

## Research article

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(Mollusca: Hydrobiidae, Lymnaeidae, Planorbidae) from Morocco****Youness Mabrouki<sup>1</sup>\*, Abdelkhaleq Fouzi Taybi<sup>2</sup> & Peter Glöer<sup>3</sup>**<sup>1</sup> *Sidi Mohamed Ben Abdellah University, Faculty of Sciences Dhar El Mehraz, Biotechnology, Conservation and Valorisation of Natural Resources laboratory, Fez, Morocco*<sup>2</sup> *Université Mohammed Premier, Faculté Pluridisciplinaire de Nador, Équipe de Recherche en Biologie et Biotechnologie Appliquées. Morocco*<sup>3</sup> *Schulstr. 3, D-25491 Hettingen, Germany*\*Corresponding author: Email: [younes\\_mab@hotmail.fr](mailto:younes_mab@hotmail.fr)<sup>1</sup>[urn:lsid:zoobank.org:author:9FE7D112-2607-4855-ABF7-9BF0BA38B8C8](https://zoobank.org/urn:lsid:zoobank.org:author:9FE7D112-2607-4855-ABF7-9BF0BA38B8C8)<sup>2</sup>[urn:lsid:zoobank.org:author:358C2481-FAD9-4524-AEFC-E18008EE04AC](https://zoobank.org/urn:lsid:zoobank.org:author:358C2481-FAD9-4524-AEFC-E18008EE04AC)<sup>2</sup>[urn:lsid:zoobank.org:author:8CB6BA7C-D04E-4586-BA1D-72FAFF54C4C9](https://zoobank.org/urn:lsid:zoobank.org:author:8CB6BA7C-D04E-4586-BA1D-72FAFF54C4C9)

**Abstract.** *Galba oblonga* (Puton, 1847), *Stagnicola fuscus* (Pfeiffer, 1821) and *Ancylus striatus* Quoy & Gaimard, 1834 are reported for the first time in North Africa, while *Mercuria globulina* (Letourneux & Bourguignat, 1887) is new to Morocco. In addition, we provide new distributional data on the two Moroccan endemic and recently described species *Aghbalia aghbalensis* Glöer, Mabrouki & Taybi, 2020 and *Mercuria bakeri* Glöer, Boeters & Walther, 2015 known previously from the type localities only, which is a key element in promoting their conservation.

**Key words.** New records, North Africa, additional information, endemic species.

**INTRODUCTION**

Thanks to its geographical position, Morocco is one of the most interesting biogeographical regions in the Western Mediterranean. It represents a contact area between Europe and Africa and a compulsory passage for much of the fauna between the Palaearctic and Afrotropical region and between the Mediterranean and the Atlantic. Within the Maghreb, Morocco possesses the most extensive lotic system (FAO 2003). The precipitation that falls in the high mountain ranges of the Rif, Middle Atlas, High Atlas and Anti-Atlas feeds rivers generally flowing north-eastern to the Mediterranean, north-westward to the Atlantic or south-eastward towards the Sahara. These ecosystems provide a variety of ecological habitats, promoting great biodiversity while at the same time offering significant socioeconomic benefits (Chillasse et al. 2001; Taybi et al. 2020a).

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 species of vertebrates (Oscos et al. 2014; 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). Un-

fortunately, these organisms are one of the most threatened freshwater taxa (Kay 1995).

Freshwater molluscs show a high degree of regional endemism, with about 80% of species endemic to the North African region (García et al. 2010), which gives them a privileged place for taxonomical and ecological studies. Previously, only 52 species of freshwater molluscs were known with certainty from Morocco (Dakki et al. 1997). However, this list was not complete and many new species were added recently, including species new to science (Boulaassaf et al. 2018, 2020; Ghamizi 2020; Glöer et al. 2020a, b; Mabrouki et al. 2020a, 2021). In order to increase knowledge on the freshwater Malacofauna of Morocco, different field expeditions have been conducted since 2014 through the northern part of the country, including its great natural barriers such as the Moulouya River basin and the Middle Atlas massif.

**MATERIAL AND METHODS**

In order to promote knowledge on the freshwater molluscs of Morocco, several field expeditions have been conducted since 2014 in the northern part of the country (Fig. 1), with a focus on the Middle Atlas and the Moulouya River basin. More than 100 localities have been investigated and most of these sampling sites were visit-

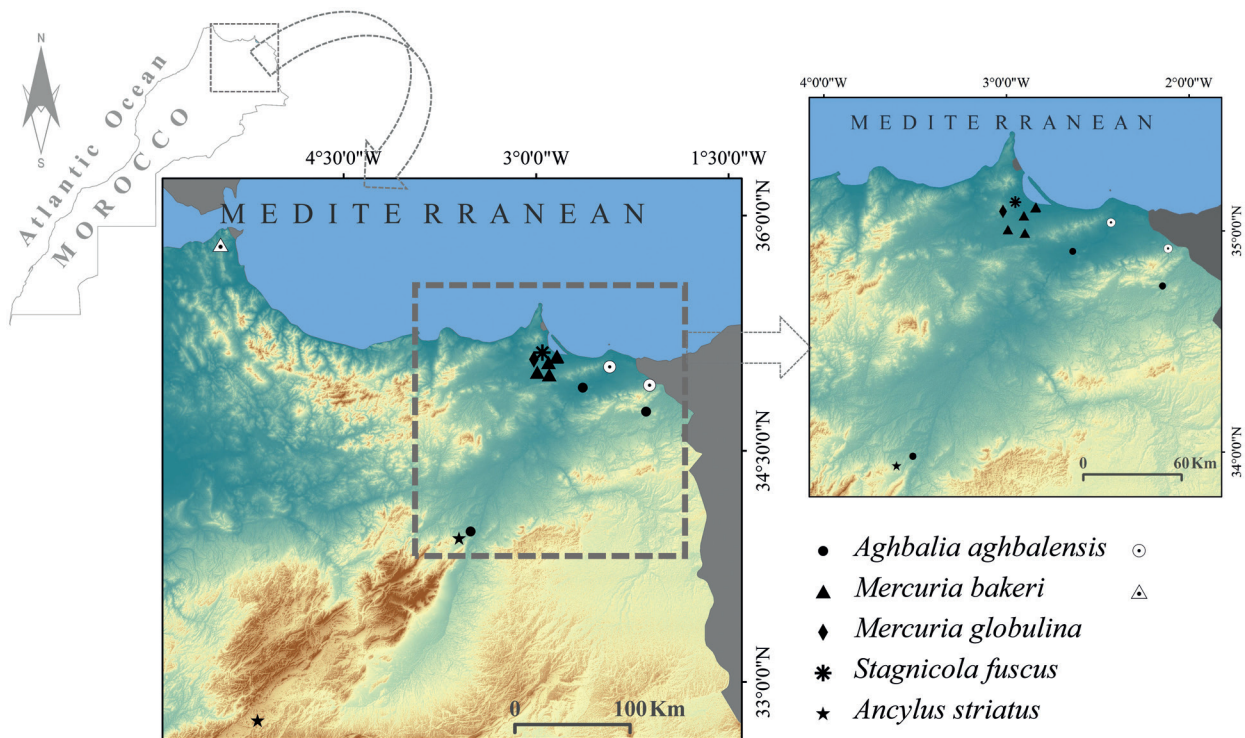


Fig. 1. Distribution range of the recorded species in Morocco (new records black, old records white).

ed at least three times (e.g., Taybi et al. 2017; Mabrouki et al. 2020b for more details on the localities). The samples of benthic fauna including molluscs were collected using kick nets or entomological forceps or by hand. 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 map was made using ArcGIS software. Voucher specimens were deposited in the collections of the authors. Identifications were made using the identification key of Glöer (2019).

## RESULTS

*Galba oblonga*, *Stagnicola fuscus* and *Ancylus striatus* are new to North Africa; *Mercuria globulina* is reported for the first time in Morocco. In addition, the two recently described Moroccan endemic species *Aghbalia aghbalensis* and *Mercuria bakeri* are reported for the first time outside their type localities.

## Family Hydrobiidae Stimpson, 1865

### Genus *Aghbalia* Glöer, Mabrouki & Taybi, 2020

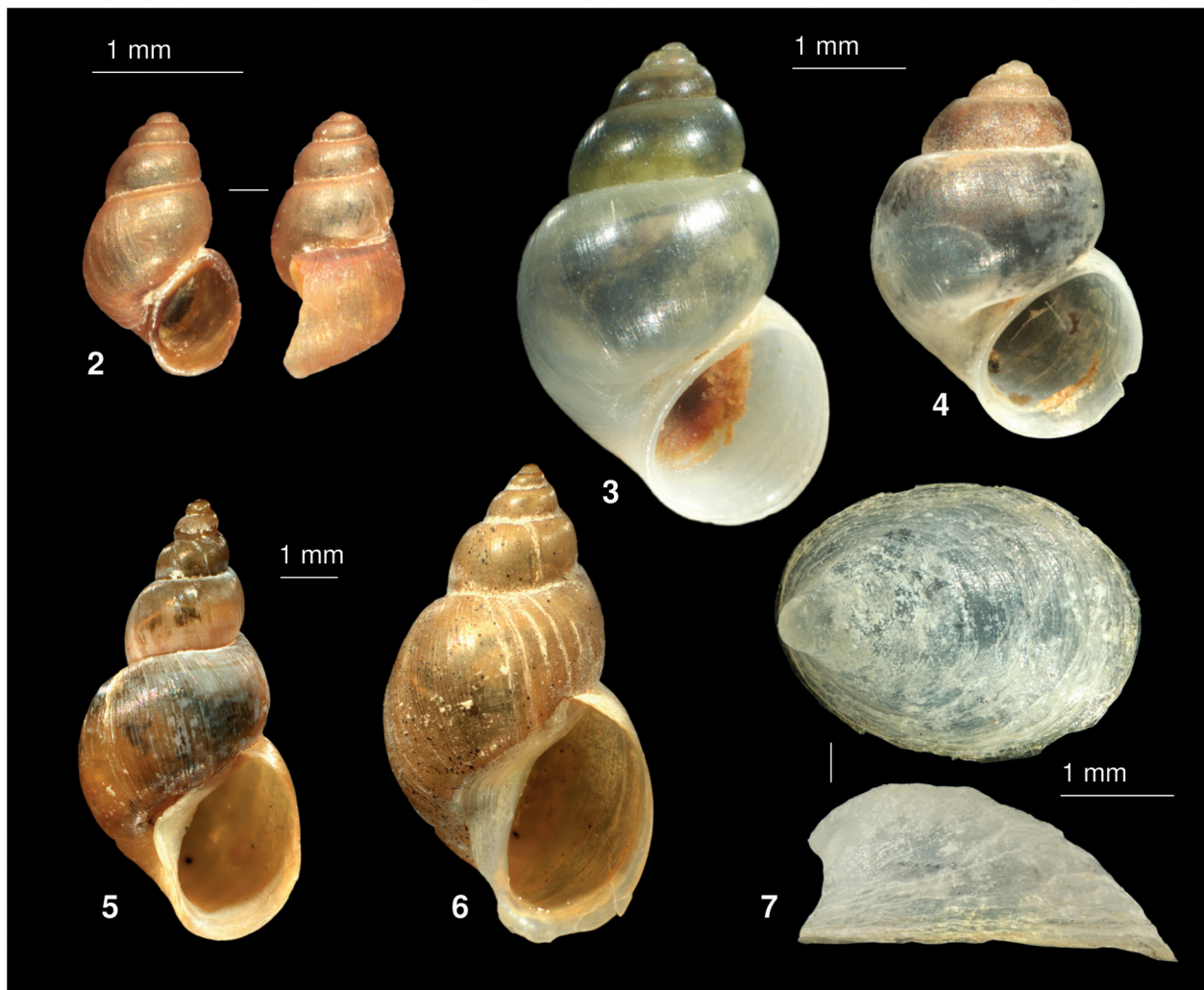
*Aghbalia aghbalensis* Glöer, Mabrouki & Taybi, 2020 (Fig. 2)

**Distribution.** This recently described Moroccan endemic was known only from its type localities Aghbal and Tiffert springs (Glöer et al. 2020a). We record it for the first time in the springs of Ain Sfa and Guercif, in addition to the potamal section of Moulouya River at a place named Safsaf (Fig. 1), increasing considerably records of its distribution area, which is a key element in promoting its conservation.

**Sampling site.** Guercif (07/09/2020) 33°57'33" N, 3°30'52.8" W; Aval Safsaf (19/06/2019) 34°54'27.53" N, 2°38'8.86" W; Ain Sfa (16/06/2019) 34°45'12"N 2°8'36" W.

**Habitat.** The species was known to occur in rheocrenous springs only. We document its presence in a big river (Fig. 8). However, the section of the Moulouya where the species was found is supplied by various freshwater springs, which may explain its presence in this habitat.

**Associated species.** *Theodoxus* sp.; *Galba truncatula* (Müller, 1774); *Melanopsis praemorsa* (Linnaeus, 1758).



**Figs 2–7.** Shells of the recorded species in Morocco. 2. *Aghbalia aghbalensis*. 3. *Mercuria bakeri*. 4. *M. globulina*. 5. *Galba oblonga*. 6. *Stagnicola fuscus*. 7. *Ancyclus striatus*.

### Genus *Mercuria* Boeters, 1971

#### *Mercuria bakeri* Glöer, Boeters & Walther, 2015 (Fig. 3)

**Distribution.** The Moroccan endemic species was known only from its type locality at the Tingitane Peninsula in northwestern Morocco (Glöer et al. 2015). We record it for the first time in the Oriental Region of the country at different localities (Fig. 1), increasing therefore its distribution range.

**Sampling sites.** Oued Messoussate (10/06/2020) 35°04'02.8" N, 2°54'11.6" W; Bouareg plain well 1 (28/06/2020) 35°06'12.3" N, 2°50'25.8" W; Bouareg well 2 (28/06/2020) 35°06'25.2" N, 2°50'14.8" W; La'azib (10/07/2020) 35°03'14.8" N, 2°57'27.9" W; Aroui (14/07/2020) 35°01'07.2" N, 2°59'37.9" W.

**Habitat.** Previously, *M. bakeri* was known inhabiting only a swampy area around a small artificial pond in the Tingitane Peninsula. During the study period, the species was collected from a watercourse and spring of low al-

titude, it was also sampled from wells, which is a new feature registered for the species (e.g., Fig. 9).

**Associated species.** *Physella acuta* (Draparnaud, 1805).

#### *Mercuria globulina* (Letourneux & Bourguignat, 1887) (Fig. 4)

**Distribution.** This Maghrebian species was previously known from Algeria and Tunisia only, where it was restricted to the central and eastern parts of the Tell (Glöer 2019; Glöer et al. 2010). We record it for the first time in Morocco from the Oriental Region. During the sampling period, the species was collected at a place named Leghriba, belonging to the Selouane River basin (Fig. 1).

**Sampling site.** Leghriba (23/07/2020) 35°04'25.3" N, 2°58'42.1" W.

**Habitat.** This species usually occupies springs and small rivers. In Morocco, it was collected from a single



well, which is also a new feature documented for the species.

#### Family Lymnaeidae Lamarck, 1799

##### *Galba oblonga* (Puton, 1847) (Fig. 5)

**Distribution.** Whether this taxon is a good species, as proposed by Vinarski & Kantor (2016: 314), is unclear. Though the type locality of *G. oblonga* is in France, it is listed in the West European literature as a form of *G. truncatula* (Glöer 2019: 219), or as a good species (see WORMS MolluscaBase 2019). We collected only one empty shell so the anatomy as well as the molecular genetic could not be studied to solve the taxonomic problem. We list this taxon here to direct attention to it for future investigations. In Morocco, *G. oblonga* was collected at Selouane (Fig. 1).

**Sampling site.** Saguia Selouane (21/08/20) 35°04'36.9" N, 2°55'23.9" W.

**Habitat.** In the study area, it was collected from an irrigation canal system, which routes the waters of the Moulouya River through the Ouled Settout reservoir (Fig. 10).

**Associated species.** *Stagnicola fuscus* (Pfeiffer, 1821); *Physella acuta*; *Melanopsis praemorsa*.

##### *Stagnicola fuscus* (Pfeiffer, 1821) (Fig. 6)

**Distribution.** The full range of this species is not known, but is likely to be found throughout Western Europe (Glöer 2019). We report it here for the first time in Morocco and North Africa. It was collected at Selouane (Fig. 1), which is the new confirmed southern limit of its distribution range in the Palearctic. The species can be identified by the short phallotheca and the two prostate folds by which it is separated from all other Palearctic *Stagnicola* spp.

*Stagnicola fuscus* is one of five European species of the *Stagnicola palustris* (Müller, 1774) species complex (Jackiewicz 1993). *Stagnicola palustris* was the only known species of the genus occurring in Morocco, therefore, its distribution in the country and surrounding area must be re-examined, since identification was formerly based probably on the shells only.

**Sampling site.** Saguia Selouane (21/08/20) 35°04'36.9" N, 2°55'23.9" W.

**Habitat.** This species prefers the mountainous regions. It frequents the standing waters or hydrosystems with a very low flow, often among the algae and macrophytes; it can also colonize artificial pipes and semi-temporary pools as in the study area, where it was found in an irrigation canal system supplied by Ouled Settout reservoir (Fig. 10).

**Associated species.** *Galba oblonga*; *Physella acuta*; *Melanopsis praemorsa*.

#### Family Planorbidae Rafinesque, 1815

##### *Ancylus striatus* Quoy & Gaimard, 1834 (Fig. 7)

**Distribution.** Previously, the genus *Ancylus* Müller, 1774 was represented by only *A. fluviatilis* (Müller, 1774) in Morocco, where it is supposed to be widely distributed (Taybi et al. 2017). However, since we record for the first time *A. striatus* in Morocco and North Africa, the status and range distribution of *A. fluviatilis* should be re-examined. *Ancylus striatus* was described initially from the Canary Islands (Quoy & Gaimard 1834), and it was recorded later from the Azores Island and the northeastern Iberian Peninsula (Pfenninger et al. 2003; GBIF 2019). During the sampling period, the species was collected at Krouchen and Guercif, corresponding to the oriental slope of the Middle Atlas Massif, which is part of the Moulouya River Basin (Fig. 1).

**Sampling site.** Krouchen (13/06/2014) 32°44'49.6" N, 5°10'17" W; Guercif (07/09/2020) 33°57'35.8" N, 3°30'40.4" W.

**Habitat.** This species is rheophilous, preferring moderate to fast-flowing, well-oxygenized rivers and streams (Fig. 11), usually on solid substrate and rocky bottoms.

**Remark.** Pfenninger et al. (2003: 2742) stated that the *Ancylus* sp. (clade 3) found in the Canary islands and Morocco as well could be *Ancylus striatus*, while Albrecht et al. (2006, Appendix I) thought it could be *Ancylus pileolus* Ferrussac, 1822, mentioned by Hubendick (1972: 110), who listed *A. striatus* and *A. pileolus* (from Scio Island) both as synonyms of *A. fluviatilis*. *A. striatus* and *A. pileolus* are both listed as accepted species by WORMS (2019). This problem cannot be solved here, however, it is possible to understand which species is meant since we refer to the identification key of Glöer (2019) where *A. striatus* has been described and depicted.

**Associated species.** *Anisus* sp; *Galba truncatula*; *Physella acuta*; *Aghbalia aghbalensis*; *Melanopsis praemorsa*.

#### DISCUSSION

High-quality data on species identity and distribution are a good tool for biodiversity management and conservation. It allows biologists and managers to come up with meaningful action steps and make wise decisions to achieve biodiversity protection (Guralnick et al. 2007; Hortal et al. 2007). Combining these data with various environmental predictors and different parameterisation techniques, it is possible to make predictions about the distribution of species, especially of endemic ones (Milan et al. 2014).

The inventory list of the freshwater mollusc fauna of Morocco is certainly still incomplete. Unfortunately, due to the great pressure on continental aquatic ecosystems,



**Figs 8–11.** 8. Big section of the Moulouya River. 9. Typical well in the study area. 10. View of Ouled Settout reservoir. 11. Water-course from the Middle Atlas.

many species will probably have disappeared before being recorded or even described. Indeed, as in most of the Maghrebian territory, the regional aquatic ecosystems are increasingly threatened by human activities, through water abstraction, habitat loss and modification, industrial effluents, domestic sewage and agricultural runoff including fertilisers, pesticides and drainage of water (Bensaad et al. 2017; Mabrouki et al. 2017; Taybi et al. 2016, 2020b). Even worse, alien invasive species, potentially able to change the current biotic interactions in benthic communities, have been recorded recently from the hydro-systems of Morocco (Mabrouki et al. 2019a, b, c, 2020c; Taybi et al. 2020c, d, e), including molluscs, such as the Asian clam *Corbicula fluminea* (Müller 1774) and the New Zealand mudsnail *Potamopyrgus antipodarum* (Gray, 1843) (Taybi et al. 2017; Taybi et al. 2021). These invasive species could be a serious problem for the native aquatic biodiversity. Therefore, monitoring the presence and distribution of species, as well as studies improving their biological and ecological knowledge, are of crucial concern in promoting the conservation of the Moroccan freshwater biodiversity.

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