

**Jkvqtke"cpf"ewt tgpv"fkvtidwvkqp"qh"cp"gpfcpi gtf"uvppgł {"*Perla grandis*
(Plecoptera: Perlidae) in the Czech Republic**

**Jkvqtkem²"c"uqw cup²"tq|-ł gp"qj tqflgp²"rq-xcvm{"*Perla grandis*
*Rgeqrvgt c<"Rgtłkfcg+"x" gum²"tgrwdnkeg**

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Perla maxima. "Rgtłkfcg."Rgeqrvgtc."hcwplkvku."nqpi/vgt o"ejcpi gu."jcdkvc"tgswktg o gpvna."cekflŁecvkqp."ctgc" restriction, Central Europe

Abstract. The rare stonefly *Perla grandis* Rambur, 1842 was recorded in several montane streams in the Hercynian mountain system and in the Carpathians in the 20th century. Now it is classified as endangered in the Red List of invertebrates of the Czech Republic due to the scarcity of recent records. The aim of this study is to examine its status at the localities where it was recorded in the first half of the 20th century and summarize all available data on its distribution in the Czech Republic. We found a considerable decline of the species in the Labe River basin as it was not re-collected at the localities of historic occurrence in the Krkonoše Mts., Orlické hory Mts. and Šumava Mts. and was not recorded at any new locality. This disappearance was probably a result of acidification of freshwater habitats in these regions in the second half of the 20th century. At present, *Perla grandis* is only frequent and locally abundant in montane streams in the Beskydy and Jeseníky Mts. which were not so severely affected by acidification. It inhabits mostly epirhithral sections of streams, but it can occur even in sections on the boundary between epirhithral and hypocrenal. It was found at elevations from 520 to 820 m a.s.l. It prefers fast flowing streams with a stable circum-neutral pH and substratum dominated by stones and boulders (lithal).

INTRODUCTION

The stonefly *Perla grandis* Rambur, 1842 (Perlidae) is a Western Palaearctic species which occurs predominantly in central and southern Europe. In the west, it was reported from the Sierra Nevada of Spain (Tierno de Figueroa et al. 2003), Pyrenees, Alps, Jura, and Vosges in France (e.g. Lubini et al. 1996, Le Doaré & Vinçon 2006) to Belgium (Aubert 1956). In the north, it was not found north of about 50°N (Illies 1978). In the north and east, it occurs in the Carpathians (e.g. Kis 1975, Krno 2000, Fiałkowski & Kittel 2002), in the south in Croatia, the Apennine Peninsula, Sicily and North Africa (e.g. Consiglio 1980, Graf et al. 2009). Based on egg morphology, Sivec & Stark (2002) confirmed specimens from Austria, Czech Republic, Italy, Morocco, Poland, Serbia, Slovakia, Slovenia, Spain, and Switzerland. The larvae inhabit oligotrophic and fast flowing streams with coarse substrate (predominantly lithal) (Graf et al. 2009). Generally, it is widespread and locally abundant at elevations of approx. 700–2000 m a.s.l. The species was found to be abundant up to 2000 m in the Alps (Aubert 1959), widespread at 860–2200 m a.s.l. in the Pyrenees (Berthélémy 1966) and present at 700–1800 m a.s.l. in the Carpathians (Wojtas 1964). The life cycle of *P. grandis* is flexible. A three-year

cycle was observed in the River Oriège (Pyrenees) (Cereghino & Lavandier 1998), whereas in the River Necker (Swiss Alps) larval development of four years was observed (Imhof 1994). Frutiger & Imhof (1997) even suggested a six-year life cycle in cold headwaters, using modelling based on the relationship between the length of embryogenesis and temperature. Emergence was observed from April to June at lower elevations (Neeracher 1910, Aubert 1959, Wojtas 1964), from June to August at approx. 900–1500 m a.s.l. (Wojtas 1964) and from July to September at the highest elevations (Wojtas 1964). Newly hatched larvae were found in July at 912 and 1855 m a.s.l. in the French Pyrenees (Cereghino & Lavandier 1998). Earlier instar larvae feed mainly on detritus. Later instars are strictly carnivorous; their diet was found to be dominated by Chironomidae (Fenoglio et al. 2007).

In the Czech Republic, *P. grandis* (as *P. maxima* Scopoli, 1763) was recorded in the Hercynian mountain system in the Šumava Mts. (the Bohemian Forest Mountains), Krkonoše Mts. (the Giant Mountains), Orlické hory Mts., Rychlebské hory Mts. and Hrubý Jeseník Mts., and in the Carpathians in the Moravskoslezské Beskydy Mts. The earliest record was announced by Klapálek from the Šumava Mts. (a single locality; Klapálek 1905, Table 1). Then, the species was recorded in the Krkonoše and Orlické hory Mts. by Křelinová (four localities, material collected in 1958 and 1959; Křelinová 1962) and in the Moravskoslezské Beskydy Mts. (a single locality, material collected in 1958; Hrabě et al. 1958). Later, it was recorded by Obrdlík (1979) in the Rychlebské hory Mts., Obrdlík (1981) and Tuša (1986, 2001) in the Hrubý Jeseník Mts., and Tuša (2001, Table 1) in the Moravskoslezské Beskydy Mts. Soldán et al. (1998) assumed that *P. grandis* disappeared from streams in the Labe River basin, because it was not found there since the 1950s. Therefore, Helešic et al. (2005) classified *P. grandis* as endangered (EN) in the Red List of invertebrates of the Czech Republic due to the scarcity of recent data on its occurrence.

The main aims of this study were (i) to revise all available earlier material of *P. grandis*, (ii) to verify the present occurrence of the species at the localities where it was recorded in the first half of the 20th century and earlier, and (iii) to summarize all available data on its distribution in the Czech Republic.

MATERIALS AND METHODS

The first part of this study included the evaluation of available historical material and the comparison of historical and recent data on the species' occurrence. The material collected by V. Landa in the 1940s (unpublished), E. Křelinová in the 1950s and 1960s (partly published by Křelinová 1962) and J. Raušer in the 1940s and 1950s was re-identified (see Bojková 2009 for details about these collections). One record from the Šumava Mts. by F. Klapálek could not be verified, because the material is not present in Klapálek's collection deposited in the National Museum in Prague. All localities with historical occurrences of the species were visited in 2006–2011 during a survey of 200 localities, which were studied in detail in the 1950s (more details in Landa & Soldán 1989 and Soldán et al. 1998). These localities were distributed to cover the main geomorphological units and aquatic habitat types in the Czech Republic. Imagines and larvae of Plecoptera were collected in all seasons except the winter. Plecoptera larvae were sampled semiquantitatively by a kick-sampling method using a metal cup of 30 cm in diameter and 0.5 mm wire mesh size. During 30-minutes sampling, equal attention was paid to all mesohabitats (places in the stream, pools, places with different substrate composition, submerged vegetation etc.). At the same sites, equal time was devoted to sweeping for adults along an approximately 100 m long section of the stream bank. Material was fixed in 75% alcohol and determined by J. Bojková. It is deposited in the Department of Botany and Zoology, Faculty of Science, Masaryk University in Brno (Plecoptera, coll. J. Bojková).

The second part of the study dealt with the **summarization of data on *P. grandis*** from the Moravskoslezské Beskydy Mts., where it has numerous populations. The material was collected during a detailed **investigation of the distribution of *Arcynopteryx compacta*** (McLachlan, 1872) and *Isogenus nubecula* Newman, 1833 in the Moravskoslezské Beskydy Mts. (for details see Kroča 2010). In this study, semiquantitative samples of Plecoptera larvae were taken

Table 1. Published records of *Perla grandis* Rambur, 1842 for which material was not re-identified.
 Tabulka 1. Publikované nálezy *Perla grandis* Rambur, 1842, které nebyly revidovány.

Mountains / pohorí	Locality: stream and (settlement) / lokality: tok a (sídllo)	Elevation (m a. s. l.) / nadmořská výška (m n. m.)	Quadrat / kvadrát	Date of collection / datum sběru	Reference / reference
Šumava Mts.	stream at Hirschenstein (= Jelenov)	700	6946	-(not recorded)	Klapálek (1905)
Rychlebské hory Mts.	Stříbrný potok (Nýznerov)	440	5768	1975–1976	Obrdlík (1979)
Hrubý Jeseník Mts.	Moravice (Karlovy)	670	5969	vi.1990	Tuša (2001)
Hrubý Jeseník Mts.	Bramná (Bramná)	780	5868	vii.1976, viii.1981	Tuša (2001)
Hrubý Jeseník Mts.	Merta (Vernířovice)	410	5968	vi.1990	Tuša (2001)
Hrubý Jeseník Mts.	tributary of Merta (Vernířovice)	410	5968	viii.1981	Tuša (2001)
Hrubý Jeseník Mts.	Merta (Kosaře)	900	5968	vii.1990	Tuša (2001)
Hrubý Jeseník Mts.	Bělá (Domašov)	510	5869	v.1993	Tuša (2001)
Hrubý Jeseník Mts.	Bělá (Bělá pod Pradědem)	680	5869	viii.1989	Tuša (2001)
Hrubý Jeseník Mts.	Šumný potok (Adolfovice)	560	5869	1975–1976	Obrdlík (1981)
Beskydy Mts.	Slavič (Morávka)	570	6477	1958	Hrabě et al. (1958)
Beskydy Mts.	Lomná (Ráztoka)	580	6475	vii.1983, ix.1984	Tuša (2001)
Beskydy Mts.	Malá Ráztoka (Ráztoka)	580	6475	vii.1994	Tuša (2001)

by the kick-sampling method using a hand net (25 cm in diameter, 0.5 mm mesh size) in 147 localities in this area. Localities were chosen to include all stream types and elevations in the Moravskoslezské Beskydy Mts. and the Podbeskydská pahorkatina Upland, and all main geomorphological units of this region. The location of the localities studied is available in Kroča (2010). Sampling in these localities took place in autumn and winter (October–January 2007–2008 and October–December 2009) and at four additional localities in the Řečice river catchment in March 2011. Sampling was performed for 30 minutes and equal attention was devoted to all respective habitats. Malaise traps were installed at 23 out of 147 localities in 2007–2009 during the vegetation season (from the second half of March or beginning of April to the end of October or the beginning of November). Samples of larvae were fixed in 4% formaldehyde and samples of imagines from Malaise traps were fixed in 70% alcohol. The material was determined by J. Kroča and it is deposited in the Water Research Institute T. G. M. in Brno (Plecoptera, coll. J. Kroča). The percentage cover of the bottom by stones, coarse and fine gravel, and sand (granulometric classification by Gordon et al. 1992) were recorded at each site. pH was measured in the field using portable instruments (WTW 340i) at five localities at Zimný potok brook, Slavíč brook, and Malá Ráztoka brook to describe the annual variability (n=12).

The following abbreviations were used in the text: MT – Malaise trap, L – larva, ♂ – male, ♀ – female.

RESULTS

Species distribution

Material examined. Bohemia: Krkonoše Mts.: Úpa river above Pec pod Sněžkou (5260), 800 m a.s.l., 28.v.1958, 6 L; 26.viii.1958, 5 L; 22.vii.1958, 12 L; 23.ix.1958, 11 L; 20.x.1958, 3L; Úpa river, Horní Maršov (5360), 7.v.1963, 5 L; Jizerka river in Dolní Mísečky (5259), 950 m a.s.l., 5.v.1956, 2 L; Jizerka river below Krausovy Boudy (5259), 880 m a.s.l., 27.ix.1957, 3 L; E. Křelinová leg., J. Bojková det., coll. E. Křelinová, National Museum, Prague; Modrý potok brook in Modrý Důl (5260), 900 m a.s.l., 16.vi.1949, 2 L; V. Landa leg., J. Bojková det., coll. E. Křelinová, National Museum, Prague; 22.vii.1958, 2 L; E. Křelinová leg., J. Bojková det., coll. E. Křelinová, National Museum, Prague; Zelený potok brook in Zelený Důl (5360), 950 m a.s.l., 18.vi.1949, 3 L; V. Landa leg.; J. Bojková det., coll. E. Křelinová, National Museum, Prague. Orlické hory Mts.: Olešenka brook Klárovka in Olešnice v Orlických horách (5664), 650 m a.s.l., 7.vii.1959, 5 L; Bělá near Šerlišký mlýn, Deštné v Orlických horách (5664), 790 m a.s.l., 17.xi.1959, 3 L; E. Křelinová leg., J. Bojková det., coll. E. Křelinová, National Museum, Prague; 20.xi.2010, 8 L; 5.v.2011, 11 L, J. Bojková et T. Soldán leg., J. Bojková det. et coll.

Moravia: Moravskoslezské Beskydy Mts.: Malá Ráztoka brook below Pustevny na Radhošti (6575), 765 m a.s.l., 14.v.–11.vi.2007 (MT), 4 ♂♂ 1 ♀; 4.vi.–24.vi.2008 (MT), 2 ♂♂ 1 ♀; Malá Ráztoka brook in Ráztoka (6475), 590 m a.s.l., 8.x.2007, 4 L; Lomná brook below Pustevny na Radhošti (6575), 720 m a.s.l., 8.x.2007, 1 L; Kyčerov brook above Velké (6576), 625 m a.s.l., 10.xii.2009, 6 L; Bučací potok brook above Ostravice-Horečky (6476), 620 m a.s.l., 19.iv.2007, 10 L; Břestový potok brook near Břestovy (6576), 580 m a.s.l., 10.xii.2009, 2 L; Kněhyňský potok brook below Kněhyňská jeskyně (6575), 730 m a.s.l., 7.xi.2007, 12 L; Kněhyňský potok below Kněhyňská jeskyně (6576), 670 m a.s.l., 7.xi.2007, 5 L; Bystrý potok brook below Kněhyně Mt. (6475), 750 m a.s.l., 8.x.2007, 1 L; Bystrý potok brook below Kněhyně Mt. (6475), 675 m a.s.l., 8.x.2007, 10 L; Mohyla brook above Ráztoky (6575), 690 m a.s.l., 7.xi.2007, 1 L; Klíny brook above Ráztoky (6575), 715 m a.s.l., 10.xii.2009, 1 L; Daličanský potok brook above Podolánky (6576), 755 m a.s.l., 1.xii.2009, 12 L; Daličanský potok brook in Podolánky (6576), 715 m a.s.l., 7.xi.2007, 23 L; all J. Kroča leg., det. et coll.

Silesia: Hrubý Jeseník Mts.: Bílá Opava river above Karlova Studánka (5969), 820 m a.s.l., 21.vi.1951, 20 ♂♂ 6 ♀♀; 23.ix.1955, 3 L; J. Raušer leg., J. Bojková det. et coll.; 21.xi.2010, 7 L; J. Bojková et T. Soldán leg., J. Bojková det. et coll.; Bílá Opava above Ludvíkov (5969),

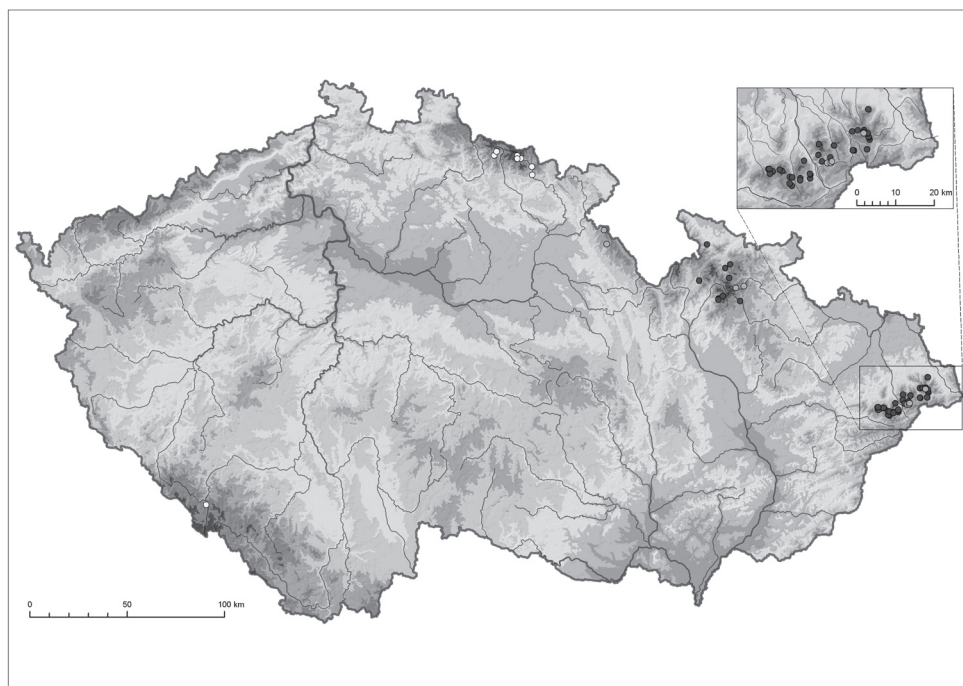


Figure 1. Map of the distribution of *Perla grandis* Rambur, 1842 in the Czech Republic. White circles indicate historical localities where the species was not found recently, grey circles indicate historical localities where the species was found recently, and black circles indicate new records.

Obrázek 1. Mapa rozšíření *Perla grandis* Rambur, 1842 v České republice. Bílá kolečka označují historické lokality, kde druh nebyl nalezen v současnosti, šedá kolečka označují historické lokality, kde byl druh nalezen také nyní, černá kolečka označují nové nálezy.

690 m a.s.l., 23.vi.1951, 10 ♂♂ 10 ♀♀; J. Raušer leg., J. Bojková det. et coll.; 21.xi.2010, 1 L; J. Bojková et T. Soldán leg., J. Bojková det. et coll. Moravsko-slezské Beskydy Mts.: Mazák potok brook below Muchovice (6476), 605 m a.s.l., 16. xii.2007, 12 L; Kobylick brook near Podbílony (6476), 550 m a.s.l., 16.xii.2007, 1 L; Satina brook above Hutě (6476), 690 m a.s.l., 16.xii.2007, 22 L; Zimný potok brook in Řepčanka (6476), 950 m a.s.l., 2.xii.2009, 1 L; all J. Kroča leg., det. et coll; Jatný potok brook in Jatny (6476), 530 m a.s.l., 15.vi.1949, 1 ♂; J. Raušer leg., J. Bojková det. et coll.; Jatný potok brook above Jatny (6476), 560 m a.s.l., 31.iii.2011, 5 L; J. Kroča leg., det. et coll; Řehucí potok brook above Řehucí (6476), 620 m a.s.l., 15.vi.1949, 2 ♂♂ 2 ♀♀; J. Raušer leg., J. Bojková det. et coll.; Řehucí potok brook near Nové Dvory (6476), 670 m a.s.l., 31.iii.2011, 2 L; Řehucí potok brook below Řehucí (6476), 570 m a.s.l., 31.iii.2011, 1 L; ; J. Kroča leg., det. et coll; Řečice river between mouths of Kobylick brook and Vilčok brook (6476), approx. 560 m a.s.l., 15.vi.1949, 1 ♀; J. Raušer leg., J. Bojková det. et coll.; Řečice river above Jatny (6476), 545 m a.s.l., 31.iii.2011, 1 L; J. Kroča leg., det. et coll; Slavič brook above Loryška (6477), 820 m a.s.l., 17.xii.2007, 2 L, 5.vi.–26.vi.2008 (MT), 7 ♂♂ 1 ♀; Slavič brook below Loryška (6477), 745 m a.s.l., 8.x.2009, 16 L; Slavič brook below Loryška (6477), 730 m a.s.l., 5.vi.–26.vi.2008 (MT), 2 ♂♂ 3 ♀♀;

26.vi.–17.vii.2008, 5 ♀♀; 8.x.2009, 16 L; Slavíč brook above Platoška (6477), 620 m a.s.l., 8.x.2009, 23 L; Slavíč brook in Slavíč (6477), 520 m a.s.l., 8.x.2009, 1 L; Frankův potok brook below Frankov (6477), 610 m a.s.l., 17.xii.2007, 5 L; Ropický potok brook above Platoška (6477), 690 m a.s.l., 8.x.2009, 6 L; Ropický potok brook near Platoška (6477), 730 m a.s.l., 10.xi.2009, 5 L; Mišacký potok brook below Myšáci (6477), 635 m a.s.l., 10.xi.2009, 7 L; Mišacký potok brook below Myšáci (6477), 605 m a.s.l., 23.i.2008, 3 L; Kotelský potok brook in Kotly (6477), 695 m a.s.l., 23.i.2008, 7 L; Javorový potok brook below Javorový Mt. (6377), 550 m a.s.l., 30.xi.2009, 6 L; all J. Kroča leg., det. et coll.

Historically, the occurrence of *Perla grandis* was confirmed at 13 localities which were studied in the 1940s and 1950s (six localities in the Krkonoše Mts., two localities in the Orlické hory Mts. and in the Hrubý Jeseník Mts., and three localities in the Moravskoslezské Beskydy Mts.) (Fig. 1).

Recent findings were from 38 localities (35 localities in the Moravskoslezské Beskydy Mts., two localities in the Hrubý Jeseník Mts., and a single locality in the Orlické hory Mts.) (Fig. 1). *P. grandis* was not re-collected at 7 out of the 13 above mentioned historical localities. It was not found at any of the 200 historical localities where it had been absent in the 1940s and 1950s. There is no recent record from the Šumava Mts., from where it was recorded by F. Klapálek at the beginning of the 20th century.

Habitat characteristics

Perla grandis has recently been found at 520–820 m a.s.l.; the majority of records were from the elevation of 550–750 m a.s.l. (Fig. 2). It mostly inhabited streams of the second and third stream order (Strahler), but it was also frequently found in first order streams. It occurred predominantly in upper sections of streams, 0.63–3.12 km far from their sources. Streams were fast flowing; the slope was usually between 3 and 10‰ (Fig. 2). It was rare in low slope streams and absent in streams of exposed slope. pH measured in 5 characteristic localities of the species was stable, 7.3 ± 0.2 (min 6.8, max 7.8).

DISCUSSION

Our results confirmed the considerable decline of *Perla grandis* in the Hercynian mountain system in the Labe River basin, as anticipated by Soldán et al. (1998). We found only a single locality (Bělá stream near Šerlišský mlýn in Deštné v Orlických horách) where it survived. The species was also not recorded in other recent studies dealing with detailed investigation of Plecoptera in high mountains in the Labe basin, in the Krkonoše Mts. (Špaček 1999, 2001), Jizerské hory Mts. (Preisler & Špaček 2001) and Šumava Mts. (Soldán 2004). A similar decline was observed in the Rhine. *P. grandis* was very common in the Rhine between Lake Constance and Basel at the beginning of the 20th century (Neeracher 1910) and today it is absent, presumably due to pollution and morphological degradation (Frutiger & Imhof 1997). Populations of *P. grandis* in streams in the Labe River basin have certainly not been influenced by these impacts as they are situated in protected areas and areas of very low urbanization and agriculture. However, all these mountains were strongly affected by acidification. The

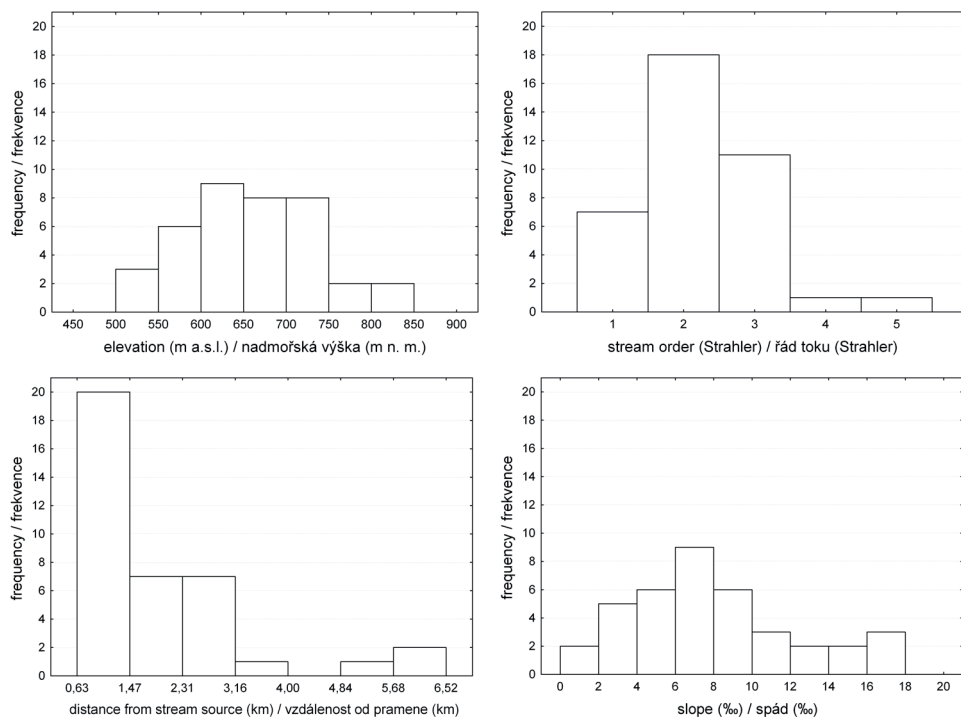


Figure 2. Frequency of occurrence of *Perla grandis* Rambur, 1842 in categories of elevation, stream order, distance from the stream source and slope of the stream section.

Obrázek 2. Frekvence výskytu *Perla grandis* Rambur, 1842 v kategoriích nadmořské výšky, řádu toku, vzdálenosti od pramene a spádu úseku toku.

anthropogenic emission of S and N compounds increased slowly before 1950 and rapidly in the 1950–1980. It peaked in the 1980s and declined markedly after 1989 (Kopáček & Veselý 2005). Point sources of S and N oxides were mostly situated in the so-called “Black Triangle” (German-Polish-Czech border, Dresden-Sokolov-Wrocław). pH ranged from approx. 4.5 to 7.0 in the acidified montane streams in this area (e.g. Winkler 1979, Vávra 1982, Hruška et al. 2002); extremely low values were measured in spring during snow melting. Acidification eliminated sensitive aquatic organisms, such as mayflies and fish (Lohniský 1982, Vávra 1982, Soldán et al. 1998). Mountains in the Morava and Odra river basins, where *P. grandis* still occurs, were less affected. Streams in the Moravskoslezské Beskydy Mts. showed pH values between approx. 6.5 and 7.5 (e.g. Anonymus 1986, 1997a,b, Fottová 1992). Current monthly measurements of pH at the localities with abundant populations of *P. grandis* showed stable circum-neutral conditions and no decrease in pH was observed in the spring months. *Perla* species are the only stoneflies in Central Europe classified as acid sensitive (Braukmann 2001). *P. grandis* was assigned to the group of continuously neutral streams, although it can infrequently be found in slightly acid streams (Braukmann & Biss 2004). Disappearance of the species from streams that had been strongly acidified in the past indicated that it is not able to survive critically acidic and very acidic conditions and/or events.

The recent area of distribution of *P. grandis* is **disjunctive**. The species is rather widespread and locally abundant in the Moravskoslezské Beskydy Mts. in geomorphological units with bedrocks of resistant sandstone, and it is probably also common in the Jeseníky Mts. (Tuša 2001) (Fig. 1, Table 1). Based on detailed investigation of streams in the Moravskoslezské Beskydy Mts., it is possible to describe the habitat preferred by this stonefly. It inhabits mostly epirhithral sections of streams, but it can even occur in sections on-the boundary between epirhithral and hypocrenal. In the Czech Republic it is a montane species, found predominantly at elevations between 550–750 m a.s.l. This range is at the lower limit or below the ranges reported from the Alps, Pyrenees, and Carpathians (cf. Aubert 1959, Berthélémy 1966, Wojtas 1964). In the studied area *P. grandis* occurred at similar localities to *Arcynopteryx compacta* (cf. Kroča 2010). The limits of its occurrence are influenced by stream morphology, especially slope and, consequently, substratum. At high elevations, it does not occur in streams with exposed slope (Mazák, Bučáci potok, and Zimný potok brooks) – *Diura bicaudata* (Linnaeus, 1758) is a dominant carnivorous stonefly in these stream sections. Similarly, it does not occur in low slope stream sections with predominantly coarse gravel substratum, where the carnivorous stoneflies *Perla marginata* (Panzer, 1799) and *Dinocras cephalotes* (Curtis, 1827) are abundant. In streams where slope increases gradually and regularly, *P. grandis* occurs even at high elevation, inhabiting stream sections several kilometers long (the Slavíč brook). The bottom substratum in the stream sections where *P. grandis* is abundant, is dominated by stones and boulders (esp. micro-, meso- and macrolithal).

Although *Perla grandis* is a common inhabitant of montane streams in many European mountains, in the Czech Republic it is a rare species, occurring frequently on only two mountains in Moravia and Silesia. Due to its sensitivity to pollution, morphological degradation, and acidification, which can cause its local decline and/or disappearance, it is presumably a good indicator of environments with low incidence of these anthropogenic impacts.

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SOUHRN

Účelem této studie bylo revidovat veškerý dostupný materiál ohrožené pošvatky *Perla grandis* Rambur, 1842 pocházející z území České republiky a na základě nových nálezů z let 2006–2011 stanovit dlouhodobé změny jejího (sub)areálu v této oblasti a příčiny jeho restrikce. Tento druh se semivoltinním, 3–6 letým životním cyklem má jiho-středoevropský areál, vyskytuje se od pohoří Sierra Nevada na Pyrenejském poloostrově, přes Pyreneje, Vogézy a Alpy (hojnější do do výšek okolo 2000 m), po východní Karpaty (výskyt ve výškách 700–1800 m), na severu dosahuje pouze asi k 50° sev. šířky. Ze Středomoří je znám z Apeninského poloostrova, Sicílie, severní Afriky a Balkánu. V České republice pocházejí historické nálezy ze Šumavy (poslední nález 1905), Krkonoš (1958–1963), Orlických hor (1959), Hrubého Jeseníku (1975–1993), Rychlebských hor (1979) a Moravskoslezských Beskyd (1958–1994) (tabulka 1, obr. 1).

V létech 2006–2011 byl druh nalezen celkem na 38 lokalitách (ve výškách 520–820 m) v Moravskoslezských Beskydech, Hrubém Jeseníku a Orlických horách, avšak potvrzen byl jen na 7 z 13 historických lokalit (srovn. obr. 1). Nově se neobjevil na žádné ze 200 historických lokalit sledovaných v 50. létech. V současné době je druh velmi vzácný až ojedinělý v Orlických horách (1 lokalita), poněkud hojnější v Hrubém Jeseníku (dvě nově zjištěné lokality, potvrzen nález z počátku 50. let) a hojný v členité části Moravskoslezských Beskyd a Podbeskydské pahorkatině (nalezen na 36 lokalitách, celkem sledováno 147 lokalit v letech 2007–2009), kde se larvy vyskytují většinou ojediněle, jen na některých lokalitách jsou lokálně hojně.

Příčinou restrikce areálu *P. grandis* v České republice není znečištění a drastické změny morfologie toku (jako je tomu např. v horním povodí Rýna), ale s největší pravděpodobností acidifikační procesy, které vrcholily koncem 80. let minulého století. Horské toky v Hercynském systému byly vystaveny silné acidifikaci, některé z nich (např. Krkonoše, Jizerské hory a částečně i Orlické hory) leží dokonce přímo v „černém trojúhelníku“ na německo-polsko-české hranici (přibližně v oblasti Drážďany-Sokolov-Wrocław). Z hlediska acidity je druh *P. grandis* klasifikován jako sensitivní a špatně odolávající jarním acidifikačním příhodám v souvislosti s táním sněhu. V kritickém období dosahovalo pH povrchové vody v západních hercynských pohořích dlouhodobě až k hodnotě pH=4,5 (což mělo za následek vymizení ryb a řady bezobratlých bentických organismů, např. jepic), zatímco v Jeseníkách a Beskydech se hodnoty dlouhodobě pohybovaly v rozmezí pH = 6,5–7,5.

Senzitivitu druhu zvyšuje i určitá habitatová specializace (srovn. obr. 2). V České republice stenotermní a proudomilné larvy obývají především krátké rychle tekoucí epirhitrální úseky toků (nejčastěji toky 2. a 3. řádu, výjimečně i přechodové epi- a metaritrální úseky o délce několik kilometrů) ve výškách nejčastěji 550–750 m a.s.l. (v ostatních evropských pohořích jsou nalézány i mnohem výše, často i nad 2500 m v Alpách) s nepřilíši exponovaným spádem toku (3–10 ‰) a nepřilíši vzdálené od pramene (0,6–3,1 km). Voda u 5 charakteristických toků vykazovala pH 7,3±0,2 (min. 6,8, max. 7,8). Larvy preferují kamenitý substrát s kameny a balvany (mikro-, meso- a makrolitál). V Moravskoslezských Beskydech v podélném profilu navazuje na velmi vzácnou dravou pošvatku *Arcynopteryx compacta* (McLachlan, 1872) a běžný druh *Diura bicaudata* (Linnaeus, 1758), v nižších partiích ji střídá *Dinocras cephalotes* (Curtis, 1827) a *Perla marginata* (Panzer, 1799).