



CONSERVATION STATUS ANALYSIS OF TERRESTRIAL SNAILS IN THE REGION OF STARA ZAGORA, DEPENDING ON ALTITUDE

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ABSTRACT

The species diversity and the conservation importance of terrestrial snails encountered in the region of Stara Zagora and the flanks of the Sarnena Sredna Gora mountain was analyzed. The terrestrial malacofauna of the Stara Zagora region was characterized for a 7-year period on the basis of both own studies and the fundamental research of (1) and (2). The region encompasses territories at a different altitude (Fig. 1) – plain (100 to 200 m altitude), premountainous (200–300 m altitude) and mountainous (400–600 m altitude) areas. Eighty terrestrial snail species were determined, 27 of them with a status of conservationally important taxons.

Key words: Snails, Sarnena Sredna Gora, Upper Thracian plain, **conservation status**

INTRODUCTION

Investigations of the terrestrial malacofauna in the region of Stara Zagora

The diversity of malacofauna on pastures in the region of Stara Zagora and the flanks of the Sarnena Sredna Gora mountain was investigated in two aspects: faunistic and parasitological. The latter aimed at determination of the role of the different snail species in life cycles of parasites. In this connection, studies performed on the subject could be further divided into two directions: first, to establish the species composition of snails involved in transmission of parasites among livestock animal species (for which snails are intermediate hosts) and second, to determine some population traits of molluscs that are beneficial for the relationship of the parasite and its definitive host (3, 4, 5, 6, 7).

Performed studies exhibited 14 terrestrial snails belonging to 13 genera, 9 families, 2 orders and 2 subclasses of the Gastropoda class.

Terrestrial gastropods in the urban environment

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Investigations on the Stara Zagora urban malacofauna have been carried out by (1) and Marinova and Georgiev only for the Ayazmoto park in 2009 (unpublished). According to (2) 54 snail species were encountered in the Stara Zagora city and region, representing 22.9% of the Bulgarian malacofauna. The high degree of similarity (83%) of urban fauna and that of the Stara Zagora surroundings should be emphasized. The authors believe that this was due to the urbanized environment – a powerful anthropogenic pressure that increases the species diversity though invasion of species from adjacent forest habitats, with a typical predominance of introduced and reduced presence of endemic species (1, 8, 18).

Terrestrial snails in Sarnena Sredna Gora mountain

The diversity of molluscs in the Sarnena Sredna Gora mountain was investigated by (2). Sixty three terrestrial snail species were found out or 26.6% of all molluscs encountered in the country. Six snail species are reported as new for the region. A considerable diversity (41 snail species) was observed in open grass habitats and areas with shrub vegetation dominated by Jerusalem thorn (*Paliurus spinachristi*) and European Hornbeam (*Carpinus betulus*). Then followed oak and pine forests with 37 and 22 registered species, respectively. In the investigated cave in Sarnena Sredna

Gora mountain, (2) has discovered a flourishing population of *Oxychilus glaber striarius*.

The purpose of this investigation was to analyze the conservation status of terrestrial snails in the region of Stara Zagora and the flanks of the Sarnena Sredna Gora mountain through analysis of available literature and own studies.

MATERIAL AND METHODS

Characteristics of the investigated region.

Studied territories (Fig. 1) are within a region that begins from the east part of the Upper Thracian plain, with a typical plain relief and continues to territories located on the flanks of Sarnena Sredna Gora and the mountain itself. The territories could be classified as plains at altitudes of 100 to 200 m. Here are the pastures at the villages of Obruchishte, Zagortsi and Rakitnitsa, pre-mountainous pastures at 200 to 400 m altitude (Stara Zagora, Ayazmoto, Zheleznik residency area, Malka Vereya, Kolena, Dalboki) and mountainous pastures at altitudes over 400 m. – Oryahovitsa,

Starozagorski Mineralni Bani, Rosovets, Stoyan Zaimovo, Ostra Mogila, Edrevo. From the viewpoint of the climatic zoning of Bulgaria, investigated territories are in climatic areas characterized with a transition from moderate continental to continental Mediterranean climate. According to the climatic zones of (9), they are situated in a transitory continental climatic zone, with most of them being in the Upper Thracian subregion and the Sub Balkan kettle subregion. More recent data (10), place the studied area in the transitory climatic zone with territories situated in the Upper Thracian plain climatic region and Sarnena Gora climatic region. According to (10), the climate of the transitory climatic zone is characterized with a mild winter and transient snow cover. From the point of view of the soil geographic zoning of Bulgaria (11), the studied region is referred to the Balkan-Apennine soil subregion of the Mediterranean soil region.



Figure 1. Map of the region with designations of investigated territories.

Studies territories belonged to the Thracian-Middle Tundzha soil province, and the Sredna Gora soil province. In this study, the biogeographical zonality pattern of Bulgaria as per (12) was used. Territories were within the Mid Bulgarian biogeographical region of the Upper Thracian plane and the subregion of the Tundzha hilly country. With respect to the flora and fauna, the Mid Bulgarian biogeographical region is characterized with a marked predominance of northern species but also with a number of Mediterranean elements that have found good conditions for development here (12).

Methods for determination of snails

Terrestrial snails were collected manually and stored either in 70% ethanol or dry.

Small-sized species were collected by separation from the soil or leaf cover using a 0.5×0.5 cm sieve.

The species identification of terrestrial snails was done according to the manuals of (13), (14), (15) In this study, the nomenclature of (16) was used.

RESULTS AND DISCUSSION

Species composition of snails

On studied territories in the Stara Zagora region, 80 terrestrial snail species were found out (two species were determined on the genus level) belonging to 25 families, 3 orders and 2 subclasses of the **Gastropoda class**.

Their systematic position (16) was as followed: From observed terrestrial snail species, most prevalent were the typical mesophiles – a total of 35 species or 14.8 % of Bulgarian terrestrial malacofauna (**Table 1**). Representatives of this group were found out in a considerable number of habitats. Then followed the group of mesophilic species that had a broader ecological tolerance – mesophiles-hygrophiles, presented with 16 species (6.77%) and mesophiles-xerophiles with 13 species (5.5%). The high prevalence of mesophilic-xerophilic species is due to the vegetation diversity, changing with altitude. The numerous roads in the region are further responsible for the fragmentation of habitats and for creation of xerophilic conditions.

Next were more stenotopic species or their distribution was determined by the presence of habitats on limestone. Leading factors are the water circulation in the habitat and the

macroelement content of soil. They could be classified as mesophiles-calciphiles (12 species) and xerophile-calciphile (1 species). Two species: *Zebrina detrita* and *Xerolenta obvia* were typical xerophiles. The number of calciphilic species was 21 or 26.25% of all found out in the region. The members of the Zonitidae family have more specific environmental requirements but nevertheless, are represented with a considerable diversity. Some of them, apart being mesophiles, were also trogliphiles (*O. glaber*), whereas others (*A. minor*) are clear hygrophiles. A large part of studied habitats in the region are suitable for the existence of these species. Apart the reduced light intensity, deciduous forests are characterized by higher humidity and lower temperature of the leaf cover.

With regard to the conservation importance, terrestrial malacofauna in the investigated region showed a high diversity (**Table 1**). From the 80 terrestrial snail species, 27 (33.75%) were with a status of conservationally important taxons. Nine species (11.25%) were of national importance – *P. elegans*, *Agardhiella truncatella*, *Vallonia excentrica*, *Chondrula bicallosa*, *Vitrea pygmaea*, *Oxychilus hydatinus*, *Limax flavulus*, *Krynickillus urbanskii*, *Helix figulina*. *Vallonia excentrica*, *Chondrula bicallosa* and *Vitrea vereae* are species, rare for Bulgarian fauna whereas *L. flavus* and *H. figulina* (2.5% of regional malacofauna) were Tertiary relicts. According to (17) 8.8% of species inhabiting the Black Sea coast, plain and hilly areas are preglacial relicts.

Fifteen species (18.75%) were of European importance – *Argna macrodonta rumelica*, *Zebrina detrita*, *Macedonica marginata*, *Laciniaria plicata*, *Bulgarica frutillaria*, *B. varnensis*, *B. bulgariensis itricata*, *Cecilioides spelaeus*, *Vitrea neglecta*, *Tandonia kusceri*, *Limax macedonicus*, *Helix lucorum*, *H. pomatia*, *Lindholmiola girva* and *Xerolenta obvia*. Of them, 3 (3.75%) were important for the world's natural heritage – *Vallonia enniensis*, *Balea perversa* and *Vitrea vereae*. The *Vitrea neglecta* species is endemic for Bulgaria (1.25%).

The terrestrial malacofauna of the Sarnena Sredna Gora mountain is characterized with rich species diversity and a conservation status.

Table 1. Ecological traits and conservation status of terrestrial snails in the Stara Zagora and Sarnena Sredna Gora Mountain regions.

Abbreviations: (according to Dedov, 1998 and Hubenov, 2005): BC -3 Berne Convention, CORINE biotopes, **ca** – calciphile, **E** – European importance, **ESC** –Red List, **eu** – eurobiont, **HD** – Habitat Directive, **li** – lithophile, **me** – mesophile, **N** – national importance, **r** – rare, **T** – terrestrial, **tr** – troglophile, **tx** – troglaxene, **W** – world importance, **xph** – xerophile; **TRL** – Tertiary relic; **BGE** – Bulgarian endemite; **R - RARE** – a rare species with low abundance

Species	Irikov and Georgiev, 2002	Georgiev, 2005	Georgiev, 2003; 2008; Georgiev and Georgiev, 2002, 2004; Georgiev et al. 2003	Marinova and Georgiev (N.P.) 2010	Ecological traits		
					Dedov, 1998; Hubenov, 2005	Conservation importance	Habitat
<i>P. elegans</i>	+	+	+	+	T, me, ca, N	National importance	4, 5, 6
<i>A. m. rumelica</i>	+	+	-	-	T, me, ca, li, tr, E	European importance	4
<i>A. truncatella</i>	+	+	-	-	T, me, ca, r, N	National importance	4, 5, 6
<i>V. enniensis</i>	+	+	-	+	T, me, W	World importance	4
<i>V. excentrica</i> R	+	+	-	+	T, me, r, N	National importance	4
<i>Z. detrita</i>	+	+	+	+	T, xph, ca, E	European importance	4, 5, 6
<i>Ch. bicallosa</i>	+	+	-	-	T, me-xph, r, N	National importance	4, 5
<i>M. marginata</i>	+	+	-	-	T, me-xph, ca, E	European importance	4, 5
<i>L. plicata</i>	+	+	-	-	T, me, ca, E	European importance	4, 6
<i>B. perversa</i>	+	-	-	-	T, me-xph, ca, V, ESC, CORINE, W	World importance	4
<i>B. b. intricata</i>	+	-	-	-	T, me, ca, E	European importance	4
<i>B. frutillaria</i>	-	-	+	-	T, me, E	European importance	5
<i>B. varnensis</i>	-	+	-	-	T, me, ca, E	European importance	4, 5, 6
<i>C. spelaeus</i>	+	+	-	-	T, me, ca, E	European importance	4, 6
<i>V. neglecta</i> BGE	-	+	-	+	T, me, E	European importance	6
<i>V. pygmaea</i>	-	+	-	-	T, me-xph, N	National importance	4
<i>V. vereae</i> R	-	+	-	-	T, xph-me, r, W	World importance	4, 6
<i>O. hydatinus</i>	+	-	-	-	T, me, tr, N	National importance	4
<i>T. kusceri</i>	+	+	-	+	T, me, eu, tx, E	European importance	4, 5, 6
<i>L. flavus</i> TRL	+	-	-	+	T, me, N	National importance	4
<i>L. macedonicus</i>	+	+	-	+	T, me, E	European importance	4, 5, 6
<i>K. urbanskii</i>	+	+	-	-	T, tx, N	National importance	4, 6
<i>H. lucorum</i>	+	+	-	+	T, xph-me, eu, E	European importance	4, 5, 6
<i>H. pomatia</i>	-	+	+	+	T, me-hg, CORINE, ESC BC-3 HD-E	European importance	4, 5, 6
<i>H. figulina</i> TRL	+	+	-	+	T, me, N	National importance	4, 5, 6
<i>L. girva</i>	-	+	-	+	T, me-xph, E	European importance	4, 5, 6
<i>X. obvia</i>	-	+	+	+	T, xph, E	European importance	1, 2, 3, 4, 5, 6

In (2) established 63 species of terrestrial gastropods that represented 26.7% of all described in the country. Out of them, 22 species were categorized as conservationally important taxons (16;17). The least important species composition of terrestrial snails from the point of view of their conservation status was determined in the plain areas of Stara Zagora at altitudes between 100 and 200 m and on part of Sarnena Sredna Gora flanks (altitude 300 m). Only 5 terrestrial snail species from those reported by (3; 4); (5, 6) and (7) had a conservation status – *P. elegans*, *Z. detrita*, *H. pomatia*, *B. frutillaria* and *X. obvia*. Next came territories located near the town and city parks. (1) established a total of 19 snail species, one of them with a high conservation importance (Table 1). Later (2010, unpublished data), 12 of them were confirmed by Marinova and Georgiev. The cause for the poorer species composition of snails could be attributed to the fact that Marinova and Georgiev have performed their study only on the territory of one park within the Stara Zagora town.

According to (17), the conservation importance of the different species is various and it is especially high when more than one criterion was met for a given taxon. For the region of Stara Zagora and the flanks of the Sarnena Sredna Gora mountain, seven species were found to satisfy these criteria – *V. excentrica*, *V. neglecta*, *V. vereae*, *L. flavus*, *H. figulina*, *B. perversa* and *H. pomatia*, the last two being of exceptional value for the world natural heritage.

CONCLUSION

Eighty terrestrial snail species were described in the region of Stara Zagora and the flanks of the Sarnena Sredna Gora mountain. Of them 27 species were with a status of conservationally important taxons. For 7 species, several criteria for evaluation of the conservation status were met. The conservation importance of terrestrial snails changed with the altitude. It was the highest on the flanks of the Sarnena Sredna Gora mountain - total of 22 species that were particularly important for the world natural heritage.

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