura flexuosa* Aubert, 1949**

Makyta, 13.iii.–16.iv.2007, 1 ♂; 16.iv.–14.v.2007, 1 ♂, both MT. Malá Tisová, 13.iii.–16.iv.2007, 3 ♂; 16.iv.–14.v.2007, 53 ♂; 14.v.–11.vi.2007, 5 ♂, all MT.

A European-Anatolian species (missing in the British Isles and the Iberian Peninsula). In the Czech Republic, it is generally common in rhithral parts of submontane and montane streams.

Distribution in the Outer Western Carpathians of the Czech Republic and Slovakia: Bílé Karpaty Mts (Krno 1994, Krno & Horník 2007, Bojková *et al.* 2012); Moravskoslezské Beskydy Mts (Hrabě *et al.* 1954, Kroča 2013a) and Podbeskydská pahorkatina Upland (Kroča 2002, 2013b).

***Nemoura fusca* Kis, 1963**

Makyta, 13.iii.–16.iv.2007, 3 ♂; 16.iv.–14.v.2007, 2 ♂; 14.v.–11.vi.2007, 1 ♂, all MT.

A Carpathians species, rare in the Czech Republic. It occurs in upper parts of montane brooks.

Distribution in the Outer Western Carpathians of the Czech Republic and Slovakia: Bílé Karpaty Mts (Bojková & Špaček 2006, Bojková *et al.* 2012) and Moravskoslezské Beskydy Mts (Bojková & Špaček 2006, Kroča 2012, 2013a).

***Nemoura marginata* Pictet, 1835**

Makyta, 16.iv.–14.v.2007, 27 ♂; 14.v.–11.vi.2007, 28 ♂; 11.vi.–9.vii.2007, 10 ♂; 9.vii.–6.viii.2007, 6 ♂, all MT. Malá Tisová, 16.iv.–14.v.2007, 9 ♂; 14.v.–11.vi.2007, 8 ♂; 11.vi.–9.vii.2007, 2 ♂, all MT.

A Southern and Central European species occurring also in the Middle East. It is generally common species of small brooks (mainly eucrenal and hypocrenal) in montane and submontane zones in the Czech Republic.

Distribution in the Outer Western Carpathians of the Czech Republic and Slovakia: Bílé Karpaty Mts (Krno 1994, Krno & Horník 2007, Bojková *et al.* 2012); Vizovická vrchovina Highland (Bojková *et al.* 2012); Moravskoslezské Beskydy Mts (Zelinka 1950, Hrabě *et al.* 1954, Tuša 2001, Kroča 2012, 2013a) and Podbeskydská pahorkatina Upland (Kroča 2013b).

***Nemoura sciurus* Aubert, 1949**

Makyta, 16.iv.–14.v.2007, 2 ♂; 14.v.–11.vi.2007, 1 ♂, all MT. Malá Tisová, 16.iv.–14.v.2007, 18 ♂; 14.v.–11.vi.2007, 11 ♂, all MT.

A Central European species. In the Czech Republic, it is generally infrequent in Bohemia (Křelinová 1962, Bojková *et al.* 2010) and more common in the Carpathians (Moravia, Silesia). It occurs in upper parts of streams (from eucrenal to epirhithral) from colline to montane zone.

Distribution in the Outer Western Carpathians of the Czech Republic and Slovakia: Bílé Karpaty Mts; Vizovická vrchovina Highland (both Bojková *et al.* 2012); Moravskoslezské Beskydy Mts (Kroča 2012) and Podbeskydská pahorkatina Upland (Kroča 2013b).

***Nemoura* sp.**

Razula NNR, 24.v.2003, 10 ♀; 7.vi.2003, 14 ♀; 27.vii.2003, 1 ♀, all SW. Makyta, 13.iili.–16.iv.2007, 6 ♀; 16.iv.–14.v.2007, 126 ♀; 14.v.–11.vi.2007, 278 ♀; 11.vi.–9.vii.2007, 115 ♀; 9.vii.–6.viii.2007, 17 ♀, all MT, 12.v.2008, 16 ♀, SW. Malá Tisová, 13.iili.–16.iv.2007, 8 ♀; 16.iv.–14.v.2007, 194 ♀; 14.v.–11.vi.2007, 243 ♀; 11.vi.–9.vii.2007, 37 ♀; 9.vii.–6.viii.2007, 1 ♀; 6.viii.–5.ix.2007, 1 ♀, all MT, 12.v.2008, 16 ♀, SW.

The above-mentioned material includes only females that could not be identified with certainty. The identification of females of the genus *Nemoura* is ambiguous.

***Nemurella pictetii* Klapálek, 1900**

Makyta, 16.iv.–14.v.2007, 1 ♂ 3 ♀; 14.v.–11.vi.2007, 3 ♂ 2 ♀, both MT. Malá Tisová, 13.iili.–16.iv.2007, 1 ♀; 16.iv.–14.v.2007, 2 ♂ 9 ♀; 14.v.–11.vi.2007, 18 ♀; 11.vi.–9.vii.2007, 1 ♂ 4 ♀, all MT.

A Euro-Siberian species, common in the Czech Republic. It prefers eucrenal, but can occur up to epipotamal and in the littoral zone of stagnant waters from the planar to the alpine zones.

Distribution in the Outer Western Carpathians of the Czech Republic and Slovakia: Bílé Karpaty Mts (Krno 1994, Bojková *et al.* 2012); Vizovická vrchovina Highland (Bojková *et al.* 2012); Moravskoslezské Beskydy Mts (Hrabě *et al.* 1958, Kroča 2012, 2013a) and Podbeskydská pahorkatina Upland (Kroča 2013b).

***Leuctra albida* Kempny, 1899**

Malá Tisová, 11.vi.–9.vii.2007, 1 ♀, MT.

Species known from Southern and Central Europe (except the Iberian and Apennine Peninsulas). In the Czech Republic, it is common and relatively abundant and prefers epirhithral and metarhithral parts of streams in montane and submontane zones.

Distribution in the Outer Western Carpathians of the Czech Republic and Slovakia: Bílé Karpaty Mts (Krno 1994, Krno & Horník 2007, Bojková *et al.* 2012); Moravskoslezské Beskydy Mts (Straškraba & Raušer 1954, Hrabě *et al.* 1954, 1958, Tuša 2001, Kroča 2002, 2012, 2013a) and Podbeskydská pahorkatina Upland (Hrabě *et al.* 1958, Kroča 2013b).

***Leuctra armata* Kempny, 1899**

Makyta, 14.v.–11.vi.2007, 1 ♀, MT.

Species occurring in the Alps and Carpathians (Graf *et al.* 2009). In the Czech Republic, it was recorded mainly from the Carpathians, but several records are known also from the Hercynian mountains (Soldán & Helešic 1999, Stehno 2000). The species prefers eucrenal and hyporenal parts of streams in montane and submontane zones.

Distribution in the Outer Western Carpathians of the Czech Republic and Slovakia: Bílé Karpaty Mts (Krno 1994) and Moravskoslezské Beskydy Mts (Straškraba & Raušer 1954, Hrabě *et al.* 1958, Tuša 2001, Kroča 2002, 2012, 2013a).

***Leuctra braueri* Kempny, 1898**

Published records. Kroča (2003): Razula NNR.

Makyta, 9.vii.–6.viii.2007, 2 ♂; 6.viii.–5.ix.2007, 79 ♂ 94 ♀; 8.x.–4.xi.2007, 3 ♀, all MT, 5.viii.2008, 15 ♂ 1 ♀, SW. Malá Tisová, 6.viii.–5.ix.2007, 11 ♂ 5 ♀; 5.ix.–8.x.2007, 2 ♀; 8.x.–4.xi.2007, 2 ♀; 4.xi.–27.xi.2007, 1 ♀, all MT.

A Central European species, widespread in small brooks and springs of montane and submontane zones in the Czech Republic.

Distribution in the Outer Western Carpathians of the Czech Republic and Slovakia: Bílé Karpaty Mts (Krno 1994, Krno & Horník 2007, Bojková *et al.* 2012); Vizovická vrchovina Highland (Bojková *et al.* 2012); Moravskoslezské Beskydy Mts (Hrabě *et al.* 1954, Tuša 2001, Kroča 2002, 2012, 2013a) and Podbeskydská pahorkatina Upland (Kroča 2013b) where is very rare.

***Leuctra digitata* Kempny, 1899**

Malá Tisová, 5.ix.–8.x.2007, 1 ♀, MT.

A European species (missing in the British Isles and eastern European Lowlands). In the Czech Republic, it is widespread species inhabiting various brooks and streams, predominantly in submontane and colline zones.

Distribution in the Outer Western Carpathians of the Czech Republic and Slovakia: Bílé Karpaty Mts (Krno 1994, Krno & Horník 2007, Bojková *et al.* 2012); Vizovická vrchovina Highland (Bojková *et al.* 2012); Moravskoslezské Beskydy Mts (Kroča 2010a, 2012, 2013a) and Podbeskydská pahorkatina Upland (Kroča 2010a, 2013b).

***Leuctra hippopus* Kempny, 1899**

Razula NNR, 24.v.2003, 4 ♀, SW. Makyta, 13.iii.–16.iv.2007, 3 ♂ 5 ♀; 16.iv.–14.v.2007, 5 ♂ 4 ♀, all MT, 16.iv.2007, 2 ♂; 12.v.2008, 3 ♀, SW. Malá Tisová, 13.iii.–16.iv.2007, 14 ♂ 37 ♀; 16.iv.–14.v.2007, 202 ♂ 266 ♀; 14.v.–11.vi.2007, 7 ♂ 21 ♀, all MT.

A western Palaearctic species, generally common in small brooks, streams and rivers in montane and submontane zones in the Czech Republic.

Distribution in the Outer Western Carpathians of the Czech Republic and Slovakia: Bílé Karpaty Mts (Krno 1994, Krno & Horník 2007, Bojková *et al.* 2012); Moravskoslezské Beskydy Mts (Hrabě *et al.* 1954, 1958, Tuša 2001, Kroča 2002, 2012, 2013a) and Podbeskydská pahorkatina Upland (Kroča 2002, 2013b).

***Leuctra cf. major* Brinck, 1949 (EN)**

Razula NNR, 27.vii.2003, 1 L, HS.

A Central and Southern European species occurring mainly in epirhinal and hyporhinal parts of montane and submontane streams. Larva was originally misidentified as *L. leptogaster* in Kroča (2003), the specimen is morphologically identical with the material of *L. major* from the Moravskoslezské Beskydy Mts and Podbeskydská pahorkatina Upland. The occurrence of *L. major* is also indirectly supported by the findings of *Dinocras cephalotes* and *Perla marginata* which co-occurred with *L. major* in Moravskoslezské Beskydy Mts (Kroča 2013a,b and unpublished data).

Distribution in the Carpathians of the Czech Republic: historically documented from the Bílé Karpaty Mts (Bojková *et al.* 2012), recently only in the Moravskoslezské Beskydy Mts (Kroča 2013a) and Podbeskydská pahorkatina Upland (Kroča 2002, 2013b).

***Leuctra nigra* (Olivier, 1811)**

Razula NNR, 24.v.2003, 1 ♂ 2 ♀; 7.vi.2003, 3 ♀; 27.vii.2003, 1 ♀, all SW. Makyta, 16.iv.–14.v.2007, 18 ♂ 14 ♀; 14.v.–11.vi.2007, 15 ♂ 31 ♀; 11.vi.–9.vii.2007, 4 ♂ 28 ♀; 9.vii.–6.viii.2007, 1 ♀, all MT, 12.v.2008, 2 ♂ 2 ♀, SW. Malá Tisová, 16.iv.–14.v.2007, 6 ♂ 3 ♀; 14.v.–11.vi.2007, 3 ♂ 18 ♀; 11.vi.–9.vii.2007, 1 ♂ 7 ♀, all MT, 12.v.2008, 2 ♀, SW.

A European species (missing in the Iberian Peninsula and eastern European Lowlands). In the Czech Republic, it is very common and abundant species that prefers small forest brooks and springs and it can also inhabit slow-flowing, muddy brooks and acidic waters in all altitude zones.

Distribution in the Outer Western Carpathians of the Czech Republic and Slovakia: Bílé Karpaty Mts (Krno 1994, Krno & Horník 2007, Bojková *et al.* 2012); Vizovická vrchovina Highland (Bojková *et al.* 2012); Moravskoslezské Beskydy Mts (Straškraba & Raušer 1954, Hrabě *et al.* 1954, 1958, Tuša 2001, Kroča 2012, 2013a) and Podbeskydská pahorkatina Upland (Kroča 2013b).

***Leuctra prima* Kempny, 1899**

Makyta, 13.iii.–16.iv.2007, 28 ♂; 16.iv.–14.v.2007, 4 ♂, both MT. Malá Tisová, 13.iii.–16.iv.2007, 30 ♂; 16.iv.–14.v.2007, 20 ♂, both MT.

A European species (missing in Fennoscandia and the British Isles). In the Czech Republic, it is rare or medium distributed species preferring small streams (hypocrenal, epirhinal) of montane, submontane and colline zones.

Distribution in the Outer Western Carpathians of the Czech Republic and Slovakia: Bílé Karpaty Mts (Krno 1994, Krno & Horník 2007, Bojková *et al.* 2012); Vizovická vrchovina Highland (Bojková *et al.* 2012) and the Moravskoslezské Beskydy Mts (Zelinka 1950, Kroča 2012, 2013a).

***Leuctra pseudosignifera* Aubert, 1954**

Makyta, 13.iii.–16.iv.2007, 89 ♂; 16.iv.–14.v.2007, 54 ♂; 14.v.–11.vi.2007, 11 ♂, all MT, 12.v.2008, 1 ♂, SW. Malá Tisová, 13.iii.–16.iv.2007, 10 ♂; 16.iv.–14.v.2007, 19 ♂, both MT.

A Western-Central European species (missing in Fennoscandia and the British Isles) which inhabits mountain and submountain small streams (up to metarhithral).

Distribution in the Outer Western Carpathians of the Czech Republic and Slovakia: Bílé Karpaty Mts (Krno 1994, Krno & Horníak 2007, Bojková *et al.* 2012), Moravskoslezské Beskydy Mts (Kroča 2012, 2013a) and the Podbeskydská pahorkatina Upland (Kroča 2013b) where is very rare.

***Leuctra* spp. *prima* subgr.**

Razula NNR, 24.v.2003, 2 ♀, SW. Makyta, 13.iii.–16.iv.2007, 183 ♀; 16.iv.–14.v.2007, 182 ♀; 14.v.–11.vi.2007, 52 ♀; 11.vi.–9.vii.2007, 1 ♀, all MT, 16.iv.2007, 4 ♀; 12.v.2008, 3 ♀, SW. Malá Tisová, 13.iii.–16.iv.2007, 410 ♀; 16.iv.–14.v.2007, 238 ♀; 14.v.–11.vi.2007, 28 ♀, all MT, 12.v.2008, 3 ♀, SW.

The above-mentioned material includes only females which could not be identified with certainty. The identification of females in the *Leuctra hippopus* group, *prima* subgroup is ambiguous.

Specimens from the site of Razula were originally misidentified as *L. rosinae* (Kroča 2003).

***Leuctra quadrimaculata* Kis, 1963 (NT)**

Published records. Kroča (2011): Makyta; Malá Tisová.

A Balkan-Carpathian species, very rare in the Czech Republic. It inhabits montane and submontane streams (mostly rhithral).

Distribution in the Outer Western Carpathians of the Czech Republic and Slovakia: Bílé Karpaty Mts (Bojková & Špaček 2006, Bojková *et al.* 2012), Javorníky Mts (Kroča 2011) and Moravskoslezské Beskydy Mts (Kroča 2011, 2012).

***Leuctra* spp. *inermis* gr.**

Published records. Kroča (2003): Razula NNR.

Makyta, 9.vii.–6.viii.2007, 1 ♀, MT. Malá Tisová, 11.vi.–9.vii.2007, 12 ♀, MT.

The above-mentioned material includes only larvae from the Razula and females which could not be identified with certainty. The identification of females in the *Leuctra inermis* group ambiguous with the exception of *L. rauscheri*.

Discussion and conclusions

Altogether 28 species (30% of recent fauna of stoneflies the Czech Republic) from 10 genera and 6 families were recorded from the Javorníky Mts. According to the updated national Red List of stoneflies (Bojková & Soldán 2013), one species is endangered (*Leuctra cf. major*), two species are vulnerable (*Dinocras cephalotes*, *Perla marginata*) and one species is near threatened (*Leuctra quadrimaculata*).

Revision of the material from Razula NNR resulted in more accurate determination (Kroča 2003). Altogether three species have been misidentified. Specimens previously determined as *Isoperla grammatica* belong to *I. sudetica*. Two females of *L. rosinae* was newly identified as *L. spp. prima* subgr. Specimen previously determined as *Leuctra leptogaster* is probably *L. major*.

When compared with the nearby Carpathian geomorphological units of the Bílé Karpaty Mts, Vizovická vrchovina Highland (39 species; Krno & Horníak 2007, Bojková & Špaček 2006, Bojková *et al.* 2012), and the Moravskoslezské Beskydy Mts, Podbeskydská pahorkatina

Upland (62 species; Bojková & Špaček 2006, Bojková & Kroča 2011, Kroča 2002, 2010a,b,c, 2011, 2012, 2013a,b), the number of stonefly species recorded in the Javorníky Mts is rather low. It is due to a small number of sites and monitored habitats (only hyporectal and epirhinal parts of streams in montane zone in the northern part of Javorníky Mts). Despite this fact, it can be assumed based on the spectrum of the species recorded that the species richness of stoneflies of the Javorníky Mts can be significantly higher.

On a geographic gradient from the Moravskoslezské Beskydy Mts (higher, colder and more rugged) to the Bílé Karpaty Mts (lower, warmer and more homogeneous), the Javorníky Mts are probably situated between two extreme positions and local occurrence of specific species from both areas can be assumed. The occurrence of *Isoperla tripartita* known from the Bílé Karpaty Mts, the Vizovická vrchovina Highland and *Nemoura dubitans*, *Protonemura meyeri*, *Capnia vidua*, *Leuctra dalmoni*, *L. inermis*, *L. pusilla* and *L. rauscheri* known from the Moravskoslezské Beskydy Mts is highly probable in the Javorníky Mts. From the species widespread in the Carpathian part of the Czech Republic, the occurrence of *I. grammatica*, *I. oxylepis*, *Perlodes microcephalus*, *Perla abdominalis*, *Siphonoperla torrentium*, *Amphinemura standfussi*, *A. sulcicollis*, *Protonemura intricata*, *Zwicknia bifrons*, *Leuctra autumnalis* and *L. fusca* is highly probable.

The fauna of stoneflies of the Javorníky Mts can include more than 40 species and can form a continuous transition between two significantly different geomorphological units of the Outer Western Carpathians.

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