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Research Article

Three Terrestrial Gastropod Species (Mollusca: Gastropoda) New to the Fauna of Bosnia and Herzegovina

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Abstract: During field trips in 2020 and 2022, three terrestrial gastropods not previously reported from Bosnia and Herzegovina were found. The records of *Lauria sempronii* (Charpentier, 1837), *Limacus flavus* (Linnaeus, 1758) and *Trochoidea pyramidata* (Draparnaud, 1805) are described. *Lauria sempronii* is the first member of the family Lauriidae reported from Bosnia and Herzegovina.

Key words: Mollusca, new geographical records, zoogeography

Introduction

The beginning of gastropod studies in Bosnia and Herzegovina dated back to the second half of the 19th century (Boettger 1885, Brancsik 1889). Intensive examinations on both freshwater and terrestrial gastropods were carried out during 20th century (e.g. Bole 1961, Nordsieck 1970, Radoman 1983), including descriptions of new species (for details, see Karaman 2006). Wiktor (1996) summarised the knowledge about slugs of former Yugoslavia. The most recent checklist of terrestrial and freshwater gastropods of Bosnia and Herzegovina (Karaman 2006) included data on 330 species and subspecies. Further data were presented by Bank & Neubert (2017) in their checklist of the land and freshwater gastropods in Europe. Recent publications on terrestrial gastropods in Bosnia and Herzegovina included descriptions of several new species (Inäbnit et al. 2021, Hofman et al. 2022). Judging by the number of publications, the fauna of terrestrial gastropods of Bosnia and Herzegovina can be considered as understudied in comparison with neighbouring countries, possibly due to the small number of native malacologists.

On two field trips in 2020 and 2022, three species not mentioned in any previous publications from the territory of Bosnia and Herzegovina were found: *Lauria sempronii* (Charpentier, 1837), *Limacus flavus* (Linnaeus, 1758) and *Trochoidea pyramidata* (Draparnaud, 1805). In the present article, we present the information on these new records.

Materials and Methods

Snails and slugs were sampled in the southwestern part of Bosnia and Herzegovina (Fig. 1). They were further processed at the Institute of Zoology, Faculty of Biology, Belgrade, and photographed with a Nikon SMZ800N stereomicroscope and a Nikon DS-Fi2 camera. They were identified following Schileyko (1998, 2006), Welter-Schul-

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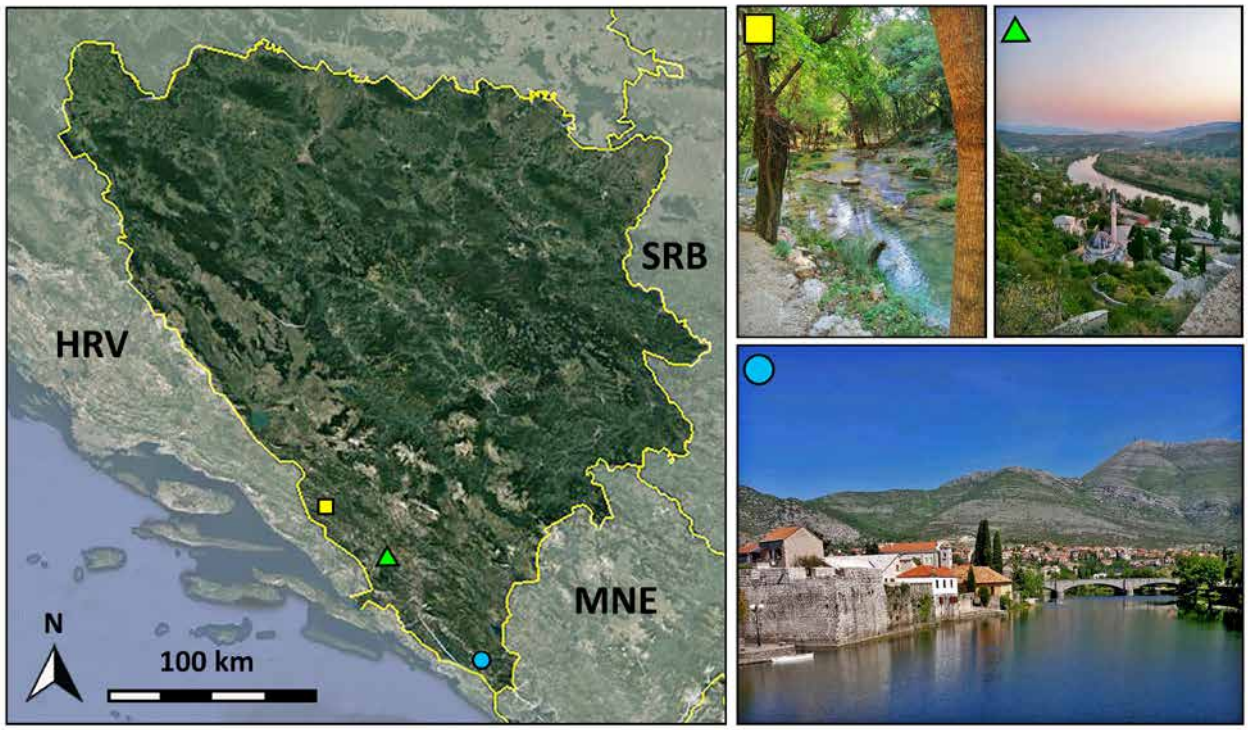

Fig. 1. Sampling sites in Bosnia & Herzegovina. Legend: yellow square – Peć Mlini; green triangle – Počitelj; blue circle – Trebinje.

tes (2012) and Rowson et al. (2014). Scale bars were settled using a Nikon DS-L3 control unit. The distribution map prepared using Google Earth Pro application (7.3.4.8248, 64-bit). The material is stored at the Institute of Zoology, Faculty of Biology, Belgrade, and in the private collection of the first author.

Results

Family Lauriidae Steenberg, 1925
Genus *Lauria* Gray, 1840
***Lauria sempronii* (Charpentier, 1837)**

Material: One specimen, spring of the river Trebižat (Peć Mlini), 12 September 2020, leg. V. Gojšina.

Diagnosis: Shell small (mostly up to 3 mm), consisting of 5–6 whorls. Colouration usually yellowish or brownish. Aperture rounded, with parietal and, rarely, also with angular tooth. Columellaris not visible (Fig. 2). Umbilicus open and narrow. Inhabiting forests; usually (but not exclusively) found on limestone (Welter-Schultes 2012).

Family Limacidae Batsch, 1789
Genus *Limacus* Lehmann, 1864
***Limacus flavus* (Linnaeus, 1758)**

Material: Nine specimens, city of Trebinje, 12 September 2022, leg. V. Gojšina.

Diagnosis: Up to 120 mm long when fully extended. Colouration usually yellow-green but could also be nearly orange, with numerous pale spots. Tentacles blackish; sole pale. Mucus yellowish to orange, transparent (Fig. 5A) (Wiktor 1996). Internal shell of the found specimens big and almost rectangular (Fig. 3C). Penis cylindrical, almost a quarter of body length. Vas deferens joins the penis apically. Spermatheca duct opening into oviduct, which is an important character for the identification of this species, distinguishing it from *L. maculatus* (Kaleniczenko, 1851), in which spermatheca duct opening near the base of the penis. Point where spermatheca duct joining the oviduct is widened (Fig. 3A) (Wiktor 1996, Rowson et al. 2014).

Family Geomitridae C.R. Boettger, 1909
Genus *Trochoidea* T. Brown, 1827
***Trochoidea pyramidata* (Draparnaud, 1805)**

Material: Four specimens, Počitelj settlement, 12 September 2020, leg. V. Gojšina.

Diagnosis: Shell conical, medium-sized (up to 10 mm), with 4.5–7 whorls. Colouration entirely white or with several brown bands, more or less pronounced. Umbilicus narrow but open (Fig. 4). This species can be distinguished from other congeners by almost smooth shell surface, without any pronounced ornamentation in form of grooves or

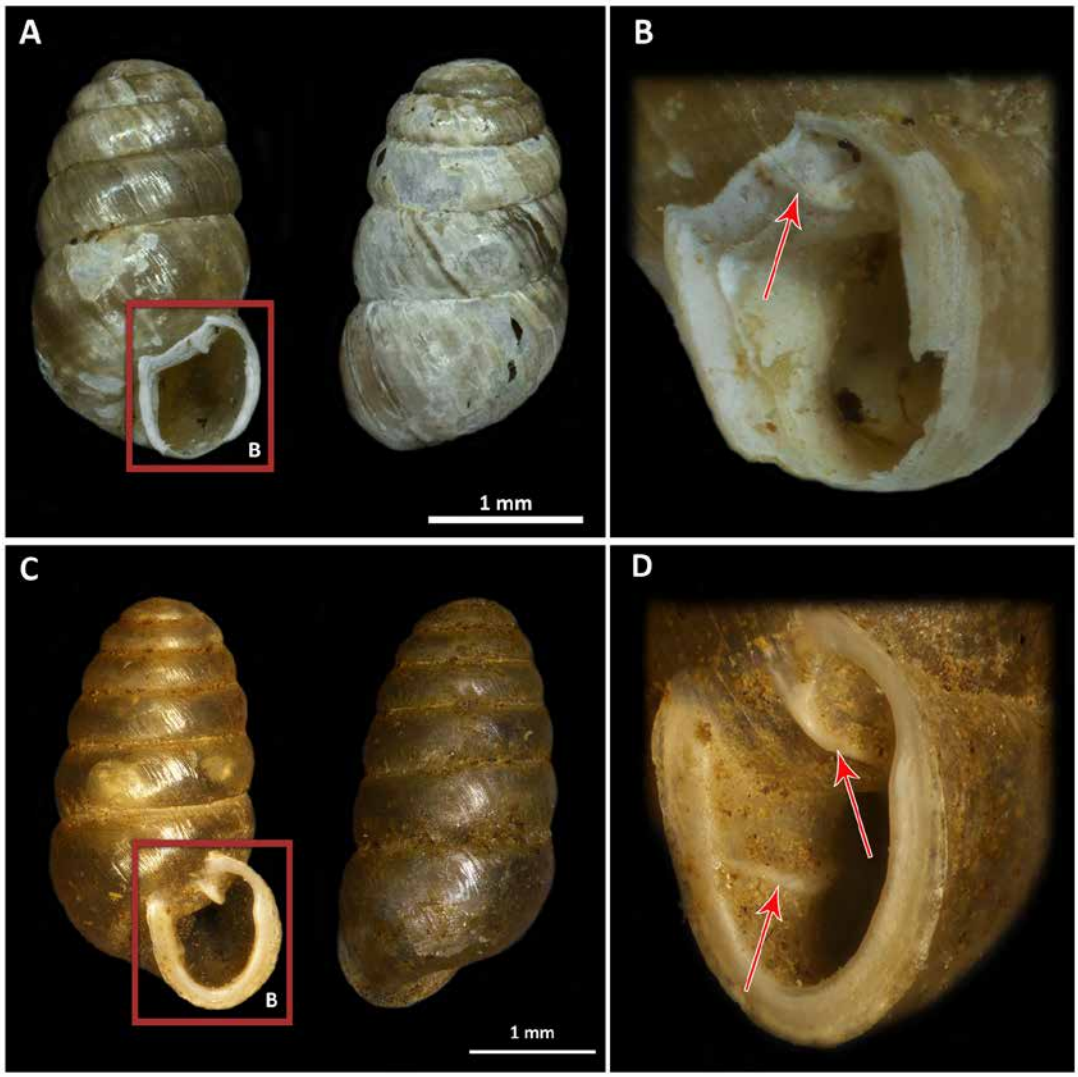

Fig. 2. *Lauria* spp. A-B, *Lauria sempronii* (Charpentier, 1837) from Peć Mlini, arrow points to parietalis; C-D, *Lauria cylindracea* (Da Costa, 1778) from Bulgaria (coll. I. Dedov), upper arrow points to parietalis, lower arrow points to columellaris.

strong ribs. Shell is not sharply keeled, as it is in many representatives of the genus. The only similar congener is *T. trochoides* (Poiret, 1789), which is characterised by a conspicuous keel present on the body whorl.

Discussion

According to Karaman (2006), the number of terrestrial gastropod species from the territory of Bosnia and Herzegovina is 198. The checklist by Bank & Neubert (2017) listed further 28 species. Thus, the total number is 226 species, although some of the species reported by Karaman (2006) have not been included in the work by Bank & Neubert (2017). However, the exact number is still to be updated.

The native distribution range of *L. flavus* was probably in southeastern Europe and Asia Minor but is has been introduced nearly worldwide, including entire territory of Europe (Wiktor 1996, Wiktor et al. 2000, Castillo 2020). *Trochoidea pyramidata* occurs only in the Mediterranean region; however, it possibly was introduced into the eastern parts of the continent (Hausdorf & Sauer 2009) where it inhabits dry habitats, usually bordering the coast, where it is frequent on plants (Germain 1930). *Lauria sempronii* occurs in several countries in Europe, including Slovenia, Croatia, Montenegro, Albania, Macedonia, Greece, Spain, Italy, France, Switzerland and Great Britain (Fehér & Erőss 2009, Bank & Neubert 2017). It inhabits limestone habitats but it is not exclusively limited to them. It can also occur in forests in tree trunks covered with moss (Welter-Schultes 2012).

The species reported herein are included in distribution maps (Welter-Schultes 2012) of a larger

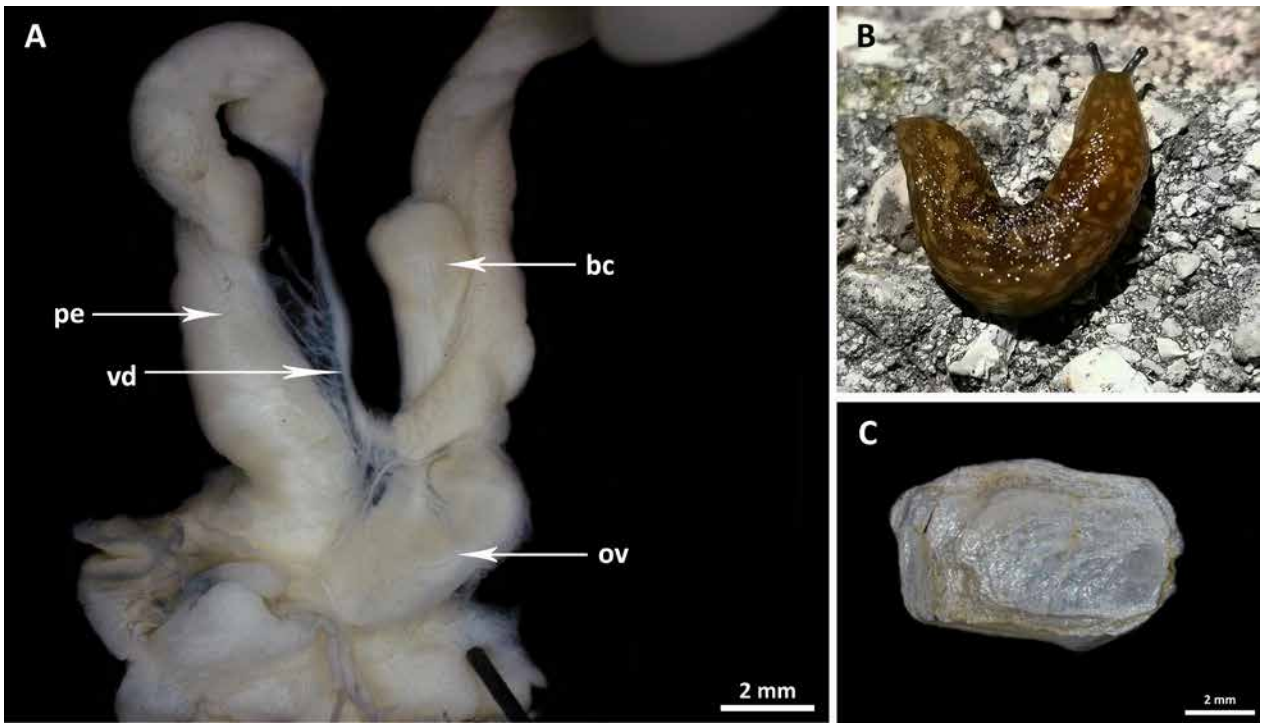

Fig. 3. *Limacus flavus* (Linnaeus, 1758) from Trebinje. A, genitalia; B, living specimen; C, internal shell. bc, bursa copulatrix; ov, oviduct; pe, penis; vd, vas deferens.

Fig. 4. *Trochoidea pyramidata* (Draparnaud, 1805) from Počitelj settlement.

region that includes Bosnia and Herzegovina. However, there is no published information regarding the presence of these three species on the territory of this county and they have not mentioned in previous checklists (Wiktor 1996, Karaman 2006, Bank & Neubert 2017). Their presence on this territory is not surprising, since they have been reported from neighbouring countries (Wiktor 1996, Štamol 2010). Therefore, the present records do not extend the distribution range of the species. Furthermore, *L. sempronii* and *T. pyramidata* can be considered as native to this region. In most areas of the Balkans, *L. flavus* inhabits synanthropic and ruderal habitats, often with high frequency of occurrence and density

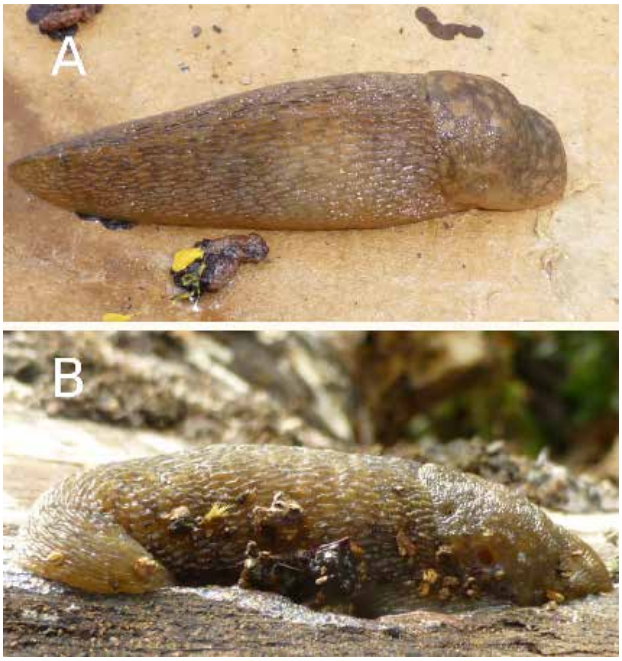

Fig. 5. *Limacus flavus*, Bulgaria, Rezovo (A) and *Limacus maculatus*, Bulgaria, Beglik Tash (B), in the rest position.

(unpublished data). The record of this species in a single locality in Bosnia and Herzegovina may also be an indication of a recent introduction of the species. Further studies are needed to understand the status of this species in the studied area.

For Bosnia and Herzegovina, these new records represent not only species records but also new generic reports for the fauna of the country. *Limacus flavus* was found in the city of Trebinje, in the old part of the city (Fig. 1). In some cases, this species could be confused with *L. maculatus* (Kaleniczenko, 1851) (Wiktor 1996). According to our observations, there are some minor external differences between the two species. Generally, *L. maculatus* is much darker and, in the resting position, it is more flattened (with a "hump-shaped" body section) while *L. flavus* is more pale and rounded (Fig. 5). In addition, *L. maculatus* occurs in sparse forest habitats, while *L. flavus* could be found in different type of habitats, including open synanthropic areas. The anatomical trait, which distinguishes these two species, is the point of the attachment of the bursa copulatrix. In *L. flavus*, it is attached to the oviduct (Fig. 3A), in contrast to *L. maculatus* where being attached near the base of the penis (Rowson et al. 2014).

Lauria sempronii is the first member of the family Lauriidae recorded into Bosnia and Herzegovina. It was found near the spring of the river Trebižat on limestone. This species is similar to *L. cylindracea* (Da Costa, 1778). The easiest way to distinguish *L. sempronii* from *L. cylindracea* is the shell size. *Lauria sempronii* has a smaller shell (2.5–3.2 mm height and 1.5 mm width) compared to *L. cylindracea* (3–4.5 mm height and 1.8 mm width). Other important differences are the less reflected margin and the weaker folds in the aperture of *L. sempronii*, as well as the angular tooth less often present and never connected to the outer lip. Additionally, *L. cylindracea* has a larger diameter of the last whorl (for more details, see Welter-Schultes 2012).

One more species described from Croatia, *L. reischuetzi* Falkner, 1985, is also similar, although being smaller than *L. sempronii*. It seems that the status of *L. reischuetzi* as a distinct species is not entirely clear and it might be conspecific with *L. sempronii* (see Welter-Schultes 2012). *Trochoidea pyramidata* is most similar to *Trochoidea trochoides* (Poiret, 1789). However, in *T. trochoides*, the umbilicus is narrower and the last whorl is clearly keeled, which is probably the easiest way to distinguish these two species (Welter-Schultes 2012). All specimens showed the previously described conical shell with well-developed brown bands, except in the case of one specimen, which was almost entirely white with faint brownish bands and only one pronounced brown band at the last whorl, near umbilicus (Fig. 4).

There are still no records for *T. trochoides* from Bosnia and Herzegovina either but it is most probably also present in this country and further studies should fill these gaps.

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