HABITAT REQUIREMENTS AND DISTRIBUTION OF *GYRAULUS ROSSMAESSLERI* (GASTROPODA: PLANORBIDAE) IN NORTHWESTERN BOHEMIA

LUBOŠ BERAN[1] & MICHAL HORSÁK[2]

[1]Agency for Nature Conservation and Landscape Protection of the Czech Republic, Kokořínsko Protected Landscape Area Administration, Česká 149, CZ–276 01 Mělník, Czech Republic
[2]Department of Botany and Zoology, Masaryk University, Kotlářská 2, Brno, CZ-61137, Czech Republic

Abstract *Recent record of a threatened planorbid gastropod* Gyraulus rossmaessleri *(Auerswald 1851) in northwestern Bohemia has stimulated further ecological research since this species occurs in the Czech part of the Elbe River basin only in this area. A detailed research of the species's distribution and habitat preferences in northwestern Bohemia were conducted in 2008–2010. Occurrence of* G. rossmaessleri *was confirmed in the surroundings of Teplice town at 35 out of 123 sites under study. We found that* G. rossmaessleri *in this area inhabits different types of temporary wetlands and was also often found in small wetlands in spring areas and in small and slowly flowing rivulets. This habitat preference has not been reported so far.*

Key words Gyraulus rossmaessleri, *Gastropoda, Planorbidae, northwestern Bohemia, distribution, habitat preferences*

INTRODUCTION

Habitat requirements and distribution of many rare and threatened European freshwater snail species are still poorly known. One such species is *Gyraulus rossmaessleri* (Auerswald 1851) – a small (4–7 mm) ramshorn snail belonging to the family Planorbidae. The shell of this species is quite similar to non-angled shells of *Gyraulus acronicus* (A. Férussac 1807) which, however, belongs to the subgenus *Gyraulus* Charpentier 1837. In contrast, *G. rossmaessleri* belongs to subgenus *Lamorbis* Starobogatov 1967 (Glöer, 2002) which is supported by several anatomical characters which should be used for a reliable identification of these species. Meier-Brook (1983) considered this species to be strictly Europaean with its centre of distribution in central Europe. On the contrary, Glöer (2002) reported a Holarctic distribution, although this information was later found to be erroneous (P. Glöer, pers. comm.) and a strictly European distribution should be noted. *G. rossmaessleri* is known from the neighbouring countries of Poland (Piechocki, 1979), Slovakia (Čejka *et al.*, 2005), Austria (Falkner, 1995) and Germany (Glöer & Meier-Brook, 2003). Falkner *et al.* (2001) mentioned its absence from the western part of Europe i.e. westward of the Rhine River. This planorbid snail prefers temporary wetlands (Piechocki, 1979; Falkner *et al.*, 2001; Beran, 2002; 2005), which are usually mesotrophic (Falkner *et al.*, 2001). In Poland, Piechocki (1979) noticed its occurrence in temporary pools and wetlands and occasionally in permanent habitats in shallow parts with vegetation (e.g. *Lemna* spp.). He also considered it to be resistant to desiccation in its habitats. Bionomy and ecology is not well known, as noted by Piechocki (1979); all known data are briefly summarized in Falkner *et al*. (2001).

Despite the fact that the occurrence of this species in the Czech Republic has been known for more than 110 years (Uličný, 1896; Schierl, 1901), the first reliable records based on anatomical characters were obtained from Bohemia (western part of the Czech Republic) as late as 2004 (Beran, 2005) but that area belongs to the Odra River basin (Fig. 1). In 2006 the occurrence

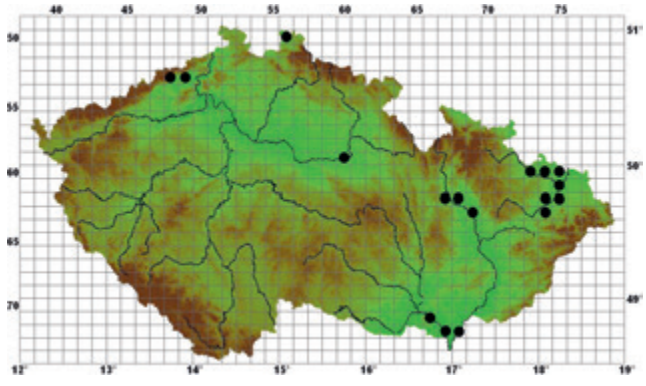

Figure 1 Known distribution of *Gyraulus rossmaessleri* in the Czech Republic (Beran, 2002 and unpublished data).

Contact author : horsak@sci.muni.cz

of *G. rossmaessleri* was also confirmed in northwestern Bohemia near Teplice town in the Elbe River basin, which has resulted in more detailed research during 2008–2010. One of the reasons for this research was the fact that *G. rossmaessleri* is classified in the Czech Republic as a critically endangered species (Beran *et al.*, 2005), which is also linked to its relation to vulnerable freshwater habitat types. The same situation is also reported from Germany (Glöer, 2002), Slovakia (Čejka *et al.*, 2005) and Hungary (Fehér *et al.*, 2004).

The main goal of this research was to study distribution and habitat requirements of this species by means of field survey of various habitat types in northwestern Bohemia. This is the first attempt to describe and summarise habitat preferences in order to bring forward data that can help to prepare suitable management for this critically endangered species.

Material and Methods

Sampling and environmental data Distributional data were collected by the senior author between 2008 and 2010. The main sampling method for aquatic molluscs was washing vegetation or sediments using a metal sieve (a kitchen strainer, diameter 20 cm, mesh size 0.5–1 mm) combined with a direct search on surfaces of stones, woods and artificial materials (e.g. plastic bags and bottles). Aquatic molluscs were determined according to their shells or dissected and then identified based on differences in their copulatory organs if the identification based only on shell was impossible. Specimens for dissection were killed in boiled water and then fixed in 70% ethanol.

The area under study, defined on the basis of historical records and geographical conditions, is situated in the northwestern Bohemia in the surroundings of Teplice town (Fig. 2). To the

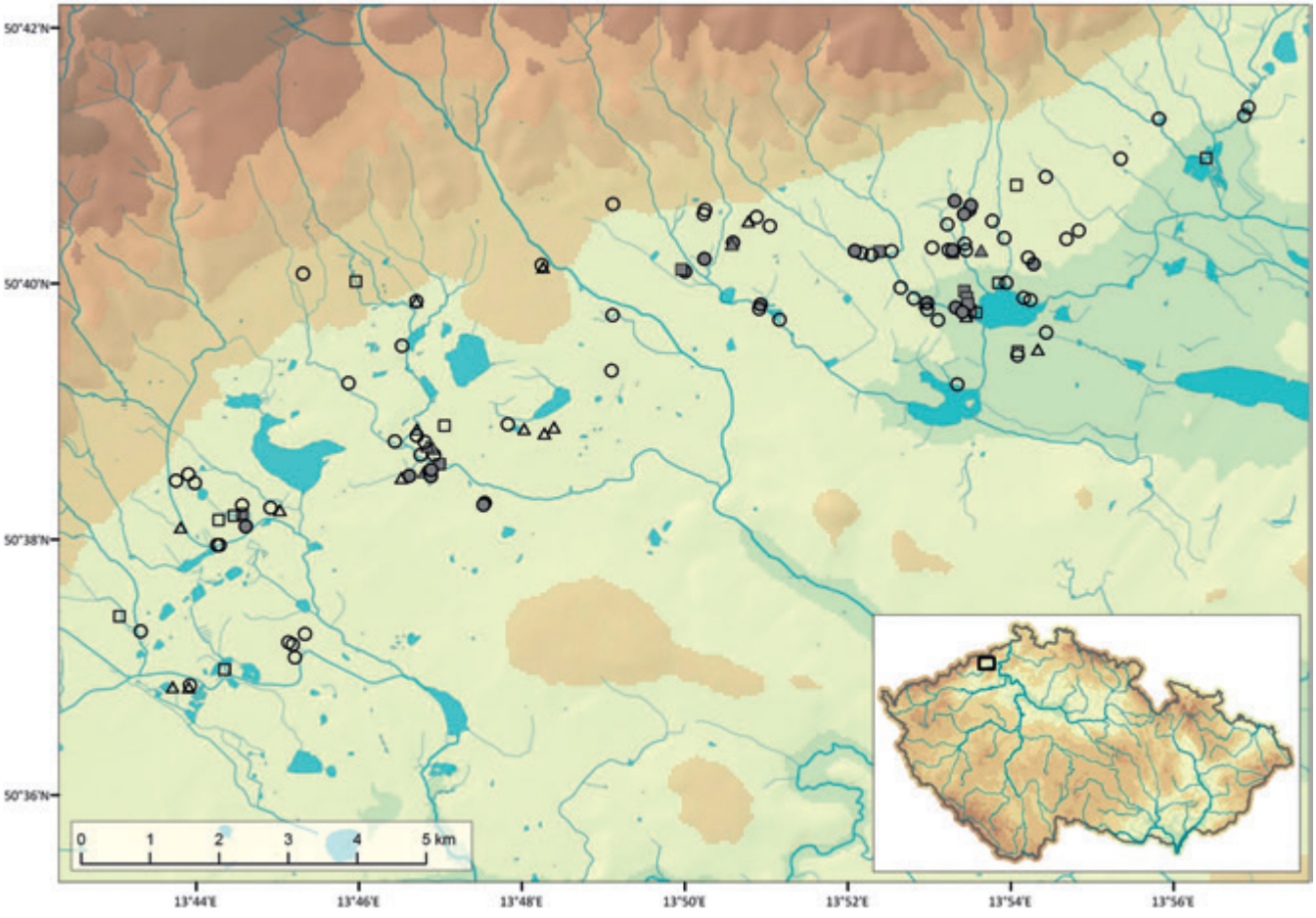

Figure 2 The area under study and distribution of studied sites; full symbols show occurrence of *Gyraulus rossmaessleri.* Abbreviations: circle, swamps; triangles, pools; squares, ditches.

north the area is well delimited by Krušné hory Mountains and on the south and west by an area which has been damaged by coal mining. Especially the northern part is rich in small brooks running from the mountains and forming various floodplain wetlands. In this area, sites potentially suitable for *G. rossmassleri*, e.g. wetlands, temporary pools, ditches or springs, were sampled.

The following eight environmental characteristics were compiled for each sampling site. (1) Altitude was measured with a GPS in the field and checked against 1:50,000 topographic maps. (2) Sites were arbitrary scored on a 5-grade scale based on their size: 1, up to 0.01 ha; 2, 0.01–0.25 ha; 3, 0.25–1 ha; 4, over 1 ha. (3) On the basis of the insolation we arbitrary classified sites on a 3-grade scale: 1, full shade; 2, partly insolated; 3, fully insolated. Sites were arbitrarily classified post-hoc into five nominal classes to describe habitat preferences of the species: (4) a temporal or at least partially permanent habitat; (5) a ditch, swamp or pool; (6) a habitat isolated from the floodplain or situated within the floodplain; (7) a site within the area of coal mining or outside of this area; (8) a site with negative human impacts (distinct eutrophication or pollution) or without visible degradation.

Data analysis The significance of relationships between continuous (altitude) and ordinal (habitat size) variables and the occurrence of *G. rossmaessleri* was tested using Mann-Whitney U test. The Fisher's exact test was used for the testing of relationships between all nominal variables and the occurrence of *G. rossmaessleri*. All eight explanatory variables were subjected to principal components analysis (PCA) on the correlation matrix (centred and standardised) to reveal the main gradients of environmental variation among studied sites. Sites in the resulting ordination diagram were classified based on the occurrence of *G. rossmaessleri* in order to show the habitat preferences of the species. The CANOCO 4.5 package (Braak & Šmilauer, 2002) was used for computing ordinations and STATISTICA 8 (Hill & Lewicki, 2007) for univariate analyses.

RESULTS

The occurrence of *G. rossmaessleri* was confirmed at 35 sites out of 123 studied. The abundance varied between 2 to 500 recorded individuals per site. Distribution of the species was not significantly explained by any of the used environmental parameters. We observed only a marginally significant effect for the occurrence in slowly flowing waters (Fisher exact test, p=0.07) and in sites within the floodplain (Fisher exact test, p=0.06). More reasonable results were obtained based on the ordination approach (PCA). After clustering studied sites in a multidimensional space based on all recorded environmental variables we can conclude that presence of the species was more frequent in the left part of the diagram, mainly in the upper left quarter (Fig. 3). The species preferred swampy and also slowly flowing, rather smaller habitats (up to 0.25 ha) which were situated within the floodplain of small brooks. In most cases it was found in temporary swamps with a high water level fluctuation during the season. In contrast, it avoided habitats at higher altitudes, in the area changed by coal mining and sites with higher negative impact (e.g. artificial eutrophication). In approximately one quarter of its sites no other snail species were recorded and in 23 sites (out of 35; 66%) co-occurred only with one, two or three species. Altogether, only seven mollusc species were collected in all the sites of this snail in northwestern Bohemia; *Pisidium casertanum* (18 sites), *Galba truncatula* (13), *Radix*

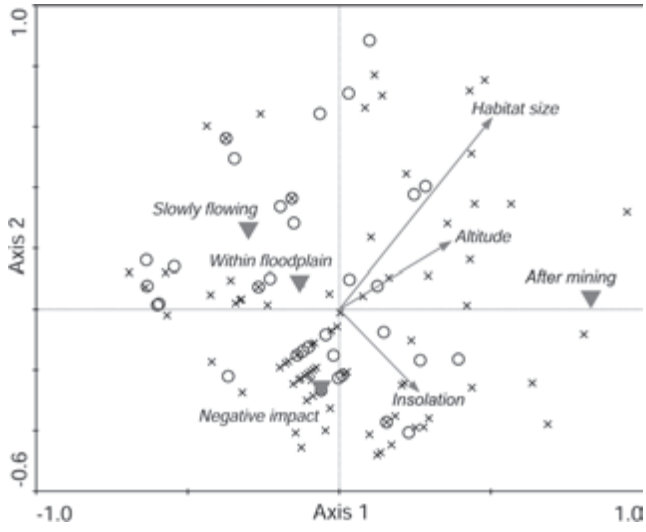

Figure 3 PCA diagram of eight environmental parameters on the first two axes; only those more important for explanation of the species occurrence were plotted. Sites are classified based on occurrence of *Gyraulus rossmaessleri*; circle, presence; cross, absence.

peregra (10), *P. personatum* (10) co-occurred most frequently.

Discussion

Distribution in the Czech Republic The occurrence of *G. rossmaessleri* was confirmed at 35 sites in the surroundings of Teplice town, northwestern Bohemia, between 2008 and 2010 (Fig. 2). This area was found as a new distributional island of this snail in Bohemia, since other records from the Czech part of the Elbe River basin near Pardubice town are more than 50 years old (see Beran, 2002). All other occurrences in the Czech Republic are known only from Odra River basin and Danube River basin. First reliable records of *G. rossmaessleri* from Silesia (Odra River basin, Baltic Sea drainage area) were published by Mácha (1963) and several new sites were found more than 35 years later in the Poodří Protected Landscape Area (Beran, 1999) and in north Bohemia near Frýdlant (Beran, 2005). In the Danube River basin, the species was found in the Litovelské Pomoraví Protected Landscape Area (central Moravia, Black Sea drainage area) (Beran, 2000) and recently also in southern Moravia (near Břeclav town, 2001, M. Horsák and L. Beran lgt.; near Lednice town, 2010 L. Beran lgt., unpubl. data).

Habitat requirements In the Czech Republic this snail inhabits different types of temporary wetlands – alder carr, swamps overgrown with *Glyceria* spp., *Carex* spp., small temporary pools or canals in floodplain forests or meadows (Beran, 2005). The same observations were reported from Poland (Piechocki, 1979) and generally also from western Europe (Falkner *et al.*, 2001). Basically, this snail occupied the same habitat types as in northwestern Bohemia with one distinct difference. In the study area it was also often found in small wetlands in spring areas and also in small and slowly flowing rivulets. Slowly flowing water was documented in approximately half of the sites with the occurrence of *G. rossmaessleri*, and this fact was also supported by the PCA analysis (Fig. 3). This habitat preference was mentioned neither by Piechocki (1979) nor by Falkner *et al.* (2001) and probably is being reported for the first time. Many of these sites (about one quarter of sites with the presence of *G. rossmaessleri*) had the character of ditches and in the past were probably used as drainage channels. With respect to conservation of this snail it is important to point out that this snail was found only in areas which were not altered by coal mining, even though numerous suitable wetlands were studied there. This snail inhabited mainly sites with partial shade. Habitats without visible anthropogenic impact (e.g. water polution) were preferred and this trend is similar to other parts of the Czech Republic where this species often inhabits wetlands in different types of protected areas (Beran, 1999; 2000; 2002; 2005). The occurrences in northwestern Bohemia were recorded between 192 and 270 m a.s.l. which is in the accordance with data from the other sites in the Czech Republic which vary between 155 and 283 m a.s.l. (Beran, 2002; above mentioned unpubl. data).

Conclusions

Gyraulus rossmaessleri was found in northwestern Bohemia in the surroundings of Teplice town at 35 sites. This area is important for the survival of this critical endangered mollusc species in the Czech Republic since this area contains the only known populations in the Elbe River basin. We found that *G. rossmaessleri* inhabits different types of temporary wetlands there and was also often found in small wetlands in spring areas and in small and slowly flowing rivulets, a fact that has not been recorded previously. In comparison with other wetland sites in the Czech Republic, the wetland sites of northwestern Bohemia are not protected despite being endangered by various negative human impacts. This requires protection of at least the most important sites.

Acknowledgements

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