A Review of the *Agardhiella* species (Gastropoda: Pulmonata: Argnidae) in Bulgaria

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Abstract: The species *Agardhiella parreyssii* (L. Pfeiffer 1884) from the first sure locality in Bulgaria was reported. It was registered on the south slope of Sarnena Sredna Gora Mountain, north-west from Stara Zagora Town (Southern Bulgaria). We made a synopsis of the whole literature for the species from the genus *Agardhiella* in Bulgaria. Some original data on their distribution, ecology, taxonomy and origin were also represented. As a result of our study the exact number of species from the genus rises from three to four in the country.

Introduction

For the Bulgarian malacofauna there were tree species from the Genus Agardhiella Hesse, 1923 reported until now. The occurrence of one of them: Agardhiella parreyssii (L. PFEIFFER 1884), recorded by JAECKEL *et al.* (1957) remained uncertain as the authors did not point an exact locality of finding and after a lot of following studies in the country this snail was not re-discovered (HUBENOV 2005). The other species from the genus seemed to be very rare, hardly finding and with only a few known localities (DAMJANOV, LIHAREV 1975). In this paper we make a general investigation of all the species from the genus in Bulgaria and we report the first sure evidence for A. parreyssii in the country with a corrected data of its taxonomy.

Material and Methods

We carried out a literature research and made a complete synopsis of all the published information about the genus *Agardhiella* HESSE, 1923 for Bulgaria. Simultaneously we also searched for Agardhiella species from various regions of the country. The specimens were collected by using a double system of sieves for soil samples or gathered by hand. Tree leaf detritus, cave clay, soil and sand river deposits were investigated. The material was deposited in the personal collections of the authors.

In the synopsis of every reported species were pointed: a valid Latin name; a synonym list of the names for Bulgaria; the author last reported the valid Latin name; published and original data for the species altitude and geographical distribution (if there was information available and 10x10 km UTM-grid coordinates); shell size; ecological, taxonomical and

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zoogeographical notes; and also the species conservation statute.

Results and Discussion

Agardhiella macrodonta (Hesse, 1916)

Agardhia macrodonta: Hesse, 1916: 116. *Agardhia macrodonta*: WAGNER, 1927: 306, Tab. 15, Fig. 115-116.

Agardhia macrodonta: JAECKEL et al., 1957: 147.

Argna bureši: URBANSKI, 1960a: 65, Fig. 4.

Argna (Agardhiella) macrodonta: URBANSKI, 1969: 229.

Argna (Agardhiella) macrodonta: PINTER, PINTER, 1970: 87, 89.

Argna (Agardhiella) bureši: PINTER, PINTER, 1970: 89.

Argna macrodonta macrodonta: DAMJANOV, LIKHAREV, 1975: 106.

Argna macrodonta macrodonta: DEDOV, 1998: 748.

Argna macrodonta: IRIKOV, GEORGIEV, 2002: 8, Table 1; 10, Table 2.

Argna macrodonta: HUBENOV, 2005: 209, 236.

Argna macrodonta rumelica: GEORGIEV, 2005: 434, Table. 2.

HESSE (1916) described A. macrodonta by empty shells gathered in the the Maritsa River deposits at Plovdiv town. In the same sample he also found and described the subspecies A. macrodonta rumelica (HESSE, 1916). WAGNER (1927) noted down that all specimens from this species were from the Maritsa River deposits, so the two forms should be originating from different localities. Later URBANSKI (1960a) described the new species A. bureši only having a single considerably large shell collected in the area of Lakatnik railway station in the Western Stara Planina Mountain. PINTER, PINTER (1970) reported A. bureši from the region of Vratsata locality in Western Stara Planina namely according to the significantly big size of the only one fragmented shell they gathered. However this species was accepted later by DAMJANOV, LIKHAREV (1975) as a synonym of A. macrodonta. Other reports were from URBANSKI (1969) -Ledenika Cave in Vrachanska Ridge in Western Stara Planina Mountain; PINTER, PINTER (1970) - Kamchia River area at the Black Sea coast (possibly not reliable data, see the text below); DAMJANOV, LIKHAREV (1975) – the area of Lakatnik railway station in the Western Stara Planina Mountain and deposits of the Maritsa River in Plovdiv Town; HUBENOV (2005) - Danube River valley, Stara Planina Mountain, transition mountainous area in Western Bulgaria, Rila and the Rhodope Mountains, Black Sea coast (the last we consider as not a reliable information); GEORGIEV (2005) – Sarnena Sredna Gora Mountain north of Stara Zagora town and in the town.

Material studied: Sarnena Sredna Gora, 20.12.2001, 1 fragmented shell, sand deposits of the Bedechka River, north from Stara Zagora town, UTM LH 80, leg. D. Georgiev, coll. A. Irikov; 03.03.2002: 1 fragmented shell, broad leaf forest in a park, in detritus near limestone rocks, Park Krairechen, Stara Zagora town, UTM LG 89, coll. D. Georgiev; 27.10.2007: 1 shell, soil deposits of the Bedechka River, UTM LH 80, coll. D. Georgiev.

Vertical distribution: According HUBENOV (2005) the species was recorded from the sea level to 1200 m alt.

As a conclusion we consider that the complete distribution of the species in Bulgaria remains unclear and not totally reliable because of the small amount of the collected material, and also of the lack of information where the species actually lives. On the basis of the data available, it was proved that the distribution of A. macrodonta is considerably restricted compared to the one of the closely related species A. rumelica.

Shell measurements (one preserved specimen from Sarnena Srenda Gora): H=3.6 mm, D=1.3 mm.

Ecological notes: URBANSKI (1969) reported the species from the area of the Ledenika Cave where he found two specimens in an old shady forest among detritus on limestone rocks. According DAMJANOV, LIKHAREV (1975) *A. macrodonta* lives in limestone areas into the rock crevices among root systems of herbaceous vegetation. Mesophilous, calcerous, lithophilous and troglophilous (HUBENOV, 2005). GEORGIEV (2005) represents more detailed information on the occupied habitats. He collected the species from broad leaf city park forests in Stara Zagora town and from *Quercus* spp. and *Alnus glutinosa* in Sredna Gora Mountain.

Taxonomical data: PINTER, PINTER (1970) accepted that the varying of the species is remarkably high and there is not a possibility to divide it into single different forms. DAMJANOV, LIKHAREV (1975)

classified it as a nominate subspecies very closely related to the widely distributed in Bulgaria other subspecies *A. macrodonta rumelica* (HESSE). This form differs from *A. rumelica* by the unchangeable morphology of its shell aperture. More accurately it was by the larger tooth and the specifications of the collumellar part (see the next species) (Fig. 1: 3).

Zoogeography: Bulgarian endemic species (DAMJANOV, LIKHAREV, 1975). Balkan group of the European mountainous element, South-European mountainous sub-element.

Conservation statute: A species with European conservation priority (HUBENOV, 2005).

Agardhiella rumelica (HESSE, 1916)

Agardhia macrodonta rumelica: HESSE, 1916: 117. Agardhia macrodonta rumelica: WAGNER, 1927: 307, Taf. 15, Fig. 117. Argna rumelica: URBANSKI, 1960b: 72, 91. Argna (Agardhiella) rumelica: URBANSKI, 1964: 21. Argna macrodonta cf. rumelica: URBANSKI, 1969: 228. Argna rumelica: URBANSKI, 1969: 230, 242. Argna macrodonta rumelica: DAMJANOV, LIKHAREV, 1975: 105, Fig. 40. Argna macrodonta rumelica: DEDOV, 1998: 748. Argna (Agardhiella) macrodonta: IRIKOV, 1999: 30. Argna macrodonta: IRIKOV, IRIKOVA 2000: 422. Argna macrodonta: IRIKOV, 2002: 89-101. Argna (Agardhiella) macrodonta: IRIKOV, MOLLOV, 2006: 764.

Described by HESSE (1916) as a subspecies of A. macrodonta found in deposits of the Maritsa River in Plovdiv town. The same material was later investigated and discussed in the paper of WAGNER (1927). URBANSKI (1960b) collected 3 specimens (shells) at the base of Tsarevets hill in Veliko Tarnovo town (Pre-Balkan area). Possibly these were shells of snails living in the limestone regions of Middle Stara Planina Mountain. They were washed away from there by the waters of the Yantra River and were deposited at the hill's base. We suppose a similar way of transportation and about the shells of A. rumelica found by the same author on the sand dunes at the Black Sea coast (north of Nesebar town, Yankovi Kashli area). Most likely the origin of these empty shells was from a locality of living animals situated in Eastern Stara Planina Mountain and they were brought on the dunes by the flow of the Hadzhiiska River. URBANSKI (1964) collected



Fig. 1. Shells of the species from genus *Agardhiella* in Bulgaria. Legend: 1 - Agardhiella parreyssii (L. PFEIFFER, 1884), a specimen from Sarnena Sredna Gora Mountain, coll. D. Georgiev, 2 - Agardhiella truncatella (PFEIFFER, 1841), a subadult specimen from deposits of Rusenski Lom River, coll. D. Georgiev, 3 - Agardhiella macrodonta (HESSE, 1916), a juvenile specimen (with not developed palatal plica) from Sarnena Sredna Gora Mountain, coll. D. Georgiev, 4 - Agardhiella rumelica (HESSE, 1916), a specimen from the Western Rhodope Mountains, coll. A. Irikov. Photo: D. Georgiev and S. Stoycheva.

the first alive specimens of A. rumelica found in Treta Bezimenna Cave near the Kumanitsa River in Troyanski Ridge (Middle Stara Planina Mountain). Despite that these animals were possibly transported inside the cave by waters (stygo-hydrochory), it was the only sure evidence for the species occurrence in Stara Planina Mountain. Other reports are: URBANSKI (1969), Ledenika Cave surroundings; Razboyski Monastery near Nishava River, south-west of Godech town in Western Bulgaria; Veliko Tarnovo town; Preobrazhenski Monastery north of Veliko Tarnovo town; DAMJANOV, LIKHAREV (1975): mostly in Stara Planina Mountain which we consider the most reliable locality. The next sites pointed by the authors like the Black Sea coast, Lom and Plovdiv towns were possibly results of the hydrochory (see the text above), and also the reports of IRIKOV (1999); IRIKOV (1999), IRIKOV, IRIKOVA (2000): Slivov Dol area in

Dobrostanski Ridge (Western Rhodope Mountains); IRIKOV (2002): Dobrostanski Ridge.

We consider that in Bulgaria *A. rumelica* is more distributed species than *A. macrodonta*, having more prolonged areal westwards, the periphery of which extends to Serbia.

Vertical distribution: The species was registered from the sea level to 800 m a.s.l. in the Western Rhodopes and 1200 m a.s.l. in Stara Planina Mountain.

Shell measurements (1 specimen from the Western Rhodopes): shell H = 4.1 mm, D = 1.2 mm; aperture H = 1.2 mm, D = 0.6 mm.

Ecological notes: According DAMJANOV, LIKHAREV (1975) the species lives in moist places on limestone terrains, into rock crevices or at the base of cliffs usually in the root systems of herbaceous plants. IRIKOV (1999) accepted that A. rumelica occurs in the leaf detritus of beech forests with rocky areas occupied with moss, Haberlea rhopopensis FRIVALDSZKY, 1835, and other vegetation. URBANSKI (1964) reported a very rare collection of live individuals under ground and into soil deposits. The same author characterized this species as a troglophile because of the shell findings in some caves. IRIKOV, MOLLOV (2006) considered that the last statement was not a proper one according to the very small amount of live specimens reported from cave interiors. IRIKOV, MOLLOV (2006) classified the species as hygro- to mesohygrophilic, cool-loving, cold-resistant and calcerous. According to these authors the data concerning the species habitat preferences are unsufficient.

Taxonomical data: IRIKOV, MOLLOV (2006) accepted that the high variability of the shell structure was the reason for the mentioning of *A. rumelica* and *A. buresi* as two distinct species or *A. rumelica* as subspecies in some of the literature sources. Considering HESSE (1926), URBANSKI (1960b, 1964), DAMJANOV, LIKHAREV (1975) and DEDOV (1998) all of them are most subspecies or morphological forms of *A. macrodonta*. URBANSKI (1960a), and also IRIKOV (1999) recommended more anatomical arguments for the clearing of the real taxonomical status of the various –macrodonta forms.

On account of that *A. macrodonta* was confused many times and mixed with the closest *A. rumelica* (DAMJANOV, LIKHAREV, 1975). Here we indicate some of the more essential conchiological differences between the two species. The more preserved shells of *A. macrodonta* are with dark corneous colour as a distinction from the whitish one of *A. rumelica*; A. rumelica is with denser, fine and slightly sloping ribs; the parietal lamella of *A. rumelica* is inclined, and respectively right in the aperture of *A. macrodonta*; the palatal tooth is more weakly developed in *A. rumelica*; the columellar part is sometimes entirely smooth or with 1-2 small plicas, which are often placed beneath basally at the aperture or at the columella (Fig. 1: 4).

Zoogeography: Endemic species for the Balkan Peninsula, registered in the mountainous regions of Bulgaria and Serbia (DAMJANOV, LIKHAREV, 1975). IRIKOV, MOLLOV (2006) classified the species as East-Mediterranean sub-element, Sub-Mediterranean element, European faunistic complex. We add that it is a part from the Balkan origin group of species which partly was restricted in its distribution on the peninsula, and partly was settled in some neighbouring mountains.

Conservation statute: A rare species (IRIKOV 2002).

Agardhiella truncatella (L. PFEIFFER, 1841)

Argna truncatella: DAMJANOV, LIKHAREV, 1975: 107, Fig. 41.

Argna truncatella: DEDOV, 1998: 348. Argna truncatella: HUBENOV, 2005: 236.

The species was reported for the northern Pre-Balkan area of Bulgaria (DAMJANOV, LIKHAREV, 1975). HUBENOV (2005) characterized it as a South-European species with distribution in Bulgaria. There were not any exact localities pointed.

Material studied: Our original information is the first sure locality of the species in Bulgaria: at the northern border of the Rusenski Lom Natural Park, near the village of Ivanovo, Danube River Valley, UTM MJ 13, material: 04.07.2006, 1 shell, deposits of Rusenski Lom River, coll. D. Georgiev.

Vertical distribution: According HUBENOV (2005) *A. truncatella* is occurring from 300 to 1000 m a.s.l.

Shell measurements (one specimen, northern border of the Rusenski Lom Natural Park): H = 4.3mm, D = 1.5 mm.

Ecological notes: Considering DAMJANOV, LIKHAREV (1975) it lives in highly moist places in the woods, at the trunk base of various tree species, under dead wood and stones with moss. Mesohygrophilic, calcerous species (HUBENOV, 2005).

Taxonomical data: The most sure conchiological indication of this species from the rest ones living in Bulgaria is the great length of the last whorl – almost about the half of the whole shell height (Fig. 1: 2).

Zoogeography: B alkan-Carpathian-Alpine group of the European mountainous element, South European mountainous subelement.

Conservation statute: A rare species of national conservation priority (HUBENOV, 2005).

Agardhiella parreyssii (L. PFEIFFER, 1884)

Agardhia parreyssii: JAECKEL et al., 1957: 146. Argna parreyssii: DAMJANOV, LIKHAREV, 1975: 108. Argna parreyssii: DEDOV, 1998: 748. Argna truncatella: IRIKOV, GEORGIEV, 2002: 8 Tab. 1; 10 Table 2, nec (L. PFEIFFER, 1841). Argna parreyssii: HUBENOV, 2005: 236. Agardhiella truncatella: GEORGIEV, 2005: 434, Tab. 2, nec (L. PFEIFFER 1841).

JAECKEL *et al.* (1957) reported the species for the Bulgarian malacofauna without pointing the locality of finding. After this publication no other records in the country were available (DAMJANOV, LIHAREV 1975) and the occurrence of *A. parreyssii* in Bulgaria remained doubtful (HUBENOV 2005).

Material studied: Sarnena Sredna Gora, 09.10.2001: 1 shell, in Qercus spp. leaf detritus near a limestone rock, Mechi Kladenets Area, UTM LH 70, coll. D. Georgiev; 20.10.2002: 9 shells (6 juv., 3 ad.) in Vassil Levski Cave, south from the village of Ostra Mogila, UTM LH 70, coll. D. Georgiev.

Vertical distribution: We found this species from 200 to 600 m a.s.l. in Sarnena Sredna Gora Mountain.

Shell measurements (three specimens from Sarnena Srenda Gora): 1. H = 4.6 mm, D = 1.6 mm; 2. H = 4.4 mm, D = 1.6 mm; 3. H = 4.0 mm, D = 1.4 mm.

Ecological notes: Mesophilic and calcerous species (HUBENOV, 2005). The hard finding of specimens shows a hidden way of life of this species (possibly living under stones and into rock crevices). The rarely gathered shells obviously went out on the soil surface after heavy rainfalls and floods in the cliff areas. GEORGIEV (2005) represented more details on the preferred habitats by the species. In his material for Sredna Gora the author registered shells of *A. parreyssii* in small caves, *Quercus* spp. and river bank forests dominated by *Alnus glutinosa* (LINNAEUS, 1758).

Taxonomical data: We found that the most essential conchiological characteristics discerning *A. parreyssii* from the rest three *Agardhiella* – species occurring in Bulgaria are: a partly glittering and whitish shell surface, which is relatively thin walled with fine ribs. The parietal lamella is weekly developed and usually there are no any teeth and lamellas in the aperture (Fig. 1: 1).

Zoogeography: Endemic species for the Balkan Peninsula (DAMJANOV, LIKHAREV, 1975). We classified the species as a Balkan-Carpathian Group of the European mountainous element, South-European mountainous sub-element.

Conservation statute: A species of national conservation priority (HUBENOV, 2005).

Conclusions

As a result from our synopsis of the literature and original data, and our first sure record of *A. parreys-sii* in Bulgaria, the exact number of species from the genus *Agardhiella* rises from three to four.

All of the four species from the genus could be considered rare on the territory of Bulgaria. This could be a consequence of their hidden way of life and of the hard finding of shells and live specimens on the ground surface.

Considering their ecology these species can be classified as hygro- to mesohygrophilic, cool-loving and cold resistant. It is mountainous by origin genus group, closely related to limestone terrains, and is actually a part of the typical epilitic, calcerous malacofauna. In zoogeographical aspect the four *Agardhiella*species are a part of one exclusively interesting and relatively small snail group of species inhabiting the mountains on the Balkans and partly in Middle Europe – the Alps and the Carpathians. Despite these species are calcerous and occurring in similar hetero-zonal rocky microhabitats, they possibly had a various origins. A part of the species could originate from the Alps or the Carpathians and afterwards they possibly migrated in the mountainous regions of Southern Europe. We consider that one of the reasons was the glaciation of the areas of their origin during the Pleistocene. During the interglacials the species could secondary invade their northern centers of origin. A. truncatella is actually a part of this

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Balkan-Carpathian-Alpine group of the European mountainous element, and South European mountainous subelement. On the other hand *A. parreyssii* possibly had a center of origin in the Carpathian area and is a part of the Balkan-Carpathian group of the South European mountainous subelement. The last two endemic species for the Eastern Balkans *A. macrodonta* and *A. rumelica* are a part of the species group with Balkan origin. Their weak invasion northwards and preferences on the occupying of the various mountain zones of the Balkans, points out ecological preferences typical of the sub-mediterranean species and affiliations to the East-Mediterranean sub-element of the Sub-Mediterranean element of the European faunistic complex.

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Преглед на род *Agardhiella* (Gastropoda: Pulmonata: Argnidae) в България

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(Резюме)

Видът *Agardhiella parreyssii* (L. PFEIFFER 1884) се съобщава за пръви път от сигурно находище в България. Той е установен по южния склон на Сърнена Средна гора, северозападно от град Стара Загора. След настоящия материал, броят на видовете от род *Agardhiella* регистрирани в страната нараства от три до четири.

Извършен е преглед на цялата налична литература за видовете от рода в България и са представени оригинални данни за разпространението, екологията, таксономията и произхода на видовете *Agardhiella* в страната.