

Overseas Dispersal of Shells of Terrestrial Snails (Gastropoda: Pulmonata) on the Bulgarian Black Sea Coast

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Abstract: Six species of terrestrial snails recorded from the Bulgarian Black Sea coast should be considered accidentally transported as shells from overseas to the territory of Bulgaria. Four species were reported by previous authors on the basis of shells found in marine sediments: *Gibbulinopsis interrupta* (Reinhardt, 1876) (reported from Bulgaria as *Pupilla bogdanovi* Urbański, 1960, and *Pupilla valkanovi* Urbański, 1960, which are recognised as junior synonyms of *G. interrupta* by the present study), *Ena nogellii* (Roth, 1850), *Chondrus tournefortianus* (Férussac, 1821), and *Multidentula squalina squalina* (Pfeiffer, 1848). Shells of two other species, *Scrobifera taurica* (Pfeiffer, 1848) and *Elia huebneri* (Pfeiffer, 1848), are reported for the first time from Bulgaria in this paper. There are no records of living specimens of these species from the Bulgarian Black Sea coast, and we believe that the shells were carried by sea currents and thus reached the Bulgarian seaside. Therefore, these species should not be considered representatives of the fauna of Bulgaria.

Keywords: Terrestrial gastropods, Bulgarian Black Sea coast

Introduction

The Black Sea covers an area of c. 423 000 km². The shoreline is shared by six countries: Romania – 245 km, Bulgaria – 378 km, Georgia – 312 km, Russia – 379 km, Turkey – 1695 km and Ukraine – 1829 km. Some of the largest rivers in Europe (Danube, Dnieper, Dniester, etc.) mouth into the Black Sea, which creates strong coastal currents. There are two main currents of circular nature (*i.e.* cyclonic currents) in this sea. In the narrowest sea part between the southern coast of Crimea and Cape Kerempe of the Anatolian coast, some of the water masses coming from the north-west turn north and thus divide the sea into two parts (East and West), each with its own cyclonic current (ZAITSEV 2008) (Fig. 1). Besides the two large circular currents, there are many smaller ones. Some of them have a constant direction while others are seasonal and change their directions.

In Bulgaria, there are only a few studies on the malacofauna contained in marine sediments. Two gastropod species were described from Bulgaria as

new (URBAŃSKI 1960) and other three species were reported as new records for the fauna of this country (HESSE 1911, PETRBOK 1941, URBAŃSKI 1960, HUDEC, VAŠÁTKO 1971, DAMJANOV, LIKHAREV 1975). The present paper reports two further species recorded as shells only from coastal habitats in Bulgaria. In this article, we survey the terrestrial gastropod species recorded as shells only from marine coastal habitats in Bulgaria and conclude that all they were transported to the Bulgarian coast by sea currents.

Material and Methods

The surveys on the terrestrial gastropods on the Black Sea coast of Bulgaria were carried away in a period of ten years (2000-2010). We studied all previously reported marine deposits and many other areas along the coast. The registered species were identified using data from catalogues and publications (DAMJANOV, LIKHAREV 1975, HUDEC, VAŠÁTKO



Fig. 1. Cyclonic currents in the Black Sea (after ZAITSEV 2008)

1971, SCHÜTT 1996, 2001, URBAŃSKI 1960, SCHILEYKO 1984, SYSOEV, SCHILEYKO 2009, GURAL-SVERLOVA, MARTYNOV 2010). The species that are newly reported in the paper were collected in marine sediments (26.08.2004) at Arapyra Beach Resort (2-3 km north from the town of Tsarevo, Southeastern Bulgaria). All collected material is preserved in the personal collection of A. Irikov.

Results

As a result of the present study, we identified six species of terrestrial snails, which should not be considered representatives of the Bulgarian fauna, since only empty shells were brought in the country by sea currents.

Scrobifera taurica (Pfeiffer, 1848) (Fig. 2.1)

One shell was found in marine sediments near Arapyra, 2-3 km north of the town of Tsarevo. The found shell was in bad condition but undoubtedly belonged to *S. taurica*. Shell with fine and dense ribs. Last whorl strongly bent inward at the end. Aperture lozenge-shaped. Neck with large basal and smaller dorsal keels. Big palatal "pit" present, corresponding to big bulge in aperture. Spiralis lacking. Columellaris clearly visible in aperture but partially obscured by the palatal concavity. Subcolumellaris deep, distinct at lower end of aperture. Lunella slightly developed, located dorsally. Principalis short, located deep within. Internal surface of aperture red.

After detailed surveys in south-eastern Bulgaria, we found no evidence of occurrence of *Scrobifera taurica* in this region. So far, the species has not been recorded from the Strandja Mountains and the southern Black Sea coast of Bulgaria and, in our opinion, it is not a representative of the Bulgarian fauna. Its contemporary geographical range includes north-eastern Turkey and the Caucasus (SCHÜTT 2001). We assume that the shell found by us had been carried by

sea currents for long time as evidenced by its worn appearance showing a long stay in seawater.

Elia (Acroeuxina) huebneri (Pfeiffer, 1848) (Fig. 2.2)

One shell was found in marine sediments near Arapyra. The found fragment of a shell was in a poor condition but the ribs, the structure of the aperture and plicae suggested that the species is *E. huebneri*. Ribs rarely located, large and sharp. Suture papillated. Basal keel strong. Subcolumellaris not visible in aperture. Four palatal plicae present, three of them long; false palatal plicae also present. Lunella distinct, laterally located.

The geographical range of this species covers NE Turkey and the Caucasus (SCHÜTT 2001). Like the previous species, we assume that the shell was carried by sea currents from a long distance as evidenced by its poor appearance after a long stay at seawater.

Gibbulinopsis (Gibbulinopsis) interrupta

(Reinhardt, 1876) (Figs. 2.3 and 2.4)

Synonyms: *Pupilla bogdanovi* Urbański, 1960; *Pupilla valkanovi* Urbański, 1960.

P. bogdanovi and *P. valkanovi* were described from sites adjacent to salterns at the town of Burgas (URBAŃSKI 1960). The description of both species was based on empty shells collected from marine deposits. There are no other records of these species in Bulgaria. In our opinion, *P. bogdanovi* is a synonym of *G. (G.) interrupta*. The same seems also valid for *P. valkanovi* but this species is with a left-coiled shell (SCHILEYKO 1984, SYSOEV, SCHILEYKO 2009, GURAL-SVERLOVA, MARTYNOV 2010). It is most likely that these shells were transferred by sea currents to the Bulgarian shore from the Caucasus.

Ena nogellii (Roth, 1850) (Fig. 2.5)

HUDEC, VAJLATKO (1971) reported this species as *Mastus ponticus* (RETOWSKI, 1887) from the Ropotamo River on the southern Black Sea coast in Bulgaria. *E. nogellii* is widespread in the Pontic region of Turkey between Bolu Province in the west and the Giresun Province in the east (HAUSDORF 2001). The species occurs in northern Turkey (SCHÜTT 1996) and we believe it was brought to the Bulgarian coast with sea currents from the Northern Black Sea shore of Turkey (see IRIKOV, ERÖSS 2008).

Chondrus tournefortianus (Férussac, 1821) (Fig. 2.6)

HESSE (1911) firstly reported the species from the vicinity of the town of Varna, where it was also found by PETRBOK (1941). Later, URBAŃSKI (1960) ascertained the species in marine sediments near Varna. All these authors, however, found only empty shells near the beach. Our studies in this area showed that the species did not occur there. The geographical range of the species includes north-western and

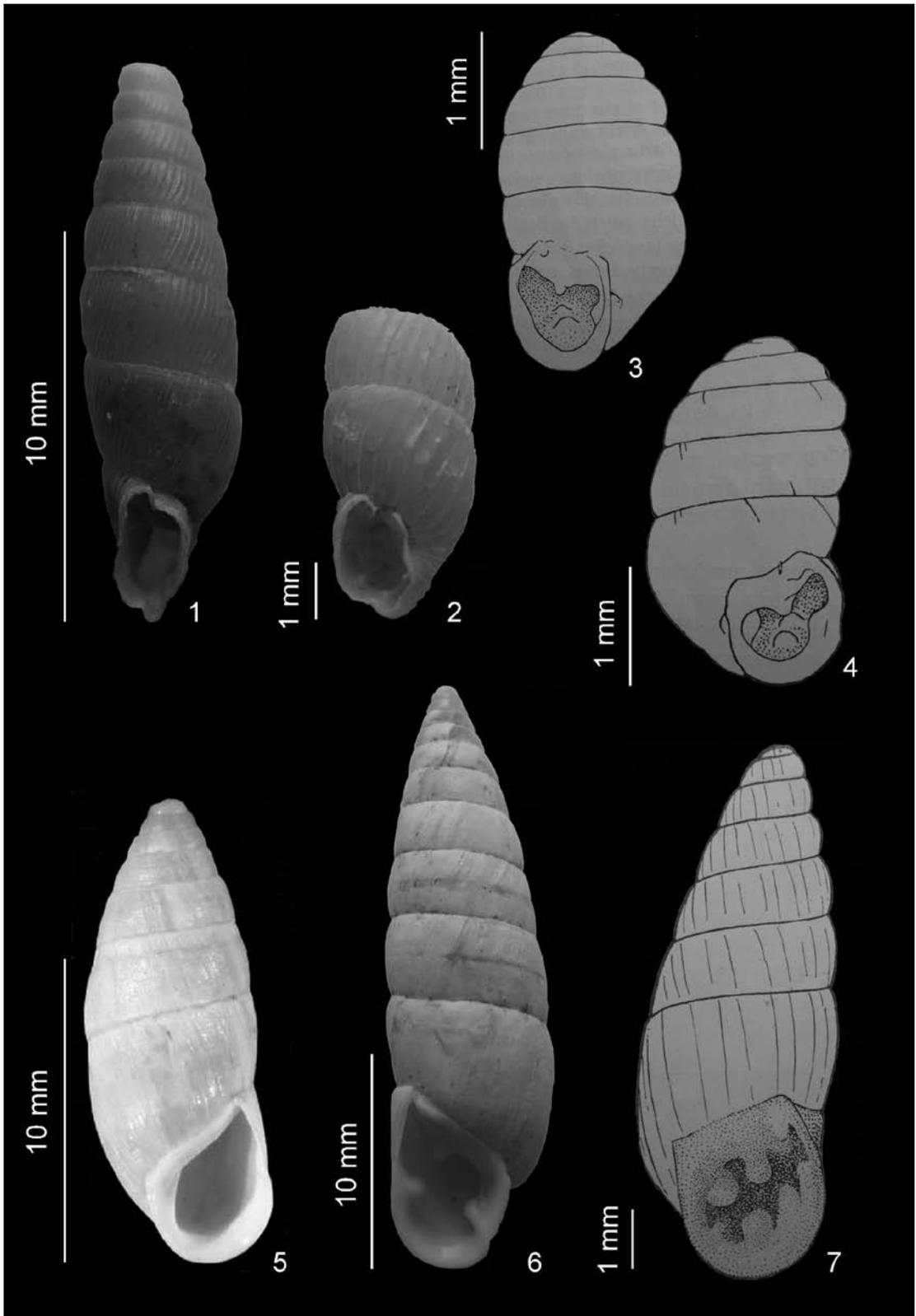


Fig. 2. Photographs – 1. *Scrobifera taurica* Pfeiffer, 1848, Bulgaria, Arapyva beach resort, photo: A. Irikov; 2. *Elia* (*Acroeuxina*) *huebneri* (Pfeiffer, 1848), Bulgaria, Arapyva beach resort, photo: A. Irikov; 3. *Gibbulinopsis* (*Gibbulinopsis*) *interrupta* (Reinhardt, 1876) (specimen with a left-coiled shell!), at 1.5 km north from the salterns of Burgas (Urbański's original picture of *Pupilla bogdanovi*); 4. *Gibbulinopsis* (*Gibbulinopsis*) *interrupta* (Reinhardt, 1876), at 1.5 km north from the salterns of Burgas (Urbański's original picture of *Pupilla valkanovi*); 5. *Ena nogellii* (Roth, 1850), NE Turkey, Erzurum Province, near Erzurum, photo: F. Welter-Schultes; 6. *Chondrus tournefortianus* (Férussac, 1821), Turkey, Divolasi Province, 40 km east of Istanbul, coll. A. Irikov, photo: A. Irikov; 7. *Jaminia squalina* (Rossmässler, 1848) (Férussac's original picture)

central Turkey (SCHÜTT 2001). We believe that it was transported to the Bulgarian coast by sea currents (see IRIKOV, ERÖSS 2008).

Multidentula squalina squalina (Pfeiffer, 1848) (Fig. 2.7)

This species was reported by DAMJANOV, LIKHAREV (1975) from the beaches at the village of Byala and the town of Nesebar. The shells were found in plant debris and in swamps. The authors suggested that the shells are thrown out by waves on the shore.

The species occurs in North Anatolia in Turkey (DAMJANOV, LIKHAREV 1975) and a single finding was reported from Albania (FEHÉR *et al.* 2008). We believe it was transported to the Bulgarian coast with sea currents from the Black Sea coast of Turkey (see IRIKOV, ERÖSS 2008).

Discussion

Based on the studies carried out in south-eastern Bulgaria over a period of 10 years, we believe that some of the mollusk species, which have been re-

ported for the fauna of the country, actually are not representatives of the Bulgarian fauna. These species were found in marine sediments on the Bulgarian coast of the Black Sea only as shells. We believe that the species mentioned in this article have more likely been transferred accidentally by marine currents to the Bulgarian coast and reported by various authors as new to science or as new records for the fauna of Bulgaria. We assume that a part of the shells has been transported from the northern and north-western Turkey (*E. nogeli*, *C. tournefortianus* and *M. squalina squalina*), while the others from the north-eastern Turkey or the Caucasus (*S. taurica*, *E. huebneri* and *G. interrupta*). A similar situation exists in Crimea (IGOR BALASHOV per. comm.) where shells of species from the Caucasus were discovered in marine sediments. This fact shows that “dispersal” of empty shells through sea currents is not a rare occasion (see biodiversitylibrary.org – RETOWSKI 1883, 1987, BALASHOV, GURAL-SVERLOVA 2012). The question about the survival of living terrestrial snail immigrants remains unclear.

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