

INVESTIGATIONS ON TERRESTRIAL SNAILS FROM THE
UNIVERSITY BOTANICAL GARDEN OF BALCHIK DURING
STUDENT VOLUNTEER ACTIVITIES

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Abstract: The present research continues the investigations on the terrestrial gastropods diversity in the Sofia University Botanical Garden in Balchik and was made during the annual volunteer activities in the area. As a result of the current work 22 species of terrestrial snails were found, 7 of which were present in the previous researches, with the most common species being *Mentissella rebeli*, *Helix lucorum*, and *Pomatias elegans*. In comparison with the study from 2016, 15 new research locations were added and 15 new species were identified for the area. We investigated a variety of habitats in the garden's territory, characterized by different vegetation and gardening regimes. The material was gathered by hand and from collected soil probes. No snails were found in parts of the garden that were exposed to a variety of gardening practices, including pesticide treatment. The University botanical garden in Balchik holds a significant biodiversity, due to its geographical position and diverse vegetation and also plays an important educational function for the biology students. This theory is confirmed also by the present research, which should be used to encourage such scientific and educational activities in the future.

INTRODUCTION

Although terrestrial gastropods are being studied intensively in Bulgaria (Dedov, 1998), there are many places for which no information for the species diversity is available. Such place is the University Botanical Garden in Balchik. It is suitable for volunteers' research and education due to the abundance of animal and plant species and the availability for students (Cohn, 2008). The diverse

vegetation and relief offer good conditions for a variety of invertebrates. The present study investigates the terrestrial gastropods for a second year in a row (Paunova *et al.*, 2017) and is conducted by students of Faculty of biology under mentor's supervision, during volunteer activities, organized in partnership with Balkan ecological center.

MATERIALS AND METHOD

Soil probes and gathered by hand material (for the larger species) were collected from 12 different types of habitats, situated in 15 locations (Figure 1) in the middle of August. Some of these locations have more than one habitat. Later the collected material was identified in a laboratory, using MBS-9 stereomicroscope optics, and identification keys (Damjanov & Likharev 1975; Welter-Schultes, 2012).



Fig. 1. Map of the researched area with the locations of the research (marked with yellow stars and numbers), and locations from previous researches - from 2013 (marked with purple dots) and 2016 (marked with red triangles).

During the gathering the following parameters were marked: date, sea level, vegetation, temperature and soil type. Material was also collected from cracks, tree stems, under rocks and other locations, differently exposed to sunlight and respectively with different humidity levels. The gastropods were collected between 10:19 and 13:14 (hh:mm). The elevation span was 30 meters, and the temperature varied between 28°C and 31°C. The lowest humidity level was 38% and the highest – 47%.

RESULTS AND DISCUSSION

As a result of the current work 22 species of terrestrial snails were found. Their distribution at the 15 locations (marked with a yellow star with the corresponding location code on Figure 1) is shown at Table 1.

Table 1. Presence of the observed gastropod species for each of the 15 researched locations in the botanical garden (corresponding to the location codes marked on the map of the researched area), and numbers followed by a letter correspond to a different habitat at the location.

Species	Location codes																			
	1	2	3	4	5	6	7	8	9A	9B	9C	10A	10B	10C	11	12	13	14	15	
<i>Pomatias elegans</i> Clessin, 1879	+	+		+	+	+	+	+				+								
<i>Truncatellina cylindrica</i> (Férussac, 1807)																				
<i>Vallonia costata</i> (Müller, 1774)	+	+									+									
<i>Vallonia puchella</i> (Müller, 1774)			+	+																
<i>Vallonia enniensis</i> (Gredler, 1856)																				
<i>Vallonia excentrica</i> Sterki, 1893																				
<i>Ena obscura</i> (O.F. Müller, 1774)				+																
<i>Zebrina kindermanni</i> (L. Pfeiffer, 1853)	+																			
<i>Chondrula tridens</i> (Müller, 1774)	+			+																
<i>Mastus</i> sp. Beck, 1837																				
<i>Menissella rebeli</i> (Sturany, 1897)				+	+	+	+	+	+	+										
<i>Cecilioides acicula</i> (Müller, 1774)																				
<i>Virrina pellicuda</i> (O. F. Müller, 1774)			+																	
<i>Vitrea</i> sp. Fitzinger, 1833																				
<i>Vitrea pygmaea</i> (Boettger, 1880)				+																
<i>Oxychilus</i> sp. Fitzinger, 1833																				
<i>Oxychilus urbanskii</i> Riedel, 1963																				
<i>Helicella candicans</i> (Ziegler, 1841)																				
<i>Monacha</i> sp. Fitzinger, 1833																				
<i>Helicigona trizona</i> (Rossmässler, 1835)																				
<i>Cepaea vindobonensis</i> (C. Pfeiffer, 1828)																				
<i>Helix lucorum</i> Linnaeus, 1758	+	+		+	+	+	+	+	+	+										

Seven of the previously identified 14 species of terrestrial snails for the Botanical Garden in Balchik (Paunova et al., 2017) were not found during the research. Those are *Monacha claustralis* (Rossmässler, 1834), *Zebrina detrita* (O. F. Müller, 1774), *Zebrina varnensis* (L. Pfeiffer, 1847), *Ceriuella virgata* (Da Costa, 1778), *Helicopsis striata* (O. F. Müller, 1774), *Lindholmiola girva* (Frivaldszky, 1835) and *Mastus rosmaessleri* (L. Pfeiffer, 1847). This brings the checklist of the gastropods for the Botanical Garden to 29 species. The terrestrial gastropod diversity is therefore relatively high.

Four of the species that were identified were most abundant, the first three of which are *Helix lucorum* (14 locations and 9 habitats), *Mentissella rebeli* (14 locations and 10 habitats), and *Pomatias elegans* (13 locations and 9 habitats). They are common and widely spread species for the Bulgarian Black Sea coastline. The fourth is *Monacha* sp. (12 locations and 9 habitats), which in Bulgaria is presented by two species, which can be separated only by their anatomical differences. No live specimens were found during the study, therefore the abundance of the genus may be a result of both the species being present at the University Botanical Garden.

Twelve species were found in only one location each, and one species (*Cattania trizona*) in two locations, that were connected, therefore it can be suspected that it is typical for only one of the locations/habitats, but shells were transferred accidentally. This conclusion is also supported by the fact that one of those locations is presented by loamy soil mixed with sand habitat, where the only other gastropods found were the most common ones.

All four species from genus *Vallonia* for Bulgaria were found during this research. The most common is *V. costata* (8 locations and 5 habitats), next is *Vallonia pulchella* (5 locations and 3 habitats), and the least common were *V. enniensis* and *V. excentrica* (both found in only one location and one habitat). *Vallonia excentrica* is the rarest species from the genus for Bulgaria. Both the least common species are found only between limestones.

Mentissella rebeli is not only one of the most common species, it is also endemic for Eastern Bulgaria (Urbanski, 1960). Also, *Zebrina kindermanni kindermanni* is a Bulgarian endemic subspecies. Three relict species from the Tertiary Period were found: *Pomatias elegans*, *Vitrea pygmaea*, *Oxychilus urbanskii*.

The habitats and the terrestrial gastropods found for each of them are presented in Table 2. For habitat number 7 – moss, four species of mosses were identified according Petrov, 1975: *Campyliadelphus elodes* (Lindb.) Kanda, *Thuidium* sp. Bruch & Schimp, *Hypnum cupressiforme* Hedw., *Amblystegium serpens* (Hedw.) Schimp.

These present results confirm that students' volunteer work can be a base for scientific research and improvement of their field skills (Cohn, 2008). We hope that this can encourage such scientific and educational activities in the future.

Table 2. Presence of each species for the observed habitats, total number of habitats for each species, and total number of species for each habitat. The habitats are as follow: 1 – rock garden (loamy soil mixed with sand, limestone rocks, and succulents), 2 – limestone rocks, 3 – dense bushes, 4 – overshadowed field with low vegetation, 5 – overshadowed loamy soil mixed with sand, 6 – overshadowed loamy soil mixed with sand and plant remainders, 7 – moss*, 8–sunny field with low vegetation, 9 – loamy soil mixed with sand, 10 – loamy soil mixed with sand under cypress (*Cupressus* sp.), 11 – loamy soil mixed with sand under a variegated boxwood (*Buxus sempervirens* aureovariegata), 12 - loamy soil mixed with sand and rocks.

Species	Habitats												No. of habitats for the sp.
	1	2	3	4	5	6	7	8	9	10	11	12	
<i>Pomatias elegans</i> Clessin, 1879	+	+		+	+	+	+	+		+	+	+	9
<i>Truncatellina cylindrica</i> (Férussac, 1807)		+											1
<i>Vallonia costata</i> (Müller, 1774)	+	+	+		+			+					5
<i>Vallonia pulchella</i> (Müller, 1774)	+	+					+						3
<i>Vallonia enniensis</i> (Gredler, 1856)		+											1
<i>Vallonia excentrica</i> Sterki, 1893		+											1
<i>Ena obscura</i> (O.F. Müller, 1774)		+						+				+	3
<i>Zebrina kindermanni</i> (L. Pfeiffer, 1853)		+			+								1
<i>Chondrula tridens</i> (Müller, 1774)		+			+					+			4
<i>Mastus</i> sp. Beck, 1837													1
<i>Mentissella rebeli</i> (Sturany, 1897)	+	+		+		+	+	+	+	+	+	+	10
<i>Cecilioidea acicula</i> (Müller, 1774)				+									1
<i>Vitrina pellucida</i> (O. F. Müller, 1774)					+								1
<i>Vitrea</i> sp. Fitzinger, 1833								+					1
<i>Vitrea pygmaea</i> (Boettger, 1880)		+											1
<i>Oxychilus</i> sp. Fitzinger, 1833	+												1
<i>Oxychilus urbanskii</i> Riedel, 1963		+		+						+	+	+	5
<i>Helicella candicans</i> (Ziegler, 1841)								+					1
<i>Monacha</i> sp. Fitzinger, 1833		+		+	+	+	+	+	+	+	+	+	9
<i>Helicigona trizona</i> (Rossmässler, 1835)		+		+	+	+	+	+	+	+	+	+	2
<i>Cepaea vindobonensis</i> (C. Pfeiffer, 1828)		+		+	+	+	+	+	+	+	+	+	1
<i>Helix lucorum</i> Linnæus, 1758	+	+	+	+	+	+	+	+	+	+	+	+	9

No. of observed species for the habitat 8 13 1 5 7 5 5 10 4 3 5 5

CONCLUSION

The terrestrial gastropod diversity in the University Botanical Garden in Balchik is relatively high. The University Botanical Gardens are diverse in habitats suitable for terrestrial snails. The limestone rocks are with highest species composition, while dense bushes are with lowest. Students' volunteer work can be combined with field and scientific work, and can be beneficial for improving the students' field skills.

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REFERENCES

1. Cohn J. 2008. Citizen Science: Can Volunteers Do Real Research? *BioScience*, 58(3), 192–197. <https://doi.org/10.1641/B580303>
2. Damjanov S. & Likharev I. 1975. Fauna Bulgarica, Gastropoda terrestria, vol. IV. — *Publ. Bulg. Acad. Sci, Sofia*.
3. Dedov I. K. 1998. Annotated check-list of the Bulgarian terrestrial snails (Mollusca, Gastropoda), 30212, 745–765.
4. Paunova L., Nenov D., Dimitrov D., Yordanova Y., Petrov P., Yordanova M., Minev D., Dedov I. & Grozdanov A. 2017. Faunistic Observations in Botanical Gardens of Sofia University During Student Volunteer Activities in 2016, *Annuaire de l'Université de Sofia "St. Kliment Ohridski" Faculté de Biologie*, 102(4), 54–61.
5. Petrov, S. 1975. Bryophyta Bulgarica. Clavis Diagnostica. In *Aedibus Acad. Sci. Bulgaricae*, Sofia (in Bulgarian).
6. Urbanski J. 1960. Systematische, zoogeographische und oekologische Studien ueber die Mollusken der Balkan-Halbinsel: III, IV, V, VI. *Bull. Soc. Amis Sci. et Lett.*, I, 51–150.
7. Welter-Schultes F. 2012. *European Non-marine Molluscs, a Guide for Species Identification / Bestimmungsbuch für Europäische Land- und Süßwassermollusken*.