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RESEARCH ARTICLE

The valvatiform hydrobiids (Gastropoda: Truncatelloidea: Hydrobiidae) of Morocco with description of a new genus and species

Вальватоидные гидробииды (Gastropoda: Truncatelloidea: Hydrobiidae) Марокко с описанием нового рода и вида

Y. Mabrouki*, P. Glöer & A.F. Taybi

Ю. Маброуки*, П. Глоер, А.Ф. Тайби

Youness Mabrouki, Laboratory of Biotechnology, Conservation and Valorization of Natural Resources, Faculty of Sciences Dhar El Mehraz, Sidi Mohamed Ben Abdellah University, Fes, Morocco. E-mail: youness.mabrouki@usmba.ac.ma

Peter Glöer, Schulstraße 3, D-25491 Hetlingen, Germany. E-mail: gloeer@malaco.de

Abdelkhaleq Fouzi Taybi, Applied Biology and Biotechnology Research Team, Multidisciplinary Faculty of Nador, Mohammed First University, Nador, Morocco. E-mail: a.taybi@ump.ac.ma

Abstract. *Menzella timedrinensis* **gen.** et **sp. nov.** is described from the Middle Atlas in Morocco. This description increases the known diversity of valvatiform hydrobiids (Hydrobiidae) of Morocco to ten species and eight genera, all known only from Morocco. A key to the genera and a brief overview of the valvatiform hydrobiids of Morocco are also provided.

Резюме. *Menzella timedrinensis* **gen.** et **sp. nov.** описан из Среднего Атласа в Марокко. Это описание увеличивает известное разнообразие вальватоидных гидробиид (Hydrobiidae) Марокко до десяти видов и восьми родов; все они известны только из Марокко. Также приводится ключ для определения родов и краткий обзор вальватоидных гидробиид Марокко.

Key words: biodiversity hotspot, microendemic species, hydrobiid snails, Middle Atlas, Gastropoda, Truncatelloidea, Hydrobiidae, new genus, new species

Ключевые слова: центр биоразнообразия, микроэндемичные виды, гидробииды, Средний Атлас, Gastropoda, Truncatelloidea, Hydrobiidae, новый род, новый вид

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Introduction

Mollusca is the second most diverse animal phylum in terms of the numbers of described species. Freshwater molluscs are represented by two dominant classes, Bivalvia and Gastropoda. Valid descriptions have been published for approximately 7000 freshwater mollusc species and there are probably 3000 to 10000 undescribed freshwater species awaiting description (Lydeard et al., 2004).

Non-marine gastropods often dominate aquatic ecosystems in terms of both biomass and numbers. Most of them are herbivorous or omnivorous grazers feeding on bacterial films, microalgae and diatoms. Many species are adapted to specific subterranean or surface hypogean aquatic habitats and to different epigean substrates (aquatic

*Corresponding author

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vegetation, stones, rocks, wood and other solid surfaces, or soft sediments) (Strong et al., 2008; Glöer, 2019).

Partly due to lifehistory traits, many small-sized freshwater gastropod species have a low dispersal capacity, reflected in high levels of genetic differentiation between populations (Ponder & Colgan, 2002). Within the Palaearctic, most members of the family Hydrobiidae Stimpson, 1865 have narrow distribution ranges (Delicado et al., 2019; Glöer, 2022), which makes them more vulnerable to humanrelated threats.

The taxonomic richness of the Hydrobiidae in Morocco is one of the highest in Africa. The family is represented in Morocco by 21 genera (Mabrouki et al., 2022a; Taybi et al., 2022a, 2022b; Taybi et al., 2023a, 2023b; and references therein). Among them, many have small dimensions (1.0–1.5 mm) and valvatiform shells, similar in shape to those of members of the genus *Valvata* O.F. Müller, 1773 of the family Valvatidae Gray, 1840.

The valvatiform or valvatiform–planorboid hydrobiids in Morocco are currently represented by nine species and seven genera, namely, *Islamia* Radoman, 1973, *Rifia* Ghamizi, 2020, *Fessia* Glöer, Mabrouki et Taybi, 2020, *Ifrania* Glöer, Mabrouki et Taybi, 2020, *Pikasia* Taybi, Glöer et Mabrouki, 2021, *Idrisiella* Mabrouki, Glöer et Taybi, 2022, and *Ainiella* Taybi, Glöer et Mabrouki, 2022 (Fig. 1). Recent field surveys conducted in the northern part of Morocco have led to the discovery of a new valvatoid genus, *Menzella* **gen. nov.**, with a new species *M. timedrinensis* **sp. nov.** The aim of this paper is to describe it and to give an overview of the valvatiform species of Hydrobiidae found in Morocco.

Material and methods

Field surveys have been carried out since 2014 (still ongoing). Several sites have been sampled in the northern part of Morocco. Most of these sampling sites were visited several times. Our aim was to document the maximum macroinvertebrate biodiversity in different microhabitats prospected at each sampling site. The samples of benthic fauna were collected using a kick net and clamps. Samples were fixed in 75% ethanol.

The dissections and measurements of the genital organs and shells were carried out using a Leica M205C stereomicroscope with a Leica DMC5400 digital camera. The type material is deposited at the Zoological Museum of Hamburg (ZMH). In addition to this, six paratypes are stored in the collection of the corresponding author.

Taxonomy

Phylum **Mollusca** Cuvier, 1795

Class **Gastropoda** Cuvier, 1795

Subclass **Caenogastropoda** Cox, 1960

Order **Littorinimorpha** Golikov et Starobogatov, 1975

Superfamily **Truncatelloidea** Gray, 1840

Family **Hydrobiidae** Stimpson, 1865

Genus ***Menzella* gen. nov.**

Type species: *Menzella timedrinensis* **sp. nov.**

Diagnosis. The new genus can be distinguished from the other valvatoid Hydrobiidae Moroccan genera by the following characters: globular valvatoid shell and hook-shaped penis with a dark spot in middle.

Comparison. Shell structure and anatomical characters of hydrobiid specimens collected from the Middle Atlas border in northern Morocco are different from the other Moroccan species of valvatoid Hydrobiidae, which make it possible to be assigned to a new genus *Menzella*. This genus is similar to the recently described *Pikasia* Taybi, Glöer et Mabrouki, 2021, but the latter has an ovoidconical shell (Fig. 1E) and a simple, broad, elongate, flat penis with an acute tip. Another similar genus, *Ifrania* Glöer, Mabrouki et Taybi, 2020, has a compressed shell (Fig. 1D) and a long slender penis. In the other genera, the penis has a penial appendix or outgrowths.

Menzella **gen. nov.** is somewhat similar to *Aretiana* Delicado et Ramos, 2021 occurring in southern Spain. However, the former has more globular shells and a wider penis.

The penis morphology characteristic of *Menzella* **gen. nov.** is not known among other hydrobiids. This feature justifies the description of a new genus, as it is acknowledged that hydrobiid genera

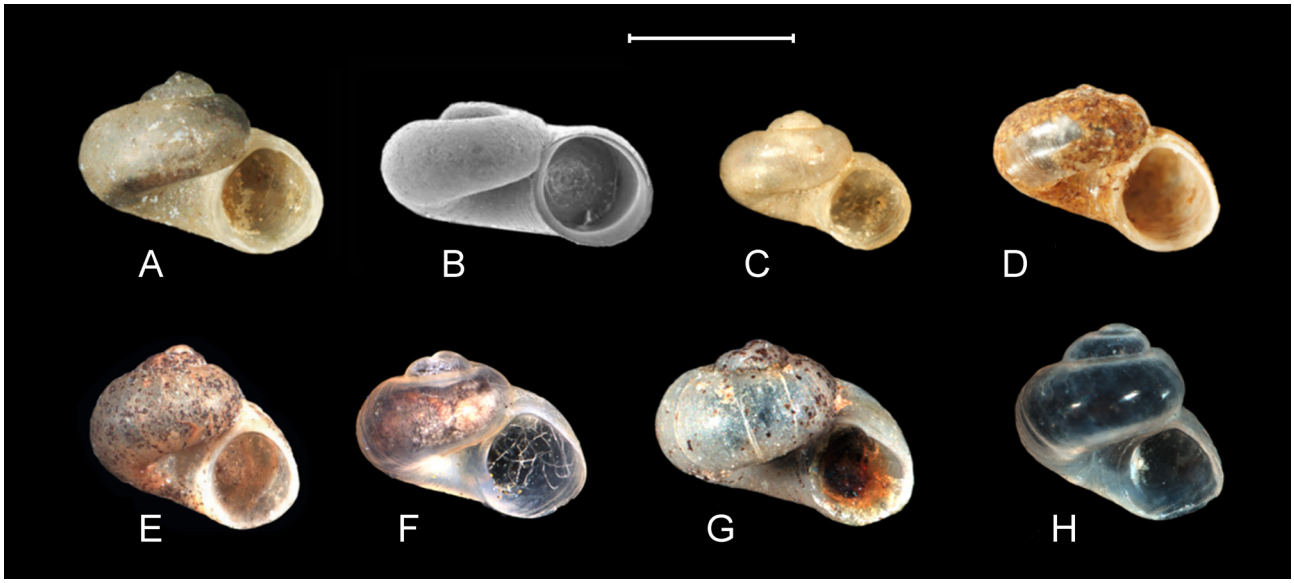


Fig. 1. Shells of Moroccan valvatiform hydrobiids. **A**, *Islamia karawiyiensis* Mabrouki, Glöer et Taybi, 2021; **B**, *Rifia yacoubii* Ghamizi, 2020 (after Ghamizi, 2020); **C**, *Fessia aouintii* Glöer, Mabrouki et Taybi, 2020; **D**, *Ifrania zerroukansis* Glöer, Mabrouki et Taybi, 2020; **E**, *Pikasia smenensis* Taybi, Glöer et Mabrouki, 2021; **F**, *Idrisiella bourkaizensis* Mabrouki, Glöer et Taybi, 2022; **G**, *Ainiella zahredini* Taybi, Glöer et Mabrouki, 2022; **H**, *Menzella timedrinensis* **gen.** et **sp. nov.** (holotype). Scale bar: 1 mm.

can be identified by dint of the shell shape in combination with the penis morphology (Radoman, 1983; Szarowska, 2006; Glöer, 2022).

Species included. Type species only.

Etymology. The generic name is derived from El Menzel, a small town near the type locality of *Menzella timedrinensis* **sp. nov.** Gender is feminine.

Menzella timedrinensis sp. nov.
(Figs 1G, 2–5)

Holotype. Male (adult specimen); **Morocco**, Middle Atlas, *Fez-Meknes Region*, *Sefrou Province*, Ain Timedrine spring nr. El Menzel town, 33°44′52.0273″N, 04°32′52.2110″W, 24 May 2022 (ZMH 141471). Kept in ethanol.

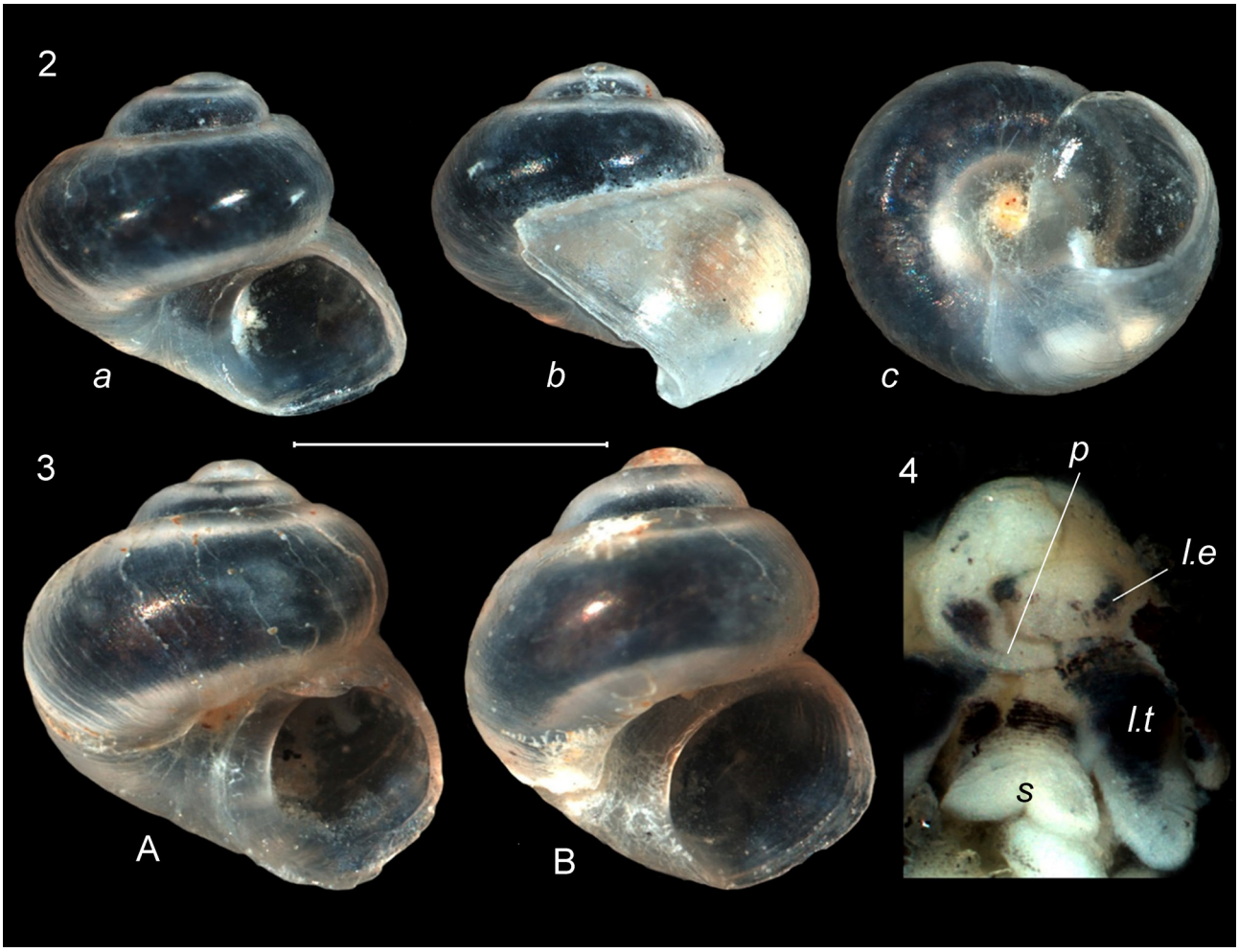
Paratypes. Same locality, 50 specimens (ZMH 141472), 6 specimens (Y. Mabrouki collection). Kept in ethanol.

Description. Shell valvatoid, globular, with 3.5 slightly convex whorls separated by a clear suture. Body whorls prominent. Aperture nearly circular, with sharp peristome. Umbilicus wide and deep. In some specimens, aperture shifted to left (Fig. 3A). In living specimens, mantle grey-black with white border, visible under translucent shell. Pigmentation of soft body variable. Tentacles long and broad (longer than snout), blackish at upper side and light at distal end. Snout wide, grey, with strong distal lobes. Eye spots well visible. Penis hook-shaped, with black spot in middle part, attached behind right eye. Female genitalia unknown.

Dimensions. Holotype: shell height 1.22 mm, diameter 1.28 mm. Paratypes: shell height 1.11–1.54 mm, diameter 1.14–1.30 mm. Shell measurements of ten measured paratypes are summarised in Table 1. The images of measured shells are given in Fig. 5.

Etymology. The species was named after the type locality, Ain Timedrine spring.

Habitat. The type locality is the Ain Timedrine spring in a rural environment in the Middle Atlas, at 671 m above sea level (Fig. 6). This karstic spring flows into the Sebou River and is characterised by a significant flow. The banks are natural, with sparse tree-lined vegetation. The sediments consist of stones, pebbles and a lot of plant debris. The entire site is subject to strong anthropogenic pressure, especially from agricultural and tourist activities during the dry season. Together with Sebou and Ouamender springs, Ain Timedrine plays an important role in stabilising



Figs 2–4. *Menzella timedrinensis* **gen.** et **sp. nov.** (2*a*–2*c*, 4, holotype; 3A, 3B, paratypes). **2**, **3**, shells; **4**, head with penis. Abbreviations: *l.e*, left eye; *l.t*, left tentacle; *p*, penis; *s*, snout. Scale bar: 1 mm.

the flow of the Sebou River. These springs ensure the sustainability of the regime of the upper reaches of the Sebou River (Akdim et al., 2012).

A key to the genera of valvatiform Hydrobiidae of Morocco

1. Unpigmented body, eye spots absent (stygobiotic) . . . . . ***Rifia***
– Pigmented body, eye spots present (crenobiotic) 2
2. Penis with penial appendix (or outgrowth) 3
– Penis without penial appendix 5
3. Eyespot simple, not very large 4
– Eyespots very large; penis triangular with a small outgrowth . . . . . ***Ainiella***
4. Penis flat, short, with a bulbous base; female sex tract with a J-shaped bursa copulatrix and coiled oviduct, receptaculum absent . . . . . ***Idresiella***
– Penis slender, tapered, with a bulge at base . . . . . ***Fessia***
5. Penis eel-like, cylindrical, very long and slender . . . . . ***Ifrania***
– Penis not very long 6
6. Shell conical; penis simple, broad, elongate, flat, with acute tip; bursa copulatrix spherical, receptaculum absent . . . . . ***Pikasia***
– Shell globular; penis hook-shaped . . . . . ***Menzella* gen. nov.**

Note. Species of the genus *Islamia* from Morocco have been described only from empty shells and temporarily assigned to this genus without knowing their anatomy, waiting to find males. In *Islamia*, the penis is bilobed and the bursa copulatrix is absent (Glöer, 2022).

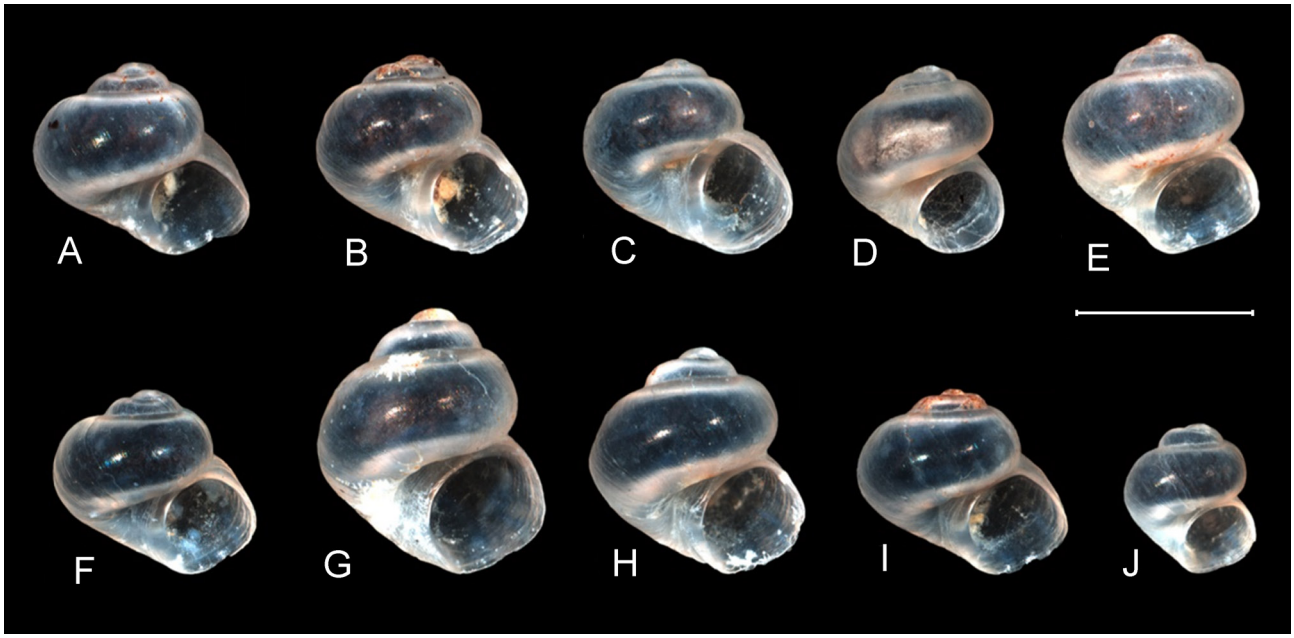


Fig. 5. *Menzella timedrinensis* **gen.** et **sp. nov.**, shells of measured paratypes (A–J). Measurements are given in Table 1. Scale bar: 1 mm.

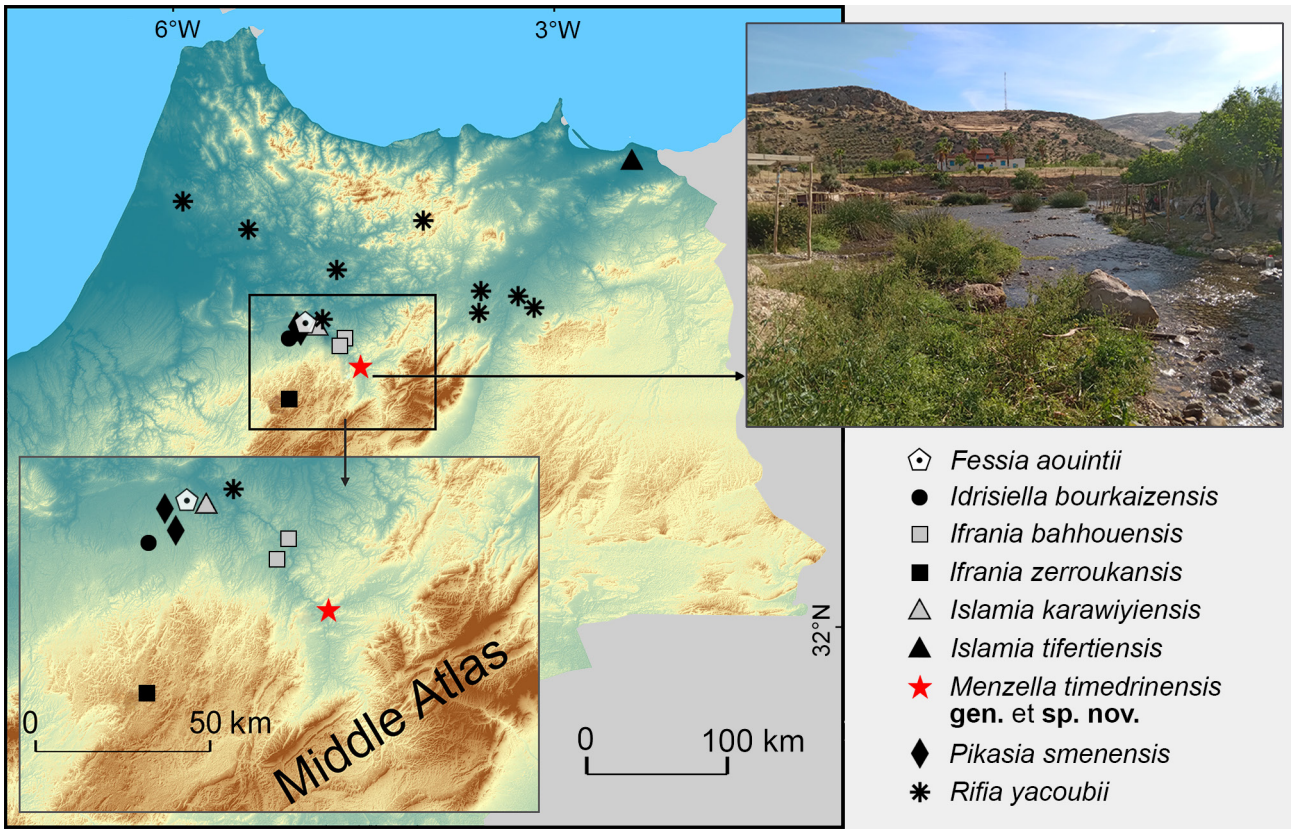


Fig. 6. Distribution of the valvatiform hydrobiid species in Morocco and the type locality of *Menzella timedrinensis* **gen.** et **sp. nov.**

Discussion

Menzella timedrinensis **gen.** et **sp. nov.** can be distinguished from the Moroccan valvatiform hydrobiids by anatomy combined with shell features. The new species is subendemic to Ain Timedrin, one of the karstic springs feeding the upper reaches of the Cebu River.

Our results increase the known biodiversity of the valvatiform hydrobiids in Morocco to eight genera; each genus is represented by one species, except for *Ifrania* and *Islamia*, which are represented by two species each. On the other hand, the presence of *Islamia* in Morocco is not confirmed anatomically due to lack of males. Future prospection and collection of new material could assign the species of *Islamia* in Morocco to other described genera or even to the new ones.

With the exception of the subterranean *Rifia yacoubii* Ghamizi, 2020, which is widely distributed in the phreatic waters of northern Morocco, all the crenobiotic hydrobiids are endemic and restricted to their type localities, namely, *Ifrania zerroukansis* Glöer, Mabrouki et Taybi, 2020 to Zerrouka Lake (Ifrane Province), *I. bahhouensis* Mabrouki, Glöer et Taybi, 2022 to the springs of Zaouiat Sidi Ben Aïssa (Sefrou Province), *Fessia aouintii* Glöer, Mabrouki et Taybi, 2020 and *Islamia karaouiyensis* Mabrouki, Glöer et Taybi, 2021 to Aouinat El Hajjaj spring (Fez Prefecture), *Pikasia smenensis* Taybi, Glöer et Mabrouki, 2021 to Ain Smen and Ain Chkef springs (Fez Prefecture and Moulay Yaâcoub Province, respectively), *Idrisiella bourkaizensis* Mabrouki, Glöer et Taybi, 2022 to Ain Bourkaiz springs (Moulay Yaâcoub Province), *Ainiella zahredini* Taybi, Glöer et Mabrouki, 2022 to Sidi Bouali spring (Sefrou Province), *Islamia tifertiensis* Glöer, Mabrouki et Taybi, 2020 to Tiffert spring (Berkane Province), and finally *Menzella timedrinensis* **gen.** et **sp. nov.** to Ain Timedrine spring (Sefrou Province) (Ghamizi, 2020; Gloër et al., 2020a, 2020b; Mabrouki et al., 2021a, 2022c; Taybi et al., 2021a, 2022c).

The distribution ranges of the valvatiform hydrobiids of Morocco seem to be limited to the northern part of the country, associated with mountainous areas, and more precisely the Middle Atlas massif (Fig. 6), which is a geographical barrier known for its other endemic molluscs and a place of high interest for the crenobiotic species or freshwater malacofauna in general (Mabrouki et al., 2022).

The Middle Atlas is a mountain range stretching over 350 km, from the southwest to the northeast of Morocco, situated between the Rif and the High Atlas Mountains, with a total area of 2.3 million hectares. It is one of the best-watered mountain ranges in the country and is of great hydrogeological interest in North Africa, being considered the "water reservoir" of the country. The Middle Atlas massif has a great diversity of wetland habitats, ranging from natural and artificial lakes to cold rivers and springs. Thus, it occupies a privileged place among the Moroccan regions of major interest for the conservation of wetland biodiversity (Chillasse & Dakki, 2004; Taybi et al., 2020; Mabrouki et al., 2022b).

According to the ecoregional delimitation given by the Freshwater Ecoregions of the World – Conservation Science Program (FEOW; www.feow.org), almost all valvatiform hydrobiids of Morocco belong to the Atlantic Northwest Africa ecoregion, except for *I. tifertiensis*, which belongs to the Mediterranean Northwest Africa ecoregion, and *R. yacoobi*, which belongs to both ecoregions.

Table 1. Shell measurements of *Menzella timedrinensis* **gen.** et **sp. nov.** (in mm; n = 10).

Shell measurements	Min	Max	Mean	SD
Shell height	1.11	1.54	1.23	0.15
Aperture height	0.56	0.76	0.63	0.06
Spire height	0.47	0.80	0.60	0.11
Diameter	1.14	1.30	1.21	0.04
Aperture width	0.61	0.76	0.67	0.04

Notes. Measurement accuracy is 0.01; SD, standard deviation.

The family Hydrobiidae sensu stricto has received considerable attention in terms of recent species discoveries in Morocco. However, further efforts are needed to improve the understanding and knowledge of this group of invertebrates, which still lacks conservation assessments compared to the vertebrates, especially in the context of climate change and desertification scenarios threatening the aquatic ecosystems of Morocco and North Africa as a whole. Many freshwater springs in Morocco have dried up and, given the high endemicity of hydrobiids in the remaining springs, it is likely that many extinctions have occurred.

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References

Akdim B., Sabaoui A., Amyay M., Laaouane M., Gille E. & Obda K. 2012. Influences hydro karstiques du système sourcier Aïn Sebou-Timedrine-Ouamender Sur l'hydrologie de l'oued Sebou (Moyen Atlas, Maroc). *Zeitschrift für Geomorphologie*, **56**(2): 165–181. https://doi.org/10.1127/0372-8854/2011/0063

Chillasse L. & Dakki M. 2004. Potentialités et statuts de conservation des zones humides du Moyen-Atlas (Maroc), avec référence aux influences de la sécheresse. *Sécheresse*, **15**(4): 337–345.

Delicado D., Arconada B., Aguado A. & Ramos M.A. 2019. Multilocus phylogeny, species delimitation and biogeography of Iberian valvatiform springsnails (Caenogastropoda: Hydrobiidae), with the description of a new genus. *Zoological Journal of Linnean Society*, **186**(4): 892–914. https://doi.org/10.1093/zoolinnean/zly093

Ghamizi M. 2020. New stygobiont genus and new species (Gastropoda, Hydrobiidae) from the Rif (Morocco). *Ecologica Montenegrina*, **31**: 50–56. https://doi.org/10.37828/em.2020.31.11

Glöer P. 2019. *The freshwater gastropods of the West-Palaearctis. Volume I. Fresh- and brackish waters except spring and subterranean snails. Identification key, anatomy, ecology, distribution*. Hetlingen: Biodiversity Research Lab. 399 p.

Glöer P. 2022. *The freshwater gastropods of the West-Palaearctis. Volume III. Hydrobiidae. Identification key, anatomy, ecology, distribution*. Hetlingen: Biodiversity Research Lab. 596 p.

Glöer P., Mabrouki Y. & Taybi A.F. 2020a. A new genus and two new species (Gastropoda, Hydrobiidae) from Morocco. *Ecologica Montenegrina*, **28**: 1–6. https://doi.org/10.37828/em.2020.28.1

Glöer P., Mabrouki Y. & Taybi A.F. 2020b. Two new valvatoid genera (Gastropoda, Hydrobiidae) from Morocco. *Ecologica Montenegrina*, **30**: 124–128. https://doi.org/10.37828/em.2020.30.12

Mabrouki Y., Glöer P. & Taybi A.F. 2022a. Ifrania bahhouensis sp. n. a new valvatiform snail (Gastropoda, Hydrobiidae) from Morocco. *Acta zoologica Academiae scientiarum Hungaricae*, **68**(4): 313–319. https://doi.org/10.17109/AZH.68.4.313.2022

Mabrouki Y., Glöer P. & Taybi A.F. 2022b. Mahrazia benlemlihi gen. et sp. nov., a new subterranean snail (Gastropoda: Hydrobiidae) from Morocco. *Bonn zoological Bulletin*, **71**(2): 204–208. https://doi.org/10.20363/BZB-2022.71.2.204

Mabrouki Y., Taybi A.F. & Glöer P. 2021. Two new species of the genera Islamia and Mercuria (Gastropoda, Hydrobiidae) from Morocco. *Ecologica Montenegrina*, **39**: 76–80. https://doi.org/10.37828/em.2021.39.8

Mabrouki Y., Taybi A.F. & Glöer P. 2022c. Idrisiella bourkaizensis gen. et sp. n., a new valvatoid snail (Gastropoda, Hydrobiidae) from Morocco. *Invertebrate Zoology*, **19**(1): 18–23. https://doi.org/10.15298/invertzool.19.1.03

Ponder W.F. & Colgan D.J. 2002. What makes a narrow range taxon? Insights from Australian freshwater snails. *Invertebrate Systematics*, **16**(4): 571–582. https://doi.org/10.1071/IT01043

Radoman P. 1983. Hydrobiodea, a superfamily of Prosobranchia (Gastropoda). I. Systematics. *Monographs of the Serbian Academy of Sciences and Arts*, **547**. Beograd. 256 p. + 12 pls.

Strong E.E., Gargominy O., Ponder W.F. & Bouchet P. 2008. Global diversity of gastropods (Gastropoda; Mollusca) in freshwater. *Hydrobiologia*, **595**: 149–166. https://doi.org/10.1007/s10750-007-9012-6

Szarowska M. 2006. Molecular phylogeny, systematics and morphological character evolution in the Balkan Rissooidea (Caenogastropoda). *Folia malacologica*, **14**(3): 99–168. https://doi.org/10.12657/folmal.014.014

Taybi A.F., Glöer P. & Mabrouki Y. 2021. Description of a new valvatoid Pikasia smenensis n. gen. n. sp., Gastropoda, Hydrobiidae) from Morocco. *Animal Biodiversity and Conservation*, **44**(2): 317–320. https://doi.org/10.32800/abc.2021.44.0317

Taybi A.F., Glöer P. & Mabrouki Y. 2022a. *Ainiella zahredini* gen. et sp. n. a new valvatoid snail (Gastropoda: Hydrobiidae) from Morocco. *Invertebrate Zoology*, **19**(3): 312–331. https://doi.org/10.15298/invertzool.19.3.04

Taybi A.F., Glöer P. & Mabrouki Y. 2022b. Four new species of the genus Pseudamnicola Paulucci, 1878 from Morocco (Gastropoda, Hydrobiidae). *Invertebrate Zoology*, **19**(2): 191–198. https://doi.org/10.15298/invertzool.19.2.07

Taybi A.F., Glöer P. & Mabrouki Y. 2022c. Two new species of Mercuria Boeters, 1971 from Morocco (Gastropoda, Hydrobiidae). *Natura Croatica*, **31**(1): 63–69. https://doi.org/10.20302/NC.2022.31.5

Taybi A.F., Glöer P. & Mabrouki Y. 2023a. A new genus and new species of springsnails (Gastropoda, Hydrobiidae) from North-East Morocco. *Nature Conservation Research*, **8**(3): 99–105. https://doi.org/10.24189/ncr.2023.022

Taybi A.F., Glöer P. & Mabrouki Y. 2023b. Gafaita gafaitensis n. gen. n. sp. a new hydrobiid snail (Gastropoda, Hydrobiidae) from Morocco. *Invertebrate Zoology*, **20**(3): 280–287.

Taybi A.F., Mabrouki Y., Dakki M., Berrahou A. & Millán A. 2020. Longitudinal distribution of macroinvertebrate in a very wet North African Basin: Oued Melloulou (Morocco). *Annales de Limnologie / International Journal of Limnology*, **56**(17): 1–11. https://doi.org/10.1051/limn/2020016

Taybi A.F., Mabrouki Y., Legssyer B. & Berrahou A. 2020. Spatio-temporal typology of the physico-chemical parameters of a large North African river: the Moulouya and its main tributaries (Morocco). *African Journal of Aquatic Sciences*, **45**(4): 431–441. https://doi.org/10.2989/16085914.2020.1727832

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