



# First Report of a Live Population of *Bulgarica fritillaria* (Frivaldszky, 1835) (Gastropoda: Pulmonata: Clausiliidae) and its Relationships with the Species of the *Bulgarica varnensis* Species-group from Bulgaria

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**Abstract:** The paper reports the first live population of *Bulgarica fritillaria* (Frivaldszky, 1835), which has been discovered at Bessapara Hills near the village of Kapitan Dimitriev in Bulgaria. The morphology of the species is redescribed on the basis of the newly-discovered population and its morphological differences from *Bulgarica varnensis* (L. Pfeiffer, 1848) are discussed. *Bulgarica fritillaria* prefers damp habitats, rich in detritus and overgrown with vegetation, mostly along river banks, which differs it from *B. varnensis*. The other three taxa of the *Bulgarica varnensis* species-group, previously considered as subspecies of *B. varnensis*, i.e. *B. pseudofraudigera* described initially as *B. v. pseudofraudigera* Nordsieck, 1973, *B. v. gabrovnitsana* Irikov, 2006 and *B. v. trimontsiana* Irikov, 2006, are recognised as full species and their rank is elevated. *Bulgarica fritillaria*, *B. gabrovnitsana*, *B. trimontsiana* and *B. pseudofraudigera* are endemic species for the fauna of Bulgaria.

**Key words:** *Bulgarica varnensis*, *Bulgarica gabrovnitsana*, *Bulgarica trimontsiana*, *Bulgarica pseudofraudigera*, distribution, taxonomy.

## Introduction

Until recently, data on *Bulgarica fritillaria* (Frivaldszky, 1835) have been scarce, regardless the fact that more than 180 years have elapsed since its description. During the period 1833–1870, the distinguished Hungarian scientist Imre Frivaldszky organised seven expeditions in the Balkans, which were almost entirely part of the Ottoman Empire at that time. On the territory of Bulgaria, the expeditions were conducted in 1833 and during 1834–1837. Frivaldszky took part in one of them. Most of the materials of plants, insects, birds and molluscs in the private collection of Frivaldszky were sold to the Hungarian Museum of Natural History and par-

tially to the Museum of Natural History of Vienna, where they have been used to describe many taxa new to science (BÁLINT & FRIVALDSZKY SR. 2009). Unfortunately, the precise collection localities have not been indicated for many of them and the only indication is “Türkei”. In that way, a great number of taxa with unidentified habitats were registered and declared later as “lost” or “extinct” in the malacological literature. Subsequently, there were speculations about their original locality. This is also the case with *B. fritillaria*, with a locality registered as “Türkei”.

The type material of *Bulgarica fritillaria* is not available, since in 1856 a fire at the Hungarian Museum of Natural History destroyed many col-

lections, including the collection of Mollusca. As a result of the identification of live samples of this species for the first time, the present study aims to conduct a more precise morphological study and a taxonomic re-assessment of this species.

The original description of *B. fritillaria* was completed by FRIVALDSZKY (1835). Later, WESTERLUND (1884) assumed that this taxon was a variety of *Clausilia varnensis* (L. Pfeiffer, 1848). During the 20<sup>th</sup> century, several researchers reported *B. fritillaria* from a number of locations in Bulgaria, adopting various systematic positions for it. HESSE (1916) examined shells from river deposits and reported *Alinda (Idyla) varnensis fritillaria* from the banks of the Maritsa River near Plovdiv. According to HESSE (1916) and WESTERLUND (1884), this taxon was a „variety“ of *B. varnensis*, which until that time was known only from Varna. Both authors, however, neither indicated data of the material examined nor grounded why they accepted *C. varnensis* as a senior synonym, thus being in contradiction with the Principle of Priority. URBAŃSKI (1960, 1964), RIEDEL & URBAŃSKI (1964) and URBAŃSKI & WIKTOR (1967) reported *Laciniaria (Bulgariaca) fritillaria* from the valley of the Chaya River (Chepelarska River), between Assenovgrad and the village of Narechen as well as from the region of the Bachkovo Monastery in the Western Rhodopes; URBAŃSKI (1964) even adopted this region as the type locality. This is a telling example of a secondary guess-work in identifying the type locality of a „lost species“ due to the absence of indication in the original description. According to URBAŃSKI (1969), *Laciniaria (Strigillaria) cana* (Held) var. *curta* Wagner in Wohlberedt, 1911 from Belovo, between the Rhodopes and the Rila Mountains, was identical with *L. (B.) fritillaria*. This author was the first to suggest that *L. fritillaria* is a valid species, which differs from *B. varnensis* morphologically and in its life-history characteristics. According to URBAŃSKI (1969), *Laciniaria (Strigilecula) cana* (Held, 1836), a species reported by MOUSSON (1859) from Veliko Tarnovo and Gorna Dzhumaya (now Blagoevgrad), is similar to *L. fritillaria* and also requires verification. NORDSIECK (1973) placed *L. fritillaria* to the genus *Bulgarica* Boettger, 1877 and proposed a differential diagnosis, which clearly distinguished it from the similar *B. varnensis*. According to him, the geographical range of *B. fritillaria* included the Balkan Mountains in the region of Sliven, Belovo (between the Rila Mountains and the Rhodopes) and Bachkovo in the Western Rhodopes. In contrast to the work by URBAŃSKI (1969) and the diagnosis of NORDSIECK (1973), DAMJANOV & LIKHAREV (1975)

regarded *B. fritillaria* as a form of *B. varnensis* in the frames of the genus of *Laciniaria* Hartmann, 1942. According to URBAŃSKI (1977), *B. fritillaria* is widely distributed in Bulgaria (Varna, Veliko Tarnovo, Sliven, the middle sections of the Rhodopes, Strumeshnitsa River above Petrich) and probably in parts of Greece and former Yugoslavia. KÖRNIG (1983) found shells of the species on the banks of the Maritsa River near Plovdiv and recognised it as endemic for the middle part of the Rhodopes.

During the 21<sup>st</sup> century, many authors (IRIKOV 2002, 2003, 2006, HUBENOV 2007, IRIKOV & ERÖSS 2008, IRIKOV & GEORGIEV 2015) adopted *B. fritillaria* as a valid species, based on both morphological and life-history characters, considering it the closest species to *B. varnensis*.

## Materials and Methods

Seventy-six live specimens were examined from the newly-recorded locality of *B. fritillaria* discovered by A. Irikov and I. Mollov on 4<sup>th</sup> August 2005. Additionally, a great number of shells were collected by I. Mollov in the deposits on the banks of the Maritsa River in the region of Plovdiv. All examined specimens are preserved in the collection of A. Irikov (No. 289 and No. 538).

The following abbreviations have been used: I = index of correlation (the width of the shell as percentage of its length); R/2 (vide NORDSIECK 1973) = number of the ribs at 2 mm from the penultimate whorl of the shell; M = median values.

## Results

Confirmed morphological characters: Shell slightly inflated, with fine ribs, with touches of white, somewhat glossy. Apex obtuse. Whorls slightly inflated, in occipital section they are set wider apart, with relatively rough and fine ribs between them. End of the peristome slightly thickened. Main palatal plica (principalis) long. Lower palatal plica short. Third plica always present, unusually short, located under the main upper palatal plica, subcolumellaris, not seen in the peristome.

**Added morphological characters:** Shell significantly inflated – I: 25.3–35.8, M = 28.9 (according to IRIKOV (2006), for *B. varnensis* – I: 21.9–26.5, M = 23.8). End of peristome with thickened callus; main palatal plica (principalis) long; upper palatal plica poorly developed and sometimes missing, posterior upper palatal plica penetrating deeply behind lunella and always longer than anterior upper palatal plica; lower palatal plica without subclaustralis and

with well-developed basalis. Often long suturalis available between parietalis and columellaris lamellas; several intralamellaris plicae frequently present (Fig. 1).

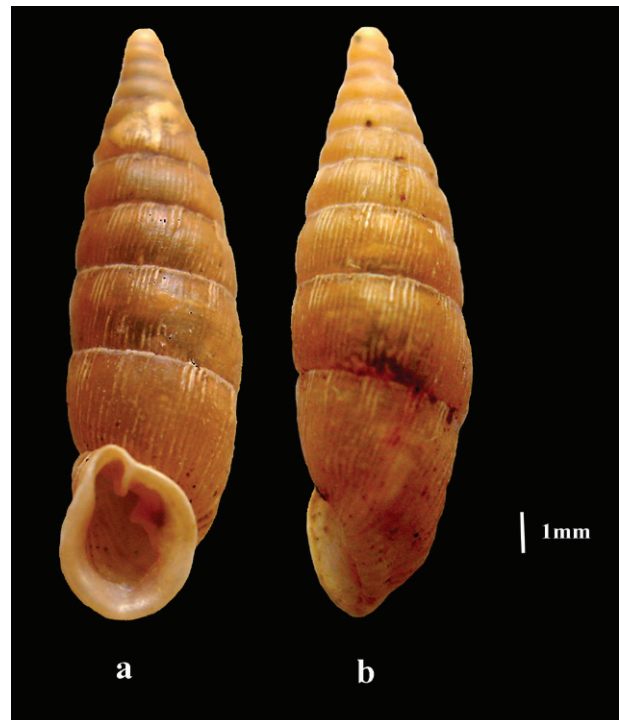
**Clausilium plate** identical with the plate of *B. varnensis* (vide Fig. 12c in IRIKOV 2006).

**Genital anatomy** is typical for the “*varnensis*” species-group.

**Metrical data:** Shell height (stature) 12.1–15.1 mm, M = 13.5 mm; shell width 3.5–4.8 mm, M = 3.9 mm; aperture height 3.1–3.8 mm, M = 3.5 mm; aperture width 2.5–3.1 mm, M = 2.7 mm; I: 25.3–35.8, M = 28.9; R/2: 17–22, M = 18.3. The most substantial variations in the size are associated with the height and width of the shell and significantly less with the height and width of the peristome.

## Discussion

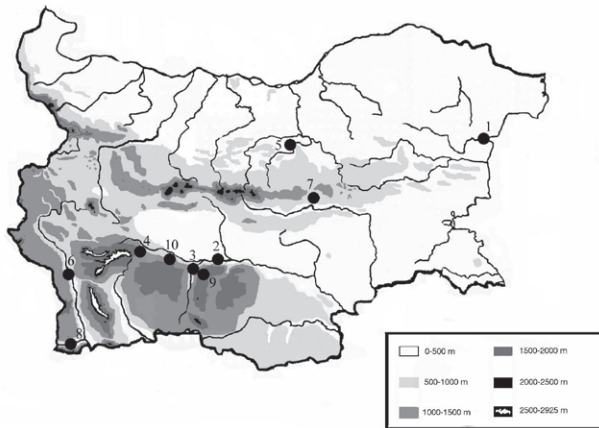
The type locality of *B. fritillaria* remains unknown. According to the above-mentioned literature sources, the species has been registered in Bulgaria in the region of Varna, on the banks of the Maritsa River above Plovdiv, Chervenata Skala Peak (Dobrostan Ridge) and in the valley of Chaya River between Assenovgrad and the village of Narechen in the Western Rhodopes as well as at Belovo, Veliko Tarnovo, Blagoevgrad, Sliven and Strumeshnitsa River above Petrich (Fig. 2). HUBENOV (2007) has indicated a rather general distribution – the Balkan Mountains, the Thracian Plains, the Rila-Rhodopes Massif, the northern Black Sea coast, from 0 to 1000 m a.s.l. In our opinion, some of the reported habitats are not verified or doubtful. E.g., Varna has been reported without presenting examined materials and the shells on the banks of the Maritsa River near Plovdiv are of unclear origin. The revised specimens of two poorly preserved shells (IRIKOV & MOLLOV 2006) near the Chervenata Skala Peak at 1400 m a.s.l. in the Dobrostan Ridge of the Western Rhodopes belong to another species differing from *B. fritillaria* and, therefore, that habitat is not valid. During our long-term study of abundant materials from the Western Rhodopes, we have not identified *B. fritillaria* in the valley of the Chepelarska River. Presently, we are inclined to accept as valid the localities in the Balkan Mountains in the region of Sliven, maybe Veliko Tarnovo, Strumeshnitsa River above Petrich and definitely the Bessapara Hills in the region of the village of Kapitan Dimitriev (Fig. 2). In our opinion, however, in the future, additional examination has to be conducted of more material as well as a verification process must be followed of all reported habitats of *B. fritillaria* (Fig. 2) and *B. var-*



**Fig. 1a, b.** *Bulgarica fritillaria*, South Bulgaria, Besaparski Hill, Trakiiska Lowland, village of Kapitan Dimitriev: a. front view, b. dorsal view.

*nensis* (vide Fig. 6 in IRIKOV 2006) identified so far, as we cannot rule out the possibility of confusing the two species as a result of inaccurate identification. This is particularly valid for the localities of the two species in the regions of Varna, Veliko Tarnovo and Sliven. While *B. varnensis* is distributed mainly in the northern, central and eastern parts of Bulgaria, *B. fritillaria* is found most often in the southern and the south-western parts of the country (Fig. 3). In our opinion, the co-occurrence of the two species must be ruled out to a large degree due to the substantial differences in their biological peculiarities. While *B. varnensis* is a draught-resistant species inhabiting warm and open habitats, *B. fritillaria* prefers damp habitats, rich in detritus and overgrown with vegetation, mostly along river banks. In accordance with their ecological preferences, we can provisionally designate both species as plains-dwelling, detritus-associated snails, not directly bound to the availability of rock habitats.

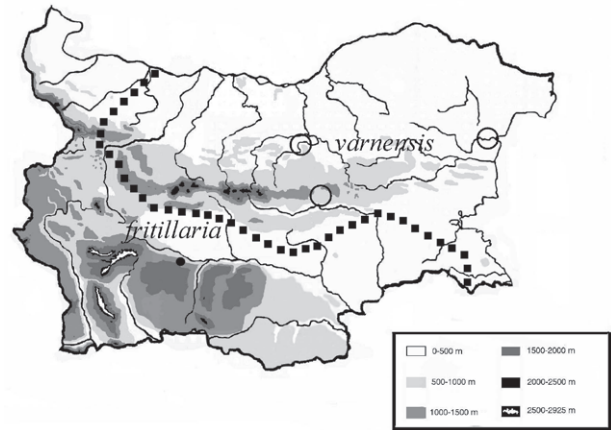
The specimens registered by the present study have been found at 270 m a.s.l. in the outskirts of the village of Kapitan Dimitriev on banks of a small rivulet. The snails of this species live among the detritus, near the roots of bushes, willow trees and hydrophilic grass vegetation in high humidity zones. That rivulet is a southern tributary of the Maritsa River and the registration of an abundant popula-



**Fig. 2.** Known localities (based on literature data - ●, new data - ■) of *Bulgarica fritillaria* on the territory of Bulgaria (the order of the reports is marked with numbers): 1 – Varna, 2 – Plovdiv, 3 – the valley of Chepelarska River from Assenovgrad to Narechen, 4 – Belovo, 5 – Veliko Tarnovo, 6 – Blagoevgrad, 7 – Sliven, 8 – Strumeshnitsa River above Petrich, 9 – Chervenata Skala Peak near Bachkovo, 10 – Kapitan Dimitriev Village.

tion of live specimens is in accordance with the numerous specimens reported on the basis of shell material only on the bank deposits of the Maritsa River near Plovdiv. During our study conducted in the area around the city of Plovdiv, we also registered only shells of the species along the banks of the Maritsa River. The newly-discovered habitat is in contradiction with the speculations of HESSE (1916), URBANSKI (1977) and KÖRNIG (1983) that *B. fritillaria* is registered only in the Rhodopes and the shells from the mountain reach Plovdiv along the tributary of the Maritsa River. In the newly-recorded habitat, *B. fritillaria* occurs jointly with *Carychium minimum* Müller, 1774, *Truncatellina cylindrica* (Ferussac, 1807), *Vallonia costata* (Müller, 1774), *V. pulchella* (Müller, 1774), *V. enniensis* (Gredler, 1856), *Acanthinula aculeata* (Müller, 1774), *Cochlicopa lubrica* (Müller, 1774), *C. lubricella* (Porro, 1838), *Merdigera obscura* (Müller, 1774), *Chondrula microtragus* (Rossmässler, 1839), *Alinda biplicata* (Montagu, 1803), *Alinda atanasovi* (Urbański, 1964), *Zonitoides nitidus* (Müller, 1774), *Vitrea neglecta* Damjanov & L. Pinter, 1969, *Oxychilus glaber* (Rossmässler, 1835), *Tandonia kusceri* (H. Wagner, 1931), *Deroceras turcicum* (Simroth, 1894), *Monacha claustralis* (Menke, 1828), *Fruticola fruticum* (Müller, 1774) and *Helix lucorum* Linnaeus, 1758.

The other three taxa of the *B. varnensis* species-group, i.e. *B. pseudofraudigera* (Nordsieck, 1973), described initially as *Bulgarica varnensis*



**Fig. 3.** Conventional boundary (■■■) of the distribution of *B. varnensis* and *B. fritillaria* on the territory of Bulgaria based on the data surveyed in this article: the newly-discovered locality of *B. fritillaria* (■); zones of overlapping of the distribution of *B. varnensis* and *B. fritillaria* (○).

*pseudofraudigera*, *Bulgarica varnensis gabrovnitsana* Irikov, 2006 and *Bulgarica varnensis trimontsiana* Irikov, 2006, can be considered as typical petrophilous species closely associated with rock habitats (“rock” snails). *Bulgarica v. trimontsiana* is registered only on the syenite rocks (the Three Hills District) in the city of Plovdiv and is absent on the other hills formed by other types of rock. These substantial differences in the ecological requirements to the habitats as well as in the morphology of the shell, the closing aperture device and the specific local distribution (vide Fig. 13 in IRIKOV 2006) of *B. gabrovnitsana* and *B. trimontsiana*, enable us to elevate them to the species rank, as suggested by NORDSIECK (1973) for *B. pseudofraudigera*.

The *Bulgarica varnensis* species-group is endemic for Bulgaria as a whole, with the only exception of *B. varnensis*, which has been reported also at the Black Sea coast of Romania. *Bulgarica fritillaria* is a Bulgarian endemic registered mostly in the southern and the south-western parts of the country, although it is quite likely that it might be registered also in Northern Greece and the Republic of North Macedonia. The remaining three species, *B. pseudofraudigera*, *B. gabrovnitsana* and *B. trimontsiana*, are local Bulgarian endemics.

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