SHORT COMMUNICATIONS
КРАТКИЕ СООБЩЕНИЯ

GYRAULUS MAROCANA SP. NOV., A NEW FRESHWATER SNAIL SPECIES (MOLLUSCA, GASTROPODA, PLANORBIDAE) FROM MOROCCO

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A new planorbid gastropod species is described: *Gyraulus marocana* sp. nov. It can be distinguished from other known species by its regularly striated ivory shell, with four whorls separated by a deep suture, prostate gland with 20 diverticula, phallotheca twice as long as the preputium and its orange stylet. The new species was found in the northern part of Morocco, in Lake Zerrouka, a Protected Area, being also a site of ecological and biological interest (known as SIBE). It is located in the Middle Atlas massif, which is a geographical barrier known for its other endemic molluscs.

Key words: basommatophoran snails, Lake Zerrouka, Middle Atlas Mts., Moroccan endemic, new taxa, Protected Area

Introduction

Freshwater gastropods are one of the major components of aquatic biota and they are essential to the maintenance and balance of freshwater ecosystems. Approximately 5000 species are found to inhabit different habitats worldwide (MolluscaBase, 2022) and about 10 000 species await description (Darwall et al., 2005).

Within gastropods, the Planorbidae family is a diverse and very heterogeneous group of freshwater pulmonate molluscs, with shell shapes ranging from flat to high spired and with varying degrees of shell sculpture, they lack an operculum and most of the species are disc-shaped. All species are left coiled, but in the crawling specimens, the underside is the functional upper side, because the shell of living specimens is laid to the left side (Glöer, 2019). Planorbid representatives populate all continents and in such a heterogeneous group, both rheophilic and limnophilic species exist. They have a varied diet that includes encrusting algae, macrophytes and detritus deposits and they can tolerate certain organic pollution (Oscoz et al., 2011).

Only a few planorbid genera are known from Morocco; most of them also occur in Europe. These are *Ancylus* Müller, 1774, *Bulinus* O.F. Müller, 1781, *Anisus* Studer, 1820, *Planorbarius* Duméril, 1806, *Planorbis* O.F. Müller, 1773, *Hippeutis* Charpentier, 1837, and finally *Gyraulus* Charpentier, 1837; the latter is presented by *Gyraulus* cf. *laevis* (Alder, 1838). However, the occurrence of *G. laevis* in Morocco must be questioned. To our knowledge the presence of *G. laevis* in Morocco, where it is supposed to be widely distributed (Taybi et al., 2017), was documented based only on shell morphological criteria. As for many Planorbidae members, the identification is not always easy and anatomical (genitalia) or molecular analyses would be the best tools for the right determination (Glöer, 2019). In this paper, we describe a new species of *Gyraulus* from the Middle Atlas in Morocco.

Material and Methods

Sampling area

In order to promote knowledge on the malacofauna of Morocco, several field expeditions have been conducted since 2014 (and still ongoing) in the northern part of Morocco, with a focus on its Protected Areas, especially on its great geographical barriers such as the Middle Atlas massif (Fig. 1). More than 150 localities have been investigated and most of these sampling sites were visited at least three times (e.g. Taybi et al., 2017; Mabrouki et al., 2020a, for more details on the localities).

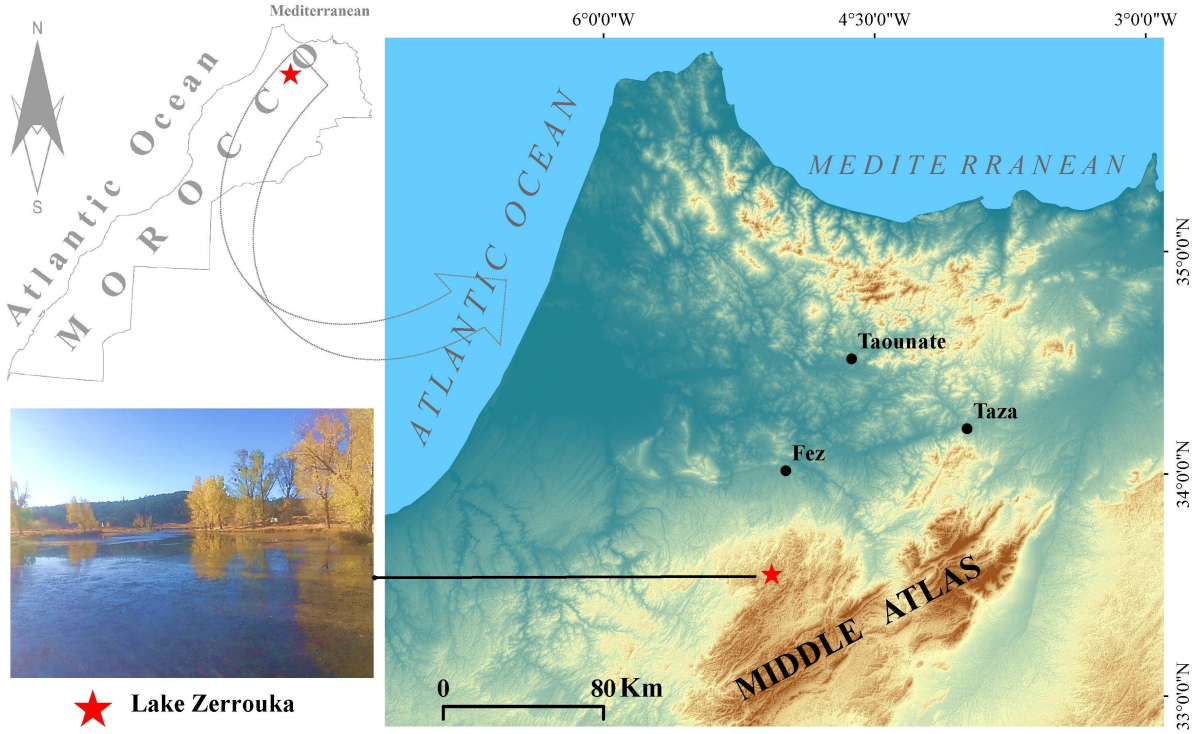

Fig. 1. The sampling site and habitat of *Gyraulus marocana* sp. nov.

Fieldwork and laboratory processing

The samples of benthic fauna (including gastropods) were collected by a kick net and clamps during 2014–2021. The samples have been fixed in 75% ethanol. The dissections and measurements of the genital organs and the shells were carried out using a stereo microscope (Leica M205C). Photos were made with a Leica M205C Microscope with a digital camera Leica DMC5400. The type material is stored in the Zoological Museum of Hamburg (ZMH) in Germany.

Results

Genus *Gyraulus* Charpentier, 1837

Type species: *Gyraulus albus* (O.F. Müller, 1774)

Diagnosis. The shells in *Gyraulus* genus are coiled in a plane, the whorls are rounded to keeled. The upper margin of the aperture is pulled forward and the penis has a stylet (Glöer, 2019).

Subgenus *Gyraulus* s.str.

Diagnosis. The shell is always planispiral, the aperture is more or less ovate. The phallotheca (pht) is longer or of the same length than the preputium (prp), the prostate gland bears 8–40 diverticula (Glöer, 2019).

Description of the new species

Gyraulus (*Gyraulus*) *marocana* Mabrouki, Glöer & Taybi, sp. nov.

Diagnosis. The ivory shell is finely and regularly striated (Fig. 2). The four whorls are separated by a deep suture. The first whorls are immersed on the underside, on the upperside the whorls lay in a plane and are slightly convex. The last one is rounded or canted. The aperture is ovate and slightly descended. The shell is 1.25–1.35 mm high and 2.98–3.25 mm broad. The body whorl has a height of 0.75 mm near the aperture.

Anatomy. The prostate gland bears about 20 diverticula. The bursa is club elongate. The border of the nidamental gland is smooth. The pht is twice as long as the preputium. The stylet is orange (Fig. 3).

Type material. Holotype: shell 1.35 mm high, 3.26 mm broad: Morocco, Zerrouka Lake, Ifran Province, 33.543250° N, 05.095194° W, 24.10.2021, leg. (ZMH 140903); three paratypes: Morocco, Zerrouka Lake, Ifran Province, 33.543250° N, 05.095194° W, 24.10.2021, leg. (ZMH 140904), three specimens in collection of Peter Glöer.

Etymology. The species was named after Morocco.

Habitat. It is located in the Province of Ifrane in the heart of the Middle Atlas at an altitude of 1613 m a.s.l. The Zerrouka Lake is a Protected Area (Fig. 1), considered a Site of Biological and Ecological Interest (SIBE) (https://ma.chm-cbd.net/manag_cons/esp_prot/sibe_ma/sibe_cont_hum/plan-d-eau-zerrouka-i-h16/sibe_h16). The area is an integral part of the Oued Tizguite Wetland, of which Oued Zerrouka is a tributary, classified as a Ramsar Site on 22.05.2019. This region is characterised by a humid bioclimate with cold

winters. The lake is supplied by a rheocenous natural spring, partially modified. The grain size of the bottom consists of stones, pebbles sand and sometimes silt and plant debris. The water body is limited by a concrete wall, at least on the west bank. The aquatic and riparian vegetation is quite varied on the lake level. The spring waters are used to supply the town of Ifrane with drinking water. The banks are subjected to a strong anthropic pressure, mainly by trampling cattle.

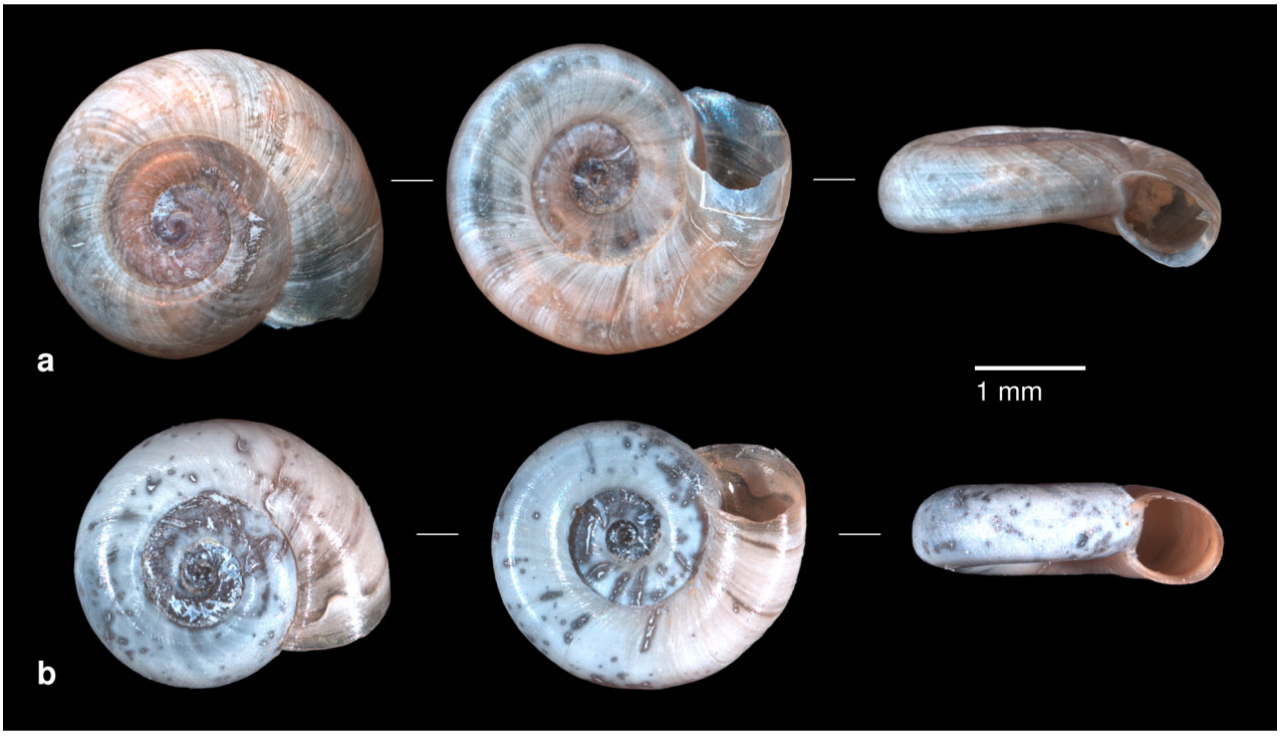

Fig. 2. The shell of *Gyraulus* (*Gyraulus*) *marocana* sp. nov. Designations: a: holoptype, b: paratype.

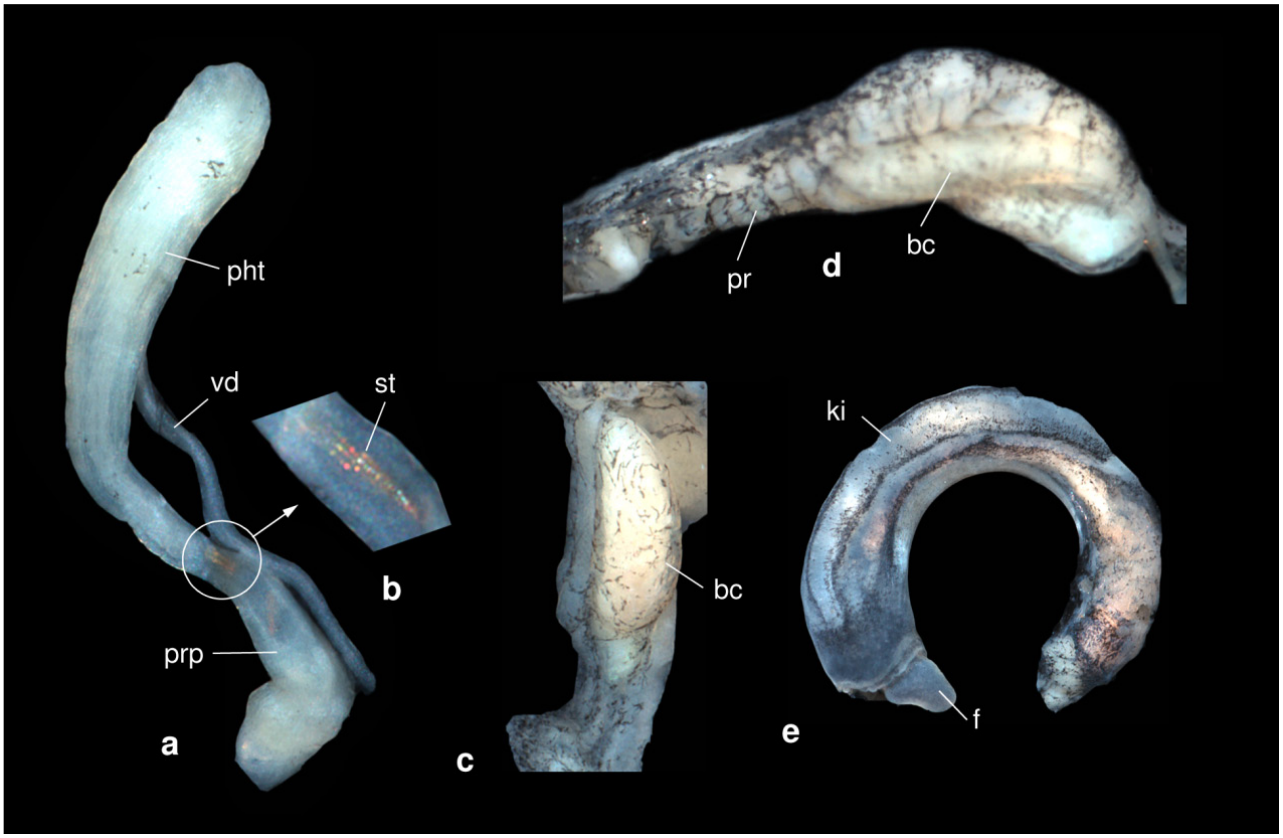

Fig. 3. Anatomy of *Gyraulus marocana* sp. nov. Designations: a: penis with phallotheca (pht), preputium (prp), vas deferens (vd), and visible stylet (st); b: stylet enlarged; c: bursa copulatrix (bc); d: prostate gland (pr); e: mantle pigmentation of the left side with kidney (ki), and foot (f).

The submerged aquatic vegetation of Lake Zerrouka consists of *Myriophyllum spicatum* L., *Ranunculus aquatilis* L., *Persicaria amphibia* (L.) Delarbre, *Potamogeton* spp., *Elodea* sp., and *Ceratophyllum* sp. Emerging vegetation consists of *Typha latifolia* L., *Juncus bufonius* L., *Schoenoplectus lacustris* (L.) Palla, and *Carex* spp.

Differential diagnosis

The new species can be distinguished from its congeners in the Western Palaearctic by its regularly striated ivory shell, with four whorls separated by a deep suture, prostate gland with 20 diverticula, pht twice as long as the preputium and its orange stylet. *Gyraulus laevis* has a thin walled and irregularly striated shell with 3.5 convex whorls, a prostate bearing only 6–15 diverticula, the ratio of pht: prp is 1.0–2.5 and the penis tip is stylet shaped. *Gyraulus albus* has a translucent shell with 4.0–4.5 fast growing whorls, the prostate gland bears 7–22 diverticula; the ratio of pht: prp is 1.2–2.2 and the penis tip is stylet shaped. The shell in *Gyraulus acronicus* (A. Férussac, 1807) is up to 7 mm and the prostate gland bears 20–40 diverticules. The shells in *G. stroemi* Westernlund, 1881 are much larger (up to 9 mm) and the prostate gland has 27-35 diverticula. *Gyraulus rossmaessleri* (Auerswald, 1852) has a non-translucent brownish shell with a characteristic white tip. The other species have less than 20 diverticula except for the narrow-ranged: *G. argaeicus* (Sturany, 1904) and *G. nedyalkovi* Gloër & Georgiev, 2012, endemic to Turkey; *G. homsensis* (Dautzenberg, 1894) endemic to Lebanon and Syria; and *G. meierbrooki* Golër & Pesic, 2007 known only from the type locality Lake Skadar, Montenegro.

Discussion

Gyraulus marocana Mabrouki, Glöer & Taybi, sp. nov. can be distinguished from the other species by the morphology of the shell anatomy. Our findings raise the known biodiversity of the planorbid snails to five genera in Morocco, and confirm the presence of the genus *Gyraulus* in North Africa and Morocco, as already stated by Meier-Brook (1983). On the other hand, the presence of *Gyraulus laevis* should be re-examined. This species was namely reported from the Coastal Plateau, the Rif, the High Atlas and the Middle Atlas (Berrahou et al., 2001; Taybi et al., 2017), since the identification was done most probably based on shell morphology.

Lake Zerrouka hosts an interesting animal biodiversity, it is a nesting site for several aquatic birds (e.g. *Fulica cristata* Gmelin, 1789, *Fulica atra* Linnaeus, 1758, *Anas ferina* Linnaeus, 1758, *A. fuligula* Linnaeus, 1758 and *A. nyroca* Guldenstad, 1770) (Chillasse et al., 2001). It is home for aquatic reptile species such as the European pond turtle *Emys orbicularis* (Linnaeus, 1758), *Mauremys leprosa leprosa* (Schweigger, 1812), and *Natrix maura* (Linnaeus, 1758) (personal observations). Lake Zerrouka has revealed recently a new genus and species of aquatic snails, *Ifrania zerroukansis* Glöer, Mabrouki & Taybi 2020 (Hydobiidae). These springsnails are known for their high endemism and narrow-range distribution, which makes Lake Zerrouka of major importance for the biodiversity of the Middle Atlas and Morocco. Therefore, there is a need in more adaptive management strategies to identify and protect the autochthonous fauna, especially in regions where freshwater ecosystems are scarce and frequently disturbed by human activities as it is the case in the whole of Morocco and North Africa (Taybi et al., 2020a). These anthropic pressures combined with drought episodes, typical of semiarid regions, like in the study area, can result in an important loss of aquatic habitats and their biodiversity.

Conclusions

In addition to its position and many geographical barriers, such as the Atlas Mountains, dividing the northern part of the country into two bioclimatic regions, Morocco is characterised by a high rate of endemism especially in its aquatic fauna (Mabrouki et al., 2019a,b; Marrone et al., 2020; Taybi et al., 2020b,c), which gives it a privileged place for faunistic and taxonomical studies. Considering the fact that each dedicated collecting expedition resulted in the discovery of as yet unrecorded species in Morocco or to science (Mabrouki et al., 2020b,2021b; Taybi et al., 2021a,b), there is little doubt that the number of planorbid species known to occur in Morocco will increase with further prospections.

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GYRAULUS MAROCANA SP. NOV., НОВЫЙ ВИД ПРЕСНОВОДНЫХ УЛИТОК (MOLLUSCA, GASTROPODA, PLANORBIDAE) ИЗ МАРОККО

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В настоящей работе описан новый для науки вид катушек, *Gyraulus marocana* sp. nov. От остальных известных видов он отличается по равномерно исчерченной раковине цвета слоновой кости с четырьмя оборотами, разделенными глубоким швом, предстательной железе с 20 дивертикулами, фаллотеке вдвое длиннее препуциума и оранжевому стилету. Новый вид был найден на севере Марокко, в оз. Зерроука, – особо охраняемой природной территории, которая также признана областью экологического и биологического интереса (так называемые SIBE). Место находки располагается в горном массиве Среднего Атласа, представляющего собой географический барьер для остальных эндемичных моллюсков.

Ключевые слова: новые таксоны, озеро Зерроука, особо охраняемая природная территория, сидячеглазые улитки, Средний Атлас, эндемик Марокко