

## Current distribution of *Beraeamyia hrabei* Mayer, 1937 (Trichoptera: Beraeidae) in the Czech Republic

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**Abstract:** *Beraeamyia hrabei* Mayer, 1937 is a relatively rare species occurring in the Czech Republic only locally and in low abundances. New data on its distribution with some ecological notes are presented in this paper.

**Key words:** Trichoptera, faunistics, *Beraeamyia hrabei*, Czech Republic, land use.

### Introduction

There are 11 species of Western Palaearctic genus *Beraeamyia* in Europe and the Mediterranean region (Malicky 2005). The occurrence of most species is restricted to the Mediterranean region from Turkey across the Balkan Peninsula to Italy. The area of distribution of *Beraeamyia squamosa* Mosely, 1930 and *Beraeamyia schmidi* Botosaneanu, 1960 reaches southern parts of Central Europe. *B. squamosa* is the westernmost species, known from Italy, the Alps and the Pyrenees (Malicky 1985). *Beraeamyia hrabei* Mayer 1937 is the only species of this genus known in the Czech Republic and neighbouring countries (except Germany) (Novák & Chvojka 2001, Szczesny 1991, Malicky 1999). Its area of distribution reaches from Greece (Karaouzas & Malicky 2015) to the Polish Carpathians (Szczesny 1986). Westernmost records are from Slovenia (Urbanič 2003) and Austria (Malicky 1999). *B. hrabei* was described by Mayer (1937, 1938) from Slovakia. In the Czech Republic the species was published for the first time by Sedlák (1971) from the Hostýnsko-Vsetínská hornatina Mts, together with the description of the larva. The only reliable published recent record is from one locality in the Bílé Karpaty Mts (Komzák & Chvojka 2012). A single record of *B. hrabei* from Bohemia (Bohemian Forest - Šumava) (Růžicková *et al.* 2004), based on larval identification only, is not verifiable and previous extensive entomological survey of this territory did not prove the species occurrence (Novák 1996). *B. hrabei* has been recorded on several new localities in Moravia and Silesia during the last decade and based on these new records the species is classified as vulnerable in the Czech Republic (Chvojka & Komzák 2017). The species is relatively rare and listed in national Red Lists in other Central European countries, i.e. Austria (vulnerable - Malicky 2009) and Hungary (endangered - Nógrádi & Uherkovich 2002).

*B. hrabei* is known to prefer epirhithral and metarhithral parts of streams with moderate to high current in colline to montane zones (Graf *et al.* 2008). It is a small species with anterior wing length about 6 mm (Malicky 2004) and flight period from June to August (Waringer & Graf 2011).

This paper gives a summary of recent findings of *B. hrabei* in the Czech Republic with a brief description of environmental conditions at sites of occurrence.

### Material and Methods

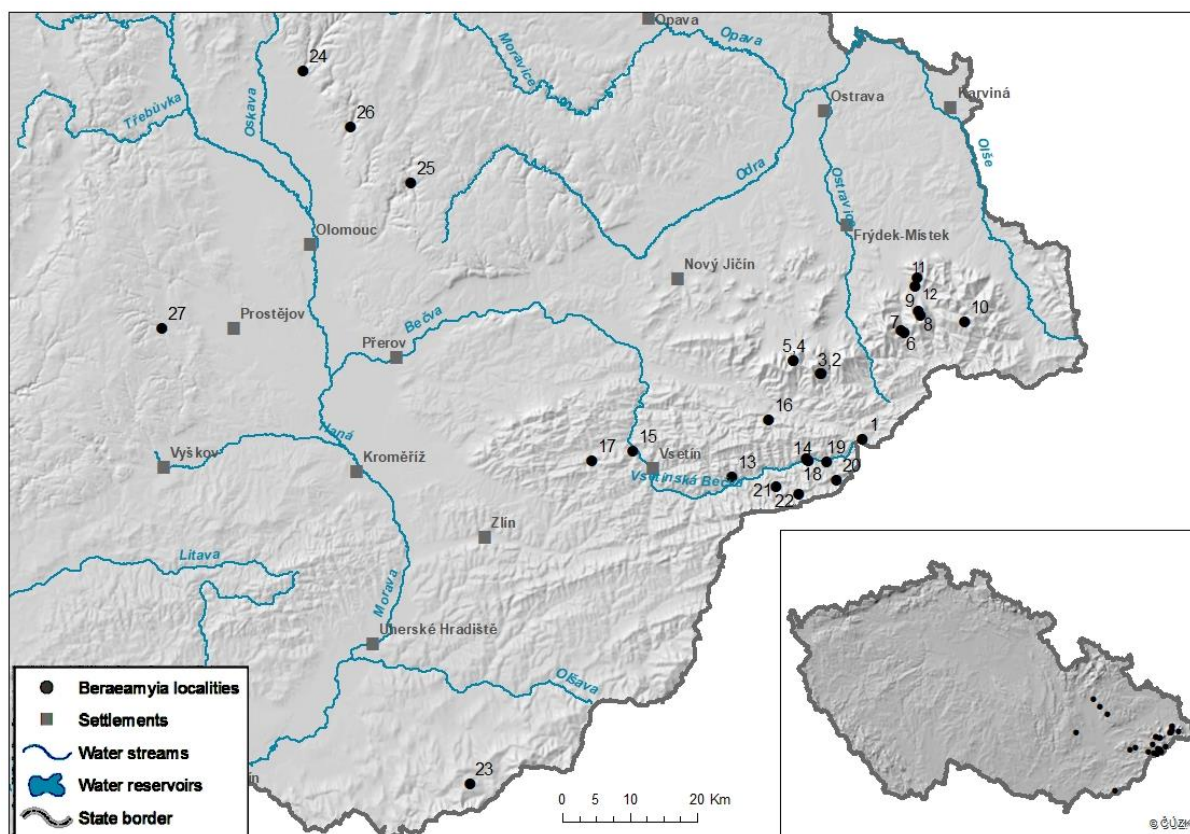
The investigated area includes the Morava River basin and the southern part of the Odra River basin (the Moravskoslezské Beskydy Mts). Material used in this study was gathered from 2008 to 2017. Adults were collected by sweeping or Malaise traps (only in the Moravskoslezské Beskydy Mts) and preserved

in 70% ethanol. The material was determined according to Malicky (2004) and deposited largely in authors' collections. Larvae and pupae were sampled by a hand net as semi-quantitative 3-minute kick samples according to the PERLA system (Kokeš *et al.* 2006), preserved in 4% formaldehyde and determined according to Waringer & Graf (2011).

**Tab 1:** Localities of occurrence of *B. hrabei* (\* Komzák & Chvojka 2012).

| Locality             | No. | G P                 | Geomorphological units                            | Quadrat | Stream           | Altitude<br>(m a.s.l.) | Coordinate  |             |
|----------------------|-----|---------------------|---------------------------------------------------|---------|------------------|------------------------|-------------|-------------|
|                      |     |                     |                                                   |         |                  |                        | N           | E           |
| Salajka 2.           | 1   | Western Carpathians | Moravskoslezské Beskydy Mts                       | 6576    | Smradlava        | 719                    | 49°24'07,2" | 18°25'16,7" |
| Kněhyňka 2.          | 2   | Western Carpathians | Moravskoslezské Beskydy Mts                       | 6575    | Kněhyňka         | 727                    | 49°29'08,2" | 18°19'22,1" |
| Kněhyňka 3.          | 3   | Western Carpathians | Moravskoslezské Beskydy Mts                       | 6575    | Kněhyňka         | 667                    | 49°29'07,0" | 18°19'28,1" |
| Malá Ráztoka A       | 4   | Western Carpathians | Moravskoslezské Beskydy Mts                       | 6575    | Malá Ráztoka     | 750                    | 49°29'57,0" | 18°15'56,7" |
| Malá Ráztoka B       | 5   | Western Carpathians | Moravskoslezské Beskydy Mts                       | 6575    | Malá Ráztoka     | 742                    | 49°29'58,5" | 18°15'55,7" |
| Mohelnice nad Zimným | 6   | Western Carpathians | Moravskoslezské Beskydy Mts                       | 6476    | Mohelnice        | 588                    | 49°32'55,8" | 18°29'20,6" |
| Zimný 3.             | 7   | Western Carpathians | Moravskoslezské Beskydy Mts                       | 6476    | Zimný potok      | 615                    | 49°33'05,4" | 18°28'53,9" |
| Vlaský 2.            | 8   | Western Carpathians | Moravskoslezské Beskydy Mts                       | 6477    | Vlaský potok     | 665                    | 49°34'24,1" | 18°31'05,6" |
| Vlaský 3.            | 9   | Western Carpathians | Moravskoslezské Beskydy Mts                       | 6477    | Vlaský potok     | 583                    | 49°34'45,9" | 18°30'45,2" |
| Slavič 4.            | 10  | Western Carpathians | Moravskoslezské Beskydy Mts                       | 6477    | Slavič           | 706                    | 49°34'12,5" | 18°36'34,7" |
| Vysutý 2.            | 11  | Western Carpathians | Moravskoslezské Beskydy Mts                       | 6377    | Vysutý           | 553                    | 49°37'22,8" | 18°30'18,8" |
| Vysutý 3.            | 12  | Western Carpathians | Moravskoslezské Beskydy Mts                       | 6377    | Vysutý           | 438                    | 49°36'44,9" | 18°30'06,7" |
| Lušová               | 13  | Western Carpathians | Hostýnsko-Vsetínská hornatina Mts                 | 6674    | Lušová           | 445                    | 49°20'11,0" | 18°09'41,0" |
| Miloňovský p.        | 14  | Western Carpathians | Hostýnsko-Vsetínská hornatina Mts                 | 6675    | Miloňovský potok | 542                    | 49°22'10,0" | 18°18'32,0" |
| Semetínský p.        | 15  | Western Carpathians | Hostýnsko-Vsetínská hornatina Mts                 | 6673    | Semetínský potok | 331                    | 49°21'36,4" | 17°57'14,6" |
| Solanecký p.         | 16  | Western Carpathians | Hostýnsko-Vsetínská hornatina Mts                 | 6575    | Solanecký potok  | 505                    | 49°25'00,7" | 18°13'33,1" |
| Štěpková             | 17  | Western Carpathians | Hostýnsko-Vsetínská hornatina Mts                 | 6673    | Štěpková         | 405                    | 49°20'31,9" | 17°52'19,5" |
| Vsetínská Bečva 1.   | 18  | Western Carpathians | Hostýnsko-Vsetínská hornatina Mts / Javorníky Mts | 6676    | Vsetínská Bečva  | 570                    | 49°22'05,0" | 18°21'05,9" |
| Vsetínská Bečva 2.   | 19  | Western Carpathians | Hostýnsko-Vsetínská hornatina Mts / Javorníky Mts | 6675    | Vsetínská Bečva  | 535                    | 49°22'01,9" | 18°18'53,3" |
| Lemešná              | 20  | Western Carpathians | Javorníky Mts                                     | 6676    | Lemešná          | 643                    | 49°20'42,8" | 18°22'29,3" |
| Malá Stanovnice      | 21  | Western Carpathians | Javorníky Mts                                     | 6675    | Malá Stanovnice  | 540                    | 49°19'45,1" | 18°15'09,7" |
| Stanovnice           | 22  | Western Carpathians | Javorníky Mts                                     | 6675    | Stanovnice       | 630                    | 49°19'17,7" | 18°17'58,0" |
| RT Klanečnice*       | 23  | Western Carpathians | Bílé Karpaty Mts                                  | 7172    | RT Klanečnice    | 460-500                | 48°53'45,3" | 17°41'06,2" |
| Oslava               | 24  | Western Carpathians | Homomoravský úval Graben                          | 6169    | Oslava           | 280                    | 49°49'27,8" | 17°12'13,5" |
| Lichníčka            | 25  | Bohemian Massif     | Nízký Jeseník Mts                                 | 6370    | Lichníčka        | 388                    | 49°41'21,0" | 17°26'54,0" |
| Sitka                | 26  | Bohemian Massif     | Nízký Jeseník Mts                                 | 6269    | Sitka            | 315                    | 49°45'21,2" | 17°18'52,3" |
| Žbánovský p.         | 27  | Bohemian Massif     | Drahanská vrchovina Highlands                     | 6567    | Žbánovský potok  | 320                    | 49°27'46,3" | 16°58'10,3" |

Explanatory Notes: G P – Geomorphological provinces



**Fig 1:** Current occurrence of *B. hrabei* in the Czech Republic. Locality numbers according to Tab. 1.

Basic physicochemical parameters (pH, conductivity, dissolved oxygen, water temperature) were measured throughout the year at all sites. The assessment of land use in the catchments was performed in ArcMap 10.4 using data of ZABAGED® (ČÚZK 2017). The list of localities in Tab. 1 is supplemented by grid references based on Zelený (1972) and Pruner & Míka (1996).

Abbreviations used in the text: L – larva, P – pupa; Mt - Malaise trap, Sw – sweeping or individual collecting of specimens, Hs – hydrobiological samples; JK – Jiří Kroča, PK – Petr Komzák, SV – Stanislav Větríček, MS – Michal Straka; WRI - T. G. Masaryk Water Research Institute, public research institution; RT – right tributary.

**Tab 2:** The range of values of physicochemical parameters measured at sites with the occurrence of *B. hrabei*

| Parameters              | minimum    | maximum     | average     |
|-------------------------|------------|-------------|-------------|
| pH                      | 6.6 – 8.0  | 7.33 – 9.1  | 7.2 – 8.2   |
| Conductivity (mS/m)     | 5.5 – 20.5 | 7.6 – 70.6  | 6.0 – 39.9  |
| Dissolved oxygen (mg/l) | 5.1 – 10.3 | 12.1 – 16.3 | 10.9 – 11.7 |
| Water temperature (°C)  | 0.0 – 3.1  | 8.9 – 22.5  | 5.8 – 10.3  |

## Results

### Published records

Komzák & Chvojka 2012: Moravia: Bílé Karpaty Mts: right tributary of the Klanečnice stream.

### Material examined

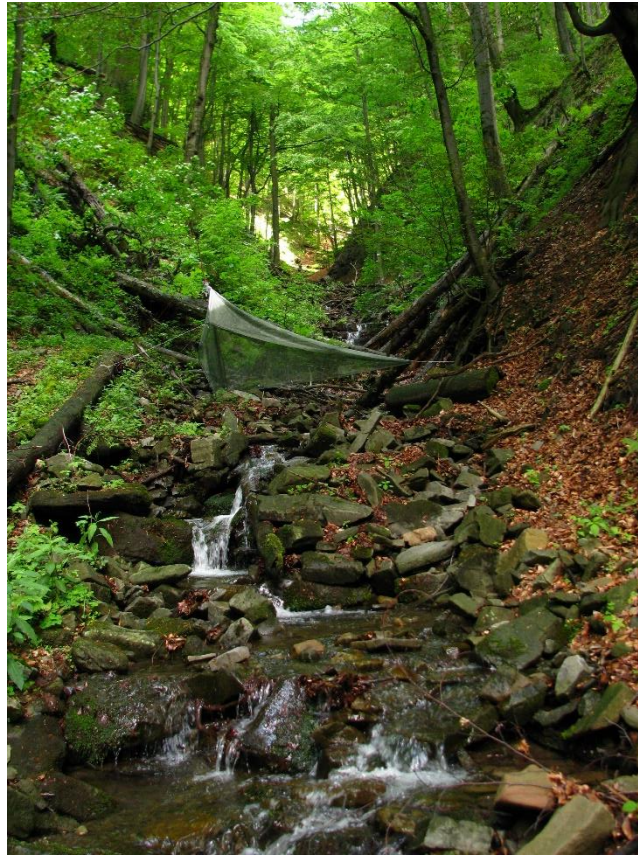
**Silesia:** Moravskoslezské Beskydy Mts: Mohelnice nad Zimným, 5.vii.2012, 2 ♂, Sw, JK leg., det. et coll. Zimný 3., 26.vi.–17.vii.2008, 1 ♂ 2 ♀♀, Mt, JK leg. et coll., PK det. Vlaský 2., 20.vi.–18.vii.2011, 1 ♀, Mt, JK leg., det. et coll. Vlaský 3., 13.vi.–15.vii.2009, 1 ♀; 15.vii.–21.viii.2009, 1 ♀, all Mt, JK leg., det. et coll. Slavič 4., 23.vi.–26.vi.2008, 1 ♂ 1 ♀, Mt, JK leg. et coll., PK det.; 26.vi.–17.vii. 2008, 1 ♂ 3 ♀♀, Mt, JK leg., det. et coll. Vysutý 2., 16.vi.–6.vii.2017, 6 ♂♂; 6.vii.–27.vii.2017, 4 ♀♀, all Mt, JK leg., det. et coll. Vysutý 3., 16.vi.–6.vii.2017, 1 ♀, Mt, JK leg., det. et coll.

**Moravia:** Moravskoslezské Beskydy Mts: Salajka 2., 24.vi.–16.vii.2008, 1 ♂ 8 ♀♀, Mt, JK leg., PK det. et coll. Kněhyňka 2., 21.v.–20.vi. 2011, 1 ♀; 20.vi.–18.vii.2011, 1 ♀, all Mt, JK leg., det. et coll.; Kněhyňka 3., 20.vi.–18.vii.2011, 1 ♂ 3 ♀♀, Mt, JK leg., det. et coll. Malá Ráztoka 1., 24.vi.–16.vii.2008, 1 ♂, Mt, JK leg., det. et coll. Malá Ráztoka 2., 11.vi.–12.vii.2007, 1 ♂, Mt, JK leg., det. et coll. Hostýnsko-Vsetínská hornatina Mts: Lušová, 7.v.2014, 4 L; 30.ix.2014, 2 L, all Hs, SV leg. et det. Miloňovský p., 6.v.2011, 2 L, Hs, SV leg. et det. Semetínský p., 24.ix.2014, 1 L, Hs, PK leg. et det. Solánecký p., 24.ix.2008, 4 L, Hs, SV leg. et det. Štěpková, 19.ix.2008, 1 L, Hs, PK leg. et det. Hostýnsko-Vsetínská hornatina Mts / Javorníky Mts: Vsetínská Bečva 1., 23.ix.2008, 4 L, Hs, PK leg. et det.; 14.vii.2009, 1 ♀P, Hs, PK leg., det. et coll.; 5.v.2011, 1 L, Hs, SV leg. et det. Vsetínská Bečva 2., 24.ix.2013, 4 L, Hs, PK leg. et det.; 18.vii.2015, 1 ♂ 2 ♀♀, Sw, MS leg., PK det., coll. WRI. Javorníky Mts: Lemešná, 15.vii.2009, 4 ♂ 1 ♀, Sw, PK leg., det. et coll. Malá Stanovnice, 14.vii.2010, 2 ♂♂ 3 ♀♀, Sw, PK leg., det. et coll.; 6.x.2010, 2 L, Hs, SV leg. et det. Stanovnice, 18.vii.2015, 1 ♀, Sw, MS leg., PK det., coll. WRI. Hornomoravský úval Graben: Oslava, 23.vii.2009, 2 ♀♀, Sw, PK leg., det. et coll. Nízký Jeseník Mts: Lichnička, 2.x.2009, 4 L, Hs, SV leg. et det.; 5.v.2015, 3 L, Hs, PK leg. et det. Sitka, 10.v.2010, 4 L; 23.ix.2010, 2 L, all Hs, PK leg. et det. Dražanská vrchovina Highlands: Žbánovský p., 15.v.2012, 4 L; 28.iv.2015, 3 L, all Hs, SV leg. et det.

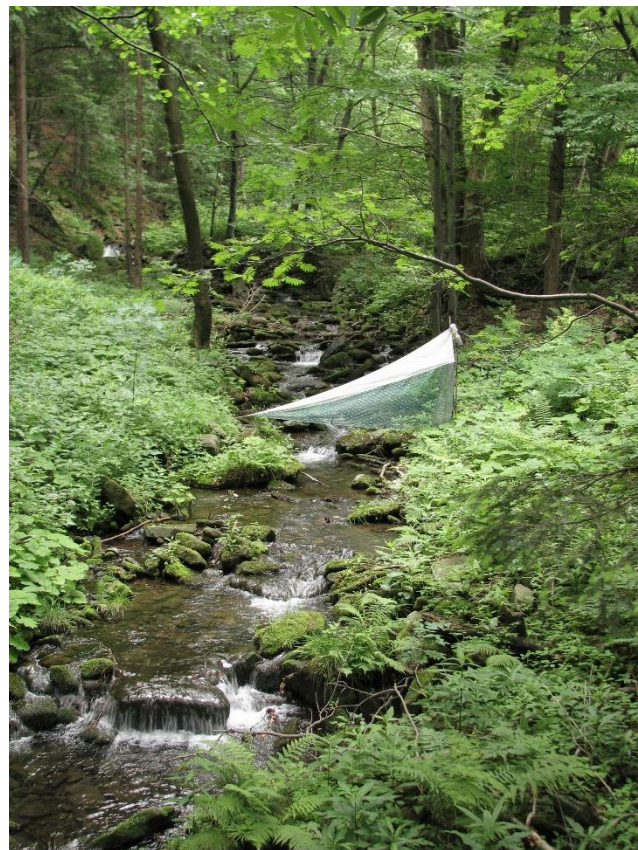
### Discussion and conclusions

*Beraeamyia hrabei* has been recently recorded at 27 localities in Moravia and Silesia (including one record published by Komzák & Chvojka (2012) from the Bílé Karpaty Mts) (Tab. 1, Fig. 1). Sites situated in Hornomoravský úval Graben, the Nízký Jeseník Mts, and the Dražanská vrchovina Highlands are the north-westernmost within the species area of distribution. During the study period (2008–2017) 56 adults, 45 larvae and 1 pupa were collected. The species occurred in very low abundances at all sites. Even at sites where Malaise traps were installed, only several specimens per season were caught. Almost all adults (except 2 specimens) were captured between June 11<sup>th</sup> and July 23<sup>th</sup>. It falls within the range of flight period of this species presented in Waringer & Graf (2011). Relatively low abundances and a short flight period may be the reasons, why the species has been overlooked for a long time.

The altitude of sites with the occurrence of *B. hrabei* was 280–750 m a.s.l. The streams were fast flowing, with substrate consisting mainly of boulders, cobbles and gravel (Fig. 2, 3), less frequently with significant share of rock or sand. Average water depth varied between 5 and 45 cm and width between 0.5 and 8 m. The maximum distance from the source was nearly 20 km, but in most cases did not exceed 10 km, and the catchment area only 4 times exceed 20 km<sup>2</sup> (the Oslava stream – 77 km<sup>2</sup> (Fig. 4), the Sitka stream – 59 km<sup>2</sup>, and the Vsetínská Bečva River – 55 km<sup>2</sup> and 24 km<sup>2</sup>). Land use in the catchment area seems to be an important parameter for the occurrence of this species. The proportion of forests in the catchment exceeded 80 % for most sites (only in several cases ranged between 50 and 80 %) and, if combined with grassland, the proportion always exceeds 90 %. If the arable land was present, it was mostly under 1 % of the area. It amounted to 6 % only in three catchments but then it was situated in the upper part of the catchment and separated from the locality by a large forested area, which most probably suppressed the negative impact of agriculture (Fig. 5). The character of studied sites is in



**Fig 2:** The mountain locality of *B. hrabei* - Vysutý 2. (Moravskoslezské Beskydy Mts, Vysutý Nat. Monument). Photo by J. Kroča.



**Fig 3:** The mountain locality of *B. hrabei* - Vlaský 3. (Moravskoslezské Beskydy Mts). Photo by J. Kroča.



**Fig 4:** The submontane locality of *B. hrabei* with the largest catchment area - Oslava (Hornomoravský úval Graben). Photo by S. Větříček.



**Fig 5:** The locality of *B. hrabei* with the highest proportion of arable land in the catchment - Žbánovský potok (Drahanská vrchovina Highlands). Photo by S. Větříček.

accordance with that of sites, where Szczesny (1986) recorded *B. hrabei* in the Polish Carpathians (depth 10–50 cm, width 0.6–5 m, boulders and cobbles, surrounded by forest, shrub and grassland). In terms of physicochemical parameters measured, no significant preference has been recorded for particular parameter. The ranges of minimum, maximum and average values of physicochemical parameters are given in Tab. 2.

In summary, *Beraemyia hrabei* occurs in the Czech Republic locally only in the Morava and Odra River basins, more often in areas with a high share of forests (eventually combined with grassland), but always in very low abundances. In view of the above mentioned facts, it is correctly classified in the Red List of threatened species of the Czech Republic as vulnerable.

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### **Současné rozšíření *Beraemyia hrabei* Mayer, 1937 (Trichoptera: Beraeidae) v České republice**

*Beraemyia hrabei* Mayer, 1937 je druh vyskytující se v Evropě i České republice poměrně vzácně a lokálně. Z našeho území existuje jen velmi málo publikovaných nálezů. Až během posledního desetiletí byl zaznamenán na 27 lokalitách na Moravě a ve Slezsku a podrobné faunistické údaje jsou prezentovány v této práci. Na našem území dosahuje tento druh severozápadní hranice svého areálu. Na všech lokalitách byl druh zaznamenán ve velmi malých počtech a výlet dospělců byl pozorován jen v krátkém období od června do července. To mohou být důvody, proč byl druh na našem území dosud přehlížen.

*B. hrabei* byla zjištěna v nadmořských výškách 280–750 m n.m. v menších (vzdálenost od pramene do 20 km, velikost povodí do 80 km<sup>2</sup>) rychleji proudících tocích se substrátem tvořeným zejména balvany, kameny a štěrkem. Ve všech povodích převažovaly nad místem nálezu lesy a v kombinaci s trvalými travními porosty jejich podíl vždy překračoval 90 %. Pokud se v povodí vyskytovala orná půda, byla vždy situována v horní části povodí a od místa nálezu oddělena rozsáhlými lesními plochami.

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