IFRANIA BAHBOUENSIS SP. N. A NEW VALVATIFORM SNAIL (GASTROPODA, HYDROBIIDAE) FROM MOROCCO

Youness Mabrouki¹, Peter Glöer² and Abdelkhaeleq Fouzi Taybi³

¹Université Sidi Mohamed Ben Abdellah, Faculté des Sciences de Dhar El Mehraz Laboratoire de Biotechnologie, Conservation et Valorisation des Ressources Naturelles Fes, Morocco; E-mail: younes_mab@hotmail.fr / youness.mabrouki@usmba.ac.ma
²Schulstr. 3, D-25491 Hetlingen, Germany; E-mail: gloer@malaco.de
³Université Mohammed Premier, Faculté Pluridisciplinaire de Nador Équipe de Recherche en Biologie et Biotechnologie Appliquées. Morocco. E-mail: taybiAf@gmail.com / a.taybi@ump.ac.ma; https://orcid.org/0000-0001-9652-5407

The genus *Ifrania* Glöer, Mabrouki et Taybi 2020 (Hydrobiidae) was recently described from Morocco; its type species is *Ifrania zerroukansis* Glöer, Mabrouki et Taybi, 2020 found in the Middle Atlas massif, geographically isolated and known for its other endemic mol- luscs. *Ifrania bahhouensis* sp. n. is a new valvatiform hydrobiid gastropod from Morocco; it can be distinguished from *I. zerroukansis* by the morphology of the shell and anatomical criteria. The new species was found in the northern part of Morocco, in the Sebou River basin. The aim of this paper is to describe the new springsnail species.

Key words: springsnail, narrow-ranged, endemic, Sebou River.

INTRODUCTION

The prosobranch mollusc family Hydrobiidae Stimpson, 1865 was long considered to be one of the largest gastropod families with more than 400 recent genera assigned. It turned out that the Hydrobiidae s. l. (hydrobiid-like taxa in terms of anatomical/morphological features) is made up now by several separate families next to Hydrobiidae s. s., based on molecular evidence (Wilke et al. 2013). The true hydrobiids are highly variable morphologically and anatomically, characterized by a closed ventral wall of the female capsule gland. Many species have pigmented coiled oviduct and/or glandular fields on the penis, which are not seen in other hydrobioid families (Wilke et al. 2013, Glöer 2019).

The family Hydrobiidae sensu stricto (commonly known as springsnails) has received considerable attention in terms of species discoveries recently in Morocco, and it is represented by 17 genera (Gloër et al. 2020a, b, Boulaassafer et al. 2021, Mabrouki et al. 2020, 2021a, 2022, Taybi et al. 2021a), among which, those who have valvatiform shape. The valvatiform snails are small species characterized typically by their tiny shells (1.0–1.5 mm) similar in shape to members of the genus *Valvata* Müller, 1773, a member of the Valvatidae family.
Most valvatiform species of the gastropod family Hydrobiidae are narrow-range in the Palaearctic (Delicado et al. 2019). They are represented in Morocco by 7 species and 6 genera, as follows: Rifiya Ghamizi, 2020, Islamia Radoman, 1973, Pikasia Taybi, Glöer et Mabrouki, 2021, Idresiella Mabrouki, Glöer et Taybi, 2022, Fessia Glöer, Mabrouki et Taybi, 2020 and Ifrania Glöer, Mabrouki et Taybi, 2020. The latter genus was represented by the single species Ifrania zerroukansis Glöer, Mabrouki et Taybi, 2020, endemic to Lake Zerrouka, located in Ifran province. Recent field surveys conducted on the northern part of Morocco have led to the discovery of a new Ifrania species, the aim of this paper is to describe it.

MATERIAL AND METHODS

Sampling. Field surveys were conducted from 2014 (still ongoing), in which several localities were prospected along the northern part of Morocco, including the Atlas Mountains, Sebou and Moulouya River basins. 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 stereomicroscope (Leica M205C) with a digital camera (Leica DMC5400). The type material is stored in the Zoological Museum of Hamburg (ZMH).

TAXONOMY

Phylum: Mollusca Cuvier, 1795
Class: Gastropoda Cuvier, 1795
Superorder: Caenogastropoda Cox, 1960
Superfamily: Truncatelloidea Gray, 1840
Family: Hydrobiidae Stimpson, 1865
Genus: Ifrania Glöer, Mabrouki et Taybi, 2020
Type species: Ifrania zerroukansis Glöer, Mabrouki et Taybi, 2020

The valvatoid shell in Ifrania has a very small spire. The body whorl is very prominent and the last whorl is descendent. The first whorls are slightly convex with a clear suture. The aperture is nearly circular, and the umbilicus is wide, not covered by the last whorl. The penis is cylindrical, long and slender.

Ifrania bahhouensis Mabrouki, Glöer et Taybi, sp. n.
(Figs 1–6)

https://zoobank.org/urn:lsid:zoobank.org:act:C31964E2-394C-4F92-B8B1-9D09E8CF2797

Type materials. Holotype ZMH 140917, 0.84 mm high, 1.07 mm broad, 3 paratypes ZMH 140918 from spring 1, 4 paratypes Paratype ZMH 140919 from spring 2
A NEW VALVATIFORM SNAIL (GASTROPODA, HYDROBIIDAE) FROM MOROCCO

Type locality. Spring 1, 07/03/21 and 24/10/21, 33°55′12.4″N 4°40′20.7″W, Zaouiat Sidi Ben Aïssa, Fez-Boulemane region. Spring 2, 24/10/21, 33°53′07.0″N 4°41′24.9″W, Zaouiat Sidi Ben Aïssa, Fez-Boulemane region.

Description. Shell. The valvatiform translucent shell is conical with a small spire and a prominent body whorl. The surface is smooth and glossy (Figs 1, 3, 5). The 3.5 whorls are convex with a triangular rounded aperture. The peristome is sharp, the umbilicus is deep and open, not covered by the aperture. The shell is 0.84–0.91 mm high and 1.07–1.19 mm broad (see Table 1).

Animal. The mantle is black with a white border. Eye spots are pigmented. The penis is long and slender with an acute penis tip (Figs 2, 4).

Operculum. The translucent, colourless operculum (with a slightly orange nucleus) is ovate with a rounded angle at the top (Fig. 6). There is no peg.

Figs 1–6. Ifrania bahhouensis sp. n.: 1 = holotype; 3, 5 = paratypes; 5 = dried shell; 2–4 = penis in situ; 6 = operculum
Differential diagnosis. The new species is little similar to *Ifrania zerroukansis* from Ifran province, but *I. zerroukansis* is much larger (1.1 mm high and 1.5 mm in diameter), and the penis in *I. zerroukansis* is longer, widened at the basis and tapered at the distal end with a pointed penis tip. In addition, *I. zerroukansis* has yellowish ovate and slightly concave operculum with an orange nucleus, *Ifrania bahhouensis* sp. n. has translucent, colourless operculum, ovate with rounded angle at the top.

Etymology. The species was named after Prof. Bahhou Jamila (University Sidi Mohamed Ben Abdellah), in recognition for the many years of teaching generations at Dhar El Mahraz Faculty of Sciences of Fez and for her scientific works carried out on the aquatic ecosystems of Morocco and particularly those of Sebou River basin.

Habitat. The new species was found in two springs located at a place named Zaouiat Sidi Ben Aïssa, Fez-Boulemane region. One of them is a rheocrenous natural spring, the bottom consists of stones, pebbles and sand, the

| Table 1. The shell measurements of *Ifrania bahhouensis* sp. n. |
|-----------------|-----|-----|-----|-----|
| Min             | 0.79| 0.88| 0.84| 0.05|
| Max             | 0.41| 0.46| 0.44| 0.03|
| Mean            | 1.07| 1.17| 1.11| 0.05|
| SD              | 0.38| 0.42| 0.4  | 0.02|
| Aperture width (aw) | 0.43| 0.48| 0.45| 0.03|

Fig. 7. The sampling sites and habitat of *Ifrania bahhouensis* sp. n.
banks are natural, with dense tree-lined vegetation and weak sunlight. The second spring is partially modified (Fig. 7), located in a rural environment, it is subjected to strong anthropogenic pressure: washing of linen, pumping of water for irrigation and domestic use, the vegetation of the banks is very heterogeneous and highly disturbed. Both springs are located in Sebou River basin at the edge of Barrage Allal El Fassi reservoir at 419 m altitude.

**DISCUSSION**

Morocco is situated at the extreme north-west of Africa, on the Atlantic and the Mediterranean and has an area of 710.850 km². It is divided into a Mountainous area (Atlas and the Rif), the Atlantic area (plateau and plains) and a vast arid area composed of plateaus and small mountains (eastern and Saharan area). This has resulted in a high diversity of ecoregions related to Mediterranean-type climates, promoting great biodiversity while at the same time offering significant socioeconomic benefits (USAID/Morocco 2008, Chillassé *et al.* 2001, Taybi *et al.* 2020, El Morabit *et al.* 2022).

Knowledge of the valvatiform Hydrobiidae fauna of Morocco has advanced significantly in recent years, with many new species added recently, including genera new to science (Glöer *et al.* 2020a, b, Mabrouki *et al.* 2021b, Taybi *et al.* 2021b). Considering the high number of Hydrobiidae that occurs in adjacent areas (e.g., ~60 hydrobiid species listed in 18 genera are known from the Iberian Peninsula of which 11 genera are valvatiform (Delicado *et al.* 2019), the number of springsnail species known to occur in Morocco will probably increase with further intensified studies and collecting expeditions, which are an urgent need.

Unfortunately, due to the great pressure on natural ecosystems, especially aquatic ones, many species will probably have disappeared before being recorded or even described. These wetlands present many socio-economic and biodiversity issues associated with multiple ecosystem services such as the provision of drinking and irrigation water, natural resources as well as hydrological regulation. In addition to climate change, they experience significant anthropogenic pressures, summed up in agriculture intensification, solid and liquid pollution, and unsuitable developments. Justifying, therefore, the implementation of conservation measures and adaptive management strategies to protect the autochthonous fauna and its natural habitats. Finally, we suggest the inclusion of all the crenobiotic valvatiform species of Morocco in the IUCN Redlist.

*Acknowledgements – We are grateful to the two anonymous reviewers for valuable comments.*
REFERENCES

Boss, K. J. (1971): Critical estimate of the number or recent Mollusca. – *Occasional Papers on Molluscs* 3(40): 81–135.

Boulaassaf, K, Ghamizi, M, Machordom, A, Albrecht, C, & Delicado, D. (2021): Hidden species diversity of Corrosella Boeters, 1970 (Caenogastropoda: Truncatelloidea) in the Moroccan Atlas reveals the ancient biogeographic link between North Africa and Iberia. – *Organisms Diversity & Evolution* 21: 393–420. [https://doi.org/10.1007/s13127-021-00490-3](https://doi.org/10.1007/s13127-021-00490-3)

Chillasse, L., Dakki, M, & Abbassi, M. (2001): Valeurs et fonctions écologiques des Zones humides du Moyen Atlas (Maroc). – *Humedales Méditerranéos* 1: 139–146.

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 the Linnean Society* 186: 892–914. [https://doi.org/10.1093/zoolinnean/zly093](https://doi.org/10.1093/zoolinnean/zly093)

El Morabet, I, El Fadili, L. R., Taybi, A. F., Mabrouki, Y., Bouhaddioui, A, & Bahhou, J. (2022): Assessment of physico-chemical and biological parameters of Aguelmam Sidi Ali Lake, a threatened Ramsar Site, Morocco. – *AACL Bioflux* 15(1): 573–583.

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

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](https://doi.org/10.37828/em.2020.28.1)

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

Mabrouki, Y., Taybi, A. F. & Glöer, P. (2020): New additions to gastropod fauna (Gastropoda: Hydrobiidae, Lymnaeidae) of Morocco. – *Ecologica Montenegrina* 31: 40–44. [https://doi.org/10.37828/em.2020.31.8](https://doi.org/10.37828/em.2020.31.8)

Mabrouki, Y., Taybi, A. F. & Glöer, P. (2021a): Two new species of the genera Islamia and Mercuria (Gastropoda, Hydrobiidae) from Morocco. – *Ecologica Montenegrina* 9: 76–80. [https://doi.org/10.37828/em.2021.39.8](https://doi.org/10.37828/em.2021.39.8)

Mabrouki, Y., Taybi, A. F. & Glöer, P. (2021b): Further records of freshwater gastropods (Mollusca: Hydrobiidae, Lymnaeidae, Planorbidae) from Morocco. – *Bonn Zoological Bulletin* 70(2): 273–279. [https://doi.org/10.20363/BZB-2021.70.2.273](https://doi.org/10.20363/BZB-2021.70.2.273)

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

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

Taybi, A. F., Glöer, P, & Mabrouki, Y. (2021a): First record of the New Zealand Mudsnail Potamopyrgus antipodarum (J. E. Gray, 1843) (Tateidae, Mollusca) in Africa. – *Graellsia* 77(2): e140. [https://doi.org/10.3989/graellsia.2021.v77.303](https://doi.org/10.3989/graellsia.2021.v77.303)

Taybi, A. F., Glöer, P & Mabrouki, Y. (2021b): Description of a new valvatiform 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](https://doi.org/10.32800/abc.2021.44.0317)
A NEW VALVATIFORM SNAIL (GASTROPODA, HYDROBIIDAE) FROM MOROCCO

USAID/Morocco (2008): USAID/Morocco under Prosperity, Livelihoods and Conserving Ecosystems (PLACE) indefinite quantity contract number EPP-I-03-06-00010-00, Task Order #03 awarded 02 September 2008, entitled Morocco Biodiversity and Tropical Forestry Assessment (“Morocco 118/119 Assessment”), 114 pp.

Wilke, T., Haase, M., Hershler, R., Liu, H-P, Misof, B. & Ponder, W. (2013): Pushing short DNA fragments to the limit: Phylogenetic relationships of ‘hydrobioid’ gastropods (Caenogastropoda: Rissooidea). – Molecular Phylogenetics and Evolution 66(3): 715–36. https://doi.org/10.1016/j.ympev.2012.10.025

Revised version submitted June 17, 2022; accepted July 12, 2022; published October 28, 2022
