

Mollusks Fauna (Mollusca: Gastropoda: Bivalvia) of Mountain Osogovo

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Abstract: The articles present the results of two year research on mollusks of Osogovo mountain range, both in its Bulgarian and FYRMacedonian parts. According to both, the literature and the original data, 61 mollusks species were found, one of them (*Vestia roschitzi neubertiana* DEDOV, 2010) is endemic for the mountain, 16 are Balkan Peninsula endemic species and one is a rare species.

Key words: Osogovo Mountain, mollusks fauna, distribution, Bulgaria, FYRMacedonia

Introduction

Osogovo Mountains occupies the part of the border region between Bulgaria and FYRMacedonia with maximum elevation 2252 m (Ruen peak). About 70% of its area (1770 m²) is placed in Macedonia, the rest (30%) in Bulgaria. There are 3 main vegetation zones – sub-mountain zone (up to 1000 m, dominant species *Quercus*); mountain zone (1000-1800, dominant species *Fagus*) and sub-alpine zone (up to 1800 m, dominant – grass species) DINCHEV, ATANASOV (1998). Coniferous zone almost lacks because of deforestation and mine industry. To date there are 25 gastropod species reported for the range of Mountain Osogovo (MOUSSON 1859, JURINIĆ 1906, WOHLBEREDT 1911, WAGNER 1934, KNIPPER 1939, URBANSKI 1960A, B, 1977, OSHANOVA 1972, PINTER 1972, NORDSIECK 1974, DAMJANOV, LIKHAREV 1975, WIKTOR 1983). In the course of same study DEDOV (2010) reported six new clausiliid species of the mountain, one of which (*V. roschitzi neubertiana*) – a new subspecies to science and the only known endemic taxon of Mountain Osogovo.

Material and Methods

The materials were collected by the authors in the localities presented in Table 1. Hand-collecting and soil-sifting methods were used. The gastropods were preserved in 70% ethanol or kept as shells. The morphological and anatomical examinations were carried out with a stereo-microscope.

Results and Discussion

The present study adds 30 new species for the mountains, 12 species new for the Macedonian part and 2 new for the Bulgarian part of the mountains. With current publications 61 mollusks species are known for Mountains Osogovo, while 8 species, reported in previous publications, were not found (*O. hydatinus*, *V. neglecta*, *L. conemenosi*, *L. brunneri*, *L. marginata*, *L. nyctelia*, *B. fruticum*, *L. girva*) (Table 2). The species *V. diaphana* is new and for Macedonian malacofauna, while *A. armata* is new for Bulgarian one.

The zoogeographic profile of Osogovo Mountains shows balance between Mediterranean (29 species) and Euro-Siberian complex (31 species).

The species with high importance for biodiversity are: one Bulgarian endemic subspecies (*V. roschitzi neubertiana*), 16 Balkan Peninsula endemics and one rare species for the mountains (*B. vetusta*) (Table 2). In Macedonian part there are no local endemic species, probably because of lack of large limestone areas. In small carbonate spots near Kochani town occur only common limestone inhabitants as *Monacha* cf. *cartusiana*, *X. obvia*, *Z. detrita*.

Main part of the gastropod biodiversity is concentrated in deciduous forest, especially in mountain zone – beech forests (16 species were found only in such forests and 4 species mainly in beech forest), other 5 occurs sub-mountain zone – oak forest, and one species – mixed forests (deciduous and coniferous trees) and ecotone zones. Seven species occur in open terrains – limestone meadows, meadows and ruderal habitats. The rest of the species can be found in habitats connected to with water – rivers' bank, reeds and ponds (Table 3).

Balkan endemic species *A. biplicata michaudi-ana*, *B. serbica*, *C. haberhaueri*, *T. kusceri*, *T. serbica*, *V. ranojevici* and *V. bulgarica*, as well as the locally rare *B. vetusta* can be found predominantly in *Fagus* forests.

Osogovo Mountains is the eastern margin of distribution of *B. serbica* and only known locality of the species for Bulgaria (DAMYANOV & LIKHAREV, 1975). One Balkan endemic species *D. turcicum* was

found in oak but probably it occurs in beech forests, as in other areas of its distribution. Balkan endemic *L. graecus* was found in an open habitat – meadow.

According to the present study, three types of habitats/landscapes are most important for the biodiversity of gastropods in Osogovo Mountains: (1) *Fagus* forests, because of their species richness, (2) river valleys as territories with diverse micro habitats and high humidity and (3) limestones, as most proper habitat for mollusks (localities 4 and 5). Particular for Bulgaria following habitats are important: 1) *Fagus* forests up to 1300 m a.s.l., because of only known locality of *B. serbica* in Bulgaria and eastern distribution boundaries for the species; 2) Limestone areas nearby vill. Stradalovo, because its high biodiversity for the mountains. In the present study 23 (44%) were found in limestone areas around vill. Stradalovo and for 10 (23%) it is only locality in the mountains. For Macedonia: 1) *Fagus* forests, up to Kriva Palanka as only known locality for the country of the species *V. diaphana* and potential habitat for *V. ranojevici*; 2) Durachka river valley, as only known locality of the rare species *B. vetusta* on the Mountains Osogovo.

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Table 1. Osogovo Mountains, Localities.

Code	Localities	Altitude	Date	Leg.
Bulgaria, Kyustendil district				
BG-1	vill. Slokoshitsa, near Novoselska river, ruderal terrain	571 m	20-21 V 2008	I. Dedov
BG-2	vill. Zgurovo, before village, meadows, on grass	562 m	19 V 2008	I. Dedov
BG-3	betw. vill. Stradalovo and vill. Rakovo, silicates rocks, ecotone with deciduous forest	729 m	19 V 2008	I. Dedov
BG-4	vill. Stradalovo, area of Lisitcha Dupka cave and adyective area, limestone rocks	750 m	10 VIII 1994 19 V 2008 05-06 IX 2008	P. Stoev, I. Dedov
BG-5	vill. Stradalovo, deciduous forest on limestone base	750-760 m	19 V 2008 05-06 IX 2008	I. Dedov
BG-6	vill. Rakovo, in village, ruderal terrain near house	786 m	19 V 2008	I. Dedov
BG-7	vill. Gyueshevo, open terrain, near customs, under stones	1100 m	VII 1996	I. Dedov
BG-8	vill. Garlyano, <i>Fagus</i> , in leaf-litter	1200 m	05-06 IX 2008	I. Dedov
BG-9	hut Studen Kladenets, ruderal terrain ner hut	1349 m	20 V 2008	I. Dedov
BG-10	hut Profilaktorium, <i>Fagus</i> , near hut, among leaf litter, in logs	1530-1545 m	20 V 2008, VII 2008	I. Dedov
BG-11	road Kyustendil - Osogovo hut, <i>Fagus</i> , in logs, under leaf litter	1592 m	20 V 2008	I. Dedov
FYRMacedonia, Kriva Palanka district				
MK-1	Durachka river, <i>Fagus</i>	750 m	13 V 2007	T. Mitev
MK-2	vill. Stantsi, ruderal terrain, bushes, trees	1100 m	13 V 2007	T. Mitev
MK-3	vill. Stantsi, <i>Fagus</i>	1200 m	13 V 2007	T. Mitev
MK-4	area of hut Lovachka Kukya, <i>Fagus</i> , near log	1400 m	13 VII 2008	I. Dedov
MK-5	up to 'Slave' area, <i>Fagus</i> , near log	1460 m	12 VII 2008	I. Dedov
MK-6	up to guard-house 'Sokol', ground stony area below Ruen	2100m a.s.l.	11 VII 2008	S.Hristovski
FYRMacedonia, Makedonska Kamenitsa district				
MK-7	Kamenishka river, flooded zone and ecotone with deciduous forest	700-750 m	02 V 2008	I. Dedov
MK-8	mine Sasa distr., <i>Quercus</i>	1020m	02 V 2008	I. Dedov
FYRMacedonia, Kochani district				
MK-9	vill. Sokolartsi, up to villagr, between two streams	365-500 m	02 V 2008	I. Dedov
MK-10	Bavchaluk area, near Kochanska river	390-490 m	14 VII 2007	I. Dedov
MK-11	up to Kochani, near dung-hill, limestone meadow	550 m	14 V 2007	I. Dedov
MK-12	vill. Yastrebnik, up Orlak area, <i>Quercus</i>	1000-1050 m	15 VII 2007	I. Dedov
MK-13	vill. Yastrebnik, Churlyak area, <i>Carpins</i>	1000-1300 m	15 VII 2007	I. Dedov
MK-14	road Ponikva area – Ratkova skala, Visoka Chuka ridge, <i>Fagus</i>	1350-1450 m	12 VII 2007	I. Dedov
MK-15	road Ponikva area – Kormina, mixed forest	1515 m	13 VII 2007	I. Dedov
MK-16	Visoka Chuka ridges, near meadows, pond near Aramiiska Cheshma	1560 m	12 VII 2007	I. Dedov

Table 1. Continued.

Code	Localities	Altitude	Date	Leg.
MK-17	Ponikva area, <i>Fagus</i>	1600 m	11 VII 2007	I. Dedov, T. Mitev, S. Hristovski
MK-18	Ponikva area, near old barrack, mountain meadows	1600 m	15 VII 2007	I. Dedov
FRYMacedonia, Probishtip district				
MK-19	vill. Zletovo, near stream (=Yamichka river), slope below <i>Carpinus</i> , ecotone	700 m	03 V 2008	I. Dedov
MK-20	vill. Kundino, Kundinsko marsh, reed	773 m	03 V 2008	I. Dedov
FYRMacedonia, Kratovo district				
MK-21	near Kratovo distr., conglomerate rocks, open terrain	890-900 m	04 V 2008	I. Dedov
MK-22	vill. Emiritsa, near Emirichka river	900 m	03 V 2008	I. Dedov, T. Mitev
MK-23	vill. Yamishte, near village	1050 m	03 V 2008	I. Dedov
FYRMacedonia, unknown district				
MK-24	Vrantsi, Vranski rid	730 m	?	?
MK-25	Krustets hill, <i>Quercus</i>	800m	22 IV 2007	?
MK-26	unknown, <i>Fagus</i>	?	?	?

Table 2. Contribution to the Mollusks fauna of the Mountains Osogovo and zoogeographic categories of the species. Abbreviation: ¹ – new records for the mountains; ² – new sp. for Macedonian part only; ³ – new sp. for Bulgarian part only. Zoogeography: Mediterranean complex: BGE – Bulgarian endemic, BLE – Balkan endemic, PMD – Ponto-Mediterranean (East-Mediterranean), HMD – Holo-Mediterranean (Circum-Mediterranean), LMD – Lato-Mediterranean (Sub-Mediterranean); Euro-Siberian complex: EU – European, PL – Palaeartic, HL – Holarctic.

№	Species	MK original data	MK literature	BG original data	BG literature	Zoogeography	loc. No
1	<i>Acanthinula aculeata</i> (Müller 1774) ¹	-	-	+	-	PL	BG-5
2	<i>Aegopinella minor</i> (Stabile 1864) ¹	+	-	+	-	EU	BG-10, MK-8, MK-26
3	<i>Agardhiella armata</i> (Clessin 1887) ¹	-	-	+	-	BLE	BG-5
4	<i>Alinda biplicata michaudiana</i> (L. Pfeiffer 1848)	-	+	-	+	BLE	BG-3, BG-8, MK-11, MK-14, MK-17, MK-22, MK-4, MK-5
5	<i>Alinda serbica serbica</i> (Müllendorf 1873) ²	+	-	+	+	BLE	BG-10, BG-11, MK-14, MK-17
6	<i>Arion silvaticus</i> Lohmander 1937 ²	+	-	+	+	EU	BG-11, MK-4
7	<i>Arion subfuscus</i> (Draparnaud 1805) ²	+	-	-	+	EU	MK-1, MK-8, MK-14
8	<i>Bradybaena fruticum</i> (Müller 1774)	-	-	-	+	EU	literature
9	<i>Bulgarica vetusta</i> (Rossmässler 1836)	+	+	-	-	LMD	MK-1
10	<i>Carychium minimum</i> (Müller 1774) ¹	-	-	+	-	EU	BG-5
11	<i>Cattania haberhaueri</i> (Sturany 1897) ³	+	+	+	-	BLE	BG-3, BG-8, MK-2, MK-6, MK-14, MK-15, MK-17, MK-22

Table 2. Continued.

№	Species	MK original data	MK literature	BG original data	BG literature	Zoogeography	loc. No
12	<i>Carpathica stussineri</i> (Wagner 1895) ¹	+	-	-	-	LMD	MK-15
13	<i>Cepaea vindobonensis</i> (Ferussac 1821)	-	-	+	+	EU	BG-2, BG-5
14	<i>Chondrina clienta</i> (Westerlund 1883) ¹	-	-	+	-	EU	BG-4, BG-5
15	<i>Chondrula tridens</i> (Müller 1774) ¹	+	-	-	-	PMD	MK-11
16	<i>Cochlodina laminata</i> (Montagu 1803)	+	+	+	+	EU	BG-8, MK-4, MK-8, MK-14, MK-17, MK-19
17	<i>Daudebardia brevipes</i> (Draparnaud 1805) ¹	+	-	-	-	EU	MK-12
18	<i>Daudebardia rufa</i> (Draparnaud 1805) ¹	-	-	+	-	EU	BG-5
19	<i>Deroceras reticulatum</i> (Müller 1774) ¹	+	-	-	-	EU	MK-1, MK-2
20	<i>Deroceras sturanyi</i> (Simroth 1894) ²	+	-	-	+	EU	MK-7
21	<i>Deroceras turcicum</i> (Simroth 1886) ²	+	-	+	+	LMD	BG-9, BG-10, MK-20, MK-25
22	<i>Euconulus fulvus</i> (Müller 1774) ¹	+	-	-	-	HL	MK-8
23	<i>Euomphalia strigella</i> (Draparnaud 1801) ¹	+	-	+	-	EU	BG-6, MK-14, MK-18
24	<i>Helix lucorum</i> Linnaeus 1758 ²	+	-	+	+	LMD	BG-1, MK-11, MK-21
25	<i>Helix pomatia</i> Linnaeus 1758 ¹	+	-	+	-	EU	BG-3, BG-5, BG-7, BG-10, MK-8, MK-15, MK-19, MK-22, MK-23
26	<i>Laciniaria plicata</i> (Draparnaud 1801)	+	+	+	+	EU	BG-1, BG-3, BG-5, MK-1, MK-19, MK-22
27	<i>Lehmannia brunneri</i> (Wagner 1931)	-	-	-	+	BLE	literature
28	<i>Lehmania marginata</i> (Müller 1774)	-	-	-	+	EU	literature
29	<i>Lehmannia nyctelia</i> (Bourguignat 1861)	-	-	-	+	EU	literature
30	<i>Limax cinereoniger</i> Wolf 1803 ²	+	-	+	+	EU	BG-10, MK-8
31	<i>Limax conemenosi</i> Boettger 1882	-	-	-	+	BLE	literature
32	<i>Limax graecus</i> Simroth 1889 ¹	+	-	-	-	BLE	MK-9
33	<i>Limax maximus</i> Linnaeus 1758 ²	+	-	+	+	EU	BG-5, MK-13, MK-14, MK-19
34	<i>Lindholmiola girva</i> (Frivaldszky 1835)	-	-	-	+	BLE	literature
35	<i>Macedonica marginata</i> (Rossmässler 1835)	-	-	+	+	BLE	BG-4, BG-5
36	<i>Merdigera obscura</i> (Müller 1774) ¹	+	-	+	-	EU	BG-5, BG-8, MK-26
37	<i>Monacha</i> cf. <i>cartusiana</i> (Müller 1774) ² complex	+	-	+	+	LMD	BG-5, BG-7, MK-11, MK-20, MK-21, MK-24

Table 2. Continued.

№	Species	MK original data	MK literature	BG original data	BG literature	Zoogeography	loc. No
38	<i>Oxychilus hydatinus</i> (Rossmässler 1838)	-	-	-	+	HMD	literature
39	<i>Oxychilus glaber striarius</i> (Westerlund 1881) ¹	+	-	+	-	BLE	BG-5, BG-8, MK-2, MK-8, MK-15, MK-19, MK-21, MK-22
40	<i>Oxyloma elegans</i> (Risso 1826) ¹	+	-	-	-	PL	MK-10
41	<i>Perforatella incarnata</i> (Müller 1774) ¹	+	-	+	-	EU	BG-9, BG-10, MK-1
42	<i>Planorbis planorbis</i> (Linnaeus 1758) ¹	+	-	-	-	HL	MK-20
43	<i>Platyla polita</i> (Reinhardt 1880) ¹	-	-	+	-	BLE	BG-5
44	<i>Pseudamnicola</i> sp. (cf.) ¹	-	-	+	-	--	BG-5
45	<i>Punctum pygmaeum</i> (Draparnaud 1801) ¹	-	-	+	-	EU	BG-5
46	<i>Radix peregra</i> (Müller 1774) ¹	+	-	-	-	PL	MK-16
47	<i>Sphaerium</i> cf. <i>corneum</i> (Linnaeus 1758) ¹	-	-	+	-	PL	BG-5
48	<i>Tandonia budapestensis</i> (Hazay 1881)	-	-	+	+	EU	BG-8, BG-19
49	<i>Tandonia cristata</i> (Kaleniczenko 1851) ²	+	-	-	+	PMD	MK-14
50	<i>Tandonia kusceri</i> (Wagner 1931) ²	+	-	+	+	BLE	BG-5, MK-1, MK-2, MK-3, MK-14
51	<i>Tandonia serbica</i> (Wagner 1931) ¹	+	-	+	-	BLE	BG-5, MK-8, MK-7, MK-22
52	<i>Tuncatellina claustralis</i> (Gredler 1856) ¹	-	-	+	-	LMD	BG-5
53	<i>Truncatellina cylindrica</i> (Ferussac 1807) ¹	-	-	+	-	HMD	BG-5
54	<i>Xerolenta obvia</i> (Menke 1828) ¹	+	-	+	-	LMD	BG-1, BG-2, MK-11
55	<i>Vestia ranojevici</i> (Pavlovic 1912) ³	-	+	+	-	BLE	BG-3, BG-8
56	<i>Vestia roshitzki neubertiana</i> Dedov 2010	-	-	+	+	BGE	BG-8
57	<i>Vitrea bulgarica</i> Damjanov, Pinter 1969	+	+	+	+	BLE	BG-5, BG-10, MK-17
58	<i>Vitrea diaphana</i> (Studer 1820) ¹	+	-	-	-	EU	MK-5
59	<i>Vitrea neglecta</i> Damjanov, Pinter 1969	-	-	-	+	BLE	literature
60	<i>Zebrina detrita</i> (Müller 1774) ²	+	-	+	+	PMD	BG-5, MK-11, MK-21
61	<i>Zonitoides nitidus</i> (Müller 1774) ¹	+	-	-	-	HL	MK-7, MK-10
	Total number of species - 61	36	7	37	28		‘ - 1 Euro-Siberian complex (31) EU – 24, PL – 4, HL – 3 Mediterranean complex (29) BGE – 1, BLE – 16, PMD – 3, HMD – 2, LMD – 7

Table 3. Ecological preferences of the Mollusks fauna of the Osogovo Mountains.
 Abbreviations: C – *Carpinus*, DCLB – deciduous forest on limestone base, F – *Fagus*, MF – Mixed forest, Q – *Quercus*, ECT – ecotone, LM – limestone meadows, MD – other meadows, LR – limestone rocks, RD – ruderal terrains, RE – reed, RB – river banks, P – ponds; WR – water related.

Region	Locality code	Habitat type	Altitude (m a.s.l.)	Main habitat		Altitude range												
						750-760	1020-1545	750-760	550-1600	1400-1545	750-1450	1350-1600	?	750				
Kyustendil	BG-1	Ruderal	571															
	BG-2	Meadows	562															
	BG-3	Rocks	729															
	BG-4	Limst. rocks	750															
	BG-5	Decid./limestone	750-760															
	BG-6	Ruderal	786															
	BG-7	Meadows	1100															
	BG-8	<i>Fagus</i>	1200															
	BG-9	Ruderal	1349															
	BG-10	<i>Fagus</i>	1530-1545															
	BG-11	<i>Fagus</i>	1592															
	BG-lit	?	?															
	Kriva Palanka	MK-1	<i>Fagus</i>	750														
MK-2		Ruderal	1100															
MK-3		<i>Fagus</i>	1200															
MK-4		<i>Fagus</i>	1400															
MK-5		<i>Fagus</i>	1460															
MK-6		Rocks	2100															
MK-lit		? <i>Fagus</i>	1560															
MK-7		Ecotone	700-750															
MK-8		<i>Quercus</i>	1020															
MK-9		Meadow	365-500															
M. Kamenitsa	MK-10	Riv. bank	390-490															
	MK-11	Limst. meadow	550															
	MK-12	<i>Quercus</i>	1000-1050															
	MK-13	<i>Carpinus</i>	1000-1300															
	MK-14	<i>Fagus</i>	1350-1450															
	MK-15	Mixed f.	1515															
	MK-16	Ponds	1560															
	MK-17	<i>Fagus</i>	1600															
	MK-18	Meadow	1600															
	Kochani	MK-19	<i>Carpinus</i>	700														
MK-20		Reed	773															
Pro-bishtip		MK-21	Meadow	890-900														
		MK-22	<i>Fagus</i>	900														
		MK-23	Meadow [?]	1050														
Kra-tovo		MK-24	?	730														
		MK-25	<i>Quercus</i>	800														
		MK-26	<i>Fagus</i>	?														
Un-known																		

