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Sporadic notes on the land snail (Gastropoda) fauna of the North Bihor Mountains, Romania

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Abstract: During a total of fifteen-day fieldwork in 2007, 2008, 2009, 2010 and 2015 in the North Bihor Mountains, we collected 258 samples of 62 terrestrial and freshwater snail and a bivalve species. *Drobacia banatica*, *Ruthenica filograna*, *Strigillaria vetusta*, *Vitrina pelucida* were found to be relatively frequent. However, *Alopiopsis bielzi*, *Cochlodina marisi*, *Ena montana*, *Merdigera obscura*, *Euomphalia strigella*, *Fruticicola fruticum*, *Laciniaria plicata*, *Orcula jetschini*, *Aspasita triaria* are considered rare.

Keywords: constancy, distribution curves, manual singling, mass sampling, number of individuals, Mollusc fauna

Introduction

The Bihar Mountains (Munții Bihorului) are the most prominent and highest part of the Apuseni Mountains in the Western Romanian Carpathians. That mountain range comprises of the Codru Moma Mountains in the west, the Pădurea Craiului Mountains in the northwest, the Vlădeasa in the northeast, and the Gilău Moun-

tains in the east. Its highest peak is Cucurbăta Mare (1849 m a.s.l.). The northern part mainly consists of karst-forming limestone, whereas the southern part consists of crystalline shales. The two subunits are separated by the Arieș and Crișul Băița Valleys.

The massif is part of Apuseni Natural Park, it is 25 km long from northwest to southeast, and has a width of 14 km. The area is characterized by an extraordinary diversity of karstic formations, such as caves, canyons and gorges. The Padiș–Cetățile Ponorului karstic plateau, with its 54 km² limestone outcrop, is a significant exokarst formation in Europe (Ponta 1998, Ponta & Onac 2018).

The annual rainfall in the Bihor Mountains reaches 1400 mm. The mean annual temperature is 2°C. The average in January is between -5 and -9 °C, and in July ranges between 8 and 16 °C. The Bihor Mountains are the source of the rivers Someșul Cald, Crișul Negru, Crișul Pietros and Arieș.

Although the species diversity is high, the area has not been investigated intensively yet. Data on malacofauna were published in monographs of Csiki (1918), Soós (1943) And Grossu (1981, 1983, 1987), and in some additional papers by various other authors (Mocsáry 1972, Lupu 1966, Varga 1983, Boeters et al. 1989, Bába & Sárkány-Kiss 1999, 2001, Sîrbu & Benedek 2004, Domokos & Vánca 2005, Sîrbu 2006, Vánca 2006, Falniowski et al. 2009, Ferhér et al. 2009, Lengyel & Páll-Gergely 2010, Deli & Domokos 2011, Deli & Subai 2011, Domokos 2013, 2015, 2016, Farkas & Deli 2015, Domokos & Lennert 2016, Domokos et al. 2018).

Material and method

Snail specimens were collected by manual singling (S) and mass sampling (M – 3dm³). At one occasion, flotsam material of ca. 2 litres was collected from the Sighiștel brook. Apart from this, aquatic molluscs were only occasionally collected.

The collected shells were cleaned and dried, and were identified based on their morphology using the following sources: Soós (1943), Grossu (1981, 1983, 1987, 1993), Kerney et al. (1983), Richnovszky & Pintér (1979), Deli & Subai (2011), Nordsieck (2007), Welter-Schultes (2012).

The nomenclature of check list was composed following MolluscaBase (<http://www.molluscabase.org>). Shells are deposited in the private collection of the senior author.

Description of the sampling sites in chronological order

Between 2007 and 2015, 25 sites were sampled in Apuseni Mountains Natural Park:

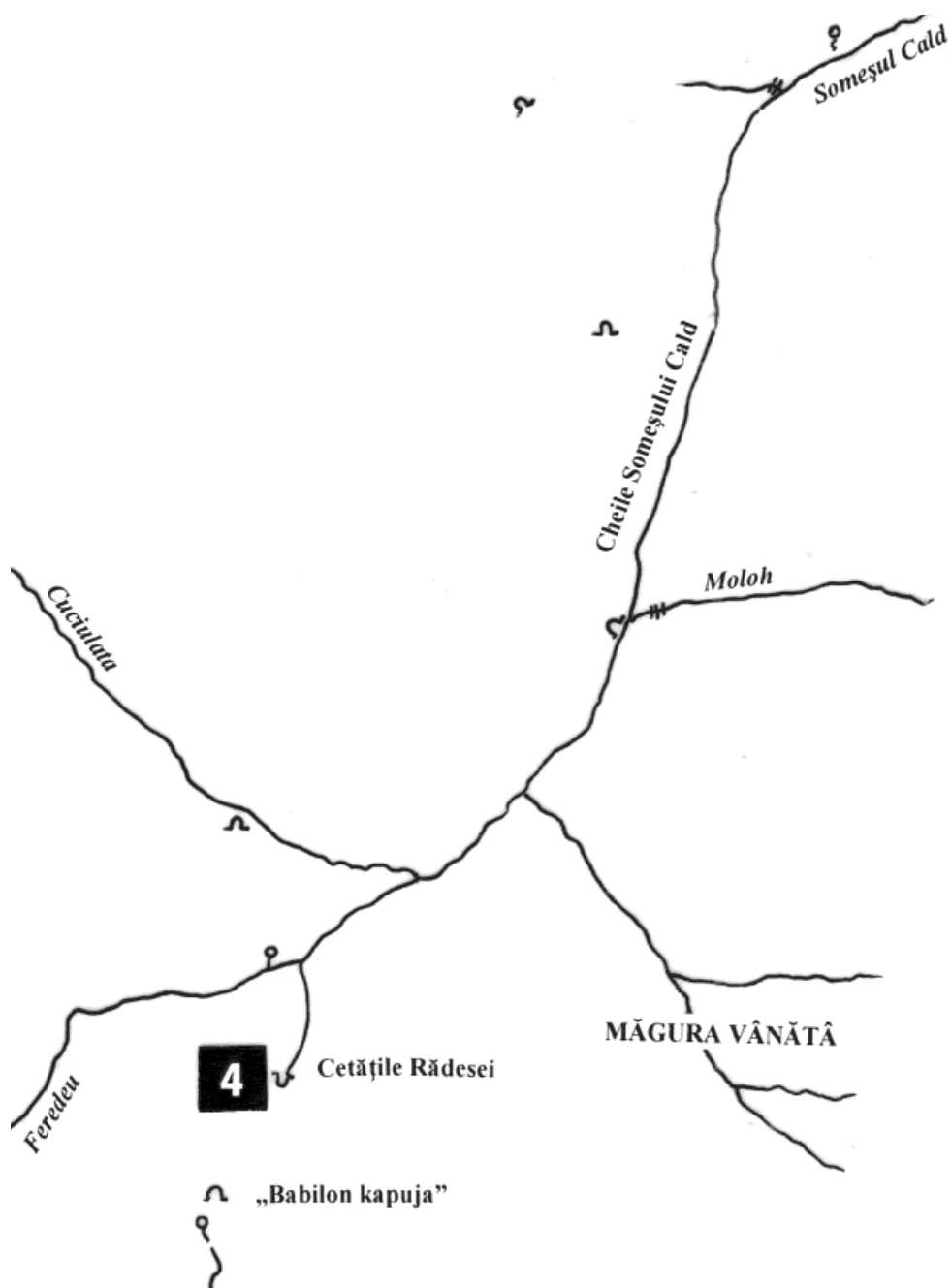


Figure 1. Hydrographic sketch map of sampling sites in the North Bihor Mountains (see text).

1. Alba county, Gârda de Sus, Peștera Ghețarul de la Scărișoara, 1060 m a.s.l., western side of pothole entrance, detric rock covered by moss and forest litter (M), 5. IV. 2007.
2. Bihor county, Pietroasa, Vale Bulz, Left side of the brook, 540 m a.s.l., under bushes (S), 10. VI. 2007.
3. Bihor county, Pietroasa, Cetățile Ponorului, cave near Dolina 3., 1000 m a.s.l., moss and forest litter-covered cliffs facing north and south (M), 11. VI. 2007.
4. Bihor county, Cheile Someșului Cald, „Babilon kapuja”, 1250 m a.s.l., stones facing south, and ground covered by great burdock (S), 12. VI. 2007.
5. Bihor county, Pietroasa, gorge east of Cabana Cetățile Ponorului, 1050 m a.s.l., stones (S), 12. VI. 2007.
6. Bihor county, Pietroasa, Valea Seacă, rock wall west of Cabana Cetățile Ponorului, 1050 m a.s.l., forest litter and moss (S), 13.VI. 2007.
7. Bihor county, Pietroasa, Iz buc Ponor, 1140 m a.s.l., hill-side facing northeast, covered with decaying plant material (S), 13. VI. 2007.
8. Bihor county, Pietroasa, Valea Brădețanului, 0.5 km N of the Iz buc Ponor, 1200 m a.s.l., the left side of the brook, great burdock-covered bank, (S), 13. V. 2007.
9. Bihor county, Sighiștel, Cheile Sighiștelui, around a cave-spring, 380 m a.s.l., rock ledges covered by forest litter and moss (M), 29. IX. 2007.
10. Bihor county, Pasul Vârtop, 1230 m a.s.l., 7 km W of the settlements Arieșeni, dell leading to Groapa Ruginoasa, great burdock near the current (S), 29. IX. 2007.
11. Bihor county, Chișcău, cliff wall near Peștera Urșilor (cave) (S) VII. 2008.
12. Bihor county, Pietroasa, Stațiunea Boga, downhill near Cascada Oșel (S), (leg. Sarkadi, L.) VIII. 2008.
13. Alba county, Gârda de Sus, Valea Ordâncușa, Poarta lui Ionel, ca. 800 m a.s.l., great burdock, moss (S) (leg. Sarkadi L.) X. 2008.
14. Bihor county, Chișcău, near ramp of the Peștera Urșilor (cave), 482 m a.s.l., hillside faces north, covered by rock-vegetation, occasionally with bushes, (M), 9. IV. 2009.
15. Bihor county, Chișcău, rock-glacier leading to the Peștera Urșilor (cave), in the vicinity of the ramp, 470 m a.s.l., (S). 9. IV. 2009.
16. Bihor county, Pietroasa, Valea Bulzului, Piatra Bulzului, 580 m a.s.l., south-exposed rock wall, woody and shady biotope with humid leaves (M), 1. XII. 2009.
17. Bihor county, Pietroasa, Stațiunea Boga, downhill near Peștera Dracului, humid leaf litter, (M), 1. XII. 2009.
18. Alba county, Gârda de Sus, Peștera Ghețarul de la Scărișoara, 1060 m a.s.l., western side of the path leading to the cave, detrital rock covered by moss and forest litter, (M), 25. IV. 2010.

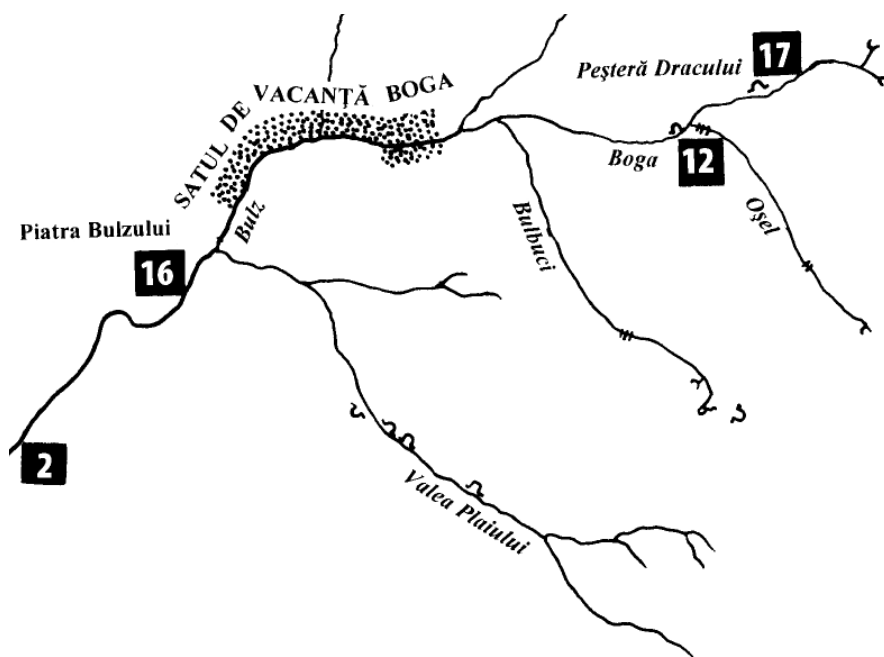


Figure 2. Hydrographic sketch map of sampling sites in the North Bihor Mountains (see text).

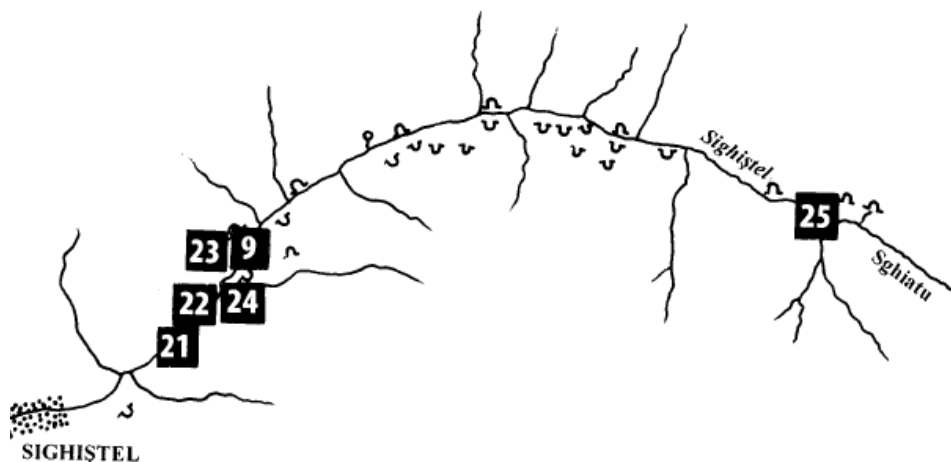


Figure 3. Hydrographic sketch map of sampling sites in the North Bihor Mountains (see text).

19. Bihor county, Chișcău, Giulești, under Dealul Vârsecilor, Valea Seaca after confluence with Țiganul (brook), 800 m a.s.l., base of rock wall, beech forest, humid leaf litter (S), 6. XI, 2010.

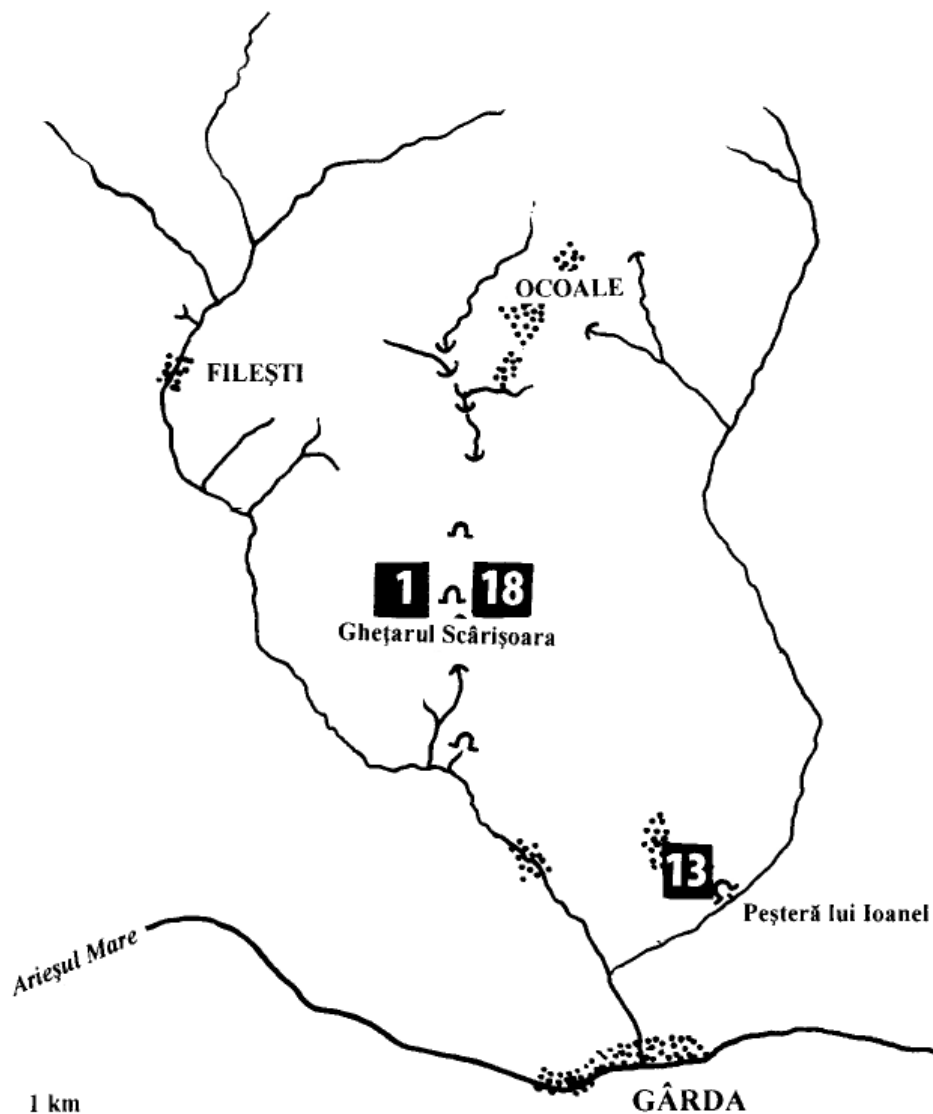


Figure 4. Hydrographic sketch map of sampling sites in the North Bihor Mountains (see text).

20. Bihor county, Chișcău, Giulești, Valea Nucșoara, rock-glacier, 1000 m a.s.l., wet and shady biotope (M), 6. XI. 2010.

21. Bihor county, Sighiștel, Cheile Sighiștelului, banks of the brook at the beginning of the gorge (S), 7. XI. 2010.

22. Bihor county, Sighiștel, Cheile Sighiștelului, flotsam material collected at begin-

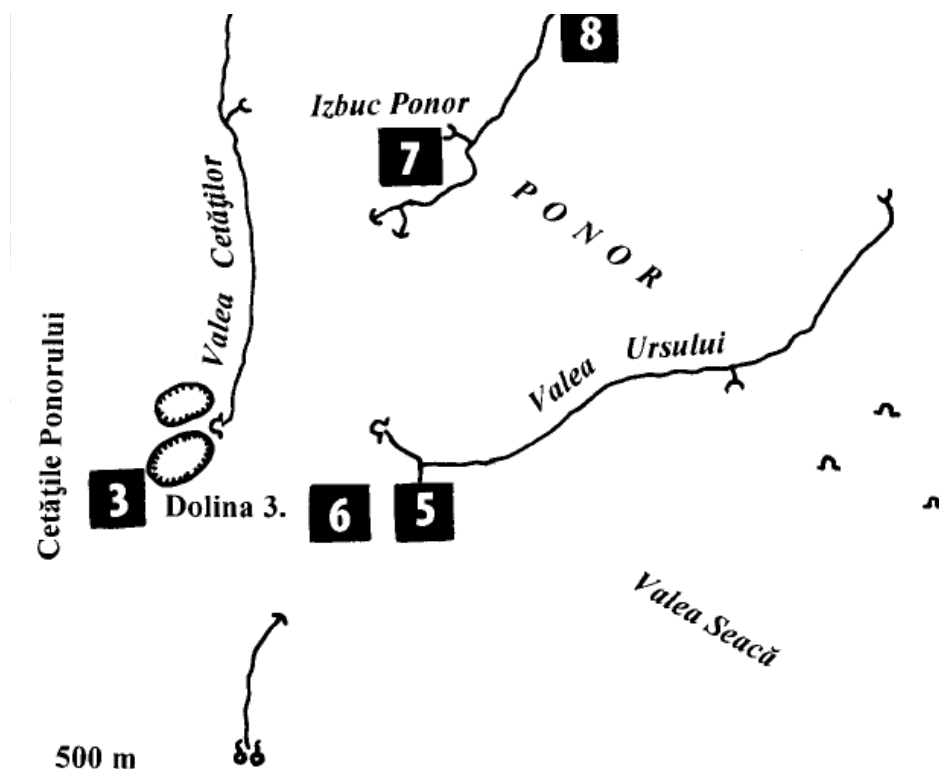


Figure 5. Hydrographic sketch map of sampling sites in the North Bihor Mountains (see text).

ning of gorge, 7. XI. 2010. 10. Quantity of the sample: 2 dm³.

23. Bihor county, Sighiștel, Cheile Sighiștelului, base of southeast-exposed rock wall at beginning of gorge, 380 m a.s.l., beech, hornbeam (M), 7. XI. 2010.

24. Bihor county, Sighiștel, Cheile Sighiștelului, base of northwest-exposed rock wall at beginning of gorge, 380 m a.s.l., beech, hornbeam (M), 7. XI. 2010.

25. Bihor county, Sighiștel, Cheile Sighiștelului, 600 m from end of gorge 600 m a.s.l., great burdock (M) 13. IX. 2015.

Results and discussion

Our investigations resulted in 62 species: 58 terrestrial snails, four freshwater snails and one bivalve. Altogether 258 samples were collected (see checklist and Tables 1./A, 1./B, 2/A, 2/B). Some rare and interesting species were found, such as *Alopi* *bielzi*, *Aspasita triaria*, *Cochlodina marisi*, *Ena montana*, *Merdigera obscura*, *Euomphalia strigella*, *Fruticicola fruticum*, *Laciniaria plicata*, and *Orcula jet-*

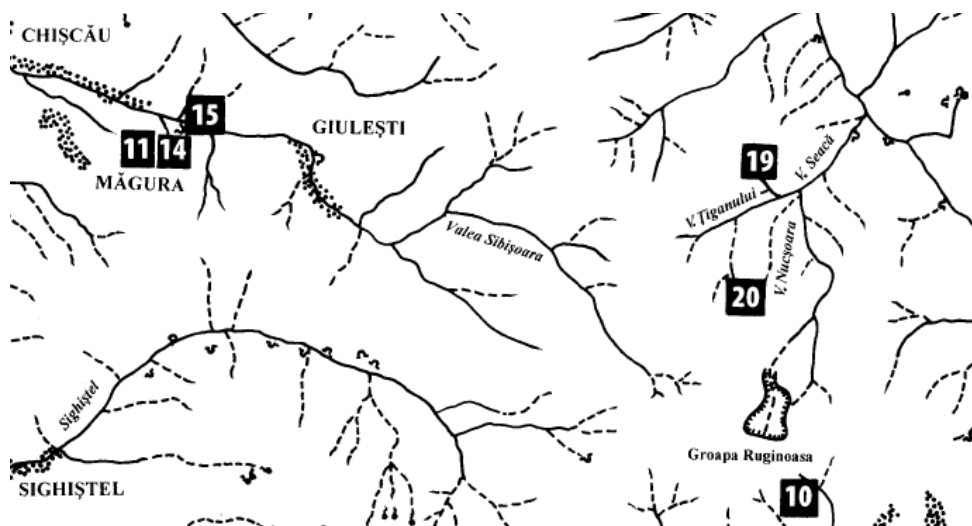


Figure 6. Hydrographic sketch map of sampling sites in the North Bihor Mountains (see text).

schini, *Drobacia banatica*, *Ruthenica filograna*, *Strigillaria vetusta* (Figs. 7–10.), and *Vitrina pellucida* are relatively frequent in the northern Bihor Mts.

Based on the collected specimens it could be stated that the following species are very variable in terms of shell morphology: *Drobacia banatica* (Fig.11.), *Granaria frumentum*, *Ruthenica filograna*, *Strigillaria vetusta* (Lengyel & Páll-Gergely 2010, Domokos 2013, 2016).

Annotated checklist of the molluscs of the Bihor Mountains

CLASS GASTROPODA

SUBCLASS PULMONATA

Aciculidae

Platyla banatica (Rossmässler, 1842)

Platyla microspira (Pini, 1884)

Platyla polita (W. Hartmann, 1840)

All these species are reported by Lengyel & Páll-Gergely (2010).

Of the three species only *P. microspira* was relatively frequent (constancy: 24%, number of collected individuals: 34), collected from Cheile Sighiștelului (380 m a.s.l.) and Peștera Ghețarul de la Scărișoara (1060 m a.s.l.).

Arionidae

Arion circumscriptus G. Johnston, 1828

In absence of living individual anatomical examination is not possible, therefore this species was identified on the basis of morphology and colour.

Camaenidae

Fruticicola fruticum (O. F. Müller, 1774)

Very rarely examined in the region by the present author. This species was collected only from rock-glacier in Valea Nucşoara.

Chondrinidae

Chondrina arcadica clienta (Westerlund, 1883)

Granaria frumentum (Draparnaud, 1801)

Clausiliidae

Alinda biplicata (Montagu, 1803)

It is a relatively rare species (number of collected individuals: five, constancy: 12,5%) here and elsewhere in Romania (Lengyel & Páll-Gergely 2010, Miklós Szekeres, pers. comm.).

Alinda stabilis (Pfeiffer, 1847)

Alopiä bielzii (Pfeiffer, 1849)

An isolated occurrence of the subspecies *Alopiä bielzi tenuis* (E.A. Bielz, 1861) was found on the south-southwestern cliffs of the Piatra Bulzului (Deli & Domokos 2011)

Cochlodina laminata (Montagu, 1803)

Cochlodina marisi (A. Schmidt, 1868)

Laciniaria plicata (Draparnaud, 1801)

Ruthenica filograna (Rossmässler, 1836)

This species is frequent in the Western Carpathian Mountains (Domokos 2015, Domokos & Lennert 2007, 2009, Domokos, Lennert & Márton 2010, Erőss

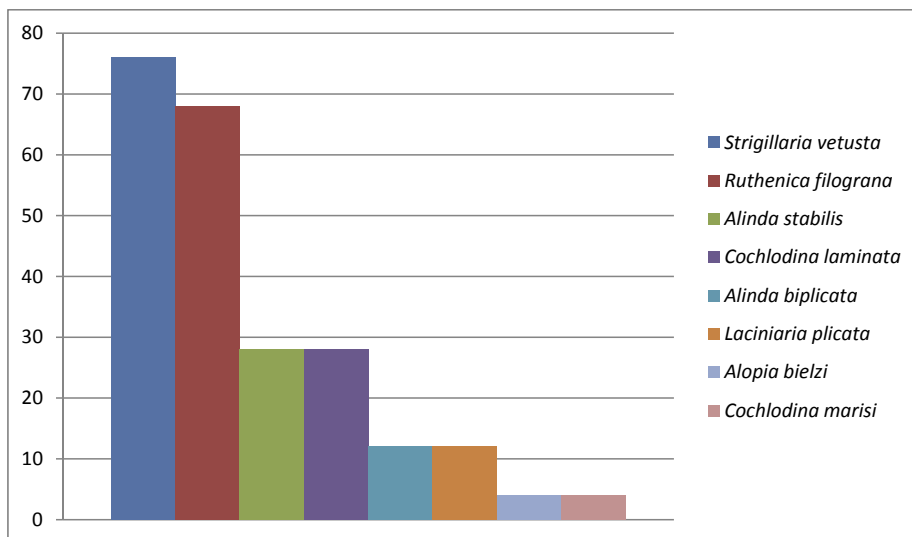


Figure 7. Number of individuals of clausiliid species in the Bihor Mountains.

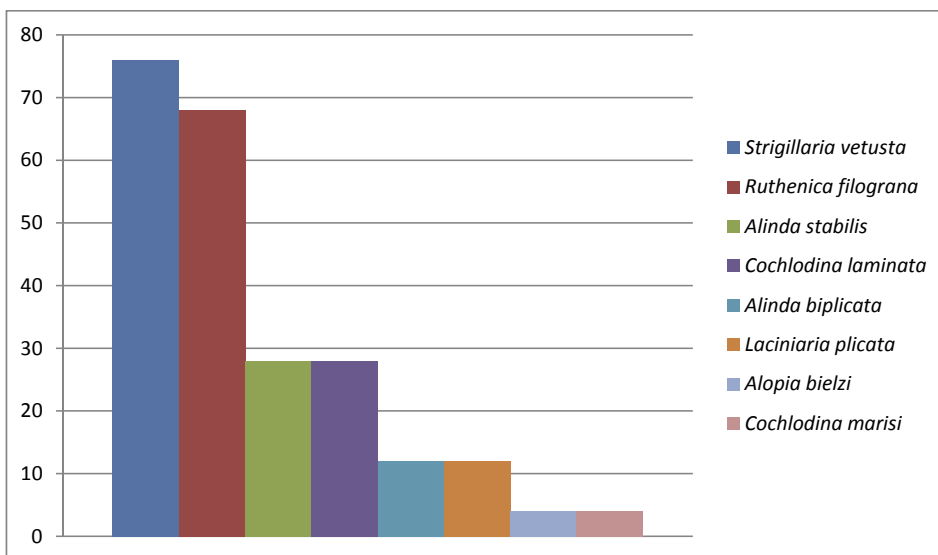


Figure 8. Constancy of clausiliid species in the Bihor Mountains.

2015), and very variable in terms of shell morphology (Domokos & Lennert 2009, Domokos, Lennert & Márton 2010, Lengyel- Páll-Gergely 2010). *Ruthenica filograna* has the highest number of collected individuals (930) and constancy (68%).

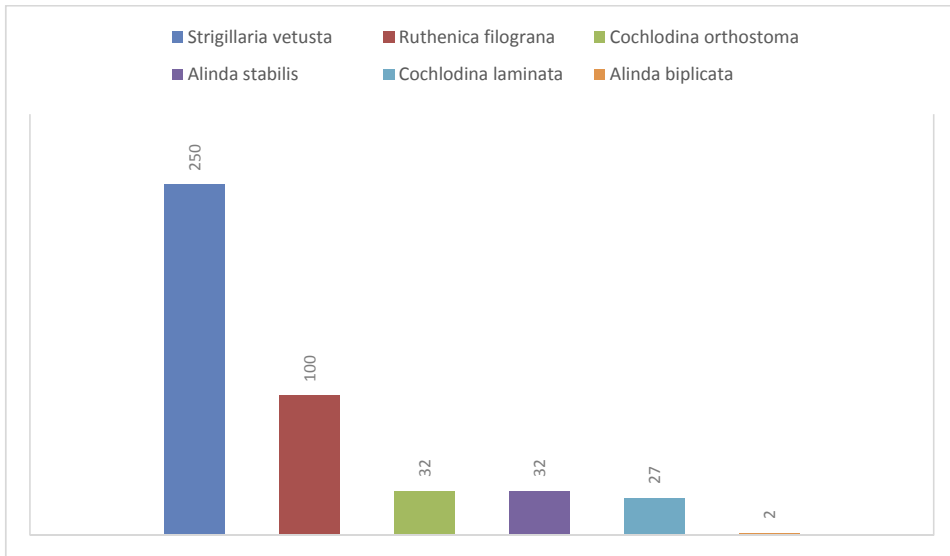


Figure 9. Number of individuals of clausiliid species in the Bihor Mountains (based on Lengyel & Páll-Gergely 2010).

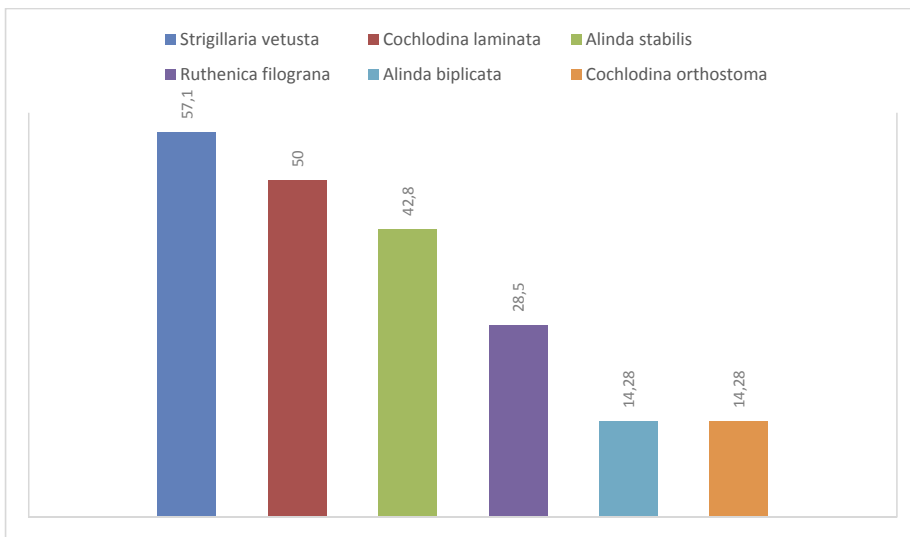


Figure10. Constancy of clausiliid species in the Bihor Mountains (based on Lengyel & Páll-Gergely 2010).

Strigillaria vetusta (Rossmässler, 1836).

A very variable species in terms of shell morphology (Lengyel & Páll-Gergely 2010). Similar to *Ruthenica filigrana*, it was found frequently (number of collected individuals: 376, constancy: 76%, see Figs. 7 and 8).

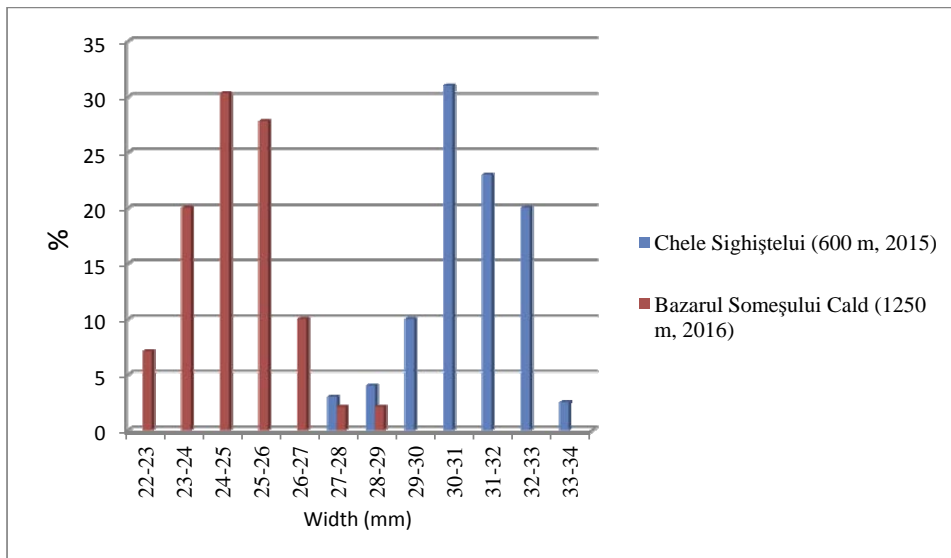


Figure 11. Frequency distribution histograms of width of *Drobacia banatica* in different biotopes (Sampling sites: 4 and 25).

Cochlicopidae

Cochlicopa lubrica (O. F. Müller, 1774)

Cochlicopa lubricella (Porro, 1838)

Ellobiidae

Carychium minimum O.F. Müller, 1774

Carychium tridentatum (Risso, 1826)

Enidae

Ena montana (Draparnaud, 1801)

This species was collected in the Ghețarul Scărișoara over 1000 m a.s.l.

Mastus bielzi (M. Kimakowicz, 1890)

Merdigera obscura (O. F. Müller, 1774)

Gastrodontidae

Zonitoides nitidus (O. F. Müller, 1774)

Helicidae

Caucasotachea vindobonensis (C. Pfeiffer, 1828)

Drobacia banatica (Rossmässler, 1838)

The largest specimen (width: 34.7 mm) was found in a rock-glacier (Nr.16. Chişcău, 09. 04. 2009.). In this sampling site the number of individuals was only five (arithmetic mean 34.2 mm)!

This is a very variable species, illustrated by specimens, which were collected at different elevations (Fig.11). *Drobacia banatica* is generalist and it has a large ecological plasticity and climatic variability. The number of individuals and constancy is illustrative of that (163 and 68%).

Arianta arbustorum (Linnaeus, 1758)

This species is found only in the alpine region of the Bihor Mountains (Cheile Someşului Cald – 1250 m, Vf. Boga –1340 m, Valea Brădetanului – 1200m).

Helix pomatia Linnaeus, 1758

Isognomostoma isognomostomos (Schröter, 1784)

A relatively rare species, its constancy reaches only 40%.

Faustina faustina (Rossmässler, 1835)

Hygromiidae

Euomphalia strigella (Draparnaud, 1801)

Kovacsia kovacsi (Varga & L. Pintér, 1972)

No living individuals were found, therefore the identification was based solely on shell morphology and on the ecology (rock-grassy, rock-shrub and open-wood).

Trochulus hispidus (Linnaeus, 1758)

Limacidae

Limax cinereoniger Wolf, 1803

Table 1/A: Sampling sites and number of species in Bihar Mts.

Species	Sampling sites												
	1	2	3	4	5	6	7	8	9	10	11	12	13
<i>Acanthinula aculeata</i>													
<i>Aegopinella epipedostoma</i>				1		3						3	
<i>Aegopinella pura</i>	12		2					4	1				
<i>Alinda biplicata</i>													
<i>Alinda stabilis</i>						1	3	4				1	3
<i>Alopia bielzi</i>													
<i>Arianta arbustorum</i>				4				5					
<i>Arion circumscriptus</i>			1										
<i>Aspasita triaria</i>	7								4				
<i>Carpathica calophana</i>			2	1				1		1			
<i>Carychium minimum</i>													
<i>Carychium tridentatum</i>	2												
<i>Caucasotachea vindobonensis</i>													
<i>Chondrina arcadica clienta</i>			1						17				
<i>Cochlicopa lubrica</i>													
<i>Cochlicopa lubricella</i>		1											
<i>Cochlodina laminata</i>	1					5	3		4				
<i>Cochlodina marisi</i>													
<i>Columella columella</i>													
<i>Drobacia banatica</i>	16	1		35	2		3	11	7	1		6	
<i>Ena montana</i>	3												
<i>Ena obscura</i>													
<i>Euomphalia strigella</i>									2		1		
<i>Faustina faustina</i>	14		1						9			3	
<i>Fruticicola fruticum</i>													
<i>Granaria frumentum</i>									37				
<i>Helix pomatia</i>			1				1						
<i>Isognomostoma isognomostomos</i>	10		3			1	5	1				2	
<i>Kovacsia kovacsi</i>		2							35				
<i>Laciniaria plicata</i>									2				
<i>Limax cinereoniger</i>			1										

Lymnaeidae

Galba truncatula (O. F. Müller, 1774)*Peregriana labiata* (Rossmässler, 1835)

Table 2/A: Sampling sites and number of species in Bihor Mts. (C = constancy %, Σ = number of individuals)

Species	Sampling sites															Σ	C
	14	15	16	17	18	19	20	21	22	23	24	25					
<i>Acanthinula aculeata</i>	2								2	2	2				8	16	
<i>Aegopinella epipedostoma</i>					5		1					1			14	24	
<i>Aegopinella pura</i>	3			3	29				7		5				66	36	
<i>Alinda biplicata</i>				3		1	1								5	12	
<i>Alinda stabilis</i>					2				1						15	28	
<i>Alopia bielzi</i>			34												34	4	
<i>Arianta arbustorum</i>															9	8	
<i>Arion circumscriptus</i>															1	4	
<i>Aspasita triaria</i>									5						16	12	
<i>Carpathica calophana</i>															5	16	
<i>Carychium minimum</i>	8						3								11	8	
<i>Carychium tridentatum</i>	6			2		10			361						381	20	
<i>Caucasotachea vindobonensis</i>	1									2					3	8	
<i>Chondrina arcadica clienta</i>	34		24	3							85	39			203	28	
<i>Cochlicopa lubrica</i>									12						12	4	
<i>Cochlicopa lubricella</i>	3								2						6	12	
<i>Cochlodina laminata</i>	9						2			4					28	28	
<i>Cochlodina marisi</i>													1		1	4	
<i>Columella columella</i>					9										9	4	
<i>Drobacia banatica</i>		5	2	5	24	1	10		1				33		163	68	
<i>Ena montana</i>															3	4	
<i>Ena obscura</i>	3									1					4	8	
<i>Euomphalia strigella</i>	1														4	12	
<i>Faustina faustina</i>							2			4	6	3			42	32	
<i>Fruticicola fruticum</i>								1							1	4	
<i>Granaria frumentum</i>			2	1							91	49			180	20	
<i>Helix pomatia</i>			1	1		1	1						1		7	28	
<i>Isognomostoma isognomostomos</i>				5	1								1		29	36	
<i>Kovacsia kovacsi</i>	32								5	51	30				155	24	
<i>Laciniaria plicata</i>	3			2											7	12	
<i>Limax cinereoniger</i>															1	4	

Moitessieriidae

Bythiospeum sp.

„All these species were collected from fresh-water sources and mountain rivers in Western Carpathian Mountains and Banat.” (Grossu 1993. p. 297).

We collected one sample only from scum of the Sighiștel brook. According to Sirbu 2006, the following species can be found in the Pișolca and Coliboaia caves of Sighiștel Valley: *B. transsylvanicum* Rotarides, 1943, *B. carpathicum* Soós, 1940 and *P. leruthi* (C. Boettger, 1940).

Orculidae

Orcula jetschini (M. Kimakowicz, 1883)

Sphyradium doliolum (Bruguière, 1792)

Oxychilidae

Aegopinella epipedostoma (Fagot, 1879)

Welter-Schultes (2012) does not report this species from Romania, but Lengyel & Páll-Gergely (2010) listed it from the Bihor Mountains and published a drawing of its reproductive anatomy.

Aegopinella pura (Alder, 1830).

Carpathica calophana (Westerlund, 1881)

Morlina glabra (Rossmässler, 1838)

Oxychilus depressus (Sterki, 1880)

Oxychilus montivagus (M. Kimakowicz, 1890)

Planorbidae

Ancylus fluviatilis O.F. Müller, 1774

Punctidae

Punctum pygmaeum (Draparnaud, 1801)

Pupillidae

Pupilla muscorum (Linnaeus, 1758)

Pyramidulidae

Pyramidula rupestris (Draparnaud, 1801)

Spelaeodiscidae

Aspasita triaria (Rossmässler, 1839)

Collected only in Cheile Sighiștelui and Ghețarul Scărișoara.

Truncatellinidae

Truncatellina cylindrica (Férussac, 1807)

Valloniidae

Acanthinula aculeata (O. F. Müller, 1774)

Vallonia costata (O. F. Müller, 1774)

Vallonia pulchella (O. F. Müller, 1774)

Vertiginidae

Columella columella (G von Martens, 1830)

„Widespread in all the Carpathians, especially in the alpine zones, but also frequent in alluvia and löes” (Grossu 1993). This species became extinct in Pleistocene in Hungary (Fűkőh et al. 1995).

Vitrinidae

Vitrina pellucida (O. F. Müller, 1774)

Zonitidae

Vitrea diaphana (S. Studer, 1820)

Vitrea contracta (Westerlund, 1871)

Vitrea crystallina (O. F. Müller, 1774)

Vitrea jetschini (M. Kimakowicz, 1890)

Vitrea subrimata (Reinhardt, 1871)

Vitrea szekeresi Deli & Subai 2011

The distribution of this species reaches its northern limit in the Bihor Mountains (Deli & Subai 2011).

CLASS BIVALVIA

SUBCLASS HETERODONTA

Sphaeriidae

Pisidium sp.

Only a single valve was collected from the flotsam of the Sighiștel brook.

Acknowledgements

This contribution is dedicated to the memory of Prof. Ioan Bușiția (1874–1953) from the high school of Beiuș, who dedicated all his active life to nature protection from the Apuseni Mountains. Prof. Bușiția noted on September 9 1931, in his touring guide-book of Apuseni Mountains [written by Czárán Gyula (1847-1906)]:

“and I wish from all my heart that the love for Nature brings many Hungarian tourists to us, so that we may delight in the beauty of our glades in brotherhood and good understanding, and practice tourism for the pleasure of our hearts and bodies”.

“și îmi doresc din toată inima, ca iubirea Naturii să aducă mulți turiști maghiari între noi, ca să putem să ne încântăm frumusețea poienilor noastre în fraternitate și în bună înțelegere, să practicăm turismul pentru plăcerea inimilor și a trupurilor noastre.”

“s óhajtom teljes szívemből, hogy a Természet iránti szeretet sok magyar turistát hozzon közibünk akikkel együtt gyönyörködhessünk havasaink szépségében, testvéri szeretettel, jó egyetértésben gyakoroljuk a turistaságot, szívünk gyönyörködtetésére s testeink edzésére.”

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