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Record of living individual of the freshwater snail *Gyraulus rossmaessleri* (Auerswald, 1852) in Slovakia after thirty-eight years (Gastropoda: Planorbidae)

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A living adult and two fresh shells of the freshwater snail *Gyraulus rossmaessleri* (Auerswald, 1852) (Gastropoda, Planorbidae) were found in the lower Morava River alluvial plain in SW Slovakia after thirty-eight years.

The shell of *Gyraulus rossmaessleri* is small- to medium sized, usually not exceeding 4 mm in diameter and 1.3 mm in height. It is similar to *Gyraulus laevis* (Alder, 1838) in shape, but umbilicus and sutires are shallower; the whorls are rounded, never angled or keeled. The aperture has a characteristic thickened lip (that does not necessarily terminate growth). Growth marks indicating growth interruptions are regularly present (desiccation of habitat). The surface is not smooth, but rather dull, with a very fine reticulate sculpture (spiral striae very close to each other). The colour is reddish brown (MEIER-BROOK 1983).

Locality and material examined: SW Slovakia, 4 km W from village of Závod (48°32'47" N, 16°57'52" E) (grid reference databank of Fauna of Slovakia DFS – 7468c), temporary pool in forest fragment of the non-inundated area behind the dam, gravel-sandy bottom covered with mud and thick layer of poplar and ash leaves (Fig. 1), 149.0 m a.s.l., 8 October, 2001, E. Bulánková and J. Halgoš leg., one living adult and two fresh shells found. The material was not dissected, identified only by shell morphology. T. Čejka det. et coll., M. Horsák rev.

Distribution: *Gyraulus rossmaessleri* is an European species with very restricted central European range. Its more or less continuous occurrence is known from S, W, central and eastern Europe: Germany (MEIER-BROOK 1983; GLÖER 2002), Austria (FALKNER 1995), Czech Republic (JUŘIČKOVÁ et al. 2001), Slovakia (LUČIVJANSKÁ & ŠTEFFEK 1991), Switzerland (TURNER et al. 1998), Poland (PIECHOCKI 1979), Hungary (RICHNOVSZKY & PINTÉR 1979); according to SCHLESCH (1942) in Lithuania as well.

LISICKÝ (1991) did not mention the species in the monograph of Slovak molluscs; few records were discovered by LUČIVJANSKÁ & ŠTEFFEK (1991) in collection of T. Weisz from 1960s (the latest record came from 1963, village of Senné, East Slovakia). ČEJKA (2000) found 3 fresh empty shells in the flood debris of the Danube River in the Bratislava City.

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Fig. 1. The habitat of the freshwater snail *Gyraulus rossmaessleri* in the dried-up stage (SW Slovakia, the lower Morava River)

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New records of *Gyraulus rossmaessleri* (Gastropoda: Planorbidae) in the Czech Republic

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Populations of the freshwater snail *Gyraulus rossmaessleri* (Auerswald, 1852) (Gastropoda, Planorbidae) were found at 4 sites in the Meandry Smědé Nature Reserve (Northern Bohemia, Czech Republic). In Bohemia this species has not been found for last 25 years and the nearest localities with its known occurrence in the past are situated about 100 km to the south-west.

Introduction

Gyraulus rossmaessleri (Auerswald, 1852) is according to MEIER-BROOK (1983) an European species with very restricted Central European range but GLÖER (2002) mentioned holarctic distribution. In comparison with other species of genus *Gyraulus* this gastropod inhabits especially temporary pools and wetlands. Conchs of *G. rossmaessleri* are often similar to non-angled conchs of *G. acronicus* (A. Férussac, 1807) and dissection is useful and often necessary for determination.

Distribution in the Czech Republic

Gyraulus rossmaessleri is mentioned from the Czech Republic for the first time in MÁCHA (1963) from Silesia. Revision of material in different collections (National Museum of Prague, private collection of P. Kuchař – owner L.R. Kolouch) showed that this species occurred in the past also in North-Western Bohemia and in Eastern Bohemia (BERAN 2002). New sites with occurrence of this species in the Litovelské Pomoraví Protected Landscape Area (Central Moravia) mentioned BERAN (2000). Recently it is known from the Litovelské Pomoraví PLA (Central Moravia), Poodří PLA, Ostrava surroundings, Opava surroundings (all Silesia) (BERAN 2002). Distribution of this gastropod in the Czech Republic in different periods is shown in BERAN (2002).

G. rossmaessleri in the Czech Republic inhabits different types of temporary wetlands – alder carrs, swamps overgrown with *Glyceria* spp., *Carex* spp., small temporary pools or canals in floodplain forest or meadows. All these types of wetlands are endangered especially outside of protected sites by different human activities (e.g., river regulation, soil draining).

New records

New sites with occurrence of *G. rossmaessleri* were found in the Meandry Smědé Nature Reserve (Northern Bohemia) near Czech – Poland border in 2004. These new sites are mentioned below. Data are as follows – geographical coordinates, code of the mapping field for faunistic grid mapping (cf. PRUNER & MÍKA 1996), name of the nearest settlement, description of the site, altitude, name of finder, number of collected individuals, date of investigation): 50°59'18" N, 15°01'42" E, 5056, Filipovka, temporary ditch near border of Meandry Smědé NR 400 m from the railway station Filipovka, 235 m, L. Beran, 6 ex., 25 April 2004; 50°59'06" N, 15°01'24" E, 5056, Filipovka, sedge marsh 10 m outside of the Meandry Smědé NR about 500 m from the railway station Filipovka, 235 m , L. Beran, 10 ex., 25 April 2004; 50°59'08" N, 15°01'34" E, 5056, Filipovka, 5056, swamp in the Meandry Smědé NR near ditch 600 m to the south from the railway station Filipovka, 235 m, L. Beran, 3 ex., 25 April 2004; 50°59'06" N, 15°01'36" E, 5056, Filipovka, ditch about 100 m before its inflow to the Smědá River in the Meandry Smědé NR, 235 m, L. Beran, 4 ex., 1 January 2004. Dissection of selected specimen confirmed the previous determination according conchs.

At mentioned localities *G. rossmaessleri* was found together with *Galba truncatula* (O.F. Müller, 1774), *Aplexa hypnorum* (Linnaeus, 1758), *Anisus leucostoma* (Millet, 1813), *Pisidium obtusale* (Lamarck, 1818), and *P. casertanum* (Poli, 1791).

In Bohemia this species has not been found for last 25 years and the nearest localities with its known occurrence more than 25 years ago are situated about 100 km to the south-west.

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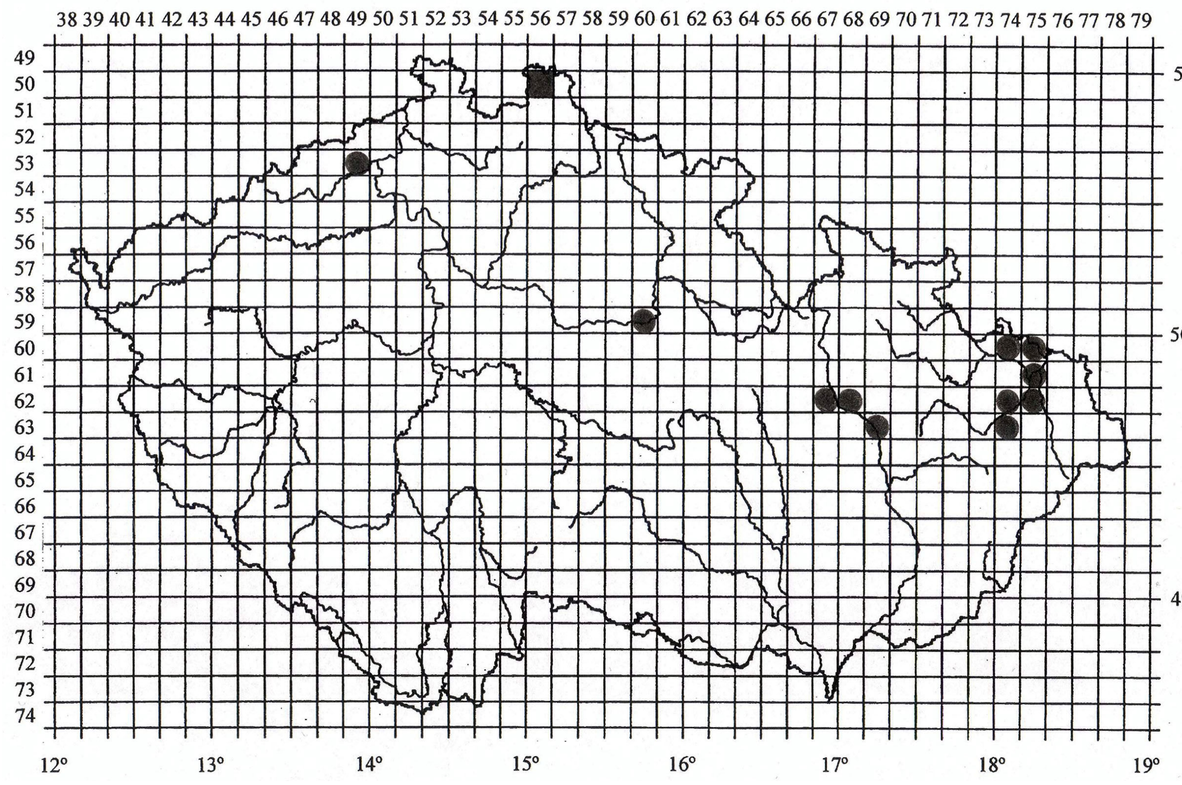

Fig. 1. The map for faunistic grid mapping with the known distribution of *Gyraulus rossmaessleri* in the Czech Republic. Full circle – adopted from BERAN (2002), full mapping field – new records mentioned above.

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The settlement of anthropogenic water-bodies of Silesia by *Ferrissia clessiniana* (Jickeli)

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In last two decades *Ferrissia clessiniana* (Jickeli, 1802) was observed in anthropogenic water-bodies in Silesia (Southern Poland). Formerly this species was found only in Western and Central Poland. In Silesia it settles the subsidence ponds, sand- and gravel-pits and dam reservoirs, where lives mostly in the rush belts. In the absence of vegetation *F. clessiniana* inhabits the stones, covered with periphyton layer, and the remains of decayed water-plants and leaves of waterside trees. Never forms the dense populations.

Introduction

The settlement of freshwater habitats by molluscs is interesting because of the rate of appearance in newly created in result of human activity water-bodies (STRZELEC 1993). Origin of such habitats makes up for the disappearance of natural fresh-water environments, what is the cause of loss in biodiversity on the disturbed area. Most of anthropogenic water-bodies despite of their origin are small and their water level varies periodically during year.

In small anthropogenic reservoirs in which small diversity of niches occurs, the disturbance of environmental conditions are easily perceptible. In result, in such water bodies, particularly when they are situated in regions being under intensive human impact the animal species diversity is in general smaller than in natural freshwater habitats (STRZELEC & SERAFIŃSKI 2004).

In anthropogenic water-bodies the alien animal species sometimes appear, coming from other geographical regions, and influence the native fauna, causing at times its impoverishment. This fact was noted in relation to the new-zealand mud-snail (*Potamopyrgus antipodarum*), which in settled various habitats reduced the abundance and diversity of native snail communities (STRZELEC 1992). The survival of invaders in new habitat depends on different environmental factors, namely habitat stability, physico-chemical water characters, vegetation and food abundance, as well as the kinds of bottom sediments. It is the cause that the most successful colonisers among snails are the ubiquitous, tolerant species (STRZELEC & SERAFIŃSKI 2004).

In the second half of 20th century on the urbanized and industrialized area of Silesia three alien snail species were observed to the first time in anthropogenic water-bodies. They were: mediterranean *Physella acuta* (Draparnaud) from the early seventies, new-zealand *Potamopyrgus antipodarum* (Gray) from eighties and *Ferrissia clessiniana* (Jickeli) from the last two decades.

The first findings of the last species are known from 1986, when it was found in artificially heated Konin lakes in Central Poland and published under the name *Ferrissia wautieri* (Mirolli) by PIECHOCKI (1986). In following years it was found in single habitats of stagnant waters in Central and Northern Poland (BERNARD 1994, WŁOSIK-BIEŃCZAK 1994, STRZELEC & LEWIN 1996), whereas in neighbouring regions the number of *Ferrissia clessiniana* findings increased from year to year (e.g. BERAN 2002).

In above-mentioned regions of Poland, *Ferrissia clessiniana* co-occurred always together with *Gyraulus albus* and *Radix peregra* and often with *Segmentina nitida* and *Lymnaea stagnalis*. All collected specimens were found on partly decayed remains of *Typha latifolia* or on its living stems, but not on other plants of abundant vegetation.

Study area and study sites

Silesia, the southern area of Poland, bordering upon Czech Republic, is the most industrialized and urbanized region of the country. During thirty years of malacological studies, which have included more than 250 anthropogenic water bodies, the first findings of *Ferrissia clessiniana* were known from the late ninetieths and during next years it was found in 17 habitats of different origin and kind. There were sand- and gravel-pits [Nos. 1–2 – Graboszyce (50°02' N, 19°14´ E), 3 – Dzierżno (50°17' N, 18°40' E), 4 – Sosnowiec (50°18' N, 19°10' E), 5 – Tychy (50°08' N, 18°59' E), 6 – Zabrze (50°19' N, 18° 47' E)], subsidence ponds [7 – Siemianowice (50°18' N, 19°02' E), 8–9 – Czułów (50°08' N, 18°59' E), 10 – Zabrze, 11 – Knurów (50°13' N, 18°40' E)] and dam reservoirs [12–14 – Katowice (50°16' N, 19°01' E), 15–17 – Rybnik (50°07' N, 18°32' E)].

The general characteristics of these kinds of water-bodies are given in STRZELEC & SERAFIŃSKI (2004). They differ in respect of area and depth. Pits and subsidence ponds are small, rarely of area greater than several ha, whereas the area of dam reservoirs exceeds sometimes several hundreds ha. Most of studied water-bodies are situated near urban agglomerations and are under heavy human impact. Their bottom is differently developed because of various origin. For subsidence ponds characteristic is bottom with thick layer of mud, with great addition of mineral substances. In pits and dam-reservoirs the bottom is of sand or gravel, covered with thin layer of silt.

In sunny places on stable bottom in all water-bodies occurred the plant conglomerations of various abundance and diversity, dependent on the fluctuation of water level, caused by seasonal changes of temperature as well as by human intervention.

During study period 17 species of water plants were found in studied habitats, most of them are characteristic for eutrophic conditions. The occurrence of plant species in particular sites is shown in Table 1.

In subsidence ponds and dam reservoirs the most common were *Typha latifolia* and *Glyceria maxima*, whereas in pits *Elodea canadensis* and *Acorus calamus*. Only in dam-reservoir the rush-belts of *Phragmites australis* and *Glyceria aquatica* were observed.

Material and methods

The snails were gathered from the area of 1 m^2 in each water-body, from plant remains and living plants, stones and submerged objects, as well as from sieved bottom sediments. The sampling sites were selected according to environmental diversity. Materials were collected in summer months.

The nomenclature of snail species is adapted from GLÖER & MEIER-BROOK (1998).

In tables the density of snails (as individuals per $1m^2$) is given as follows:

A…single specimen
B…2–5 specimens
C…6–10 specimens
D…above 10 specimens

Results and discussion

In the study area *Ferrissia clessiniana* were found most commonly on submerged leaves of water plants and on stems of *Typha latifolia* and *Glyceria aquatica*. In the absence of plant it settled the submerged stones covered with periphyton layer (as Dzierżno and Czułów), the decayed leaves of waterside trees (in Zabrze) and the plant detritus deposited on the bottom.

The periodical fluctuation of water level and even its lack in some periods, what is characteristic for postindustrial water-bodies, are the factors limiting the occurrence of snails. Although *Ferrissia clessiniana* has at disposal the adaptation to the survival of dry periods in form of septum formation in young individuals, in studied periodically drying habitats the septal forms were found only rarely.

In all water-bodies *Ferrissia clessiniana* occurred mainly in littoral insolated zone together with 16 other snail species (Table 2). In particular water-bodies there occurred from 3 to 11 species. The co-occurrence of some species with *Ferrissia clessiniana* was very different one. In dam reservoirs it was found most often with *Potamopyrgus antipodarum* and *Physella acuta,* in sand and gravel-pits with *Radix peregra* and *Gyraulus albus*, whereas in subsidence ponds with *Segmentina nitida*, *Radix auricularia* and *Planorbarius corneus*.

The most interesting is the occurrence of big population of studied species in artificially heated dam-reservoirs in Rybnik (STRZELEC 1999). It seems that this mediterranean species was confronted there with particularly convenient conditions, what resulted in increase of population size. It was observed in relation to other species introduced from warmer than central-European climate, e.g. *Physella acuta* and *Potamopyrgus antipodarum*.

Similarly as in other regions the populations *Ferrissia clessiniana* undergo changes during year. Independently of their size they appear and disappear alternately in the same place. It may result both of reproductive processes and of the translocations conditioned by day length.

Table 1. The vegetation of particular water- bodies.

	Species	Sand-and gravel- pits						Subsidence ponds					Dam reservoirs					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	*Polygonum amphibium* L.							X	X					X		X	X	X
2	*Nuphar lutea* (L.) Sm														X			
3	*Ceratophyllum demersum* L.	X			X				X			X				X	X	
4	*Myriophyllum verticillatum* L.	X			X	X			X	X								
5	*Sagittaria sagittifolia* L.	X																
6	*Alisma plantago-aquatica* L.								X									
7	*Hydrocharis morsus ranae* L.		X				X											X
8	*Elodea canadensis* Michx.	X	X		X		X		X			X						
9	*Potamogeton natans* L.		X		X	X		X				X						
10	*Potamogeton crispus* L.	X			X			X	X	X								
11	*Iris pseudoacorus* L.	X							X	X								
12	*Schoenoplectus lacustris* (L.) Palla																X	
13	*Phragmites australis* (Cav.)			X				X				X	X	X		X	X	X
14	*Glyceria aquatica* (L.) Wahlb			X				X	X	X	X		X	X	X		X	X
15	*Lemna minor* L.		X				X	X	X		X				X	X	X	X
16	*Acorus calamus* L.	X	X			X	X		X									
17	*Typha latifolia* L.				X	X	X	X	X	X	X	X	X	X		X	X	X
	Species number	7	5	2	6	4	5	7	11	5	3	5	3	4	3	5	7	6

Table 2. The snail communities in particular water-bodies.

	Species	Sand and gravel pits						Subsidence ponds					Dam reservoirs					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	*Potamopyrgus antipodarum* (Gray, 1843)			A		D		C		D			D	C	D	D	D	D
2	*Bithynia tenatculata* (Linnaeus, 1758)								A									
3.	*Physa fontinalis* (Linnaeus, 1758)																	D
4	*Physella acuta* (Draparnaud, 1805)				D	B							D	D	B	C	C	
5	*Lymnaea stagnalis* (Linnaeus, 1758)	B	D			A			B	B	D							B
6	*Radix peregra* (O.F. Müller, 1774)	D	D	B	D	D	B			A		B				A	B	B
7	*Radix auricularia* (Linnaeus, 1758)	A		C				D	A		D							
8	*Planorbis planorbis* (Linnaeus, 1758)			B	A											A		D
9	*Galba truncatula* (O.F. Müller, 1774)			D														
10	*Anisus vortex* (Linnaeus, 1758)	B	A		A													D
11	*Bathiomphalus contortus* (Linnaeus, 1758)						D				B							
12	*Gyraulus albus* (O.F. Müller, 1774)	D	D	A	C	D	B		B	B	B	D			B	C		B
13	*Armiger crista* (Linnaus, 1758)		A	A	B										D			B
14	*Segmentina nitida* (O.F. Müller, 1774)	B	A		B				A	A	B	D		D	B	B		B
15	*Planorbarius corneus* (Linnaeus, 1758)						A		B	A	D	C				A		B
16	*Ferrissia clessiniana* (Jickeli, 1802)	B	A	B	D	D	D	D	D	B	C	B	B	B	D	D	C	C
17	*Acroloxus lacustris* (Linnaeus, 1758)		B			A			A									
18	Species number	7	8	8	8	7	5	3	8	7	7	5	3	4	6	8	4	11

According to LILL (1990) *Ferrissia clessiniana* spreads along river-systems in plant remains while by birds and men assistance to isolated water bodies. From among studied habitats only subsidence ponds are beyond the flowing systems. It is, together with unfavorable physico-chemical conditions, the reason that proportionally fewer habitats of the last kind are colonized by *Ferrissia clessiniana*.
The obtained results show any negative impact on the native snail fauna, what was stated in relation to *Potamopyrgus antipodarum* in postindustrial ponds (STRZELEC 2005).

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Gastropods in subterranean shelters of the Czech Republic

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DVOŘÁK L., 2005: Gastropods in subterranean shelters of the Czech Republic. – Malacologica Bohemoslovaca, 4: 10–16. Online serial at <http://mollusca.sav.sk> 15-Sep-2005.

Gastropods in different types of cellars, nature caves, abandoned galleries, and military bunkers have been studied. The major part of localities is situated in W and SW Bohemia, findings from other parts of the Czech Republic are scarce. Species at different types of subterranean shelters are listed. Some interesting features, e.g., remarkable species, big specimens, depigmented populations, and hibernating snails, are mentioned.

Introduction

Although molluscs are well-studied group of animals, no complex studies from subterranean shelters (excluding troglobionts) were published. Several data are available on occurrence of typical species (e.g., *Limacus flavus*, *Limax maximus*, *Oxychilus cellarius*, *O. draparnaudi*, etc.) in cellars, predominantly in papers on mollusc faunas in towns (KLAUSNITZER 1988, SEIDL 1955, JUŘIČKOVÁ 1995, STRZELCZYK 1995).
Preliminary results of the author's survey were published (DVOŘÁK 1999), as well as summary of records from limestone caves of SW Bohemia (DVOŘÁK 2003). This study uses data, which were published in both papers (DVOŘÁK 1999, 2003) and adds new unpublished data.

Material and Methods

Gastropods were found within the entire space of the shelter – on walls, ceilings, and grounds, under bricks, wood blocks, or in debris. The author did this research with a hand lamp and under a direct picking; sifting was not used. The research was done mostly in a winter time due to a possible immigration of gastropods from a cold outer neighbourhood. Collected specimens were determined according to LOŽEK (1956) and KERNEY et al. (1983). Specimens of *Deroceras reticulatum*, *Limacus flavus*, as well as some specimens of *Limax* sp., *Arion* sp., *Aegopinella* sp., *Oxychilus* sp., and *Lehmannia marginata* were dissected. The major part of collected specimens is deposited in the author's collection.

List of localities

All localities are listed in the following order: number of a grid system of the Czech Republic (PRUNER & MÍKA 1996), locality (listed alphabetically), stand, and date(s) of findings. See information map of localities on Fig. 1.
1 5644, Korunní, gallery, 12 Feb 2000. **2** 5739, Podhradí, cellars of former castle Neuschloss, 4 Feb 1997, 6 Feb 1998, 11 Feb 2001. **3** 5739, Podhradí, cellars of former castle Spodní zámek, 3 Feb 2004. **4** 5740, Horní Luby, cellars of castle, 12 Feb 2001, 24 Feb 2003, 3 Feb 2004. **5** 5743, Karlovy Vary, cellars of hotel Sevastopol, 12 Feb 2000. **6** 5839, Hazlov, gallery by creek, 4 Feb 2003. **7** 5839, Libá, cellars of castle, 11 Feb 2001. **8** 5839, Pomezná, cellars of former fortress, 11 Feb 2001, 4 Feb 2003. **9** 5840, Skalná, cellars of castle, 14 Feb 1996, 4 Feb 1997, 6 Feb 1998, 15 Feb 1999. **10** 5840, Skalná, small cellar near house No. 198, 4 Feb 1997, 6 Feb 1998, 15 Feb 1999. **11** 5840, Starý Rybník, cellars of castle, 14 Feb 1996, 4 Feb 1997, 3 Feb 2004. **12** 5841, Kostelní Bříza, cellars under castle park, 13 Feb 1996, 10 Feb 2001, 31 Jan 2003. **13** 5842, Horní Slavkov, cellars behind former petrol pump, 13 Feb 1996, 2 Feb 1997, 6 Feb 1998, 10 Feb 2001, 31 Jan 2003. **14** 5842, Loket, cellars by bridge near porcelain factory Thun, 1 Feb 2004. **15** 5842, Loket, cellars by railway station, 4 Feb 1997. **16** 5842, Staré Sedlo, cave Kančí, 25 Feb 2003.

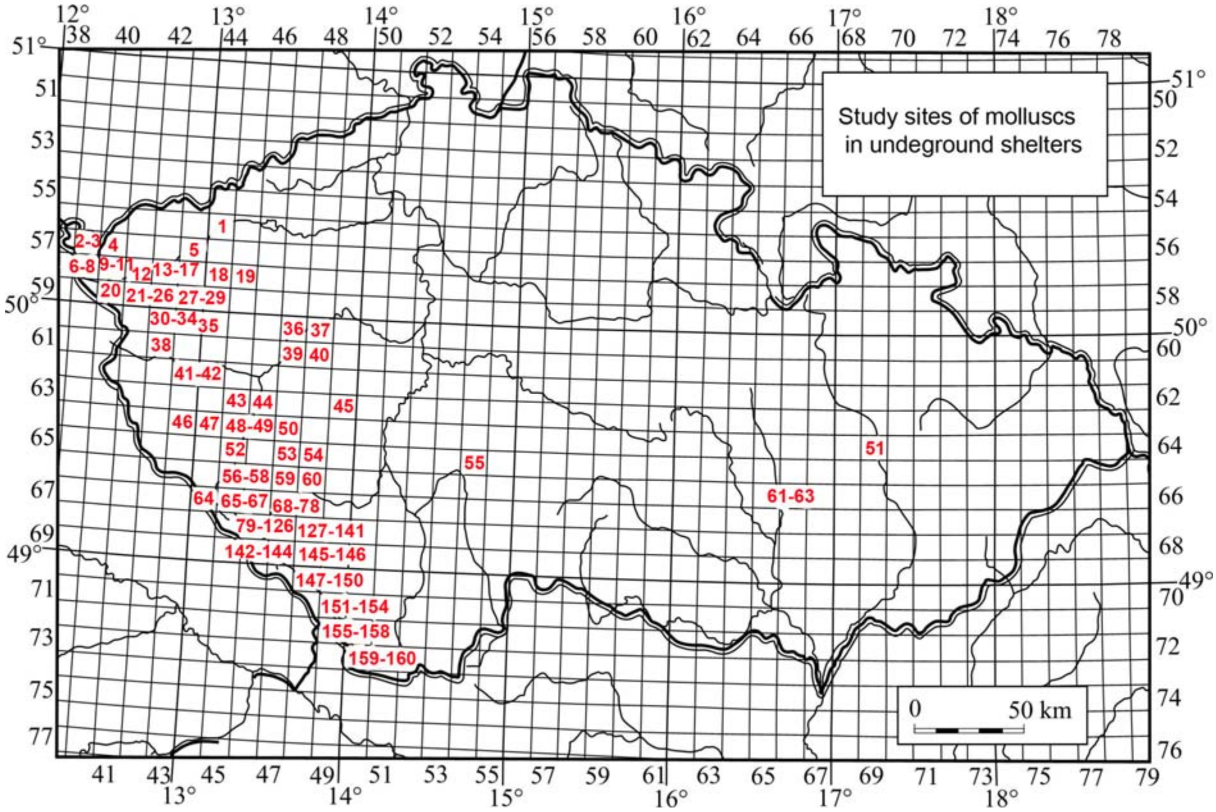

Fig. 1. A schematic map of surveyed localities.

17 5842, Údolí, cellar of house, 1 Feb 2004. **18** 5844, Luka, brewery cellars, 14 Feb 1999, 12 Feb 2000. **19** 5845, Zlatý vrch, gallery, 12 Feb 2000, 12 Feb 2001. **20** 5940, Kyselecký Hamr, cellar, 1 Feb 2003. **21** 5941, Krásná Lípa, cellars of former castle, 10 Feb 2001, 31 Jan 2003. **22** 5941, Zámek Kynžvart, cellars of brewery, 12 Feb 1996. **23** 5941, Zámek Kynžvart, cellars in the rock, 5 Feb 1997. **24** 5942, Bečov nad Teplou, small cellar near turning to Louka, 9 Feb 2001, 1 Feb 2003, 29 Jan 2004. **25** 5942, Bečov nad Teplou, gallery, 7 finds from Jan–Feb 1996–2004. **26** 5942, Prameny, gallery Levá Amálka, 5 Feb 1998. **27** 5943, Bečov nad Teplou, cellars of castle, 9 Feb 2001, 31 Jan 2003. **28** 5943, Bečov nad Teplou, gallery under railway line, 13 Feb 1996. **29** 5943, Toužim, cellars of castle, 12 Feb 1999. **30** 6042, Boněnov, gallery Portál, 2 Feb 2003. **31** 6042, Michalovy Hory, gallery Barbora, 6 finds from Jan–Feb 1996, 1999–2004. **32** 6042, Pístov, small cellar, 4 Feb 1998, 13 Feb 2000, 9 Feb 2001. **33** 6042, Výškovice, gallery Cave of Incas, 2 Feb 1997, 13 Feb 2000. **34** 6042, Výškovice, gallery S jezírkem, 2 Feb 1997, 13 Feb 1999, 13 Feb 2000. **35** 6043, Klášter Teplá, cellars of monastery, 9 Feb 2001. **36** 6047, Liblín, cellars of distillery, 6 finds from Jan–Feb 1996, 1997, 2000–2004. **37** 6048, Modřejovice, small cellar by road, 10 Feb 2000, 6 Feb 2001. **38** 6142, Planá u Mariánských Lázní, cellars of house No. 770, 19 Apr 2003. **39** 6147, Svinná, cellars of castle, 10 Feb 2000, 6 Feb 2001, 28 Jan 2003, 28 Jan 2004. **40** 6148, Plískov, gallery on hill Bukov, 28 Jan 2003. **41** 6243, Stříbro, gallery Urban II, 26 Jan 2004. **42** 6243, Stříbro, gallery Urban IV, 27 Jan 2003. **43** 6345, Chotěšov, cellars of monastery, 5 finds from Jan–Feb 1996–2003. **44** 6346, Dolní Lukavice, cellars of gardening., 7 Feb 1996, 8 Feb 2000, 30 Jan 2001, 20 Feb 2003 **45** 6349, Lázský rybník reservoir, upper tunnel in dike, 27 Feb 2001. **46** 6443, Horšovský Týn, cellars of castle, 13 Feb 1997, 7 Feb 2000. **47** 6444, Holýšov, gallery, 6 Feb 1996, 13 Feb 1997, 7 Feb 2000, 29 Jan 2003. **48** 6445, Červené Poříčí, cellars of brewery, 8 Feb 2000. **49** 6445, Roupov, cellars of castle, 14 Feb 1997. **50** 6447, Blovice, cellars of manor, 8 Feb 2000, 20 Feb 2003. **51** 6469, Olomouc, cellars of house in Heydukova street, 14 Nov 2003. **52** 6545, Chudenice, gallery Na Vápence, 25 Oct 2000. **53** 6547, Nepomuk, cellars of brewery, 14 Feb 1997. **54** 6548, Zlatá hora, gallery, 7 Jan 1997. **55** 6554 Chýnov, Chýnovská cave, 16 May 2000. **56** 6645, Loreta, gallery, 9 finds from Jun, Apr, Jul, Dec 1998–2002. **57** 6645, Týnec, cellars of castle, 7 Feb 1996. **58** 6646, Mlázovy, cellars of castle, 6 finds from Jan, Mar, Nov, Dec 1995, 1996, 1998, 2000. **59** 6647, Nalžovské Hory, cellars of castle, 11 Jul 1996. **60** 6648, Prácheň, gallery, 27 Nov 1996, 21 Mar 1997, 21 Jul 1999, 13 Oct 2000. **61** 6666, Moravian Karst, Hadí cave, 10 Mar 2001. **62** 6666, Moravian Karst, cave in valley Vaječník, 29 Jul 2001. **63** 6666, Moravian Karst, Jurová cave, 19 Dec 2001. **64** 6744, Svatá Kateřina, gallery, 7 finds from Nov–Jan 1998–2003. **65** 6745, Březí, cellars by pond, 27 Nov 2000. **66** 6745, Čachrov, cellars of fortress, 9 Jan 1996. **67** 6746, Hrádek u Sušice, cellars of castle, 5 finds from Jan and Nov 1996, 1997, 2000, 2001. **68** 6747, Budětice, cellars of house No. 10, 9 finds from almost all months 1996, 1999–2002. **69** 6747, Čepice, gallery, 33 finds from almost all months 1996, 1999–2004. **70** 6747, Dobršín, cave Na Svatu, 23 Apr 2000, 22 May 2001, 27 Feb 2002, 16 Oct 2002. **71** 6747, Chanovec, gallery, 15 finds from different months 1996–2003. **72** 6747, Rabí, cellars of castle, 3 Dec 2003. **73** 6747, Sušice, Lysandrovské sklepy cellars (No. 310), 29 Nov 2000, 27 Feb 2002. **74** 6747, Sušice, gallery U čističky, 7 finds from Nov–Jan 1997–2002. **75** 6747, Sušice - pod Svatoborem, cellar of summerhouse of J. Havránek, 19 Jul 1999 **76** 6747, Sušice - pod Svatoborem, cellar of summerhouse of R. Sloup, 13+20 Jul 1999. **77** 6747, Žichovice, cave, 26 Oct 2000. **78** 6747, Žichovice, small gallery, 4 finds from Nov–Jan 2000–2003. **79** 6846, Dobrá Voda, cellars of school, 25 Oct 1996. **80** 6846, Peklo, cave, 21 Oct 1998, 22 Nov 1999, 18 Oct 2001. **81** 6846, Peklo, cave Peklo I, 13 Jan 2000, 15 Nov 2002. **82** 6846, Prášily, brewery cellars, 9 Oct 1996. **83** 6847, Amálino údolí, gallery A, 20 finds from almost all months 1996–2003. **84** 6847, Amálino údolí, gallery B, 10 finds from Aug–Mar 1999–2002. **85** 6847, Amálino údolí, gallery Bedřich, 6 finds from Mar, Oct, Nov 2000–2003. **86** 6847, Amálino údolí, gallery I, 15 Nov 1999, 14 Dec 1999. **87** 6847, Amálino údolí, gallery II, 19 finds from almost all months 1995–2003. **88** 6847, Amálino údolí, gallery Myší díra, 22 Sep 1995, 15 Sep 2000. **89** 6847, Amálino údolí, gallery Nad Nadějí, 20 Nov 1996, 27 Nov 1997, 22 Dec 1999. **90** 6847, Amálino údolí, gallery Průchodná, 9 finds from Jan, Mar, Sep–Nov 1998–2002. **91** 6847, Amálino údolí, gallery Překvapení, 27 Oct 2000, 3 Oct 2001, 9 Nov 2001. **92** 6847, Amálino údolí, gallery Sněmovní, 15 Oct 1998, 16 Sep 1999, 15 Sep 2000. **93** 6847, Amálino údolí, gallery Štolička, 15 Sep 2000, 9 Nov 2001. **94** 6847, Amálino údolí, gallery Veřejné záchodky, 15 Sep 2000, 3 Oct 2001, 13 Mar 2002, 30 Aug 2002. **95** 6847, Amálino údolí, gallery Vlevo, 16 Sep 1999, 23 Nov 2000. **96** 6847, Amálino údolí, gallery Vpravo, 19 Jan 2001. **97** 6847, Amálino údolí, gallery Za křižovatkou, 5 finds from Sep–Dec 1999–2001. **98** 6847, Bohdašice, bunker 31, 1 Oct 1998. **99** 6847, Buzošná, cellars of destroyed mill, 31 Oct 1996, 11 Sep 1997, 13 Nov 1997. **100** 6847, Kašperské Hory, cellars of house No. 184, 6 finds from Jan, Jul, Sep, Nov, Dec 1995–1997. **101** 6847, Nezdice, cave Fík, 3 Feb 2002, 12 Nov 2002, 3 Jan 2004, 4 Jan 2005. **102** 6847, Nové Městečko, bunker 34, 1 Oct 1998. **103** 6847, Opolenec, bunker 15, 12 Sep 2000, 16 Aug 2002, 1 Sep 2004. **104** 6847, Opolenec, bunker 17, 12 Sep 2000. **105** 6847, Opolenec, bunker 27, 10 Sep 1999, 12 Sep 2000. **106** 6847, Opolenec, bunker 28, 10 Sep 1999, 12 Sep 2000. **107** 6847, Podzuklín, cellars of gamekeeper's lodge, 23 Nov 1999, 30 Dec 1999. **108** 6847, Podzuklín, cellars in rock, 18 Oct 2001. **109** 6847, Ramajzl, bunker 37, 2 Oct 1998, 13 Oct 1999, 15 Nov 2000. **110** 6847, Ramajzl, bunker 39, 2 Oct 1998, 15 Nov 2000, 10 Oct 2001. **111** 6847, Ramajzl, bunker 40, 2 Oct 1998, 13 Oct 1999, 15 Nov 2000. **112** 6847, Ramajzl, bunker 8, 25 Sep 1998, 13 Oct 1999, 15 Nov 2000. **113** 6847, Strašín, cave, 10 finds from Mar, Sep–Jan 1995–2003. **114** 6847, Tuškov, bunker 11, 10 Sep 1998, 12 Sep 2000, 16 Aug 2002. **115** 6847, Tuškov, bunker 12, 10 Sep 1999, 9 Dec 1999, 12 Sep 2000, 1 Sep 2004. **116** 6847, Tuškov, bunker 13, 10 Sep 1999, 12 Sep 2000. **117** 6847, Tuškov, bunker 14, 16 Aug 2002. **118** 6847, Tuškov, bunker 29, 12 Sep 2000, 16 Aug 2002. **119** 6847, Ždánov, bunker 22, 7 May 1998, 13 Oct 1999. **120** 6847, Ždánov, bunker 23, 7 May 1998, 13 Oct 1999, 22 Mar 2001. **121** 6847, Ždánov, bunker 4, 20 Jan 1997, 13 Oct 1999, 15 Nov 2000. **122** 6847, Ždánov, bunker 5, 4 Nov 1996, 15 Nov 2000, 30 Jan 2002. **123** 6847, Ždánov, small cellar by road, 15 Nov 2000. **124** 6847, Ždánov, galleries, 13 Oct 1998, 6 Dec 2001. **125** 6847, Žlíbek, bunker 51, 30 Jan 2002. **126** 6847, Žlíbek, bunker 6, 5 finds from Jan, Mar, Sep–Nov 1998–2002. **127** 6848, Čestice, cellars under castle park, 9 Nov 2000, 16 Dec 2000. **128** 6848, Čkyně, cellars by castle, 16 finds from Sep–Mar 1996–2005. **129** 6848, Jaroškov, cellar of house No. 5, 6 Nov 1994, 20 Jul 1995. **130** 6848, Maleč, cellars of house No. 6, 29 Sep 1999. **131** 6848, Maleč, cellars of school, 9 finds from almost all months 1995–2001. **132** 6848, Mladíkov, cave, 28 Jan 2001, 17 Aug 2001. **133** 6848, Přečín, cellars of castle, 13 finds from Jun, Sep–Mar 1996–2002. **134** 6848, Vacov, cellars of house No. 74, 29 Oct 2001. **135** 6848, Vacov, cellars of rectory, 30 Nov 1996. **136** 6848, Vacov, small cellar by the house No. 9, 28 Sep 2001. **137** 6848, Vacov, water supply shaft by panel house, 15 Jul 1996. **138** 6848, Vacov, water supply shaft by post office, 23 Sep 1995. **139** 6849, Lčovice, cellars near castle, 6 finds from Jun, Oct, Dec–Mar 1996–1998. **140** 6849, Malenice, cave Jiřičkova sluj, 11 Oct 2001, 8 Mar 2002. **141** 6849, Malenice, cave Na Betani, 23 Nov 1999, 3 Nov 2000, 11 Oct 2001. **142** 6946, Na Vrchách, bunker 3, 25 Oct 1996. **143** 6947, Zhůří, bunker 1, 30 Oct 2000, 13 Sep 2002. **144** 6947, Zhůří, bunker 2, 18 Oct 1996, 30 Oct 2000, 13 Sep 2002. **145** 6948, Sudslavice, cave, 5 finds from Jan, May, Aug, Sep 1997–2002. **146** 6948, Vimperk, cellars of castle, 6 Mar 1996, 20 Dec 1999. **147** 7048, Zátoň, bunker 10, 26 Jun 1996. **148** 7048, Zátoň, bunker 9, 26 Jun 1996, 2 Oct 1997, 11 Jul 1998, 15 Nov 1998. **149** 7049, Krejčovice, gallery, 16 Dec 1999, 6 Jan 2005. **150** 7049, Mlynářovice, gallery, 16 Dec 1999, 10 Nov 2000. **151** 7149, Chlum, cellars of former school, 22 Jan 2001. **152** 7149, Pěkná, bunker 50, 22 Sep 1999. **153** 7150, Michal, bunkers 18+19, 30 Sep 1997. **154** 7150, Žumberská dolina, cellar of ruin, 10 Nov 2000, 11 Dec 2000. **155** 7249, Huťský Dvůr, gallery in quarry, 29 Jun 1996. **156** 7249, Zadní Zvonková, bunker 20, 1 Oct 1997. **157** 7250, Mokrá, cellar of manor, 14 Mar 2000. **158** 7250, Muckov, gallery, 30 Jun 1999, 21 Sep 1999, 16 Dec 1999, 2 Nov 2003. **159** 7350, Svatý Tomáš, cellars of castle, 1 Jul 1999, 16 Dec 1999, 26 Jun 2000. **160** 7351, Frymburk, Faitl's cellar, 14 Mar 2000.

List of species

Nomenclature follows JUŘIČKOVÁ et al. (2001), numbers under every species correspond with the list of localities.

Lymnaeidae
Radix peregra s.str. (O.F. Müller, 1774): 26

Cochlicopidae
Cochlicopa lubrica (O.F. Müller, 1774): 105, 110, 112, 116, 143, 144, 152, 154

Valloniidae
Acanthinula aculeata (O.F. Müller, 1774): 110

Vertiginidae
Vertigo pusilla O.F. Müller, 1774: 110

Clausiliidae
Cochlodina laminata (Montagu, 1803): 70, 145
Macrogastra plicatula (Draparnaud, 1801): 62, 81, 110, 112
Macrogastra ventricosa (Draparnaud, 1801): 109, 110, 112
Clausilia cruciata (Studer, 1820): 110
Alinda biplicata (Montagu, 1803): 43, 70, 101, 110
Bulgarica cana (Held, 1836): 110

Punctidae
Punctum pygmaeum (Draparnaud, 1801): 105

Discidae
Discus rotundatus (O.F. Müller, 1774): 4, 9, 36, 44, 52, 55, 58, 67, 71, 81, 85, 105, 107, 109, 110, 112, 113, 128, 131, 132, 133, 136, 139, 142, 150, 158, 160
Discus ruderatus (A. Férussac, 1821): 19, 154

Euconulidae
Euconulus fulvus (O.F. Müller, 1774): 105, 109, 110, 143, 144

Vitrinidae
Vitrina pellucida (O.F. Müller, 1774): 19, 106, 114, 115, 116, 122, 144, 154
Eucobresia diaphana (Draparnaud, 1805): 71, 81, 112, 121
Semilimax semilimax (J. Férussac, 1802): 83, 85, 105, 106, 108, 110, 115, 123, 141, 143

Zonitidae
Aegopis verticillus (Lamarck, 1822): 63
Aegopinella minor (Stabile, 1864): 71, 141
Aegopinella nitens (Michaud, 1831): 39, 85, 109, 110, 112, 154, 159
Aegopinella pura (Alder, 1830): 152
Perpolita hammonis (Ström, 1765): 19, 105, 116, 143, 143
Oxychilus cellarius (O.F. Müller, 1774): 2, 8, 11, 21, 32, 34, 39, 46, 48, 55, 58, 61, 67, 68, 69, 73, 81, 100, 107, 112, 113, 128, 129, 131, 133, 134, 136, 140, 141, 145, 146, 149, 155, 156, 158, 159, 160
Oxychilus depressus (Sterki, 1880): 60, 84, 85, 150
Oxychilus draparnaudi (Beck, 1837): 4, 9, 36, 43, 44, 48, 67, 139, 160
Oxychilus glaber (Rossmässler, 1835): 62, 63, 140, 141, 145

Limacidae
Limax cinereoniger Wolf, 1803: 1, 2, 7, 12, 13, 14, 15, 23, 25, 31, 33, 36, 40, 47, 54, 55, 56, 64, 69, 71, 74, 80, 82, 83, 84, 85, 87, 88, 90, 91, 92, 94, 95, 97, 101, 103, 104, 105, 106, 108, 109, 110, 111, 112, 113, 114, 115, 117, 118, 120, 126, 128, 135, 141, 142, 144, 148, 156, 159
Limax maximus Linnaeus, 1758: 2, 4, 6, 7, 9, 10, 11, 12, 13, 18, 25, 26, 27, 35, 36, 38, 39, 41, 43, 44, 47, 56, 57, 58, 66, 67, 68, 69, 73, 75, 76, 77, 78, 79, 82, 128, 133, 136, 138
Limacus flavus (Linnaeus, 1758): 51
Malacolimax tenellus (O.F. Müller, 1774): 64, 84, 85, 91, 97, 103, 112, 126
Lehmannia marginata (O.F. Müller, 1774): 9, 19, 20, 31, 32, 33, 42, 60, 69, 71, 82, 83, 84, 85, 87, 89, 90, 91, 92, 93, 97, 99, 109, 120, 122, 159

Agriolimacidae
Deroceras reticulatum (O.F. Müller, 1774): 76, 139, 141, 152

Boettgerillidae
Boettgerilla pallens Simroth, 1912: 45, 73, 133

Arionidae
Arion distinctus Mabille, 1868: 68, 84, 85, 128, 133
Arion fasciatus (Nilsson, 1823): 36, 65, 76, 133
Arion lusitanicus Mabille, 1868: 3, 47, 101
Arion rufus (Linnaeus, 1758): 36, 58
Arion silvaticus Lohmander, 1937: 81
Arion subfuscus (Draparnaud, 1805): 69, 70, 71, 83, 87, 92, 93, 96, 97, 103, 106, 110, 114, 120, 124, 126, 131, 133, 139, 140, 159

Bradybaenidae
Fruticicola fruticum (O.F. Müller, 1774): 5, 60, 77, 140

Hygromiidae
Euomphalia strigella (Draparnaud, 1801): 37
Petasina unidentata (Draparnaud, 1805): 81, 110, 111, 158
Trichia hispida (Linnaeus, 1758): 39, 44, 58, 81, 98, 109, 110, 130, 131, 133, 136, 139, 147, 152, 154, 159, 160
Trichia sericea (Draparnaud, 1801): 9
Monachoides incarnatus (O.F. Müller, 1774): 8, 19, 44, 70, 71, 81, 84, 85, 101, 107, 109, 110, 111, 112, 115, 116, 126, 131, 141, 148, 153, 154, 155, 158, 159
Urticicola umbrosus (C. Pfeiffer, 1828): 107, 109, 110, 111, 112, 154

Helicidae

Arianta arbustorum (Linnaeus, 1758): 2, 4, 8, 10, 16, 17, 21, 43, 58, 80, 97, 99, 106, 107, 119, 121, 123, 135, 139, 143, 148, 154, 156, 157, 159, 160
Helicigona lapicida (Linnaeus, 1758): 15, 24, 25, 27, 30, 52, 60, 69, 70, 71, 74, 78, 81, 83, 84, 86, 87, 89, 90, 94, 99, 101, 113, 114, 122, 125, 132, 158
Isognomostoma isognomostomos (Schröter, 1784): 70, 71, 109, 110, 111, 112
Causa holosericea (Studer, 1820): 109, 110, 111, 112, 142, 149
Cepaea hortensis (O.F. Müller, 1774): 2, 13, 17, 36, 37, 39, 43, 44, 48, 58, 98, 102, 115, 118, 127, 133, 136, 137, 159
Cepaea nemoralis (Linnaeus, 1758): 9
Helix pomatia Linnaeus, 1758: 2, 5, 8, 9, 11, 13, 18, 22, 28, 29, 36, 37, 39, 43, 44, 48, 49, 50, 53, 58, 59, 69, 71, 72, 74, 112, 113, 116, 121, 125, 127, 131, 133, 139, 140, 141, 145, 151, 153

Results and discussion

Gastropods were found at 160 localities: 29 military bunkers, 15 karst or pseudokarst caves, 73 cellars of different types, and 43 galleries (old gold, silver, graphite, limestone, and other subterranean mines). A total number of 53 species of Gastropods were found. There were 948 positive controls (with presence of some species at any locality). Some localities were visited repeatedly.
The most constant species throughout the whole spectrum of shelters was *Limax cinereoniger* (59 localities) followed by *Limax maximus* (39), *Helix pomatia* (39), *Oxychilus cellarius* (37), *Helicigona lapicida* (28), *Discus rotundatus* (27), *Arianta arbustorum* (26), *Lehmannia marginata* (26), and *Monachoides incarnatus* (25).
The lowest number of species was found in natural caves: 24 species. However, the low number may result from a low number of surveyed caves (15). Most often recorded species were *Oxychilus cellarius* (7 localities), *Limax cinereoniger*, *Oxychilus glaber*, and *Helicigona lapicida* (5 localities). Findings in caves reflect assemblages of their surroundings; e.g. *Petasina unidentata*, *Aegopis verticillus*, and *Arion silvaticus* were found in caves surrounded by a mixed forest cover, while *Fruticicola fruticum* and *Aegopinella minor* were found in warm limestone areas. Findings of petrophilous and/or epilithic species as *Helicigona lapicida*, and *Isognomostoma isognomostomos* are typical. The most typical cave species is *Oxychilus glaber*. This troglophilous species (RIEDEL 1996) was found in 5 limestone caves (2 in Moravian Karst, 3 in SW Bohemia) only. The findings in SW Bohemia are remarkable because *O. glaber* occurs in this region only in a small area including all three caves (DVOŘÁK 2003).
Different subterranean shelters indicate galleries. This type of shelter comprises all man-made rock cavities primarily originated as mines, and which was not used after the end of mining. The number of species found at these stands is 26. The most frequent species in galleries were *Limax cinereoniger* (23 localities), *Lehmannia marginata* (17), *Helicigona lapicida* (16), and *Arion subfuscus* (9). All mentioned species prefer this type of shelter. The major part of galleries is situated in forests, and the high representation of forest species is an expected result (18 species from 26). The occurrence of two species is remarkable. *Radix peregra* s.str. was found ca. 2 m deep in one water-flooded gallery. Troglophilous (RIEDEL 1996) and scarcely occurred species *Oxychilus depressus* were found in four galleries only, but not in the other types of shelters.
There were found 31 species in 73 cellars. In this type of shelters are comprised big cellars of significant buildings (castles, monasteries), as well as little cellars in houses, used cellars in rock and other man-made and man-used subterranean spaces (except military bunkers). The highest representation contains following species: *Limax maximus* (30 localities), *Helix pomatia* (26), *Oxychilus cellarius* (23), *Arianta arbustorum* (17), and *Cepaea hortensis* (15). All mentioned species occur in cellars with a higher frequency than in galleries, for example. Other species typical for cellars are *Trichia hispida* (17 localities, 11 are cellars), *Oxychilus draparnaudi* (its all 9 localities are cellars), *Arion fasciatus* (4), and *Boettgerilla pallens* (3). The majority of species occurring in cellars (ca. 50%) forms euryoecious species. Very interesting species is *Limacus flavus* (Fig. 2). Only two localities of this species are known in the past two decades from the Czech Republic: Prague – Košíře, Zapova street, 1991, LOŽEK in JUŘIČKOVÁ (1995), and locality No. 51 of this study. *L. flavus* was firstly recorded at this locality on the 3rd of Sep 2003 (M. Maňas and M. Kutal, 2 ex.), than on the 14th of Nov 2003 (L. Dvořák and M. Maňas, 2 ex.). Data from East Germany show (BAADE 2003), that this species is not as rare as thought and can be found at suitable stands in some regions.

Fig. 2. *Limacus flavus* from locality No. 51 (Olomouc). Photo: M. Rudlová

Military bunkers are situated predominantly in the Bohemian forest and its foothills. The majority of the 33 recorded species represent forest species. No typical ruderal species were listed between 10 euryoecious species at these stands. These results reflect gastropods fauna in bunkers surroundings. The most common species in bunkers were *Limax cinereoniger* (18 localities), *Monachoides incarnatus* (9), and *Cochlicopa lubrica* (7). Some significant and rare species were found in bunkers inside of a broad leaf forest, e.g. *Bulgarica cana*, *Clausilia cruciata* or *Causa holosericea*.

Subterranean shelters do not represent enemy milieu for gastropods and many of species can be found in mass numbers here. The highest numbers were found in cellars – *Arianta arbustorum* (209, 124, 64 or 63 individuals), *Oxychilus cellarius* (55 or 41), *Discus rotundatus* (33), *Oxychilus draparnaudi* (31), *Helix pomatia* (22), and *Limax maximus* (21). Many of these species are typical for cellars. The most common species in caves are members of the genus *Oxychilus*: *O. cellarius* (26 individuals) and *O. glaber* (16). In galleries, *Limax maximus* (26 and 24 specimens), *L. cinereoniger* (14), and *Helicigona lapicida* (15), can occur in mass numbers there. Many of species can be found in bunkers in large numbers, e.g. *Cochlicopa lubrica* (135 or 70 individuals), *Petasina unidentata* (86), *Alinda biplicata* (82), *Monachoides incarnatus* (76) or *Isognomostoma isognomostomos* (60).

Some populations could survive in subterranean shelters for several generations, which explains slightly (but visibly) depigmentated populations of *Arianta arbustorum* in cellars No. 4 and 139 (Horní Luby and Lčovice), *Cepaea nemoralis* in cellar No. 9 (Skalná) or *Oxychilus cellarius* in gallery No. 69 (Čepice).

Some species (namely genus *Oxychilus* and *Limax*) often penetrate into deeper parts of galleries – Bečov nad Teplou No. 25, Amálino údolí No. 87 – and caves – Strašín No. 113, Malenice No. 141. Cellars under research do not have parts with higher distances from the entrances. The exact measurements came from the gallery in Čepice No. 69. So, *Limax maximus* was found 38 m deep, *Arion subfuscus*, 49 m, and *Oxychilus cellarius* 69 m deep in this gallery.

The findings of big individuals of several common species also indicate, that subterranean spaces are suitable for the occurrence of gastropods. E.g., individuals of *Oxychilus cellarius* from cellars No. 100 (Kašperské Hory) were up to 10.9 mm wide, those from cave no. 55 (Chýnov) up to 11.1 mm, and those from cellars no. 68 (Budětice) regularly more than 10 mm, but up to 14.2 mm wide! Similarly wide shells had individuals of *Oxychilus draparnaudi* from cellars Nos. 36, 43, and 139 (Liblín, Chotěšov, Lčovice) – 13.2, 13.2, and 14.6 mm, respectively. In addition, individuals of third *Oxychilus* species, *O. glaber*, were up to 13.0 mm wide in cave No. 145 (Sudslavice). Other gastropods (including Helicidae) had sporadiccally big shells too.

Some species have hibernated in subterranean shelters. This feature was not studied or observed regularly, but it was conducted for big species predominantly, e.g. for *Helix pomatia* or *Arianta arbustorum*.

Conclusions

The author has found 53 species of gastropods in 160 subterranean shelters (caves, cellars, galleries, and bunkers). The cave fauna comprised typical species of surrounding biotopes with one interesting species: *Oxychilus glaber*. The most typical species for galleries were slugs and *Helicigona lapicida*. Predominantly euryoecious species were found in cellars. The most interesting one is *Limacus flavus*, which occurs irregularly in the Czech Republic. The gastropods fauna of the bunkers is formed by species of surrounding biotopes, including remarkable species such as *Bulgarica cana* or *Clausilia cruciata*. The author presents basic facts indicating regular using of subterranean shelters by gastropods – mass occurrence, partly depigmentated populations, occurrence in deeper parts of some localities and big shells of some species.

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Menetus dilatatus (Gould, 1841) (Gastropoda: Planorbidae) in the Lipno Reservoir (Southern Bohemia, Czech Republic)

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BERAN L., 2005: *Menetus dilatatus* (Gould, 1841) (Gastropoda: Planorbidae) in the Lipno Reservoir (Southern Bohemia, Czech Republic). – Malacologica Bohemoslovaca, 4: 17–20. Online serial at <http://mollusca.sav.sk> 5-Oct-2005.

Menetus dilatatus (Gould, 1841) has been found in July 2005 in the Lipno Reservoir (Bohemian Forest = Šumava Mts., Southern Bohemia, Czech Republic) at 12 particular sites. This locality is about 80 km south of the nearest known locality of *Menetus dilatatus* and more than 160 km south of the Elbe Lowland where *Menetus dilatatus* occurs in many sites including the Elbe River. The altitude of the Lipno Reservoir reaches 725 m a.s.l. and is the highest known altitude of *Menetus dilatatus* in the Czech Republic.

Introduction

Menetus dilatatus (Gould, 1841) is a native mollusc in the Nearctic Region in the eastern part of the U.S.A. (KERNEY 1999). Up to now only one species of the genus *Menetus* H. & A. Adams, 1855 which was introduced from North America to Europe. In Europe it has been recorded for the first time in Great Britain in 1869 (KERNEY 1999). Today it is known mainly from Western and Central Europe. Recent distribution in Europe is presented in MÜLLER et al. (2005). In the Czech Republic this species has been recorded for the first time in 1994 from a sandpit near Kolín (BERAN 1994). The distribution up to 1996 is presented in BERAN (1997) and data up to 2001 are summarised in BERAN (2002). The localities of this species are concentrated in the Elbe Lowland between Ústí nad Labem and Týnec nad Labem from altitude 151–235 m a.s.l. (BERAN 2002). In 2002, *Menetus dilatatus* has been found in the Otava River in the Orlík Reservoir (Southern Bohemia) in altitude about 350 m a.s.l. This locality is more than 80 km south of localities in the Elbe Lowland (BERAN 2003).

Material and Methods

In 2005, the author studied aquatic molluscs of the Lipno Reservoir (Bohemian Forest, Southern Bohemia, Czech Republic). The Lipno Reservoir was built in 1960 on the Vltava River near the town of Vyšší Brod in altitude 725 m a.s.l. With an area of 4870 ha (capacity 306 000 000 m^3) it is the largest water body in the Czech Republic (VLČEK et al. 1984).
The main sampling method for aquatic molluscs is washing vegetation or sediments with a metal sieve (a kitchen strainer, diameter 20 cm, mesh size 0.5–1 mm) in combination with searching of stones, wood and waste (plastic bags and bottles). This method was also used in this case when shallow and overgrown places or stones near banks of the water reservoir were searched. Molluscs were determined by their conchs.
Conchs of *Menetus dilatatus* from selected sites are deposited in author's collection.

Results and Discussion

Menetus dilatatus has been found in July 2005 in the Lipno Reservoir at particular sites mentioned below.

Data presented are as follows: geographical coordinates, code of the mapping field for faunistic grid mapping (cf. PRUNER & MÍKA 1996), name of the nearest settlement, description of the site, number of individuals, and date of investigation.

1 – 48°37'59" N, 14°13'52" E, 7351, Lipno nad Vltavou, Lipno Reservoir in the south-eastern part of the water reservoir ca 300 m from the dam, 3 specimens, 25 July 2005;

2 – 48°38'25" N, 14°12'43" E, 7351, Lipno nad Vltavou, Lipno Reservoir at a village, 4 spec. (coll.), 29 July 2005;

3 – 48°37'50" N, 14°10'28" E, 7351, Přední Výtoň, Lipno Reservoir at avillage, 3 spec., 24 July 2005;

4 – 48°39'32" N, 14°09'54" E, 7351, Frymburk, Lipno Reservoir at a village near a ferry, 3 spec., 27 July 2005;

5 – 48°41'26" N, 14°07'02" E, 7350, Kovářov, Lipno Reservoir west and north-west of a village, 10 spec., 29 July 2005;

6 – 48°40'29" N, 14°03'47" E, 7350, Kyselov, bank of the Lipno Reservoir in the Rakovská Zátoka bay near a road, 3 spec., 24 July 2005;

7 – 48°41'15" N, 14°04'03" E, 7350, Kyselov, bank of the Lipno Reservoir near a ferry, 20 spec., 24 July 2005;

8 – 48°43'00" N, 14°04'16" E, 7250, Radslav, Lipno Reservoir at a village, 30 spec. (coll.), 29 July 2005;

9 – 48°44'06" N, 14°03'13" E, 7250, Přední Zvonková, Lipno Reservoir near Valtrov, 6 spec., 26 July 2005;

10 – 48°44'18" N, 14°06'03" E, 7250, Černá v Pošumaví, Lipno Reservoir near a marina (left side of the road Černá v Pošumaví – Hůrka), 20 spec. (coll.), 25 July 2005;

11 – 48°44'22" N, 14°06'16" E, 7250, Černá v Pošumaví, the bay of the Lipno Reservoir on the right side of the road Černá v Pošumaví – Hůrka, 15 spec., 25 July 2005;

12 – 48°45'36" N, 14°01'18" E, 7250, Horní Planá, Lipno Reservoir near a ferry, 2 spec., 26 July 2005.

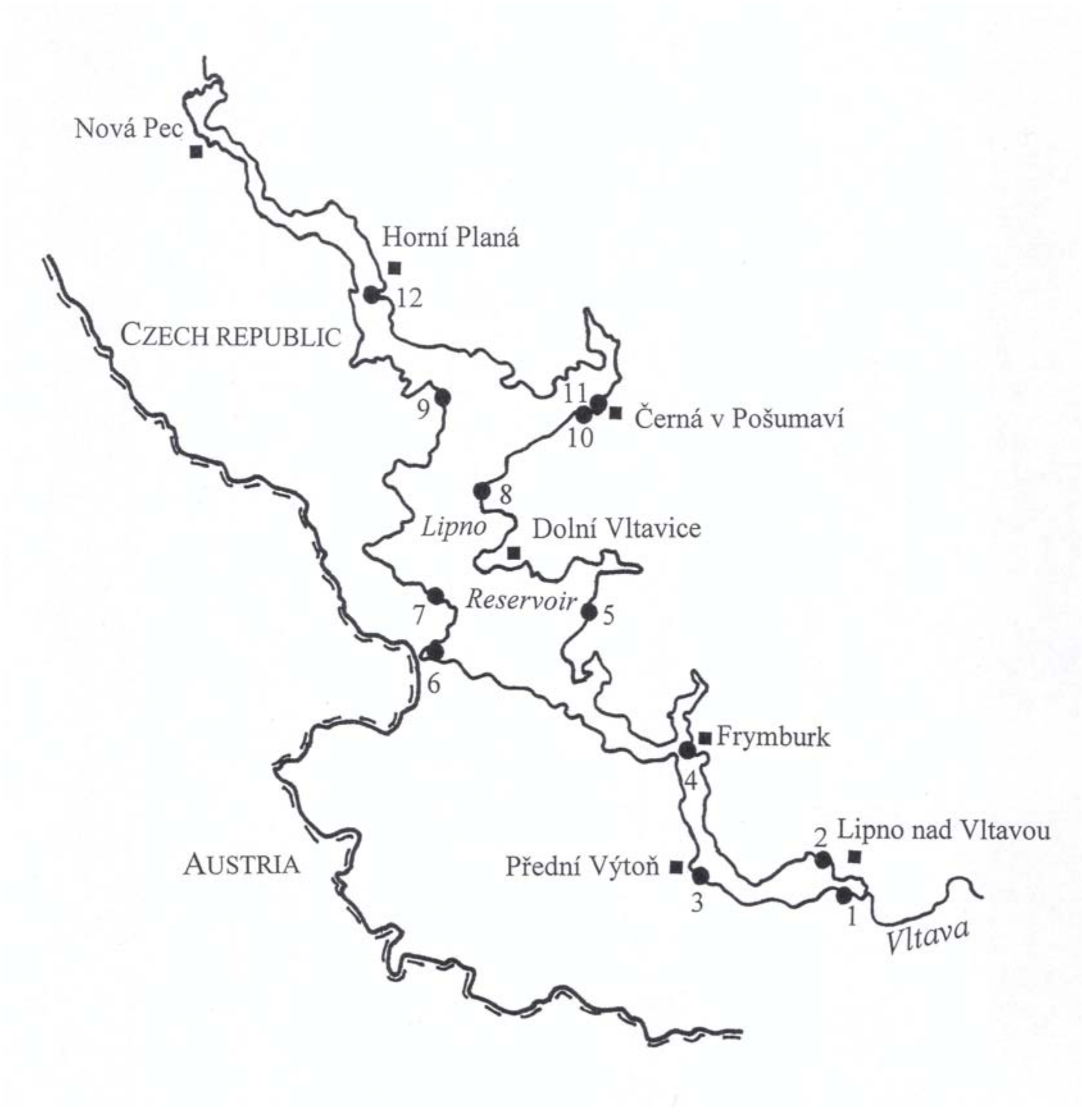

Fig. 1. The map of the Lipno Reservoir with localities under study.

Thus, it is evident that *Menetus dilatatus* occurs at a large part of this water reservoir. *Menetus dilatatus* has been found at particular localities mainly on the stones on the banks of the water reservoir together mainly with *Radix auricularia* (Linnaeus, 1758), *R. ovata* (Draparnaud, 1805) = *R. balthica* (Linnaeus, 1758) sensu GLÖER & MEIER-BROOK (2003), and *Gyraulus albus* (O.F. Müller, 1774). Bigger stones (one dimension at least 10 cm), respectively their sides opposite of the water level were preferable habitats, when the highest density (6 individuals per approx. 150 cm^2 – one side of the stone, loc. 8) was documented. Its occurrence on the vegetation together with more than 10 other species as *Acroloxus lacustris* (Linnaeus, 1758), *Stagnicola corvus* (Gmelin, 1791), *R. ovata* (Draparnaud, 1805), *Lymnaea stagnalis* (Linnaeus, 1758), *Physa fontinalis* (Linnaeus, 1758), *Anisus leucostoma* (Millet, 1813), *Bathyomphalus contortus* (Linnaeus, 1758), *Gyraulus albus* (O.F. Müller, 1774), *G. crista* (Linnaeus, 1758), *Hippeutis complanatus* (Linnaeus, 1758), *Planorbarius corneus* (Linnaeus, 1758) were also observed during washing vegetation with a metal sieve. All individuals of this species were found at depth 5–70 cm from the water level.

Aquatic molluscs of the Lipno Reservoir were studied by L. Dvořák mainly in November 2003 when the water level was 3.5 m lower than maximum stage (DVOŘÁK & BERAN 2004). *Menetus dilatatus* was not found but research was directed to unionids and conditions for searching of gastropods living on stones or on the vegetation were not favourable.

The Lipno Reservoir is situated about 80 km south of the known locality of *Menetus dilatatus* in the Otava River in the Orlík Reservoir (BERAN 2003) and more than 160 km south of the Elbe Lowland where *Menetus dilatatus* occurs in many sites including the Elbe River (BERAN 2002). This is the second case when *Menetus dilatatus* was found in the large water reservoir. Thus, it will be useful to give consideration to occurrence of *Menetus dilatatus* in further large water reservoirs mainly in the Vltava River Basin. The altitude of the Lipno Reservoir reaches 725 m a.s.l. This altitude is the highest known altitude of the occurrence of *Menetus dilatatus* in the Czech Republic and it is more than 500 m higher than the altitude of the sites in the Elbe Lowland but it is necessary to note that so large water reservoir makes conditions for existence of population of *Menetus dilatatus* more suitable. The same phenomenon was documented also in the case of several other species living in the Lipno Reservoir presented in DVOŘÁK & BERAN (2004) or at the text above when the altitude of the Lipno Reservoir is the highest known altitude of their occurrence in the Czech Republic.

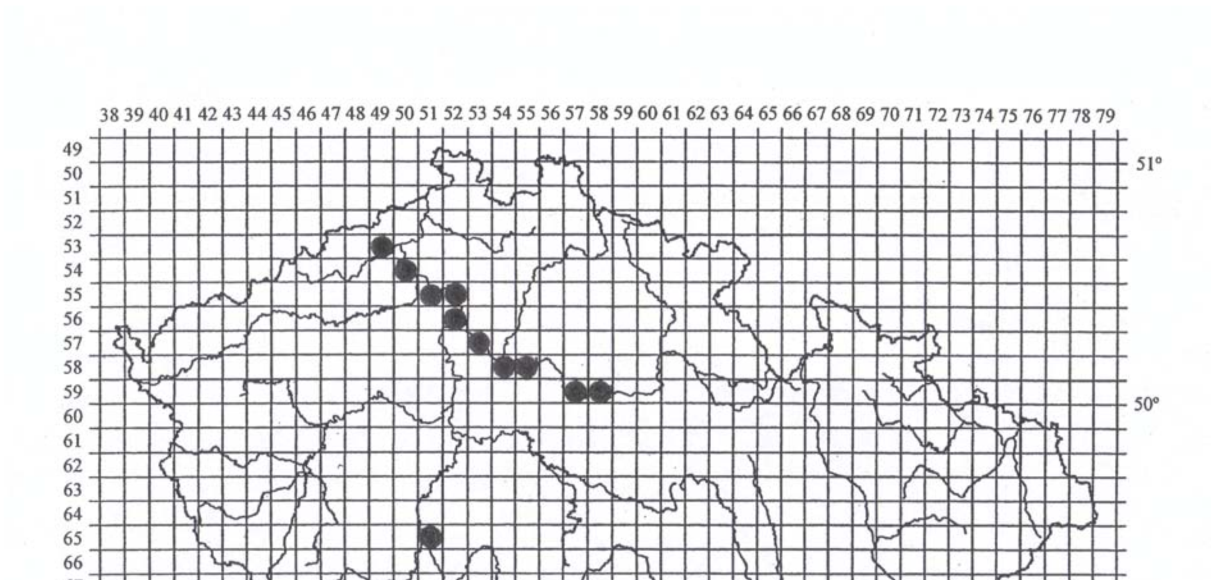

Fig. 2. The map for faunistic grid mapping showing the known distribution of *Menetus dilatatus* in the Czech Republic. Full circle – adopted from BERAN (2003), full mapping field – new records presented above.

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Príspevok k topografickému výskumu malakofauny okresu Levice

Contribution to the topographic malacological survey in the Levice District, SW Slovakia

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The paper brings new information on mollusc distribution of Levice District in southern part of Central Slovakia. The data were obtained from 14 localities, which lie mainly in the vicinity of the Ipeľ River and southern slopes of Štiavnické vrchy Mts. Together 78 mollusc species (50 land species and 28 fresh-water species) were found. From 9 localities a litter sample from 1m^2 was analyzed for quantitative evaluation of snail assemblages. Malacocoenoses of thermophilous forest mollusc species were determined in the area of Štiavnické vrchy Mts. foothill (localities 2, 7, 8). The species *Limacus flavus*, *Euconulus praticola, Pisidium amnicum* and *Unio crassus albensis* are important from the viewpoint of nature conservation and geographical distribution. Carpathian species *Bythinella austriaca*, *Vestia turgida*, *Bielzia coerulans* and also European forest species *Merdigera obscura* reach the southern boundary of their natural area of occurrence. Typical for this region are malacocoenoses of xeric biotopes, composed from species of 4–6 ecoelement – *Cecilioides acicula, Cepaea vindobonensis, Granaria frumentum*, *Chondrula tridens*, *Xerolenta obvia*, *Truncatellina cylindrica, Cochlicopa lubricella* and *Monacha cartusiana*. High diversity was observed by freshwater malacocoenoses. *Anodonta anatina attenuata, A. cygnea solearis*, *Unio tumidus zelebori*, *Radix ampla* are typical for stagnant water biotopes (abandoned 'paleopotamon' side arms). In slow flowing waters of the Ipeľ River beside the common species also rare species like *Anisus septemgyratus* and *Pisidium amnicum* were detected. Interesting is also the occurrence of strong population of invasive species of Asian mussel *Sinanodonta woodiana*, which is known to infiltrate into a number of streams all around Slovakia.

Úvod

Z okresu Levice sú dosiaľ publikované len ojedinelé údaje o malakofaune (LISICKÝ 1991, ŠTEFFEK 1986, 1987), ktoré pochádzajú z jeho severnej časti (južné svahy Štiavnických vrchov) a preto sú predložené výsledky výskumu pôvodným príspevkom do tejto problematiky. Väčšina lokalít (7), ktoré sme preskúmali, ležia v Ipeľskej pahorkatine. Len zbery z náplavov Dekýšskeho potoka a potoka Jablonianka pri Pečeniciach sú z južného úpätia Štiavnických vrchov. Prvý orientačný výskum mäkkýšov okresu sa uskutočnil počas konania VIII. Západoslovenského tábora ochrancov prírody v dňoch 30.6.–5.7. 1990 v Čajkove, ktorého výsledky dosiaľ neboli publikované. Príležitostne sme preskúmali niekoľko ďalších lokalít, z ktorých sme získali zaujímavé nálezy druhov, ojedinelo sa vyskytujúcich na Slovensku. Práve oni boli dôvodom ďalších výskumov v rokoch 2003–2005 hlavne v južných okrajoch Štiavnických vrchov a v okolí Ipľa. Výsledky z týchto výskumov podávame v predloženom príspevku.

Metódy

Mäkkýše sme získali niekoľkými metódami odberu – odberom povrchovej hrabanky z kvadrátov 1×1 m, ručným zberom ulít priamo z povrchu pôdy a vodné druhy boli získané predovšetkým z náplavov na brehoch tokov alebo vodných nádrží. Podrobnejší výskum sme zamerali na dva typy biotopov, ktoré sú pre územie tohto okresu charakteristické. Sú to jednak vodné biotopy v okolí pôvodného toku Ipľa (Ipeľská pahorkatina) a jednak xerotermné biotopy na južne exponovaných svahoch Ipeľskej pahorkatiny a Štiavnických vrchov. Zbery v roku 2004 sme vykonali výlučne odberom náplavov tokov. Nomenklatúra je podľa práce FALKNER et al (2001). Druhy čeľade Unionidae boli do poddruhov v zmysle práce NESEMANN (1993). Materiál je uložený u prvého autora príspevku.

Zoznam preskúmaných lokalít

1. Levice: hrad (7777d) – sutiny na úpätí hradných múrov (9.5.1975, 28.8.1977, 11.9.2003, leg. a det. J. Šteffek)
2. Čajkov: Deberčie (7677d) – krovinatý biotop na nive potoka Podlužianka (6.5.1985, 26.5.1985, 6.4.1990, 14.4.2004, leg. a det. J. Šteffek)
3. Levice: rybníky (7877b) – najstarší rybník s porastom vodných rastlín a násyp kanála (leg. J. Šteffek, A. Falniowski, M. Szarowska, det J. Šteffek, 28.6.1990)
4. Vyškovce nad Ipľom (7979a) – vŕbový a agátový porast v okolí Ipľa (leg. J. Šteffek, A. Falniowski, M. Szarowska, det J. Šteffek, 27.6.1990)
5. Preseľany–Vyškovce nad Ipľom (7979a): alúvium pomaly tečúceho ramena Ipľa (leg. J. Šteffek, A. Falniowski, M. Szarowska, det J. Šteffek, 27.6.1990, 28.6.1990)
6. Tešmak (7979a): depresia pri Ipli (leg. a det. J. Šteffek, 11.4.1982, 2.5.1984, 6.3.1992, 14.9.1994)
7. Jabloňovský Roháč (7678d): niva Dekýšskeho potoka s porastom *Carpinus betulus, Quercus* sp., *Alnus glutinosa* (leg. a det. J. Šteffek 7.9.1983, 14.5.1987)
8. Pečenice (7678d): niva potoka Jablonianka s porastom *Corylus avellana, Urtica dioica* (leg. a det. J. Šteffek, 14.4.2004)
9. Santovka (7878a): tufová kopa v obci (leg. a det. J. Šteffek, 7.4.1994)

Výsledky

Druhové zloženie mäkkýšov preskúmaných lokalít zachytáva Tabuľka 1. Na území okresu sa vyskytujú zástupcovia mäkkýšov všetkých ekoelementov (sensu LISICKÝ 1991). Pravé lesné druhy (silvikoly) boli zistené len na južných úpätiach Štiavnických vrchov. Všetky patria k nenáročným druhom, podobne ako aj druhy 2. ekoelementu, kde sú zaradené lesné druhy s širšou valenciou. Významnejší je len nález karpatského druhu lesných močiarov *Vestia turgida*, ktorý tu dosahuje jeden z najjužnejších výskytov v rámci svojho areálu. Podobne aj ďalší karpatský druh *Bielzia coerulans* má tu južnú hranicu výskytu na území Slovenska.

Pre územie Ipeľskej pahorkatiny sú však charakteristické druhy otvorených biotopov 4., 5. a 6. ekoelementu. Atlanticko–mediteránny druhu *Monacha cartusiana* tu má severnú hranicu svojho prirodzeného výskytu na Slovensku. Izolovaná lokalita tohto druhu je v intraviláne Žiaru nad Hronom, ale zrejme tento druh bol sem zavlečený. K ojedinelým nálezom na Slovensku patrí druh *Limacus flavus*, ktorý žije synantropne v pivničkách vinohradov. Má mediteránny pôvod. V súčasnosti má izolované lokality po celej Európe. Na našom území bol zistený v Banskej Bystrici (BRABENEC in LISICKÝ 1991), v Strážovských vrchoch (KROUPOVÁ 1982) a v Liptovskej kotline (KROUPOVÁ 1986).

Výrazný vplyv človeka na krajinu levického okresu charakterizujú aj ďalšie dva synantropné druhy –*Limax maximus* a *Oxychilus draparnaudi*, ktoré sa mimo intravilánu šíria len ojedinelo údoliami tokov.

Z 8. a 9. ekoelementu si pozornosť zasluhuje predovšetkým stredo-severoeurópsky ripikolný druh *Euconulus praticola*, ktorý patrí k typickým predstaviteľom pôvodných močiarnych biotopov. Do 80. rokov boli na Slovensku známe dva centrá jeho výskytu – severozápadná oblasť centrálnych Karpát a juh Podunajskej roviny (LISICKÝ 1991). Na základe posledných výskumov sa však ukazuje, že je ďaleko viac rozšírenejší.

V Ipeľskej pahorkatine sú početne zastúpené vodné malakocenózy. Väčšina zistených vodných druhov patrí k nenáročným a bežne sa vyskytujúcim druhom. Južnú hranicu výskytu má v Štiavnických vrchoch alpsko-karpatský druh *Bythinella austriaca.* Z anexových druhov, v zmysle Smernice Rady Európy č. 92/43/EHS z 21. mája 1992 o ochrane biotopov, voľne žijúcich živočíchov a voľne rastúcich rastlín, sa na území vyskytuje lastúrnik *Unio crassus albensis*. Žije v Ipli, z kadiaľ počas záplav preniká aj do depresií jeho inundačného pásma. Poddruhy druhov čeľade Unionidae vyčlenil na základe ich geografického rozšírenia NESEMANN (1993). K všeobecne ohrozeným druhom, ktorým sa počet známych lokalít rapídne znižuje, patrí aj *Pisidium amnicum*.

Podobné spoločenstvo vodných mäkkýšov ako v Levických rybníkoch žije aj v Bátoveckej priehrade (7778a), ktorá leží v severovýchodnej časti okresu na úpätí Štiavnických vrchov. Tu sme dňa 28.6.1990 len ručne, bez dôkladnejšieho prieskumu, odobrali druhy *Gyraulus albus*, *Lymnaea stagnalis*, *Acroloxus lacustris*, *Radix auricularia* a *Galba truncatula*, preto sme túto lokalitu do tabuľky nezahrnuli.

Zo strany ochranárov si určite zasluhuje pozornosť zvyšok mŕtveho ramena Ipľa medzi Preseľanmi a Vyškovcami, ktoré miestni obyvatelia volajú Csepi tó (Morské oko). Veľké množstvo hubiek (Porifera) svedčí o čistote tejto lokality. Zistili sme tu druhy *Anodonta anatina attenuata,, A. cygnea solearis*, *Unio tumidus zelebori*, *Radix ampla* a v blízko ležiacom periodickom kanále aj *Planorbarius corneus*, *Planoris planorbis*, *Lymnaea stagnalis*, *Anisus vortex*, *Stagnicola corvus* a i.

K zaujímavým nálezom patrí aj ázijský druh *Sinanodonta woodiana* z Ipľa pri Tešmaku (14.9.1994). Spolu s týmto druhom boli nájdené: *Sphaerium rivicola*, *S. corneum*, *Anisus septemgyratus, Lithoglyphus naticoides*, *Bithynia tentaculata*, *Stagnicola* cf. *turricula*, *Galba truncatula, Unio tumidus zelebori*, *U. crassus albensis* a *Anodonta anatina attenuata*. Druh *Sinanodonta woodiana* sa do našich vôd dostal v larválnom štádiu s introdukovanými druhmi rýb (tolstolobik, amur), na ktorých larva (glochídium) určité obdobie žije ako parazit na žiabroch (URISHINETS & KORNIUSHIN 2001, HALGOŠ 1999). V súčasnosti je druh známy aj z ďalších lokalít Slovenska – Podunajsko (HALGOŠ 1999), Laborec pri Stretave (leg. J. Šteffek, K.-O. Nagel, 12.8.2004, 7398a), Čierna voda pri Závadke (leg. J. Šteffek, K.-O. Nagel, 10.8.2004, 7298a). Orientačné vzorky malakofauny pochádzajú aj z ďalších lokalít, ktoré však v tabuľke neuvádzame. Priamo z Ipľa pri Šahách (7979b), ešte tesne pred reguláciou toku, uvádza P. Deván (10.4.1983) veľké populácie druhov *Lithoglyphus naticoides* a *Planorbarius corneus* a zo Sikenice v Horšianskej doline (7778c) druh *Ancylus fluviatilis* (13.4.1983). Známe nálezisko fosílnej malakofauny – Šiklóš (Vápeník) pri Leviciach (leg. a det. J. Šteffek, 7877b, 14.5.2005) má spoločenstvo recentnej malakofauny tvorené termofilnými druhmi *Cecilioides acicula*, *Truncatellina cylindrica, Morlina glabra*, *Merdigera obscura* a *Aegopinella minor*. Na pasienkoch Žabej hory medzi Bohunicami a Bátovcami (leg. J. Šteffek, 28.9.1974, 7678a) boli zas zozbierané druhy *Chondrula tridens*, *Truncatellina cylindrica* a *Vitrina pellucida*.

Záver

V priebehu rokov 1975 až 2005 boli v okrese Levice príležitostne vykonané výskumy malakofauny. Zistilo sa 78 druhov mäkkýšov, z čoho 28 patrí k vodným druhom a 50 je suchozemských. Napriek tomu, že krajina okresu je prevažne zmenená poľnohospodárskymi aktivitami, nachádzajú sa tu ostrovy zachovalej prírody v podobe lužných porastov a mŕtvych ramien v okolí Ipľa. Práve tu sa nachádzajú aj niektoré vzácne, zriedkavo sa vyskytujúce druhy malakofauny (*Anisus septemgyratus*, *Euconulus praticola, Pisidium amnicum*). Na druhej strane výraznú synantropizáciu veľkej časti územia charakterizujú viaceré introdukované druhy (*Physella acuta, Oxychilus draparnaudi, Limax maximus, Limacus flavus*). Rastie aj populácia ázijského introdukovaný lastúrnik *Sinanodonta woodiana*, ktorý sa rýchlo šíri do rôznych vôd Slovenska a môže predstavovať vážne problémy pre našu pôvodnú vodnú malakofaunu. Výsledky predložené v tomto príspevku sú ojedinelým zdrojom informácií o malakofaune levického okresu. Podrobným výskumom malakofauny, predovšetkým z oblasti posledných zvyškov mŕtvych ramien Ipľa, sa určite zistia aj ďalšie druhy.

Poďakovanie. Príspevok vznikol vďaka podpore projektov VEGA 2/2001/21 a 1/0600/03.

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Tab. 1. Mäkkýše vybraných lokalít okresu Levice
Tab. 1. Molluscs of selected sites in the Levice District)

Ekoelement (Lisický, 1991)	**D r u h (Species)**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**
I. (9) Silvicolae (Forest species)	*Aegopinella pura* (Alder)	–	–	–	–	–	–	2	–	–
	Bielzia coerulans (M. Bielz)	–	–	–	–	–	–	2	–	–
	Cochlodina laminata (Montagu)	–	2	–	–	–	–	2	–	–
	Daudebardia rufa (Draparnaud)	–	–	–	–	–	–	–	2	–
	Isognomostoma isognomostomos (Schröter)	–	–	–	–	–	–	4	–	–
	Lehmannia nyctelia (Bourguignat)	–	–	–	–	–	–	2	–	–
	Monachoides incarnatus (O.F.Müller)	–	3	–	–	–	–	2	2	–
	Malacolimax tenellus (O.F.Mülller)	–	–	–	–	–	–	2	–	–
	Vitrea diaphana (S. Studer)	–	–	–	–	–	–	–	3	–
II. (9) Silvicolae (Eurytopic forest species)	*Aegopinella minor* (Stabile)	–	10	1	–	–	–	–	5	–
	Arianta arbustorum (Linnaeus)	–	–	–	1	–	–	2	–	–
	Arion fuscus (O.F.Müller)	–	–	–	–	–	–	1	–	–
	Bradybaena fruticum (O.F.Mülller)	–	–	–	15	–	–	10	3	–
	Balea biplicata (Montagu)	–	6	–	–	–	–	–	7	–
	Cepaea hortensis (O.F.Müller)	–	–	2	–	–	–	–	–	–
	Helix pomatia Linnaeus	–	1	3	8	–	1	1	–	–
	Limax cinereoniger (Wolf)	–	2	–	–	–	–	–	–	–
	Morlina glabra (Rossmässler)	–	–	–	–	–	–	2	3	–
III. (2) Druhy lesných močiarov (Sp. of forest wetlands)	*Macrogastra ventricosa* (Draparnaud)	–	–	–	–	–	–	–	3	–
	Vestia turgida (Rossmässler)	–	–	–	–	–	–	–	4	–
IV. (5) Stepicolae (Steppe species)	*Cecilioides acicula* (O.F.Müller)	–	–	–	–	–	3	–	–	5
	Cepaea vindobonensis (C. Pfeiffer)	–	8	1	2	–	3	–	–	–
	Granaria frumentum (Draparnaud)	–	–	–	–	–	–	–	–	18
	Chondrula tridens (O.F.Müller)	–	2	1	–	–	1	–	–	–
	Xerolenta obvia (Menke)	40	–	–	–	–	–	–	–	7
V. (6) Patenticolae (Open area species)	*Euomphalia strigella* (Draparnaud)	–	12	–	1	–	–	3	3	–
	Pupilla muscorum (Linnaeus)	58	–	–	–	–	–	–	–	9
	Truncatellina cylindrica (Férussac)	5	–	3	2	–	–	–	–	15
	Vallonia costata (O.F.Müller)	42	–	–	–	–	–	–	–	7
	Vallonia excentrica Sterki	–	–	–	–	–	–	–	–	2
	Vallonia pulchella (O.F.Müller)	6	–	3	–	–	–	–	–	11
VI. (2) Xericolae (Xeric sp.)	*Cochlicopa lubricella* (Porro)	–	–	–	–	–	–	–	2	9
	Monacha cartusiana (O.F.Müller)	–	–	8	–	–	–	–	–	–
VII. (10) Agricolae (Species of mesic biotopes)	*Cochlicopa lubrica* (O.F.Müller)	3	4	4	–	–	–	7	8	3
	Deroceras reticulatum (O.F.Müller)	–	–	–	–	–	–	1	–	–
	Limacus flavus Linnaeus	–	2	–	–	–	–	–	–	–
	Limax maximus Linnaeus	–	–	–	1	–	–	–	–	–
	Nesovitrea hammonis Ström	–	–	–	1	–	–	–	–	–
	Oxychilus cellarius (O.F.Müller)	–	–	–	–	–	–	3	–	2
	Oxychilus draparnaudi (H. Beck)	–	–	–	–	–	–	–	5	–
	Punctum pygmaeum (Draparnaud)	–	11	–	–	–	–	–	–	–
	Trichia lubomirskii (Slósarski)	–	–	–	–	–	–	1	–	–
	Vitrina pellucida (O.F.Müller)	2	3	7	1	–	–	–	11	13
VIII. (2) Hygricolae (Hygrophilous sp.)	*Carychium tridentatum* (Risso)	–	8	–	–	–	–	–	12	–
	Succinella oblonga (Draparnaud)	–	–	–	–	–	–	–	3	–

IX. (5) Ripicolae (Polyhygrophilous species)	*Carychium minimum* (O.F.Müller)	–	7	–	–	–	–	–	–	–
	Pseudotrichia rubiginosa (Rossmässler)	–	–	–	6	–	1	–	–	–
	Succinea putris (Linnaeus)	–	–	–	1	–	1	–	–	–
	Zonitoides nitidus (O.F.Müller)	–	–	–	1	–	6	4	2	–
	Euconulus praticola (Reinhardt)	–	–	–	–	–	2	–	–	–
X. (27) Hydricolae (Aquatic species)	*Acroloxus lacustris* (Linnaeus)	–	–	5	–	–	–	–	–	–
	Anisus leucostomus (O.F.Müller)	–	–	–	2	–	1	–	–	–
	Anisus septemgyratus (Rossmässler)	–	–	–	2	–	–	–	–	–
	Anisus vortex (Linnaeus)	–	–	–	–	4	–	–	–	–
	Anodonta anatina attenuata Held	–	–	–	2	1	6	–	–	–
	Bithynia tentaculata (Linnaeus)	–	–	–	–	–	2	–	–	–
	Bythinella austriaca (Frauenfeld)	–	2	–	–	–	–	–	–	–
	Gyraulus albus (O.F.Müller)	–	–	15	–	–	–	–	–	–
	Gyraulus crista (Linnaeus)	–	–	3	–	–	–	–	–	–
	Lithoglyphus naticoides (C.Pfeiffer)	–	–	–	4	–	14	–	–	–
	Radix auricularia (Linnaeus)	–	–	2	–	–	–	–	–	–
	Stagnicola corvus (Gmelin)	–	–	–	–	20	3	–	–	–
	Stagnicola cf. *turricula* (Held)	–	–	–	–	–	3	–	–	–
	Lymnaea stagnalis (Linnaeus)	–	–	1	–	2	–	–	–	–
	Galba truncatula (O.F.Müller)	–	5	–	1	–	1	–	5	–
	Physella acuta Draparnaud	–	–	4	–	–	–	–	–	–
	Pisidium amnicum (O.F.Müller)	–	–	–	1	–	–	–	–	–
	Pisidium cf. *casertanum* (Poli)	–	2	–	–	–	–	–	3	–
	Planorbarius corneus (Linnaeus)	–	–	–	1	13	2	–	–	–
	Planorbis planorbis (Linnaeus)	–	–	–	–	4	3	–	–	–
	Segmentina nitida (O.F.Müller)	–	–	–	–	–	3	–	–	–
	Sinanodonta woodiana (Lea)	–	–	–	–	–	3	–	–	–
	Sphaerium corneum (Linnaeus)	–	–	–	–	–	1	–	–	–
	Sphaerium rivicola (Lamarck)	–	–	–	–	–	12	–	–	–
	Unio crassus albensis Hazay	–	–	–	–	–	5	–	–	–
	Unio pictorum (Linnaeus)	–	–	–	4	–	–	–	–	–
	Unio tumidus zelebori Zelebor	–	–	–	1	–	–	–	–	–
Počet druhov (Number of species)	**78**	**7**	**18**	**16**	**21**	**6**	**22**	**18**	**19**	**12**

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Spoločenstvá suchozemských mäkkýšov severnej časti Devínskej Kobyly (Malé Karpaty)

Land snail assemblages of the north part of the Devínska Kobyla hill (Malé Karpaty Mts., SW Slovakia)

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Present paper is focused on two topics. First topic is focused on evaluation of mollusc assemblages of northern part of the Devínska Kobyla hill (Malé Karpaty Mts.). The second topic was evaluation of all published data on molluscs of this area. The research was conducted during vegetation period of the year 1978. From 9 types of biotopes altogether 47 quantitative samples were sampled. The assemblages were evaluated on the base of constancy and dominance of the species. Altogether 7913 mollusc specimens were obtained from the samples. Composition and status of the forest mollusc assemblages in northern part of the Devínska Kobyla was shown to be determined by the substratum, age of forest stand and the degree of the biotopes disturbance. The species richest assemblage was detected within old grown forest (biotope 7) and calcareous substratum. The species poorest were assemblages found within clear-cut and young stand (biotopes 5, 8). Species rich community was found also in old growth forest with quartzite substratum, however a number of steppe species is absent within this biotope. The molluscan communities of open habitats were observed only in the northern part of the Devínska Kobyla foothill area. They occur mainly within xeric degraded grassland biotopes (vacant pastures, deforested fields). Within other non-limestone substratum biotopes only species poor coenoses composed of single or e few of species occurred (biotopes 2 and 6). The exception was the natural xeric grassland biotopes, which were typical biotopes for rich community of steppe molluscs (biotope 9). Extremely rich were limestone rocks, which are in addition partially covered by forest. The rich forest land snail community together with a number of xeric species was found here (biotope 3). In second part mollusc species composition of northern and southern part of the Devínska Kobyla massive and the Devínske Hradné Bralo hill are compared. Altogether 65 mollusc species (51 species in north part, 44 species in south part, 37 species in the Devín Castle hill) were found in whole area until nowadays. 10 mollusc species were found only in the southern part of the Devínska Kobyla massive (*Bythinella austriaca*, *Chondrula tridens, Zebrina detrita, Vitrea subrimata, Nesovitrea hammonis, Limax cinereoniger, Limax maximus, Arion fuscus, Pisidium casertanum a P. personatum*), 5 species were found only in northern part of the Massive (*Platyla polita, Pyramidula pusilla, Vertigo pusilla, Vitrea crystallina, Monachoides vicinus*) and 4 species were only found in the Devínske Hradné Bralo hill (*Pupilla sterri, Balea perversa, Trichia striolata danubialis, Fruticicola fruticum*). During our research 3 species new not published from this area were found (*Platyla polita, Nesovitrea hammonis* and *Limax maximus*).

Úvod

Je málo miest v strednej Európe, ktoré by sa mohli pochváliť územím takej vedeckej hodnoty ako je Bratislava s Devínskou Kobylou. Mesto si čoraz viacej odkrajuje z okolitej prírody a práve preto, aby nedošlo k zániku tohto jedinečného miesta, bola Devínska Kobyla v roku 1964 vyhlásená za štátnu prírodnú rezerváciu, ktorá bola v zmysle Zákona NR SR o ochrane prírody č. 287/1994 bola premenovaná na národnú prírodnú rezerváciu. Zriadenie tejto rezervácie vyvolalo potrebu bližšieho poznania Devínskej Kobyly, územia na ktorom sa nachádzajú zvyšky teplomilných a suchomilných rastlinných a živočíšnych spoločenstiev ojedinelého typu (FUTÁK 1964).

Množstvo prác, ako floristických tak aj faunistických, svedčí o veľkom záujme o toto územie. Už na začiatku novoveku v 16. storočí sa objavujú prvé prírodovedné práce z tohto územia, v ktorých sa Devínska Kobyla spomína ako zaujímavá lokalita v rámci Západných Karpát (FERÁKOVÁ 1997). I keď záujem o Malé Karpaty bol v minulosti pomerne veľký, je doteraz známych len veľmi málo údajov o malakofaune severnej časti Devínskej Kobyly.

Prvá práca pojednávajúca o mäkkýšoch aj Devínskej Kobyly je práca SZÉPA (1897), ktorá je výsledkom malakozoologického výskumu širšieho okolia Bratislavy a Dunaja. Ďalšia práca od ORTVAYA (1902) je súborným faunistickým dielom okolia Bratislavy, ale neprináša nič nového o mäkkýšoch Devínskej Kobyly, lebo autor cituje všetky údaje od SZÉPA (1897). PONEC (1972) vydáva prácu o malakofaune Malých Karpát, v ktorej okrem vlastných zberov spomína aj dosiaľ nepublikované zbery Nožeka a Brabenca z územia Devínskej Kobyly a Devína. Neskôr spolu s Lisickým vydávajú doplnky na základe revízie materiálu (LISICKÝ & PONEC 1979). Aj v práci LOŽEKA (1974) je uvedených niekoľko druhov z Devínskeho hradného brala.

Koncom sedemdesiatich rokov minulého storočia vypracoval J. Šteffek dva materiály o mäkkýšoch Malých Karpát vrátane Devínskej Kobyly, ktoré žiaľ nevyšli tlačou. Prvou bola záverečná správa o histórii malakozoologického výskumu Malých Karpát, ktorú vypracoval na Ústave experimentálnej biológie a ekológie SAV (ŠTEFFEK 1976) a druhou je dizertačná práca autora, v ktorej zhodnotil malakocenózy a vývoj krajiny Malých Karpát (ŠTEFFEK 1978). Výsledky z výskumu len južnej časti Devínskej Kobyly však publikoval o rok neskôr (ŠTEFFEK 1979). V ďalšej práci (ŠTEFFEK 1985) zhodnotil malakofaunu dvoch hradov – Devínskeho hradného brala a Bratislavského hradu. KROUPOVÁ-LUČIVJANSKÁ (1984) prináša diagnózu súčasného stavu krajiny Bratislavy vrátane Devínskej Kobyly na základe mäkkýšov. Údaje o malakofaune Devínskej Kobyly sú aj v súborných prácach LOŽEKA (1964) a LISICKÉHO (1991). Populárne ladený príspevok o malakofaune Devínskej Kobyly uverejnil ČEJKA (1998). Poslednú prácu o malakofaune Devínskej Kobyly publikoval ČEJKA (2005), v ktorej zhodnotil súčasné poznatky o malakofaune Devínskej Kobyle z vlastných zberov a len z niekoľkých vybraných publikovaných prác.

Hlavné ťažisko predloženej práce spočíva vo vyhodnotení spoločenstiev mäkkýšov deviatich typov biotopov zo severnej časti Devínskej Kobyly, ktorá doteraz nebola z hľadiska malakofauny podrobne spracovaná. Faunistické údaje z tejto časti Devínskej Kobyly sú len v práci ŠTEFFEKA (1978) a niekoľko zberov z oblasti Štokeravskej vápenky vykonal ČEJKA (2005). Súčasťou tejto práce je aj porovnanie doteraz známych údajov o malakofaune v troch samostatných celkoch tohto fragmentu Malých Karpát – južná časť Devínskej Kobyly, severná časť a Devínske hradné bralo (Tab. 2). V tabuľke sú uvedené aj odkazy na vybrané publikácie, v ktorých bol ten-ktorý druh publikovaný.

Prírodné pomery Devínskej Kobyly vo vzťahu k malakofaune

Devínska Kobyla (514 m n.m.) je malé územie ohraničené obcami Devínska Nová Ves, Dúbravka, Lamač, Karlova Ves a Devín. Spolu s Hainburgskými vrchmi tvorí najjužnejšiu časť Malých Karpát. Toto územie je naprieč prelomené štyrmi zlomami, ktorých intenzita smerom na severovýchod ubúda. Horopisným výsledkom je rozdelenie južnej časti Malých Karpát na dve horské skupiny (Hainburskú a Devínsku horskú skupinu) a tri brány:

- Karnuntská – nachádza sa v Rakúsku a je dlhá 14 km,
- Devínska – nachádza sa na Slovensku aj v Rakúsku a je dlhá 3–4 km,
- Lamačská – nachádza sa na slovenskej strane.

Hlavnou bránou je Devínska brána, ktorou preteká Dunaj. Toto územie sa nachádza medzi najvyššími vrchmi horských skupín – Hundsheimer Berg (476 m) v Rakúsku a Devínskou Kobylou (514 m). Masív Devínska Kobyla sa vyznačuje neobvyklou rozmanitosťou geologického zloženia, ktoré hrá dôležitú úlohu pri rozšírení a disperzii malakofauny. Na pomerne malej ploche sa nachádzajú horniny rôzneho geologického veku, počínajúc prvohornými a končiac štvrtohornými.

Výhodné prírodné podmienky, priaznivá zemepisná poloha a životné prostredie umožnili na území Devínskej Kobyly existenciu mnohým živočíchom rozšíreným v juhovýchodnej Európe (mediteránne, submediteránne, pontické a panónske druhy). Tieto druhy sú veľmi citlivé na kolísanie rôznych ekologických faktorov a na území Devínskej Kobyly našli vyhovujúce podmienky pre svoju existenciu. Preto k najvýznamnejším druhom tejto fauny patria rozličné suchomilné a teplomilné druhy – xerotermofily. Dnes ešte nepoznáme základný inventár

fauny Devínskej Kobyly. Je známe, že tu žije niekoľko tisíc druhov, pričom väčšina z nich patrí medzi článkonožce.
Juhovýchodná časť Devínskej Kobyly je pomerne jednotvárna z hľadiska geológie, aj malakofauny. Nachádza sa tu bratislavský žulový masív, na ktorom môžeme nájsť slabo vyvinuté populácie lesných druhov (*Helicodonta obvoluta, Cochlodina laminata*, *Aegopinella minor*, *Monachoides incarnatus*). Na severe tejto časti sa nachádzajú piesčité vápence z treťohôr (sarmat). Severozápadná časť Devínskej Kobyly je rôznorodá. V okolí Dúbravky sa nachádzajú prvohorné pararuly, svorové ruly so žilkami pegmatitov, taktiež amfibolity a fylity. Tu sa stretávame s podobnou malakocenózou ako na bratislavskom žulovom masíve. Okrem prvohorných hornín sa tu nachádzajú spraše, sute, delúviá a alúviá zo štvrtohôr. Vápencové sutiny patria k najbohatším biotopom na malakofaunu. Vrch Devínska Kobyla (514 m) je tvorený fylitmi, kremencami (spodný trias), vápencami a dolomitmi (stredný trias), tmavými vápencami (druhohory), pieskami a pieskovcami (helvét, treťohory), piesčitými biotitickými vápencami (treťohory) a alúviami, sprašami, sutinami (štvrtohory).
Oblasť Devínskej Kobyly spadá do teplej klimatickej oblasti s teplým letom a miernou zimou. Celé územie Devínskej Kobyly je vystavené vetrom dujúcim zo Záhorskej nížiny, čo do značnej miery ovplyvňuje faunu a flóru sledovaného územia.
Z fytogeografického hľadiska je Devínska Kobyla fragmentom Malých Karpát. FUTÁK (1964, 1972) však považuje za správnejšie ju uvádzať spolu s Hainburskými vrchmi. Odôvodňuje to tým, že je tu omnoho viac suchomilného a teplomilného rastlinstva ako v oblasti Malých Karpát.
Prirodzeným vegetačným krytom Devínskej Kobyly boli dubové a dubovo-hrabové lesy. Vo vrcholovom dubovo-hrabovom poraste sa vyskytuje aj buk, ktorý na severnej časti prechádza v súvislý porast. Väčšina druhov rastlín Devínskej Kobyly je teplomilná, zväčša patriaca ponticko-panónskej flóre. Flóra severnej strany Devínskej Kobyly je chudobnejšia ako južnej, kde mozaikovitosť, farebnosť a rast vegetácie sú podmienené reliéfom, ktorý sa tu strieda po niekoľkých metroch. Rastie tu viac ako 1500 cievnatých rastlín, 150 machorastov, takmer 140 lišajníkov a asi 480 húb. Pre Devínsku Kobylu je zvlášť pozoruhodný výskyt niektorých druhov, ktoré sa na Slovensku vyskytujú len zriedkavo (FERÁKOVÁ 1997).

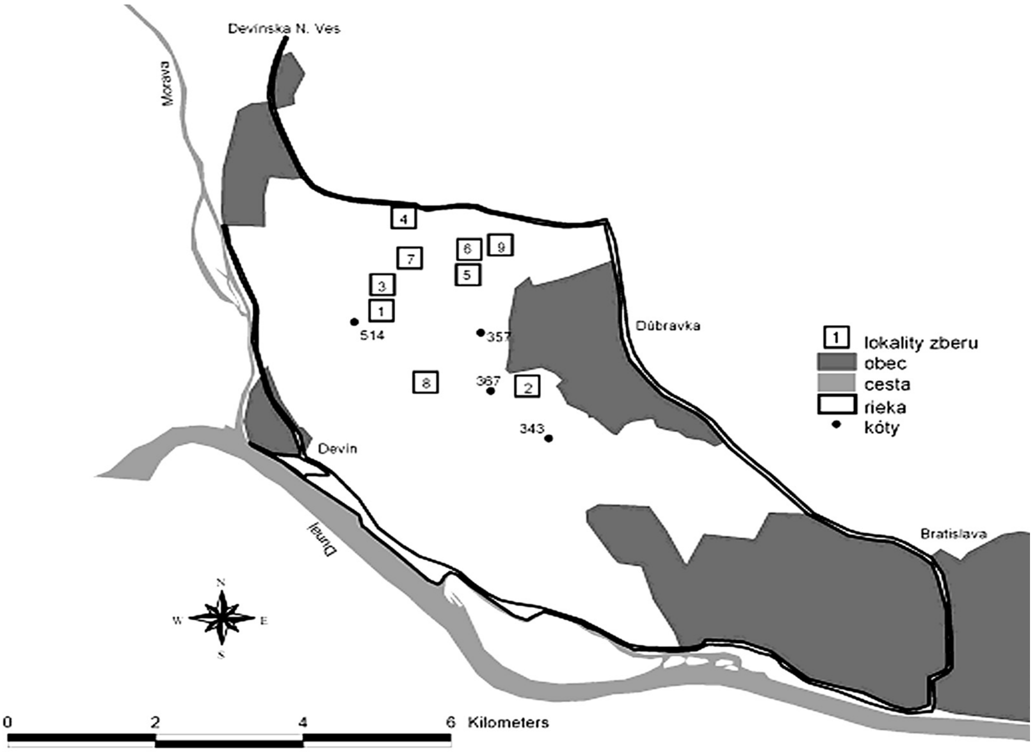
Materiál a metodika

V roku 1978 sme počas vegetačného obdobia uskutočnili výskum spoločenstiev mäkkýšov severnej časti Devínskej Kobyly, ktorej južnú hranicu určujú kóty Hlboká dráha (222 m) na západe, Devínska Kobyla (514 m), Švábsky vrch (367 m) a Hrubý breh (343 m) na východe. Lokality sme vyberali tak, aby boli zastúpené hlavné typy biotopov. Kvantitatívne vzorky na jednotlivých biotopoch (lokalitách) sme sa snažili vyberať náhodne, aby vyhodnotenie bolo objektívne. Pri svojej práci sme používali bežnú metódu kvantitatívneho odberu. Zo zvoleného biotopu sme odobrali 5 až 6 kvantitatívnych vzoriek hrabanky z kvadrátov 25×25 cm. Živé jedince veľkých druhov (*Helix pomatia*, *Cepaea vindobonensis* a *Xerolenta obvia*) sme po sčítaní pustili späť do prírody. Jednotlivé vzorky sme preosiali cez tri sitá s rôzne veľkými okami a ručne prebrali pod lupou.
V práci podávame výsledky zo 47 kvantitatívnych vzoriek z 9 typov biotopov. Z týchto vzoriek sme získali 7913 exemplárov patriacich 36 druhom. Vyhodnotenie sme robili podľa častosti (frekvencie) výskytu druhu v odobratých vzorkách z každého biotopu osobitne, pričom druhy boli zaradené do jedného zo štyroch stupňov konštantnosti (K) – eukonštantný 100–75 %, konštantný 75–50 %, akcesorický 50–25 %, akcidentálny 25–0 % a podľa počtu exemplárov v kvantitatívnej vzorke daného typu biotopu, čo nám určilo dominanciu (D) tiež v štyroch stupňoch – dominantný 100–15 %, subdominantný 15–6 %, recedentný 6–1 %, subrecedentný 1–0 % (SCHMID 1966). V každom type biotopu boli vybrané jeden alebo dva vedúce druhy, ktoré dominovali aj v rámci konštantnosti aj dominancie.
Nomenklatúra je podľa práce FALKNER et al. (2001) a druhy boli určované podľa LOŽEKA (1964).

Charakteristika preskúmaných lokalít

O každej lokalite je uvedená stručná charakteristika biotopu, nadmorská výška, štvorec Databanky fauny Slovenska a dátum zberu. Všetky zbery vykonali J. Šteffek a Ľ. Siraňová, determinoval J. Šteffek. Materiál je uložený u autora príspevku:
1 – Devínska Kobyla: sutinový les na kremencovom podklade cca 400 m VSV od kóty Devínska Kobyla (514 m), s porastom *Fraxinus excelsior, Carpinus betulus, Ulmus carpinifolia, Acer platanoides, Tilia grandifolia,* 360 m n.m., 7868a, 25.5.1978.
2 – Devínska Kobyla: opustený pasienok nad štadiónom Dúbravka s trávnatým porastom a vyššími bylinami *Leucanthemum vulgare, Trifolium* sp., *Anthyllis vulneraria,* 290 m n.m., 7868a, 4.6.1978.
3 – Devínska Kobyla: hrabový les severne od lokality č. 1 s porastom *Carpinus betulus, Quercus robur, Fagus silvatica*, 430 m n.m., 7868a, 25.5.1978.
4 – Devínska Kobyla: vápencové skaly pri úpätí lomu (v okolí je bukový porast) východne od Štokeravskej vápenky, 220 m n.m., 7768c, 25.5.1978
5 – Devínska Kobyla: mladý obnovný les po ťažbe SSZ od závodu Technické sklo, 280 m n.m., 7768c, 30.5.1978.
6 – Devínska Kobyla: degradovaný xerotermný svah na plytkej skalnatej pôde so severozápadnou expozíciou pod lokalitou č. 5, s porastom *Plantago lanceo-*

latum, Dactylis glomerata, Anthyllis vulneraria, Tithymalus amygdaloides, Leucanthemum vulgare, Trifolium pratense, 200 m n.m, 7768c, 30.5.1978.
7 – Devínska Kobyla: sutinový les vo vápencovej rokline JZ od lok. č. 6 s porastom *Acer platanoides, Fraxinus excelsior, Ulmus carpinifolia, Carpinus betulus, Euonymus verrucosa, Tilia grandifolia, Fagus silvatica, Corylus avellana, Cornus mas, Staphylea pinnata*, 250 m n.m., 7868c, 13.8.1978.
8 – Devínska Kobyla: ťažbou preriedený zmiešaný les 2 km JZ od lokality č. 2 s porastom *Tilia grandifolia, Quercus robus, Fagus silvatica, Carpinus betulus, Acer platanoides,* 370 m n.m., 7868a, 27.8.1978.
9 – Devínska Kobyla: xerotermný vápencový skalnatý svah juhozápadne od závodu Technické sklo s porastom *Origanum vulgare, Trifolium pratense, Anthylis vulneraria, Achillea millefolium*, *Agrimonia eupatoria* 190 m n.m., 7768c, 3.8.1978.



Obr. 1. Rozmienstneie skúmaných lokalít.
Fig. 1. Location of the surveyed sites.

Vyhodnotenie malakocenóz v preskúmaných biotopoch

Biotop č. 1. Zvláštny ráz tomuto biotopu dodávajú obrovské kremencové skaly s porastom úživného sutinového lesa. Na úpätí brál je bohato vyvinutá prevažne lesná malakocenóza. Z kvantitatívnych vzoriek sme získali 21 druhov mäkkýšov v počte 1440 exemplárov. Prevahu tvoria druhy, z ktorých šesť je prísne lesných ekoelementov – *Aegopinella pura*, *Vertigo pusilla*, *Merdigera obscura*, *Monachoides incarnatus, Cochlodina laminata*, *Acanthinula aculeata* a päť druhov patrí k prevažne lesným druhom, ktoré sa môžu vyskytovať aj na zatienených biotopoch nelesného charakteru (kroviny, skalné sutiny, brehy ciest) – *Aegopinella minor, Balea biplicata*, *Helix pomatia*, *Morlina glabra*, *Cepaea hortensis*. Dohromady sa tu teda vyskytlo 11 silvikolných druhov. K nim však môžeme priradiť aj šesť zo skupiny agrikolných druhov, ktoré žijú v rôznych a teda aj lesných biotopoch *Vitrina pellucida*, *Vertigo alpestris*, *Cochlicopa lubrica*, *Punctum pygmaeum*, *Clausilia dubia* a *Euconulus fulvus*. Medzi zaujímavé druhy tohto biotopu patrí hlavne silvistepikolný prvok *Truncatellina claustralis*, ktorý má len niekoľko lokalít výskytu v rámci celých Malých Karpát (ŠTEFFEK 1978). ČEJKA (2005) ho z územia Devínskej Kobyly nedoložil. Skupinu patentikolných druhov tvoria *Vallonia costata*, *Truncatellina* *cylindrica* a jeden silvistepikolný druh *Euomphalia strigella*. Zloženie malakofauny, ktoré je prevažne tvorené lesnými druhmi, nasvedčuje tomu, že tu v priebehu vývoja krajiny nedošlo k celoplošnému odstráneniu lesa a tak tu mohli tieto druhy prežiť v sutinovom svahu kremencových skál. Najväčšiu dominanciu trvorili druhy *Balea biplicta* a *Vallonia costata*, podľa ktorých bola stanovená malakocenóza. Ostatné preskúmané biotopy nesú stopy väčších alebo menších zásahov, o čom svedčí väčšie zastúpenie patentikolných druhov a slabšie zastúpenie lesných druhov.

Biotop č. 2. Predstavuje opustený pasienok s trávnytým xerotermným porastom, poznačený antropickou činnosťou (turistika, branné cvičenia a kurzy). Z kvantitatívnych vzoriek sme dohromady získali 220 exemplárov, ktoré patria 9 druhom. Prevažná väčšina zistených druhov sú stepikoly, patentikoly a xerikoly. Len jeden zistený druh je agrikol so širokou ekologickou valenciou (*Vitrina pellucida*). Najväčšie zastúpenie majú stepikolné druhy *Xerolenta obvia*, *Mediterranea inopinata, Granaria frumentum*, *Cepaea vindobonensis,* z ktorých prvé dva patria k mladoholocénnym prisťahovalcom. Pontický druh *Xerolenta obvia* je v súčasnej dobe v niektorých oblastiach výskytu na Slovensku na ústupe (Slovenský raj, Medzianske skalky), inde zase preniká do nových území (Sklené Teplice, 28.4.2003, leg. J. Šteffek). Podľa LOŽEKA (1973) do strednej Európy prenikol až v postglaciáli. *Mediterranea inopinata* je zaujímavý aj tým, že je jedným z ojedinelých subteránne žijúcich mäkkýšov na Slovensku. Často býva zahrabaný až vyše 1 m pod povrchom zeme. Najľahšie sa tento druh získa z krtincov. Pre tento typ biotopu bola vyčlenená malakocenóz s vedúcimi druhmi *Xerolenta obvia* a *Granaria frumentum*.

Biotop č. 3. Predstavuje hrabový les s prímesou dubu a buka vo vrcholovej časti Devínskej Kobyly s východnou expozíciou. Z 5 kvantitatívnych vzoriek sme získali 22 druhov mäkkýšov v počte 171 exemplárov. Najväčšie zastúpenie majú druhy silvikolné (s. l.) *Monachoides incarnatus, Cochlodina laminata, Aegopinella pura, Acanthinula aculeata, Helicodonta obvoluta, Semilimax semilimax, Aegopinella minor, Helix pomatia, Morlina glabra.* Prekvapením bolo zistenie jedného exemplára petrofilného druhu *Pyramidula pusilla,* ktorý nebol na inej lokalite Devínskej Kobyly zistený. Spoločenstvo dopĺňajú nenáročné druhy *Euomphalia strigella* a *Vitrina pellucida.* Vysoká prítomnosť termofilov poukazuje na teplý stredoeurópsky les a predstavuje typ malakocenózy *Monachoides incarnatus – Aegopinella pura*.

Biotop č. 4. Biotop tvoria vápencové skaly, ktoré sú najvhodnejším substrátom pre malakofaunu o čom svedčí aj pomerne veľké zastúpenie druhov. Na lokalite sme z kvantitatívnych vzoriek získali 21 druhov mäkkýšov v počte 903 exemplárov. V okolí je bukový porast. Najväčšie zastúpenie v lokalite majú druhy otvorených biotopov (patentikoly) – *Vallonia costata, V. pulchella, Truncatellina cylindrica, Pupilla muscorum, Euomphalia strigella* a stepikoly *Granaria frumentum, Xerolenta obvia, Cepaea vindobonensis, Chondrina arcadica clienta* a *Truncatellina claustralis*. Podobne ako pri lokalite č. 1, aj tu si pozornosť zasluhuje *Truncatellina claustralis*, ktorý má v rámci Slovenska najjužnejší výskyt práve tu na Devínskej Kobyle, podobne ako aj *Chondrina arcadica clienta*. Okrem menovaných druhov sa tu nachádzajú aj silvikoly *Acanthinula aculeata, Balea biplicata, Aegopinella minor, Helix pomatia* a *Semilimax semilimax*, niekoľko agrikolov a jeden xerikolný druh *Cochlicopa lubricella*. Malakocenózu vyčleňujú druhy *Truncatellina cylindrica – Granaria frumentum*.

Biotop č. 5. Biotop predstavuje slabo vyvinutý zmiešaný les s bohatým bylinným porastom a starými peňmi. Z kvantitatívnych vzoriek sme získali 10 druhov prislúchajúcich 1046 exemplárom. Najväčšie zastúpenie v lokalite majú silvikolné druhy *Acanthinula aculeata, Merdigera obscura, Aegopinella minor, Helix pomatia, Balea biplicata*. Po jednom druhu sú tu zástupcovia patentikolov – *Truncatellina cylindrica* a silvistepikolov – *Euomphalia strigella*. Tri druhy sú agrikolné – *Vitrina pellucida*, *Punctum pygmaeum* a *Vitrea contracta.* Malakocenózu vyčleňujú druhy *Truncatellina cylindrica – Punctum pygmaeum*. Druhové zloženie svedčí o priaznivom vývoji lesnej malakocenózy, ktorá prečkala odlesnenie pri starých pňoch.

Biotop č. 6. Biotop predstavuje degradovaný xerotermný svah ktorý vznikol odlesnením. Získali sme len jeden druh *Xerolenta obvia* v počte 82 exemplárov. Lokalita je typickým príkladom, kedy do priestoru vyrúbaného lesa na extrémnom stanovišti nalietavajú suchomilné druhy rastlín a preniká sem najskôr tento „pioniersky" druh xerotermných trávnych porastov.

Biotop č. 7. Charakteristickým znakom toho biopu sú vápencové skaly v sutinovom lese. Z kvantitatívnych vzoriek sme získali 26 druhov mäkkýšov v počte 3951 exemplárov. Môžeme konštatovať, že táto lokalita je druhovo najbohatšia zo všetkých skúmaných lokalít. Najbohatšie je zastúpená skupina silvikolných druhov *Merdigera obscura, Acanthinula aculeata, Monachoides incarnatus, Semilimax semilimax, Platyla polita, Helicodonta obvoluta, Cochlodina laminata, Balea biplicata, Aegopinella minor, Morlina glabra, Helix pomatia* a *Vitrea crystallina*. Stepikolné druhy zastupujú *Truncatellina claustralis, Granaria frumentum* a *Cepaea vindobonensis*., čo svedčí o niekdajšom väčšom odlesnení tejto locality. Staré ulity druhu *Granaria frumentum* sme nachádzali aj v hustom lesnom poraste. Zistené tu boli aj patentikoly *Truncatellina cylindrica, Vallonia costata,* jeden silvistepikol *Euomphalia strigella*, štyri agrikolné druhy so širokou ekologickou valenciou – *Punctum pygmaeum, Vitrina pellucida, Clausilia dubia, Vitrea contracta* a jediný dosiaľ zistený hygrikolný druh na severnej strane Devínskej Kobyly – *Columella edentula*.

Biotop č. 8. Ťažbou preriedený zmiešaný les patrí k častým javom v našich lesoch. Radikálne odlesnenie, navyše odstránenie drevnej hmoty neumožňuje prežitie citlivým lesným druhom. V takomto zničenom biotope dochádza k rýchlemu vysušovaniu, kde sa len pri pňoch dokážu udržať nenáročné druhy. Z piatich kvantitatívnych vzoriek sme získali 6 exemplárov dvoch lesných druhov, ktoré zároveň určujú malakocenózu *Helix pomatia – Aegopinella minor*.

Biotop č. 9. Kamenistý xerotermný svah patrí k ojedinelým na severnej strane Devínskej Kobyly. Na týchto plytkých biotopoch s nízkym trávnatým porastom nachádzame hlavne patentikolné a stepikolné druhy *Xerolenta obvia, Granaria frumentum, Cepaea vindobonensis, Cochlicopa lubricella, Euomphalia strigella, Truncatellina cylindrica, Pupilla muscorum* a *Vallonia costata*. Malakocenózu charakterizujú druhy *Xerolenta obvia* a *Truncatellina cylindrica*.

Diskusia

Pestrá geologická stavba (cca 11 druhov hornín s rozličným geologickým vznikom a rôznym zložením), významné fytocenózy a samozrejme postavenie Devínskej Kobyly, ako najjužnejšej časti Malých Karpát, dali možnosť vzniku rôznym malakocenózam. Fylity poskytujú len priemerné podmienky pre rozvoj malakofauny. Kremence, ktoré len v prípade, že sú porastené sutinovým porastom lipy, javora a jaseňa, poskytujú vhodné podmienky pre malakofaunu. Menované stromy sú totiž schopné svojim koreným systémom získavať rozpustený vápnik a tento akumulovať vo svojich listoch. Po opade listov sa pod stromami zvyšuje pH územia a to je lákadlom pre mäkkýše, ktoré na stavbu svojich ulít potrebujú práve uhličitan vápenatý. Prevahu však tvoria vápence a dolomity, ktoré sú najvhodnejším substratom pre výskyt malakofauny.

Piesky a pieskovce, ktoré pochádzajú z treťohôr a tvoria vlastne južnú časť Devínskej Kobyly (lokalita Sandberg), sú porastené xerotermnou vegetáciou so spoločenstvom stepikolných druhov mäkkýšov *Xerolenta obvia*, *Mediterranea inopinata, Granaria frumentum* a *Truncatellina cylindrica*. Tento typ biotopu sa síce v severnej časti nenachádza, ale tieto druhy sú na trávnatých xerotermných svahoch bežné aj tu. Tam, kde vychádzajú na povrch vápencové bralá, pristupujú k nim ešte *Clausilia dubia* a *Chondrina arcadica clienta* a *Truncatellina claustralis*, ako je to na príklade biotope č. 4.

Pre Devínsku Kobylu je najtypickejšia malakocenóza na xerotermných lúkach južnej aj severnej strany. Najbohatšia malakocenóza je vyvinutá na kamenistom xerotermnom svahu (biotop č. 9). Desať druhov mäkkýšov, ktoré sa tu vyskytli, sú hlavne predstaviteľmi stepikolného ekoelementu – *Xerolenta obvia*, *Granaria frumentum*, *Truncatellina cylindrica* a *Euomphalia strigella*.

Mimoriadne vyvinutá malakocenóza sa vyskytuje na vápencových sutinách (biotop č. 7) ale aj na sutinách s kremencovým podkladom (biotop č. 1), kde sú už spomínané sutinové porasty s lipou, javorom, jaseňom a brestom. Pokiaľ na kremencoch chýbajú stepikolné druhy, na vápencoch sú v porovnateľnom množstve ako silvikoly (Tab. 1).

Zásahy človeka do prírody Devínskej Kobyly mali a majú nemalé následky aj na prítomnosť niektorých druhov mäkkýšov – zalesňovanie nepôvodnými drevinami, výstavba chát, výstavba ciest, vysoká návštevnosť, vplyv exhalátov, holorubná ťažba. Prirodzený vegetačný kryt na Devínskej Kobyle, ako už bolo vyššie spomenuté, tvorili dubové a dubovohrabové lesy. V sedemdesiatich rokoch minulého storočia sa tu zalesňovalo a to i na miestach, kde súvislý les už niekoľko storočí predtým nebol. Vysádzali sa dreviny nevhodné pre toto stanovište – *Pinus nigra, Gleditschia triacanthos, Robinia pseudoacacia, Eleangnus angustifolia, Larix decidua*, ktoré čiastočne menili chemizmus pôdy (acidifikácia a nitrifikácia), a tak sa mnohé druhy dosiaľ do týchto porastov nenasťahovali. Časť lesov na Devínskej Kobyle bola odstránená výstavbou ciest a chát. Postupne sa z týchto oblastí vytrácali citlivé lesné druhy mäkkýšov a na ich miesta prichádzali druhy iné, ktorým odlesnené biotopy vyhovovali, tzv. novodobí prisťahovalci (*Xerolenta obvia, Mediterranea inopinata).* Aj záhradkári priniesli svojimi aktivitami nové prvky. Zrejme prenosom zeminy sa sem dostali druhy ako napríklad *Oxychilus draparnaudi a Limax maximus*.

Ďalší vplyv na malakofaunu mali zrejme aj exhaláty. Je pozoruhodné, že počas výskumu severnej strany Devínskej Kobyly neboli zistené druhy čeľade *Limacidae, Agriolimacidae* a *Arionidae*, ktoré najrýchlejšie reagujú na exhaláty, pretože nemajú schránku. Je tiež pravdepodobné, že veľké suchá v období výskumu boli príčinou, že sme druhy daných čeľadí nezachytili. ČEJKA (2005) uvádza ako vzácny výskyt druh *Deroceras* cf. *reticulatum* z okolia Štokeravskej vápenky. V lesoch sa konštantne vyskytli druhy *Aegopinella minor, Helix pomatia, Balea biplicata, Aegopinella pura, Helicodonta obvoluta* a *Monachoides incarnatus.*

Druhým cieľom tohto príspevku bolo porovnať zloženie malakofauny Devínskej Kobyly zo severnej strany, kde bolo zistených 51 druhov, s malakofaunou južnej strany, kde je zistených 44 druhov a malakofaunou Devínskeho hradného brala, z kadiaľ je známych 37 druhov. Celkovo bolo na tomto území zistených 65 druhov mäkkýšov. Toto porovnanie síce čiastočne vykonal aj ČEJKA (2005), lenže nezohľadnil všetky dostupné zdroje o malakofaune Devínskej Kobyly a v jeho zozname je uvedených len 50 druhov. Tab. 2 prináša toto porovnanie. Na severnej strane sa nepodarilo zistiť 13 druhov, známych z južnej strany alebo z Devínskeho hradného brala, no len z tejto časti Devínskej Kobyly je zatiaľ známych 5 druhov (*Platyla polita, Pyramidula pusilla, Vertigo pusilla, Vitrea crystallina, Monachoides vicinus*). Na južnej strane sa nevyskytlo 19 druhov zo všetkých známych druhov tohto územia, ale len tu bolo zistených 10 druhov (*Bythinella austriaca*, *Chondrula tridens, Zebrina detrita, Vitrea subrimata, Nesovitrea hammonis, Limax cinereoniger, Limax maximus, Arion fuscus, Pisidium casertanum a P. personatum*). Na Devínskom hrade sa dosiaľ nezistilo 29 druhov známych zo severnej alebo južnej časti Devínskej Kobyly, zato sú len z tadiaľto známe 4 druhy (*Pupilla sterri, Balea perversa, Trichia striolata danubialis, Fruticicola fruticum*.

Druh *Chondrula tridens,* ktorý SZÉP (1897) uvádza z Devínskej Kobyly, nikto ďalší zatiaľ nepotvrdil, i keď ho z druhej strany Dunaja z viacerých lokalít okolia Hainburgu uvádza KLEMM (1974). Jeden exemplár druhu *Pyramidula pusilla* z hrabového lesa (biotop č. 3) bol sem zrejme zavlečený z niektorého vápencového brala.

Z hľadiska zoogeografického majú na severnej strane najväčšie zastúpenie druhy európskeho areotypu (sensu LISICKÝ 1991), ktorých bolo zistených 15 druhov. Druhou najpočetnejšou skupinou (11 druhov) sú areotypy veľkých areálov (holarktické, palearktické). Alpsko-karpatská proveniencia je zastúpená 3 druhmi a 7 druhov má centrum rozšírenia v južnej Európe.

Záverom možno konštatovať, že prítomnosť stepikolných a xerikolných druhov mäkkýšov je významným rysom nielen južne, ale aj severne exponovaných svahov Devínskej Kobyly. Tieto biotopy sú charakterizované hlavne mladoholocénnymi prisťahovalcami *Xerolenta obvia, Mediterranea inopinata* a druhmi *Granaria frumentum, Cepaea vindobonensis, Truncatellina cylindrica* a *T. claustralis*.

Záver

V predloženej práci boli riešené dva ciele. Prvý pojednáva o malakocenózach severnej strany Devínskej Kobyly (Tab. 1) a druhým cieľom bolo vyhodnotenie všetkých údajov o malakofaune Devínskej Kobyly (Tab. 2). Výskum prebehol počas vegetačného obdobia roku 1978. Z každého z 9 typov biotopov bolo odobratých 5–6 kvantitatívnych vzoriek (25×25 cm). Malakocenózy sme vyhodnotili na základe konštantnosti a dominancie zistených druhov (SCHMID 1966). Zo 47 kvantitatívnych vzoriek sme získali 7913 exemplárov. Zloženie a stav lesných malakocenóz na severnej strane Devínskej Kobyly určuje substrát, vek porastov a zachovalosť biotopu. Na bázickom substrate so starým lesným porastom (biotop č. 7) bola zistená bohatá lesná malakocenóza na rozdiel od biotopov č. 5 a 8, ktoré sú poznačené ťažbou a mladým vekom porastov. Bohatá lesná malakocenóza bola zistená aj v starom sutinovom lese na kremencoch (biotop č. 1), kde však na rozdiel od vápencových sutín, chýbajú vápnomilné stepikolné druhy mäkkýšov, podobne ako na biotope č. 4, ktorý predstavuje zvyšok pôvodného vrcholového hrabovéhe lesa s dobre vyvinutou lesnou malakofaunou (Tab. 1). Nelesné malakocenózy sa na severnej strane Devínskej Kobyly vyskytujú len na úpätí tohto masívu. Jedná sa hlavne o degradované xerotermné porasty (opustené pasienky, odlesnené plochy), na ktorých prebieha sukcesia. Aj napriek vápencovému substrátu, je tu chudobná malakocenóza tvorená nenáročnými druhmi (biotop č. 2 a 6). Výnimku tvoria prirodzené trávnaté xerotermné svahy, na ktorých sa počas dlhého vývoja vyvinula xerofilná vegetácia a druhové zloženie je oveľa bohatšie (biotop č. 9). Mimoriadne bohaté sú vápencové skaly, ktoré sú navyše čiastočne tienené lesným porastom. Tu je jednak bohatá lesná malakocenóza, nachádzajúca dostatok úkrytu v tieni lesa a brál a tiež typická malakocenóza stepikolov (biotop č. 3).

V druhej časti príspevku sú vyhodnotené aj všetky dostupné údaje o mäkkýšoch Devínskej Kobyly, na výskume ktorých sa podielali T. Čejka, M. Lisický, V. Kroupová-Lučivjanská, V. Ložek, R. Szép, J. Ponec a J. Šteffek v rokoch 1897–2005. Z celkového počtu 65 druhov mäkkýšov, ktoré boli dosiaľ zistené na celom území Devínskej Kobyly, je zo severnej časti známych 51 druhov, na južnej strane je 44 druhov a na Devínskom hradnom brale bolo dosiaľ zistených 37 druhov (Tab. 2). V našich zberoch sa vyskytli druhy mäkkýšov, ktoré na území Devínskej Kobyly neboli dosiaľ publikované (*Platyla polita, Nesovitrea hammonis* a *Limax maximus*).

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Tabulka 1. Malakocenózy severnej časti Devínskej Kobyly.
Table 1. Land snail assemblages of the north part of Devínska Kobyla hill, Malé Karpaty, Mts.

Lokalita (locality)		**1**		**2**		**3**		**4**		**5**		**6**		**7**		**8**		**9**	
∑ zberov (samples): 25×25 cm			**5**		**5**		**5**		**5**		**5**		**5**		**6**		**5**		**6**
∑ druhov (species):			**21**		**9**		**12**		**21**		**10**		**1**		**26**		**2**		**10**
∑ druhov (species): max.:			**19**		**6**		**9**		**18**		**9**		**1**		**25**		**2**		**7**
min.:			**15**		**2**		**7**		**13**		**6**		**1**		**16**		**1**		**0**
stred (middle):			**17**		**4**		**8**		**16**		**7,5**		**1**		**20,5**		**2**		**3,5**
Konštantnosť (constancy):	**EE**	**%**	**K**	**%**	**K**	**%**	**K**	**%**	**K**	**%**	**K**	**%**	**K**	**%**	**K**	**%**	**K**	**%**	**K**
Acanthinula aculeata	1	80	4			60	3	20	1	100	5			67	4				
Aegopinella pura	1	60	3			**80**	**4**												
Cochlodina laminata	1	100	5			100	5							83	5				
Helicodonta obvoluta	1					40	2							100	6				
Merdigera obscura	1	100	5							40	2			83	5				
Monachoides incarnatus	1	100	5			**100**	**5**							83	5				
Platyla polita	1													67	4				
Semilimax semilimax	1					40	2	40	2					67	4				
Vertigo pusilla	1	100	5																
Aegopinella minor	2	100	5			100	5	100	5	100	5			83	5	20	1		
Balea biplicata	2	**100**	**5**	20	1			100	5	40	2			**83**	**5**				
Cepaea hortensis	2	20	1																
Helix pomatia	2	80	4			40	2	60	3	60	3					**100**	**5**	17	1
Morlina glabra	2	40	2			40	2							50	3				
Vitrea crystallina	2													17	1				
Cepaea vindobonensis	4			20	1			80	4					33	2			33	2
Granaria frumentum	4			**100**	**5**			**100**	**5**					100	6			50	3
Chondrina arcadica clienta	4							40	2					100	6				
Mediterranea inopinata	4			20	1			20	1					33	2				
Pyramidula pusilla	4					20	1												
Truncatellina claustralis	4	60	3					20	1					83	5				

Xerolenta obvia	4					**100**	**5**					100	5					**100**	**5**								**67**	**4**
Euomphalia strigella	5		40	2					80	4		80	4		100	5					100	6					50	3
Pupilla muscorum	5											100	5														33	2
Truncatellina cylindrica	5		40	2		60	3					**100**	**5**		**100**	**5**					**100**	**6**					**33**	**2**
Vallonia costata	5		**100**	**5**								100	5								67	4					17	1
Vallonia pulchella	5					20	1					100	5															
Cochlicopa lubricella	6					20	1					100	5								67	4					17	1
Clausilia dubia	7		40	2								20	1								100	6						
Cochlicopa lubrica	7		60	3																								
Euconulus fulvus	7		80	4																								
Punctum pygmaeum	7		100	5								60	3		**100**	**5**					100	6						
Vertigo alpestris	7		100	5																								
Vitrea contracta	7											20	1		20	1					83	5						
Vitrina pellucida	7		100	5		20	1		20	1		100	5		80	4					100	6					17	1
Columella edentula	8																				17	1						
∑ všetkých exempl. (all ind.):				**1440**			**220**			**171**			**903**			**1046**			**82**			**3951**			**6**			**94**
∑ exempl. (individuals): max.:				**317**			**65**			**50**			**233**			**327**			**37**			**1034**			**2**			**49**
min.:				**229**			**20**			**18**			**79**			**136**			**3**			**338**			**1**			**0**
stred (middle):				**213**			**43**			**34**			**156**			**232**			**20**			**686**			**2**			**25**
Dominancia (dominance):		**No**	**%**	**D**	**No**	**%**	**D**	**No**	**%**	**D**	**No**	**%**	**D**	**No**	**%**	**D**	**No**	**%**	**D**	**No**	**%**	**D**	**No**	**%**	**D**	**No**	**%**	**D**
Acanthinula aculeata	1	22	1,5	4,4				5	2,9	1	2	0,2	0,4	34	3,3	6,8				99	2,5	16,5						
Aegopinella pura	1	54	3,7	10,8				**73**	**43**	**15**																		
Cochlodina laminata	1	9	0,6	1,8				7	4,1	1,4										13	0,3	2,16						
Helicodonta obvoluta	1							5	2,9	1										29	0,7	4,83						
Merdigera obscura	1	46	3,2	9,2										3	0,3	0,6				129	3,3	21,5						
Monachoides incarnatus	1	18	1,6	3,6				**35**	**21**	**7**										41	1	6,8						
Platyla polita	1																			31	0,8	5,2						
Semilimax semilimax	1							2	1,1	0,4	2	0,2	0,4							32	0,8	5,3						
Vertigo pusilla	1	48	3,3	9,6																								
Aegopinella minor	2	79	5,5	15,8				23	14	4,6	26	2,9	5,2	149	14	29,8				165	4,2	27,5	1	17	0			

Balea biplicata	2	**446**	**31**	**89,2**	1	0,5	0,2				86	9,5	17	7	0,7	1,4				**642**	**16**	**107**						
Cepaea hortensis	2	1	0,1	0,2																								
Helix pomatia	2	7	0,5	1,4				3	1,8	0,6	5	0,6	1	3	0,3	0,6				8	0,2	1,3	**5**	**83**	**1**	1	1	0,2
Morlina glabra	2	4	0,3	0,8				2	1,1	0,4										22	0,6	3,7						
Vitrea crystallina	2																			1	0	0,2						
Cepaea vindobonensis	4				1	0,5	0,2				13	1,4	2,6							2	0,1	0,33				3	3,2	0,5
Granaria frumentum	4				**27**	**12**	**5,4**				**147**	**16**	**29**							439	11	73,2				25	27	4,2
Chondrina arcadica clienta	4										8	0,9	1,6							157	4	26,2						
Mediterranea inopinata	4				1	0,5	0,2				1	0,1	0,2							7	0,2	1,2						
Pyramidula pusilla	4							1	0,6	0,2										65	1,7	11,5						
Truncatellina claustralis	4	5	0,3	1							1	0,1	0,2							498	13	83						
Xerolenta obvia	4				**178**	**81**	**36**				24	2,7	4,8				**82**	**100**	**16**							**15**	**16**	**2,5**
Euomphalia strigella	5	4	0,3	0,8				10	5,8	2	22	2,4	4,4	22	2,1	4,4				26	0,7	4,33				4	4,2	0,7
Pupilla muscorum	5										27	2,9	5,4													15	16	2,5
Truncatellina cylindrica	5	6	0,4	1,2	5	2,3	1				**303**	**34**	**61**	**634**	**61**	**127**				**565**	**14**	**94,2**				**26**	**28**	**4,3**
Vallonia costata	5	**422**	**29,3**	**84,4**							67	7,4	13							62	1,6	10,3				3	3,2	0,5
Vallonia pulchella	5				1	0,5	0,2				25	2,8	5															
Cochlicopa lubricella	6				2	0,9	0,4				12	1,3	2,4							233	5,9	38,8				1	1	0,2
Clausilia dubia	7	5	0,3	1							11	1,2	2,2							118	3	19,7						
Cochlicopa lubrica	7	21	1,4	4,2																								
Euconulus fulvus	7	7	0,5	1,4																								
Punctum pygmaeum	7	98	6,8	19,6							4	0,4	0,8	**161**	**15**	**32,2**				225	5,7	37,5						
Vertigo alpestris	7	71	4,9	14,2																								
Vitrea contracta	7										1	0,1	0,2	1	0,1	0,2				13	0,3	2,2						
Vitrina pellucida	7	143	9,9	28,6	2	0,9	0,4	1	0,6	0,2	41	4,5	8,2	42	4	8,4				340	8,6	56,7				1	1	0,2
Columella edentula	8																			3	0,1	0,5						

Vysvetlivky (Explanations): K – konštantnosť výskytu druhu (constancy of species occurrence): eukonštantný (euconstant) – 100–75 %, konštantný (constant) – 75–50 %, akcesorický (accesoric) – 50–25 %, akcidentálny (accidental) – 25–0 %, No – počet exemplárov (number of individuals), D – stupeň dominancie (dominance): dominantný (dominant) – 100–15 %, subdominantný (subdominant) – 15–6 %, recedentný (recedent) – 6–1 %, subrecedentný (subrecedent) – 1–0 %.

Tabulka 2. Porovnanie nálezov mäkkýšov podľa autorov v troch častiach Devínskej Kobyly.
Table 2. Comparison of the data on molluscs according authors in three different parts of Devínska Kobyla Hill.

Druh (Species)	**EE**	**J časť**	**DHB**	**S časť**
Platyla polita (W. Hartmann, 1840)	1 SI			sff´25.5.1978
Bythinella austriaca (Frauenfeld, 1859)	10 FN	sff´78		
Carychium minimum O.F. Müller,1774	9 RP		sff´85	sff´78
Carychium tridentatum (Risso, 1826)	8 HG	pnc´72, sff´78, cjk´05		sff´78
Succinella oblonga (Draparnaud, 1801)	8 HG			sff´78
Cochlicopa lubrica (O.F. Müller, 1774)	7 AG		pnc´72, sff´78, 85, cjk´05	sff´78
Cochlicopa lubricella (Rossmässler, 1834)	6 XC	pnc´72, cjk´05	sff´79, cjk´05	cjk´05
Vallonia costata (O.F. Müller, 1774)	5 PT(SI)	sff´78, cjk´05	pnc´72, sff´78,85, cjk´05	sff´78, cjk´05
Vallonia pulchella (O.F. Müller, 1774)	5 PT	pnc´72, sff´78, cjk´05	pnc´72, sff´78,85, cjk´05	sff´78
Vallonia excentrica Sterki, 1893	5 PT		sff´78, 85	sff´78
Acanthinula aculeata (O.F. Müller 1774)	1 SI	cjk´05		sff´78, cjk´05
Pupilla muscorum (Linnaeus, 1758)	5 PT		pnc´72, sff´78,85, cjk´05	sff´78
Pupilla sterri (Voith 1840)	4 ST		sff´78,85, cjk´05	
Granaria frumentum (Draparnaud, 1801)	4 ST	pnc´72, sff´78, cjk´05	pnc´72, sff´78,85, cjk´05	sff´78, cjk´05
Chondrina arcadica clienta (Westerlund, 1883)	4 STp	sff´78	pnc´72, sff´78,85	sff´78, cjk´05
Pyramidula pusilla (Vallot, 1801)	4 ST			sff´78
Columella edentula (Draparnaud, 1805)	6 HG	cjk´05		sff´78
Truncatellina cylindrica (A. Férussac, 1807)	5 PT	pnc´72, sff´78, cjk´05	pnc´72, sff´78,85, cjk´05	sff´78, cjk´05
Truncatellina claustralis (Gredler, 1856)	4 ST(SI)	pnc´72	sff´79	sff´78
Vertigo pusilla O.F. Müller 1774	1 SI			sff´78
Vertigo pygmaea (Draparnaud, 1801)	5 PT	sff´20.10.1995	sff´85	sff´78
Merdigera obscura (O.F. Müller, 1774)	1 SI	sff´78, cjk´05		sff´78, cjk´05
Zebrina detrita (O.F. Müller 1774)	4 ST	pnc´72, sff´78, cjk´05		
Chondrula tridens (O.F. Müller 1774)	4 ST	szp´1897		
Cochlodina laminata (Montagu, 1803)	1 SI	sff´78, cjk´05		sff´78
Clausilia dubia Draparnaud, 1805	7 Sip		sff´85	sff´78, cjk´05
Balea perversa (Linnaeus, 1758)	7 Agp		pnc´72, sff´78, 85	
Balea biplicata (Montagu, 1803)	2 SI(AG)	pnc´72, sff´78, cjk´05	pnc´72, sff´78, 85, cjk´05	sff´78, cjk´05
Cecilioides acicula (O.F. Müller 1774)	4 ST	sff´78, cjk´05	pnc´72, sff´78,85	sff´78, cjk´05
Punctum pygmaeum (Draparnaud, 1801)	7 AG	cjk´05	sff´78	sff´78
Discus rotundatus (O.F. Müller 1774)	2 SI(AG)	sff´78, cjk´05	sff´78	sff´78
Vitrea subrimata (Reinhardt, 1871)	1 SI	lsc-pnc´79		
Vitrea crystallina (O.F. Müller 1774)	2 SI(AG)			sff´78
Vitrea contracta (Westerlund, 1871)	7 AG	pnc´72, cjk´05		sff´78

Euconulus fulvus (O.F. Müller 1774)	7 AG	pnc´72, cjk´05		sff˝78
Daudebardia rufa (Draparnaud, 1805)	1 SI	sff˝30.5.1978, cjk´05		sff˝78
Oxychilus draparnaudi (H. Beck, 1837)	7 AG		sff˝78, 85	sff˝78, cjk´05
Morlina glabra (Rosmässler, 1835)	2 SI(AG)	pnc´72, sff˝78		sff˝78, cjk´05
Mediterranea inopinata (Uličný, 1887)	4 ST	sff˝20.10.1995,cjk´05	sff˝78	sff˝78
Mediterranea depressa (Sterki, 1880)	1 SI		pnc´72, sff˝78	cjk´05
Aegopinella pura (Alder, 1830)	1 SI		sff˝85	sff˝78
Aegopinella minor (Stabile, 1864)	2 Sith	pnc´72, sff˝78, cjk´05	sff˝78, 85, cjk´05	sff˝78, cjk´05
Aegopinella nitens (Michaud, 1831)	1 SI	cjk´05	pnc´72, sff˝78	sff˝78
Nesovitrea hammonis Strom, 1765	7 AG	sff˝20.10.1995		
Semilimax semilimax (J. Férussac, 1802)	1 SI	pnc´72, cjk´05		sff˝78
Vitrina pellucida (O.F. Müller 1774)	7 AG	pnc´72, sff˝78, cjk´05	pnc´72, sff˝78,85, cjk´05	sff˝78. cjk´05
Limax cinereoniger Wolf, 1803	2 SI(AG)	sff˝78		
Limax maximus Linnaeus, 1758	7 SIp	sff˝4.9.1977		
Deroceras reticulatum (O.F. Müller 1774)	7 AG	pnc´72, sff˝78, 79		cjk´05
Arion fuscus (O.F. Müller 1774)	2 SI(AG)	sff˝78, cjk´05		
Fruticicola fruticum (O.F. Müller 1774)	2 SI(AG)		cjk´05	
Helicodonta obvoluta (O.F. Müller 1774)	1 SI	pnc´72, sff˝78, cjk´05		sff˝78
Euomphalia strigella (Draparnaud, 1801)	5 SS	pnc´72, sff˝78, cjk´05	sff˝78, 85	sff˝78, cjk´05
Trichia striolata danubialis (Clessin, 1874)	2 SI(AG)		sff˝85	
Petasina unidentata Draparnaud, 1805	1 SI	cjk´05	Potúčková´27.6.1981	sff˝78
Monachoides incarnatus (O.F. Müller 1774)	1 SI	pnc´72, sff˝78, cjk´05	pnc´72, sff˝78, 85	sff˝78
Monachoides vicinus (Rossmässler, 1842)	3 Sih			sff˝78
Urticicola umbrosus (C. Pfeiffer, 1828)	3 SIh		cjk´05	sff˝78
Xerolenta obvia obvia (Menka, 1828)	4 ST	pnc´72, sff˝78, cjk´05	pnc´72, sff˝78,85, cjk´05	sff˝78, cjk´05
Arianta arbustorum (Linnaeus, 1758)	3 Sih		pnc´72, sff˝78, 85, cjk´05	sff˝78
Cepaea hortensis (O.F. Müller 1774)	2 SI(AG)		pnc´72, sff˝78, 85, cjk´05	sff˝78
Cepaea vindobonensis (C. Pfeiffer, 1828)	4 ST(SI)	pnc´72, sff˝78, cjk´05	sff˝85, cjk´05	sff˝78, cjk´05
Helix pomatia Linnaeus, 1758	2 SIth	pnc´72, sff˝78, cjk´05	sff˝85, cjk´05	sff˝78, cjk´05
Pisidium casertanum (Poli, 1791)	10 RVPDt	sff˝78		
Pisidium personatum Malm, 1855	10 RVPDt	sff˝78		
∑ druhov (species total) 65		**44**	**37**	**51**

Vysvetlivky (Explanations): EE – Ecoelement [sensu Lisický 1991]: ❶ silvikoly (forest species); ❷ prevažne lesné druhy (prevailingly forest species); ❸ druhy lesných mokradí (species of forest wetlands) ❹ stepikoly (steppe species); ❺ patentikoly (species of open area grounds); ❻ xerikoly (xerophilic species); ❼ agrikoly (mesophilic species), ❽ hygrikoly (hygrophilic species; ❾ ripikoly (species of open area wetlands); ❿ vodné druhy (aquatic species), EE – Ekoelement (ecoelement) sensu Lisický (1991), cjk – T. Čejka, lsc – M.J.Lisický, pnc – J. Ponec, szp – R. Szép, sff – J. Šteffek.

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First record of *Chondrina clienta* (Westerlund, 1883) from Bohemia (Czech Republic)

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The occurrence of land snail *Chondrina clienta* (Westerlund, 1883) (Gastropoda: Chondrinidae) from Bohemia (Czech Republic) is reported for the first time.

So far, the land snail *Chondrina clienta* has been known within the Czech Republic only from Moravia (LOŽEK 1956, JUŘIČKOVÁ et al. 2001). This East Alpine and Southeast European snail is restricted to limestone rocks. In other parts of its range it occurs occasionally on walls and buildings (CAMERON 2003). In the Czech Republic it is common only in the Moravian Karst Protected Landscape Area (PLA) and Pálava PLA. The remaining known distribution is limited to four isolated sites (Fig. 1). Recently, a new isolated site has been discovered in the Rychlebské Hory Mts (JUŘIČKOVÁ et al., 2005). This new site is an old limestone quarry and the circumstances of the species occurrence indicate a non-native spreading in the recent time.

Locality and material examined: E Bohemia, Luže village (49°53'05.8" N, 16°01'55.8" E, mapping grid – 6162), on a wall of Košumberk castle, 360 m a.s.l., 15 August 2004, one living adult specimen, J. Novák and M. Novák leg. and coll., M. Horsák det.

This is the first finding from a castle on non-limestone bedrock within the Czech Republic. Košumberk castle is another distributional extension of this species toward the northwest, like the limestone quarry in the Rychlebské Hory Mts. Both these occurrences seem to be non-native and they may document new spreading of *Chondrina clienta* in the recent time.

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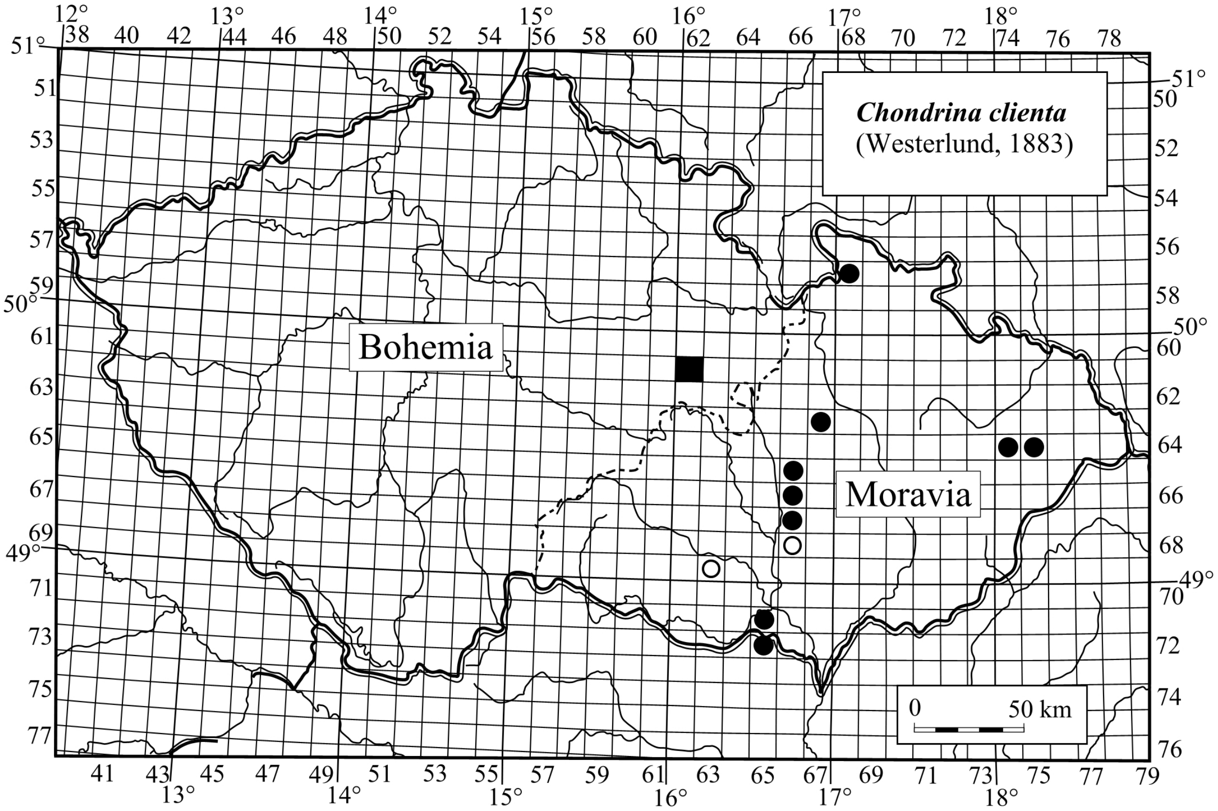

Fig. 1. Present distribution of *Chondrina clienta* in the Czech Republic; broken line shows the historical border between Bohemia and Moravia. Black dot – current populations, empty dot – extinct populations, black square – the first record in Bohemia. The map was adopted from JUŘIČKOVÁ et al. (2005).

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The long-term transformations of Gastropod communities in dam-reservoirs of Upper Silesia (Southern Poland)

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Studies on snail communities in nine dam reservoirs in Upper Silesia were carried out in two periods: 1980–90 and 1995–2004. The observed changes referred to domination patterns. There was found that after introduction of two alien gastropods *Physella acuta* and *Potamopyrgus antipodarum* they became the dominants in four reservoirs by the simultaneous percentage decrease of earlier native dominants. The species density decreased in second study period in five reservoirs, mainly in effect of alien species invasion, but in some cases in consequence of various human interventions. Taking into account the whole collection the commonest species in the first study period were *Radix peregra* and *Planorbis planorbis*, while *Radix peregra*, *Potamopyrgus antipodarum*, and *Physella acuta* in the second. Inexplicable is however the mass occurrence of *Valvata piscinalis* in Żywiecki dam reservoir, because in whole Soutern Poland it is one of rarest snail species both in rivers and stagnant water bodies.

Introduction

The dam reservoirs originate by the damming of riverbed with different earth or concrete dams, which cause the water over-flow on adjacent area. It can take place in river valley if the borders are sufficiently high or in specially excavated deep pits. The characteristic feature of all dam reservoirs is the permanent water flow, periodically retarded or even stopped when necessary. The regulation of water flow is the cause of water-level fluctuations and of temporary exposure of bottom area, normally flooded. It results in the lack of permanent biocoenoses in the shallow littoral of many reservoirs.

Characteristic for these reservoirs is the distribution of grain size in bottom sediments along their length: the greatest grains are deposited in upper part and the smallest by the dam. It affects in great measure the distribution of benthonic plants and animals in particular zones.

The serious difficulty for organism living in dam reservoirs is the repeated water replacement, causing that its retention time can last no longer than several months. Thus the water differs in succeeding periods, according to the conditions in catchment area. The periodical or irregular fluctuation in water level affect negatively the formation of littoral zone, what is then the cause of poor vegetation development in it.

Water retention in reservoirs does induce the physical, chemical and biological changes in the stored water and in bottom sediments. The chemical composition of water in reservoirs can differ from that of the inflows (BERGCAMP et al. 2000, STRZELEC et al. 1999). Some reservoirs require more than 20 years developing stable condition. Eutrophication of dam reservoirs may be a result of great influxes of organic loads and nutrients, what is many cases in the consequence of anthropogenic influences in the catchment (BERGCAMP et al. 2000), and it is just the situation in the region of our studies.

As yet the impact of environmental specificity of dam reservoirs on living organisms was studied in single reservoirs of southern Poland in relation to some plant and animal communities (particularly fish).

Our materials collected during two decades made possible the comparison of gastropod communities from reservoirs of various sizes and different utilization ways as well as the statement of changes, which occurred during twenty years. It is noteworthy to say that from late 1980s the industry recession in southern Poland (mainly in Upper Silesia and adjacent area) resulted in improvement of environmental conditions particularly in reduction of water pollution. One of the aims of this study is therefore the estimation of the importance of these changes for the snails in dam reservoirs.

Study area and study sites

The Upper Silesia is a southern area of Poland, where the natural lakes are absent, while the rivers of various size and types are numerous. Most of them are uncontrolled, what results in frequent floods of various consequences. As the protection against floods the numerous retention reservoirs of different size and volume were built during two last centuries. On our study area between Odra and upper Wisła (49°30'–50°30'N, 18°-19°30'E), which is one of most industrialized regions in Poland, more than 30 dam reservoirs were constructed. Some of them play significant role in energetics. All studied reservoirs are situated on 300–400 m a.s.l.

Among 9 reservoirs investigated by us (their characteristics are given in Table 1) some serve the industrial purposes, other the flood control, communal water supply and recreation, but most are of multipurpose type.

According to the surface area only one of them may be classified as big (more than 1000 ha), six are of medium size (100–1000 ha) and two are small (below 100 ha). All are limnic, with water exchange 2–4 times per year.

Table 1. General characteristics of investigated dam reservoirs. Main task: S – water supply, R – recreation, L – flood control, E – electricity generation. Remarks: Rybnik – artificially elevated water temperature; Gzel – on montane river; Przeczyce – leaking bottom.

Reservoir	On river	Year of construction	Main task	Area in ha	Max. depth	Years of investigations
Rybnik	Ruda	1972	E+R+L	470	11	1984, 1995
Gzel	Gzel	1974	R	30	5	1982, 1995
Żywiec	Soła	1967	R+L+S	1060	21	1987, 1998
Paprocany	Gostynia	1870	R+L	130	2	1984, 2004
Kozłowa Góra	Brynica	1937	S+L	580	6	1986, 1999
Przeczyce	Czarna Przemsza	1963	S+L	510	11	1984, 1997
Poraj	Warta	1978	R+L	550	12	1980, 1997
Chechło	Chechło	1945	R	54	4	1980, 2001
Łąka	Pszczynka	1986	L+R+S	420	6	1992, 2004

Similarly as in majority of dam reservoirs the vegetation was poor and slightly diversified in both study periods. It resulted from frequent and considerable water level fluctuation, impeding the development of greater masses of water plants and reed swamps in effects of periodical bottom exposure in littoral zone. The number of plant species ranged in particular reservoirs from 5 to 22. Totally in all reservoirs 35 plant species have been found.

In comparison with other anthropogenic water bodies of the same region water in studied habitats was in study period of rather good quality (STRZELEC & SERAFIŃSKI 2004).

Material and methods

The investigations were carried out in nine dam reservoirs in Upper Silesia during two periods: the first in years 1980–1990 and the second in years 1995–2004. In the first study period 14 252 specimens, belonging to 24 gastropod species and in the second 13439 specimens from 24 species have been collected. Only living individuals were taken into account in order to avoid the including of dead shells of river species in collection. The snails were gathered from rush and water plants, bottom sediments and various submerged objects in the littoral zone of reservoirs to the depth of about 1 m. Individuals were identified morphologically and only doubtful specimens were checked anatomically too.

Most specimens were released after identification and only some of them (first of all the doubtful) preserved in alcohol. In all collections the domination patterns, diversity (by the use of Simpson's index) and the percentage similarities of snail communities were estimated.

Results

During both periods of investigations 25 species of freshwater snails were foud in nine dam-reservoirs. In particular habitats in the first period 6–19 species and in the second 8-20 species occurred (Tables 4 and 5). The snail species number is highly correlated with plant species richness ($r=0.94$, $t=7.18$, $p<0.001$), but not with area of the reservoir. Despite of small differences in total species number the species diversity in different study periods is significantly unlike in almost all reservoirs. In five reservoirs it increased, and in four decreased in the second period in comparison with the first one (Table 2). It seems, that the main cause of diversity decrease was the mass occurrence of single snail species, in the first place *P. antipodarum*. Impossible to explanation is the enormous increase in abundance of *Valvata piscinalis* in the second study period in Żywiecki reservoir, what caused the fivefold decrease of snail species diversity during 11 years. It is noteworthy to say that the decrease in species diversity is not always interrelated to decrease in species number.

Table 2. Values of Simpson's diversity index in different periods of investigation.

	STUDY PERIOD		
DAM RESERVOIRS	First	Second	MASS APPEARANCE OF
Rybnik	0.50	0.60	*P. antipodarum*, *Ph. acuta*
Gzel	0.80	0.52	*P. antipodarum*
Żywiec	0.81	0.09	*V. piscinalis*
Paprocany	0.55	0.46	*Ph. acuta*
Kozłowa Góra	0.59	0.77	
Przeczyce	0.80	0.75	
Poraj	0.59	0.81	
Chechło	0.81	0.84	
Łąka	0.87	0.40	*P. antipodarum*

The snail species number increased during study period in 4 reservoirs, among which three, namely Gzel, Przeczyce, and Chechło serve mainly recreational purposes, and Kozłowa Góra was in the late 1990s repaired and recultivated. The inflow of communal savages was reduced significantly, what over several years produced the enlargement of snail community composition to 20 species. The opposite effect was observed in Łąka dam reservoirs after its incorporation in communal water-supply system, when the number of snail species dropped from 19 in early 1990s to 7 in 2004. May be that in this case it was likewise the result of mass appearance of *P. antipodarum*, observed there from the beginning of recent century. Generally the species similarity between collections from two periods amounted to from 30% in Kozłowa Góra and Łąka to 73.3% in Gzel. It seems that the lesser environmental manipulations the greater communities similarity.

The more striking differences were found in relation to domination pattern in gastropods communities both in the whole collection and in particular reservoirs. As dominants were classified these species which contribute in the collection in at least 20% of the individuals sum. Taking into account the whole collection the dominants in the first study period were *R. peregra* and *P. planorbis*, whereas in the second *P. antipodarum* only. In particular reservoirs these changes were as shown in Table 3.

Table 3. Changes in domination in particular reservoirs in two study periods.

	DOMINATIONS IN STUDY PERIOD	
RESERVOIR	First	Second
Rybnik	*P. planorbis*	*P. antipodarum, Ph. acuta*
Gzel	*P. planorbis, A. vortex*	*P. antipodarum*
Żywiec	*R. peregra, G. albus*	*V. piscinalis*
Paprocany	*P. planorbis*	*Ph. acuta*
Kozłowa Góra	*L. stagnalis*	*R. peregra, P. planorbis*
Przeczyce	*L. stagnalis*	*G. albus, P. planorbis*
Poraj	*R. peregra*	*P. planorbis*
Chechło	*R. peregra*	*G. albus*
Łąka	*P. planorbis*	*P. antipodarum*

The changes in domination pattern caused that percentage similarity of snail communities in two study periods were very low. They amounted to in: Rybnik 0.03, Gzel 0.28, Żywiecki 0.09, Paprocany 0.14, Kozłowa Góra 0.56, Przeczyce 0.52, Poraj 0.44, Chechło 0.43, Łąka 0.28. However the percentage similarity of both total collections amounted to 0.50.

Comparing the commoness indexes of snail species in two study periods one may notice, that it increased only in two prossobranch species (*P. antipodarum* and *V. piscinalis*) and from among pulmonates only in the Physids. All other pulmonate snails, most common in the first study period, lost their high values of commoness index in the second (Fig. 1).

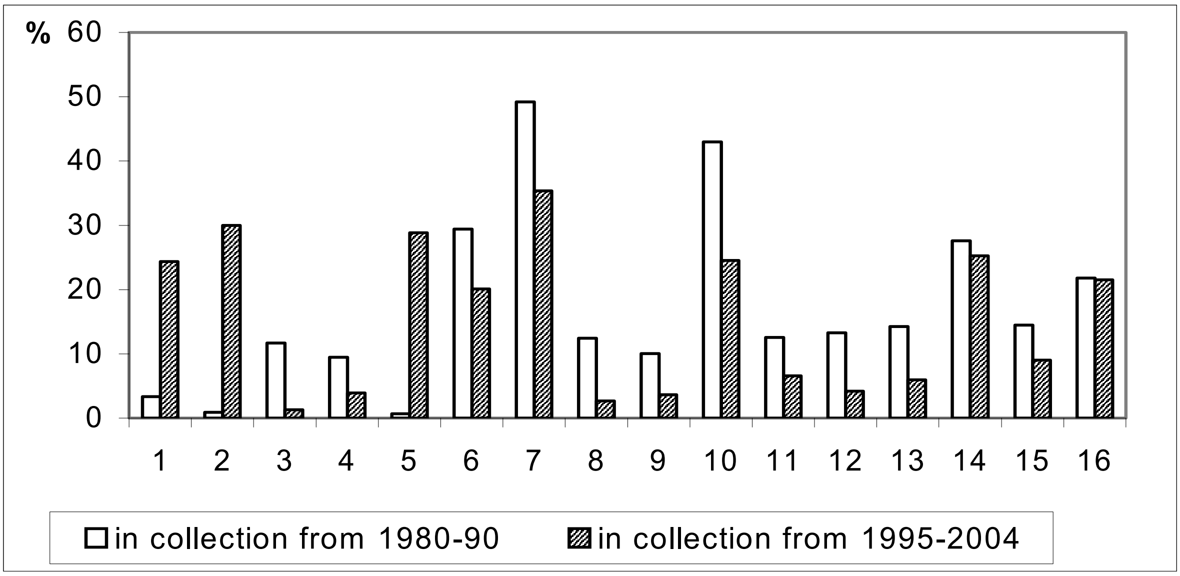

Fig. 1. Commoness index of 16 most common snail species in nine dam reservoirs. Explanations: 1 – *V. piscinalis*, 2 – *P.antipodarum*, 3 – *A. hypnorum*, 4 – *Ph. fontinalis*, 5 – *Ph. acuta*, 6 – *L. stagnalis*, 7 – *R. peregra*, 8 – *R. auricularia*, 9 – *G. truncatula*, 10 – *P. planorbis*, 11 – *A. spirorbis*, 12 – *A. vortex*, 13 – *B. contortus*, 14 – *G. albus*, 15 – *S. nitida*, 16 – *P. corneus*.

Discussion

Data concerning the qualitative and quantitative transformations of Gastropod communities in dam reservoirs with time are very scarce in malacological literature. Most publications refer to species composition and abundance of mollusc communities or particular species occurring in large dam reservoirs (e.g. PETR 1972, ARMITAGE 1977, HARMAN 1997, DVOŘÁK & BERAN 2004, BERAN 2005). In Poland the gastropods in these habitats were investigated chiefly together with other zoobenthos components or even only marginally treated (ZAĆWILICHOWSKA 1965a, b; KRYŹANEK 1979, 1991) or the studies refer to the malacofauna of single dam reservoirs in differently long time periods (JURKIEWICZ-KARNOWSKA 1998, 2001, STRZELEC 1999, 2000, STRZELEC & MICHALIK-KUCHARZ 2003).

The comprehensive studies of JURKIEWICZ-KARNOWSKA (1998, 2001) summarized the changes that appeared during 15 years in mollusc community inhabiting the lowland Zegrzyński dam reservoir situated near Warszawa on the Narew River. She has found that the snail species number in its littoral zone dropped in this period from 16 to 9, what she attributed to progressive eutrophication of the reservoir. Interesting is, that similarly as in our studies, the loss affected mainly the phytophilous snail species. The snail fauna of Zegrzyński dam reservoir differs from observed in Upper Silesia in the absence of some species dominated in reservoirs investigated by us, namely *P. planorbis*, *B. contortus, A. crista*, and *S. palustris*. Very likely it results merely from the size differences of studied water-bodies. Observed by JURKIEWICZ-KARNOWSKA (1998, 2001) decrease in species diversity during 15 years was similar to found in our investigations. Instead the great differences are between her results concerning the domination patterns in Zegrzyński reservoir and occurring in Upper–Silesian reservoirs. In Zegrzyński reservoir the permanent dominant was *V. viviparus*, completely absent in our study. *B. tentaculata,* species very rare in Upper-Silesian reservoirs, was the constant element in Zegrzyński reservoir. The last was dominated by Bivalves, particularly by *Dreissena polymorpha,* the abundance of which increased during study years (JURKIEWICZ-KARNOWSKA 2001). These molluscs were rare or even absent in Upper-Silesian reservoirs, investigated by us. Similar mussels domination observed KRYŹANEK (1991) in large Goczałkowice dam reservoirs (32 km^2 area) situated on upper Wisła in Upper Silesia. Among snails in first period of its existence most abundant were *L. stagnalis*, *Ph. fontinalis*, and *G. albus*. In early 1990s I. REMBECKA (materials unpublished) collected 20 snail species in its littoral, among which the most abundant on sites overgrown with water plants were *A. vortex*, *L. stagnalis*, *A. spirorbis*, and *P. planorbis*, whereas *R. peregra* dominated in stony littoral only. It is striking that two reservoirs of similar age and size, poor vegetation, almost the same kind of bottom sediments and eutrophication stage as Zegrzyński and Goczałkowice are, differ to so great measure in faunistic relation. For only distinct difference is the water retention time amounting to 15 days in Zegrzyński and 60–120 days in Goczałkowice.

We feel sure that the dam reservoirs, considering their environmental instability are interesting but unappreciated objects for hydrobiological investigation. They enable the estimation of the impacts of particular physical, chemical and biological factors on biocoenose as a whole in various stages of their development and on particular animal and plant species living in controlled conditions.

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Table 4. Domination, frequency and commoness of snail species in materials of first study period.

Snail species	Rybnik	Gzel	Żywiec	Paprocany	Kozłowa Góra	Przeczyce	Poraj	Chechło	Łąka	Frequency %	Domination %	Commoness index %
Viviparus contectus (Millet, 1813)				0.9					0.8	22.2	0.19	2.05
Valvata cristata O.F.Müller, 1774				4.6						11.1	0.50	2.35
Valvata piscinalis (O.F.Müller, 1774)			4.1						0.9	22.2	0.50	3.33
Potamopyrgus antipodarum (Gray, 1843)									0.7	11.1	0.1	0.93
Bithynia tentaculata (Linnaeus, 1758)									0.7	11.1	0.1	0.93
Aplexa hypnorum (Linnaeus, 1758)			15.8	0.6				10.5	0.8	44.4	3.1	11.69
Physa fontinalis (Linnaeus, 1758)		8.2	0.9		3.3				5.6	44.4	2.0	9.48
Physella acuta (Draparnaud, 1805)	0.1									11.1	0.01	0.70
Lymnaea stagnalis (Linnaeus, 1758)	2.4	6.5		7.7	7.1	31.4	19.0	1.5	11.1	88.8	9.74	29.40
Radix peregra (O.F.Müller, 1774)	5.4	2.4	27.1	1.3	60.3	16.3	71.6	34.2	16.0	100.0	24.25	29.24
Radix auricularia (Linnaeus, 1758)	0.7	1.7				0.9	1.0	0.1	0.5	66.7	2.32	12.44
Stagnicola corvus (Gmelin, 1791)		6.5					0.3			22.2	0.75	4.09
Stagnicola palustris (O.F.Müller, 1774)		2.1					0.5	13.8	0.4	44.4	1.87	9.10
Galba truncatula (O.F.Müller, 1774)	3.3		10.3	0.4				1.7	0.6	55.5	1.81	10.02
Planorbis planorbis (Linnaeus, 1758)	67.7	35.6		64.9	10.7	17.7	7.3		20.0	77.7	23.77	42.97
Anisus spirorbis (Linnaeus, 1758)			14.7			0.1		16.8	0.3	44.4	3.54	12.54
Anisus vortex (Linnaeus, 1758)	0.1	20.2				9.8			5.7	44.4	3.98	13.29
Bathyomphalus contortus (Linnaeus, 1758)				1.8	0.3	11.2		13.6	6.0	55.5	3.65	14.24
Gyraulus albus (O.F.Müller, 1774)	0.1	1.5	24.0	1.1	18.3	0.3	0.1	5.3	12.0	100.0	7.63	27.60
Gyraulus rossmaessleri (Auerswald, 1852)			3.1				0.1	1.9		33.3	0.57	4.34
Armiger crista (Linnaeus, 1758)		1.1					0.1			22.2	0.13	1.72
Segmentina nitida (O.F.Müller, 1774)	1.9	10.3		4.7		6.9		0.5	2.9	66.6	3.14	14.47
Planorbarius corneus (Linnaeus, 1758)	18.3	3.6		11.6		5.4	0.1	0.1	14.7	77.7	6.12	21.81
Acroloxus lacustris (Linnaeus, 1758)									0.3	11.1	0.03	0.61
N species	10	12	8	11	6	10	10	12	19			
N specimens	1068	1104	1617	1394	1460	1090	2337	3291	994			
Simpson's diversity index	0.50	0.80	0.81	0.55	0.59	0.80	0.59	0.81	0.87			

Table 5. Domination, frequency and commoness of snail species in materials of second study period.

Snail species	Rybnik	Gzel	Żywiec	Paprocany	Kozłowa Góra	Przeczyce	Poraj	Chechło	Łąka	Frequency %	Domination %	Commoness index %
Valvata cristata O.F.Müller, 1774					1.1					11.1	0.01	0.33
Valvata piscinalis (O.F.Müller, 1774)			95.5		0.2	0.31	0.2		0.1	55.5	10.9	24.37
Potamopyrgus antipodarum (Gray, 1843)	43.0	68.3		1.4					69.1	44.4	20.2	29.95
Bithynia tentaculata (Linnaeus, 1758)	4.2	6.4								22.2	1.2	5.11
Aplexa hypnorum (Linnaeus, 1758)					0.2			0.5		22.2	0.1	1.31
Physa fontinalis (Linnaeus, 1758)		1.1			4.9					22.2	0.7	3.94
Physella acuta (Draparnaud, 1805)	45.9			71.4	15.0			0.3	2.0	55.5	14.9	28.81
Lymnaea stagnalis (Linnaeus, 1758)		2.1		1.4	5.8	13.0	16.9	7.8	3.8	77.7	5.2	20.10
Radix peregra (O.F.Müller, 1774)	0.8	2.7	0.6	13.6	22.9	19.6	18.6	19.4	14.4	100.0	12.5	35.37
Radix auricularia (Linnaeus, 1758)		1.6				0.1		0.2		33.3	0.2	2.65
Stagnicola corvus (Gmelin, 1791)		1.1			0.1	0.4	19.3		0.7	55.5	2.4	11.54
Stagnicola palustris (O.F.Müller, 1774)		2.1			0.9	0.5	4.1	0.3		55.5	0.9	6.98
Galba truncatula (O.F.Müller, 1774)			0.1		0.4	0.1		2.1		44.4	0.3	3.65
Planorbis planorbis (Linnaeus, 1758)	1.5	2.1		5.7	20.3	29.1	22.6			66.6	9.0	24.53
Anisus spirorbis (Linnaeus, 1758)					2.4	0.1		9.3		33.3	1.3	6.61
Anisus vortex (Linnaeus, 1758)		6.4			0.7					22.2	0.8	4.21
Bathyomphalus contortus (Linnaeus, 1758)			0.1	1.4	3.8			1.8		44.4	0.8	5.96
Gyraulus albus (O.F.Müller, 1774)	0.4	0.5	3.7		5.3	32.8	1.0	30.3		77.7	8.2	25.25
Gyraulus rossmaessleri (Auerswald, 1852)		1.1			6.4					22.2	0.8	4.30
Armiger crista (Linnaeus, 1758)					2.7	0.1		4.7		33.3	0.8	5.16
Segmentina nitida (O.F.Müller, 1774)	0.3	1.1		0.7	0.1		0.4	8.4		66.6	1.2	9.02
Planorbarius corneus (Linnaeus, 1758)	0.2	2.1		4.4	0.3	4.2	16.7	9.3	9.9	88.8	5.2	21.49
Ferrissia clessiniana (Jickeli, 1802)	3.6	1.1								22.2	0.5	3.33
Acroloxus lacustris (Linnaeus, 1758)					0.9			0.2		22.2	0.1	1.49
N species	9	15	5	8	20	12	9	14	7			
N specimens	1893	674	1648	1240	2823	1739	854	1708	1360			
Simpson's diversity index	0.60	0.52	0.09	0.46	0.77	0.75	0.81	0.84	0.40			

OBSAH – CONTENTS

RECENZENTI – REVIEWERS

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