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Two new species of the genera *Islamia* and *Mercuria* (Gastropoda, Hydrobiidae) from Morocco

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Abstract
Two new hydrobiid species *Islamia karawiyiensis* n. sp and *Mercuria atlasica* n. sp. are described here from Fez prefecture of Morocco. Samples were collected in 2020. Photos of the holotypes are presented in addition to the penis morphology of the new *Mercuria*. The map of the sampling area with the type locality and the habitat description are given.

Key words: Morocco, Gastropoda, Hydrobiidae, new species.

Introduction

Freshwater molluscs play a vital role in freshwater ecosystems, as they are essential to the maintenance and balance of aquatic biota, primarily through their control of water quality and nutrient balance through filter-feeding and algal-grazing and, to a lesser degree, as a food source for predators including a number of vertebrates species (Tachet et al. 2020). There are an estimated 7,000 valid species around the world and about 10,000 more await description (Darwall et al. 2005).

Characterized by their small sizes, the Hydrobiidae family is one of the largest freshwater gastropod families in the world (Wilke et al. 2009). The distribution of its members is limited by their stenotherm condition; most of them are obvious crenophilous, typically found in river sources and springs. In this family, we can observe a morphological convergence of the shell as well as an extreme variability of shell characteristics depending on the environment in which the animals live (Oscoz et al. 2014; Glöer 2019). Although this family has received considerable attention in terms of species discoveries in Morocco (e.g. Glöer et al. 2020a, b; Ghamizi 2020), the Hydrobiidae investigations related to the taxonomy, ecology, biomonitoring and molecular analysis in the country or in North Africa in general are still insufficient, and major efforts are needed to palliate the gape.

New investigations conducted recently through the Middle Atlas massif in Morocco revealed two new species of the genera *Mercuria* and *Islamia*. The aim of this paper is to describe the new species.

Material and methods

Field surveys were conducted from 2014 (and still ongoing) through the northern part of the country, including in its great natural barriers such as the Moulouya River basin and the Middle Atlas massif (Figure 1). Most of these sampling sites were visited several times. Our goal was to document maximum macroinvertebrate biodiversity in the different microhabitats prospected at each sampling site. The samples of benthic fauna were collected by a kick net and clamps. 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 (ZEISS); the photographs were made with a digital camera system (Leica R8). The type material is stored in the Zoological Museum of Hamburg (ZMH).

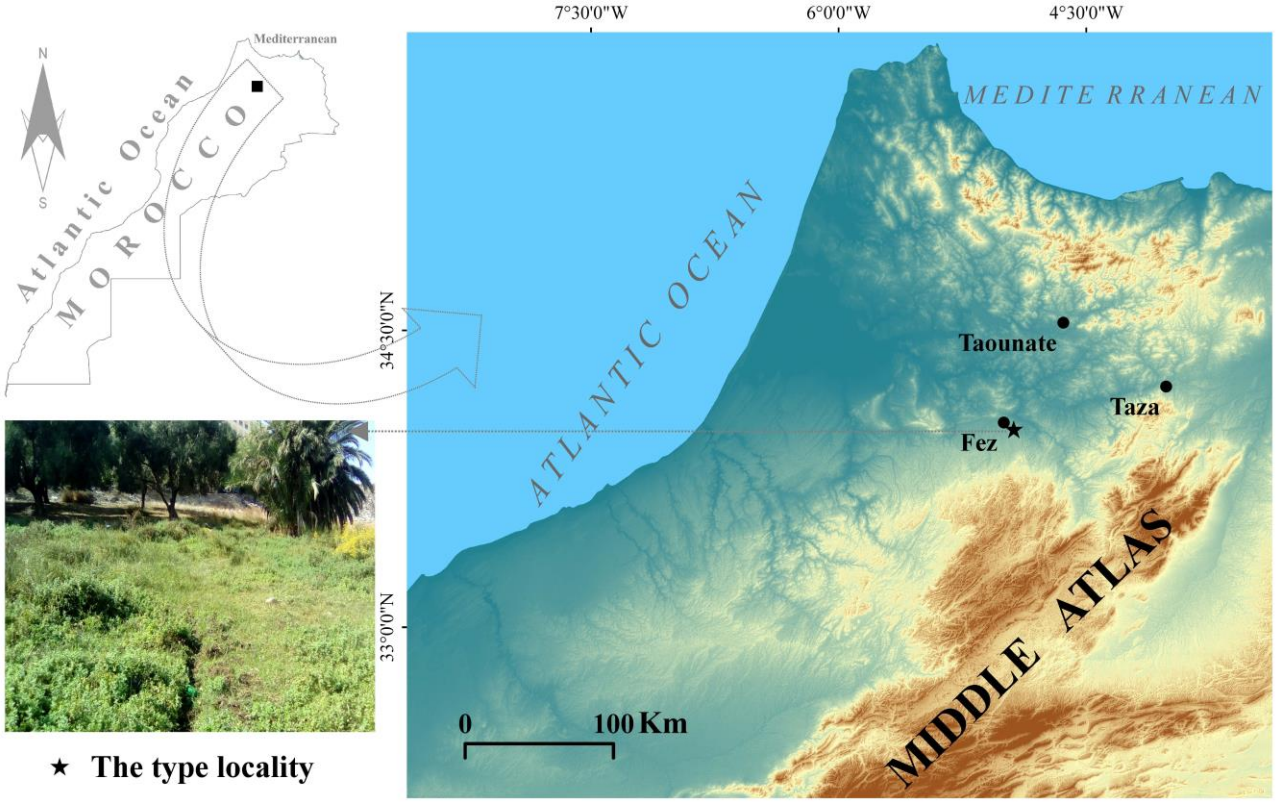


Figure 1. The sampling site and habitat of *Islamia karawiyiensis* n. sp and *Mercuria atlasica* n. sp.

Results

The first new species is a valvatoid hydrobiid snail, possibly a member of the genus *Islamia*, which also inhabits Northern Spain (Asturias and Catalonia). Unfortunately we did not find a male to identify the genus by the penis morphology, as hydrobiid species are characterized by the penis morphology in combination with the shell shape (Szarowska 2006). The second species could be assigned to the genus *Mercuria*.

Genus *Islamia* Radoman, 1973

Type species: *Hydrobia valvataeformis* Möllendorf, 1873.

The shell is valvatiform with a roundish-ovoid aperture and a sharp outer lip. Species of the genus occur in the Balkan Peninsula, Turkey (Radoman 1983), Italy (Cossigniani & Cossigniani 1995), France (Falkner et al. 2002) and Spain (Bank & Neubert 2017). The species of *Islamia* are usually endemic to their type locality.

Islamia karawiyiensis n. sp.
Fig. 2
https://zoobank.org/urn:lsid:zoobank.org:act:4B73B5AC-BA3D-41A6-BAFC-370E572C7806

Material examined: **Holotype:** 0.8 mm high, 1.25 mm broad (ZMH 140821). **Paratypes**: 33 from type locality (ZMH 140822) + 5 in coll. Glöer.

Locus typicus: Morocco, Aouinat El Hajjaj, Fez prefecture, (28-09-20), 34°01'36.7"N 4°58'06.9"W.

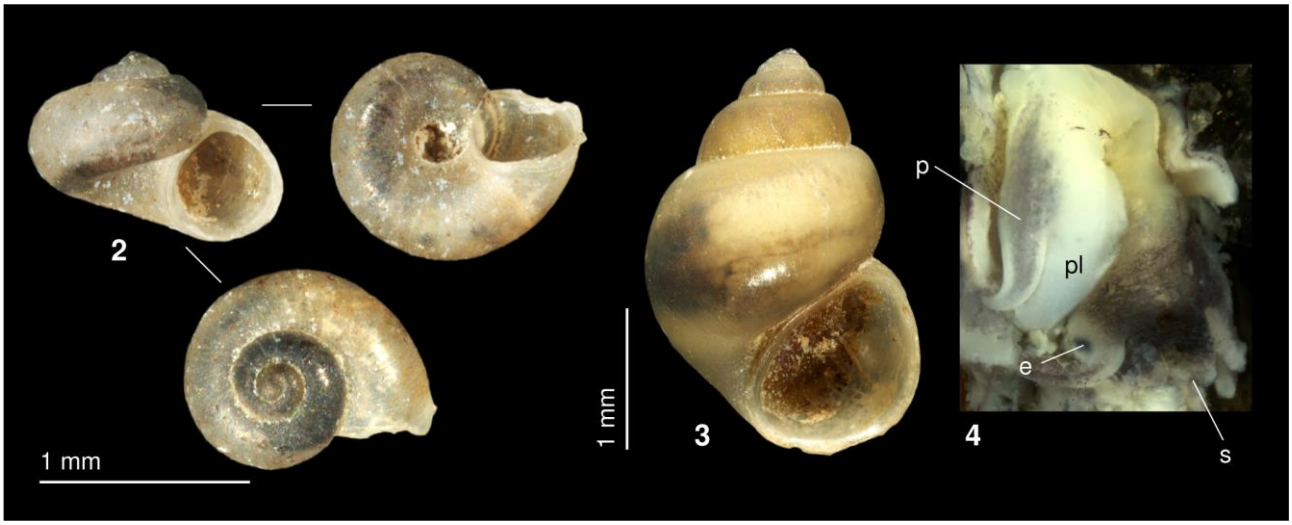
Description: The valvatoid light-brownish shell has 3.25 slightly convex whorls (Figure 2). The spire is short, the body whorl is prominent. The aperture is circular with a sharp peristome. The umbilicus is deep and wide. The shell is 0.8 mm high and 1.2-1.3 mm broad.

Discussion: Because we did not find a male after several attempts, the new valvatoid species described herein is included in the genus *Islamia*. The genus inhabiting the Iberian Peninsula and Balearic Islands (Ruiz Cobo et al. 2018) is already represented in Morocco by *I. tifertiensis* Glöer, Mabrouki & Taybi 2020. The latter species is endemic to Lower Moulouya (Northeastern Morocco), characterized by a light corneous glossy shell, conical with a very short spire and a very prominent inflated body whorl. In addition, *I. tifertiensis* differs from the new species in the more vertically compressed shell. Otherwise, the study area "Aouinat El Hajjaj" located in central Morocco, has revealed recently the new valvatoid genus and species *Fessia aouintii* Glöer, Mabrouki & Taybi, 2020. While *I. karaouyiensis* n. sp. has a light-brownish bigger shell, *F. aouintii* has a tiny translucent shell with a silky surface. The two species might co-occur together.

Etymology: The specific name refers to the University of al-Qarawiyyin, also written Al-Karaouine, is a university located in Fez, Morocco. Some sources such as the UNESCO and the Guinness World Records cite the Qarawiyyin as the oldest university or oldest continually operating higher learning institution in the world.

Habitat: One of the springs in a village named Aouinat el Hajjaj or Laaouina located in eastern Fez, characterized by different springs that arise on the surface and sink on the ground. The grain size of the bottom consists of stones, pebbles and sand, the banks are covered with dense vegetation of *Mentha* spp (Figure 1). The entire area is under anthropogenic impacts

Distribution: Morocco; only known from type locality.



Figures 2-4. **2:** shell of *Islamia karawiyiensis* n. sp., **3:** shell of *Mercuria atlasica* n. sp., **4:** male copulatory organ. Abbreviations: e: eye, p: penis, pl: penial lap, s: snout.

Genus *Mercuria* Boeters, 1971
Type species: *Cyclostoma simile* Draparnaud, 1805

The shell is milky whitish, especially in the region of the umbilicus. The penis possess a large and flat triangular or rounded lobe. The operculum is light orange.

Mercuria atlasica n. sp.
Fig. 3-4
https://zoobank.org/urn:lsid:zoobank.org:act:9A47A682-2827-41FC-83D4-4D6194ECBAFB

Material examined: **Holotype**: shell height 2.95 mm, width 2.0 mm (ZMH 140823). **Paratypes**: (1) Fes 27/10/20, 10 paratypes (ZMH 140824), (2) Aouinat El Hajjaj 27/10/20, 10 paratypes coll Glöer, 31 paratypes ZMH 140825.

Locus typicus: Morocco, Aouinat El Hajjaj, Fez prefecture, 27/10/20, 34°01'36.7"N 4°58'06.9"W.

Description: The dark yellowish conical shell has 5.5 fast growing, slightly convex whorls with a deep suture (Figure 3). The body whorl is prominent. The ovate aperture is somewhat oblique, narrowed at the top with a rounded angle. The peristome is sharp, the umbilicus is closed. The shell is 2.8-3.0 mm high and 1.9-2.0 mm broad.

Male copulatory organ: The greyish penis is long, broad and tapered at the tip (Figure 4). The penial lobe is long and broad, whitish and rounded at the distal end.

Discussion: The new species can be distinguished from its congeners in Morocco by its penis almost equal in length with the unpigmented penial appendix. *M. tingitana* Glöer, Boeters & Walther, 2015 has black short and triangular penis, *M. targouasensis* Glöer, Boeters & Walther, 2015 has gradually tapering penis and slightly pigmented penial appendix, shorter than penis and *M. tensiftensis* Boulaassafer, Ghamizi & Delicado, 2018 has a gradually tapering dark pigmented penis with dark pigmented penial appendix. While *M. bakeri* Glöer, Boeters & Walther, 2015 has a long strap-like penis and *M. midarensis* Boulaassafer, Ghamizi & Delicado, 2018 has gradually tapering to strap-like penis and similarly pigmented penial appendix. All other *Mercuria* spp. known from Morocco occur in coastal regions.

Etymology: Named after the Atlas Mountains.

Habitat: This species seems rheophilous, preferring moderate to fast-flowing, well-oxygenized springs and streams (Figure 1), usually on solid substrate and stony bottoms but it can be found among aquatic vegetation.

Discussion

In addition to the new species, four valvatoid species are known to occur in Morocco, the depigmented and stygobiot *Rifiya yakoubii* Ghamizi 2020, which lives in the phreatic waters of the south border of the Rif region, the upstream of Moulouya, Sebou and Loukkos basins, and the crenobiotic species *Ifrania zerroukansis* Glöer, Mabrouki & Taybi 2020, *F. aouintii* and *I. tiferitensis* all endemic to their type localities. In addition to the new species described here, the genus *Mercuria* is represented in Morocco by the following species *M. gauthieri* Glöer, Bouzid & Boeters, 2010; *M. targouasensis*; *M. tingitana*; *M. bakeri*; *M. tensiftensis* and *M. midarensis*. Only *M. gauthieri* is widely distributed, the others are mostly endemic or regionally endemic (Boulaassafer et al. 2018; Glöer et al. 2015; Mabrouki et al. 2020).

Up to date, twelve genera have been identified belonging to the Hydrobiidae family in Morocco (Mabrouki et al. 2020), most of which are endemic to the country. Indeed, Morocco has multiple geographical barriers, such as the Moulouya River Basin, the Sahara, the Rif Mountains and the Atlas Mountains. The latter divides the northern part of the country into two bioclimatic regions, which in turn are responsible for the high levels of endemism (Mabrouki et al. 2019). Future field expeditions could reveal many new endemic taxa.

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