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Short note

Shell Size of the Freshwater Snail Radix auricularia (Linnaeus, 1758) Collected from Water Vegetation: A Case Study from South-East Bulgaria

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Abstract. The specimens of the freshwater snail *Radix auricularia* collected from Southeastern part of Bulgaria during the cold period as a whole were with mean shell height of 3.7 mm. During spring and summer it was similar, 3.3 mm. The ratio of the size groups was more equally spread during cold seasons rather than in warm ones. The variation index during cold seasons is about seven times higher than in the warm ones (Var = 13.1 and 2.14, respectively). On the five plant species the gastropods had different mean shell heights. For *C. demersum* it was 3.4 mm (min-max = 1.4-15.8 mm), and for *E. canadensis* 7.9 mm (min-max = 2.4-14.6 mm), *M. spicatum* it was 2.8 (min-max = 2.4-3.4 mm), *P. natans* 3.9 (min-max = 1.1-9.0), *P. pusillus* 4.8 (min-max = 3.1-8.2).

Key words: freshwater, quantity, gastropods, size, vegetation.

Introduction

The studies on the Bulgarian freshwater snails have started from the work of MOUSSON (1859), and continued with many others mainly focused on the taxonomy and diversity of species in various regions of the country (for example: BOURGUIGNAT, 1870, 1880; WAGNER, 1927; URBAŃSKI, 1960; ANGELOV, 1959, 1965, 1967, 1972, 1976).

Some ecological notes on the freshwater snails were given as a result of hydrobiological works (as RUSSEV *et al.*, 1998; KIRIN *et al.,* 2003, and many others) or synopses (ANGELOV, 2000; HUBENOV, 2005, 2006). Recently the first data on the habitats (GEORGIEV, 2005a, 2005b, 2006, 2008; GEORGIEV & STOYCHEVA, 2009), and species diversity, especially this one of the family Hydrobiidae Troschel, 1857 was intensively studied (GLÖER & PEŠIĆ, 2006; ZETTLER, 2008; IRIKOV & GEORGIEV, 2008; GEORGIEV & STOYCHEVA, 2008, 2011; GLÖER & GEORGIEV, 2009; 2011; GEORGIEV, 2009, 2011a, 2011b, 2011c, 2011d; GEORGIEV & GLÖER, 2011).

In Bulgaria there is a lack of detailed investigations regarding the ecology of the freshwater molluscs, while in the same time the foreign literature is quite rich on such kind of researches. Some of the most significant aspects of the ecology of freshwater gastropods are their relations with the aquatic plants. Both are quite sensitive to water pollution, and are often used as bio-indicators (GECHEVA & YURUKOVA, 2008). Focus on this question was made by the works of VASILEVA *et al.* (2009, 2011) but not considering the size of the gastropods and their age groups.

The aim of this study is to investigate the size characteristic of the populations of *Radix auricularia* (Linnaeus, 1758) dwelling on different water macrophytes during the cold and warm seasons in South-East Bulgaria.

Material and methods

The research was conducted through the period 2008 - 2009 in the Upper Thracian Lowland: Maritsa River in the city of Plovdiv, flood area near the bridge at UFT, N42°09` E24°43`; Eastern Rhodopes: Varbitsa River at around 3 km south of the town of Kardzhali, N41°34` E25°23`; Eastern Rhodopes: Perperek River, within the village of Perperek, N 41 ˚ 45` E 25 ˚ 21`; Eastern Rhodopes: Chernoochene dam in the village, N 41 ˚ 40 `E 25 ˚ 32'. The field trips were made from 19.02.2009 until 12.11.2009.

The mollusks were collected by hand or with a sack, along with the aquatic vegetation and were transported to the laboratory. The material was collected from total of 3119 g herbage biomass from the plant species: *Ceratophyllum demersum* L. – Rigid Hornwort (Varbitsa River: 150 g, and Maritsa River: 575 g, Chernoochene: 300 g), and *Elodea canadensis* Michx. – Pondweed (Maritsa River: 809 g), *Myriophyllum spicatum* L.- Eurasian watermilfoil (Chernoochene: 350 g), *Potamogeton natans* L.- floating pondweed (Varbitsa River: 685 g), *Potamogeton pusillus* L.- small pondweed (Perperek River: 250 g). The analysis of the results was made according to the plant species and season (cold – autumn and winter, and warm – spring and summer).

The material (total of 335 specimens) was separated from the plants by hand and by running water. The shells of the molluscs were measured (only the shell height was considered) and determined by GLÖER & MEIER-BROOK (2003) and a reference collection. The size groups were considered according to 1 mm. The index of variation was calculated using the program MS Excel.

Results and Discussion

The specimens collected during the cold period as a whole (number of specimens N = 28) were with mean shell height of 8.8 mm (min-max = 4.4-15.8 mm). During spring and summer (number of specimens N = 307) it was more than twice lower, 3.3 mm (min-max = 1.1-9.7 mm).

During the warm season specimens (in the following, in parentheses % of the total number of collected specimens) with shell height of 1-4 mm dominated (78.15%), and the most numerous was the group size 2.1-3 mm (35.50%l). Lowest percentage had the snail with shell height of 9.1-10 mm (0.33%). Specimens with shells higher than 10 mm were not registered. Such we found during the cold seasons, those with shell height between 9 and 16 mm (42.84%). Higher percent had the group 4-9 mm (57.16%), and specimens shorter than 4 mm were not collected. Accepting the maximal sizes of the species pointed by GLÖER & MEIER-BROOK (2003), of 8-12 mm shell height we consider that during warm seasons on the water vegetation studied the juvenile specimens dominate, and during the cold period subadults are as frequent as the juvenile, and some adults could also be found. The ratio of the size groups was more equally spread during cold seasons rather than in warm ones (Table 1, 2).

Table 1. Number and percent of the size groups of *Radix auricularia* on the freshwater macrophytes during spring and summer.

Size group	Number of specimens	%
1-2 mm	48	15.65
2.1-3 mm	109	35.50
3.1-4 mm	83	27.00
4.1-5 mm	33	10.76
5.1-6 mm	17	5.54
6.1-7 mm	6	1.96
7.1-8 mm	5	1.63
8.1-9 mm	5	1.63
9.1-10 mm	1	0.33
Total	307	100.00

The variation index during cold seasons is about seven times higher than in the warm ones (Var = 13.1 and 2.14, respectively).

On the five plant species the gastropods had similar mean shell heights. For *Ceratophyllum demersum* it was 4.8 mm (min-max = 2.5-8.9 mm), *Elodea canadensis* 7.2 mm (min-max = 3.6-10.0 mm) *Myriophyllum spicatum* it was 2.8 (min-max = 2.4-3.4 mm),

Potamogeton natans 3.9 (min-max = 1.1-9.0), *Potamogeton pusillus* 4.8 (min-max = 3.1-8.2).

Table 2. Number and percent of the size groups of *Radix auricularia* on the freshwater macrophytes during autumn and winter.

Size group	Number of specimens	%
4.1-5 mm	4	14.29
5.1-6 mm	4	14.29
6.1-7 mm	5	17.86
7.1-8 mm	3	10.71
8.1-9 mm	0	0
9.1-10 mm	3	10.71
10.1-11 mm	1	3.57
11.1-12 mm	1	3.57
12.1-13 mm	3	10.71
13.1-14 mm	3	10.71
14.1-15 mm	0	0
15.1-16 mm	1	3.57
Total	28	100.00

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