Basteria
JOURNAL OF THE NETHERLANDS MALACOLOGICAL SOCIETY
VOLUME 90 (2) | 15 September 2026
e-ISSN 3117-9924

Two new valvatiform species of Hydrobiidae (Gastropoda) from Andalusia (S Iberian Peninsula)

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Martín-Álvarez, J.F., López-Soriano, J., Raven, J.G.M., Sánchez, O., & Quiñonero-Salgado, S., 2026. Two new valvatiform species of Hydrobiidae (Gastropoda) from Andalusia (S Iberian Peninsula). – Basteria, 90 (2): 220-230. Leiden. *Online version published 15 September (ICZN compliant).*

Keywords: freshwater, springsnails, *Kulyiella*, *Ganduliella*, endemics, hotspot, Andalusia.

Two new species of valvatiform springsnails are described from the provinces of Granada and Sevilla (Andalusia), southern Spain. Their status is validated by DNA analysis, by comparing them with the known sequences of other Iberian Hydrobiidae. For each of the two species a new genus is erected: *Kulyiella marginata* gen. nov. spec. nov. and *Ganduliella irippensis* gen. nov. spec. nov. The provinces Granada and Sevilla are consolidated as an important hotspot of springsnails.

urn:lsid:zoobank.org:pub:875A82B2-EEC5-467C-9069-4AAEF699761C
DOI 10.5281/zenodo.22165175

INTRODUCTION

The family Hydrobiidae is the richest family of freshwater snails, considering the total number of species, both in Europe and worldwide (Glöer, 2022). It includes many species and genera in the Iberian Peninsula, with crenobiont and stygobiont representatives. Recently, many new genera of stygobionts have been described, such as *Alfahariella* Quiñonero-Salgado, López-Soriano, Raven, Glöer & Prieto, 2024; *Onubiella* Martín-Álvarez, Quiñonero-Salgado, López-Soriano, Raven & Glöer, 2024; *Robustiella* Quiñonero-Salgado, López-Soriano & García-Meseguer, 2025; *Alagoniella* Quiñonero-Salgado, López-Soriano, Raven & Sánchez, 2025; or *Siuraniella* Quiñonero-Salgado, López-Soriano, Raven, Pascual, García, Solé & Sánchez, 2025, along with many others previously described (Quiñonero-Salgado et al., 2024, 2025a, 2025b; López-Soriano & Quiñonero-Salgado, 2025).

Some of these new genera have already been validated by anatomic and/or genetic studies (Quiñonero-Salgado et al., 2024 & 2025b), but we are far from understanding the complete richness of this fauna, and their phylogenetic relationships. Many regions are undersampled, such is the case of southern Spain. This area has already been proposed as a hotspot for crenobiont Hydrobiidae (Arconada & Ramos, 2003), particularly because of the elevated number of species of the genus *Corrosella* Boeters, 1970 (Delicado et al., 2013). Preliminary samplings in the western part of Andalusia have already unveiled some new stygobiont taxa, including a new genus in Huelva province (Martín-Álvarez et al., 2024a). Also, the first stygobiont mollusc was recently described for Murcia Autonomous Region, *Robustiella incantata*

Quiñonero-Salgado, López-Soriano & García-Meseguer, 2025. So, we are probably still far from understanding the full richness of this family in this area of Iberia, including both stygobiont and crenobiont representatives.

In the present article, we describe two new genera and species of valvatiform Hydrobiidae from the provinces of Granada and Sevilla (Andalusia, southern Spain). Molecular tools confirm them as different taxa compared to all previously described from nearby areas or even the whole Iberian Peninsula.

MATERIAL AND METHODS

Specimen collection and morphological analysis. — The different localities were visited from September 2024 to April 2026. To obtain the material, stones were lifted, and sediment was collected from the spring and later washed with the use of sieves of different mesh (2.0, 1.0 and 0.25 mm). Shells were separated with the help of a brush and cleaned with tap water.

Protoconch whorls are counted following Bouchet & Kantor (2004), i.e. the nucleus is counted as half a whorl. Type specimens were photographed under a trinocular Nexius Zoom NM1903-S stereomicroscope with a Euromex cmex-10pro camera. Empty shells representing the type material were mounted on an aluminium stub for scanning electronic microscopy (sem) to reveal their microsculpture. sem images were made without coating in a jeol jsm-6480 LV using low vacuum, 10 KV voltage and 30 Pa pressure.

Abbreviations: jfma: J.F. Martín-Álvarez; Naturalis: Naturalis Biodiversity Center (Leiden); rmnh: Rijksmuseum van Natuurlijke Historie, now part of Naturalis; sem: Scanning Electron Microscopy; sqs: Sergio Quiñonero-Salgado; a.s.l.: above sea level; s: shell.

dna extraction, pcr amplification, sequencing and genetic analysis. — Protocols of dna extraction and pcr amplification were carried out as explained in detail in Martín-Álvarez et al., 2024b. For this study, the phylogenetic analysis was conducted using seven new sequences of the newly described species, as well as another 61 available sequences of Iberian Hydrobiidae species from GenBank plus one sequence of *Mercuria balearica* (Paladilhe, 1869) used as outgroup. Sequences were deposited in GenBank with the accession numbers PZ382287-PZ382288 and PZ381516-PZ381520.

The test software iq-tree v3.1.1. (Minh et al., 2020) was used to predict the nucleotide substitution model showing the best bic and aicc scores deploying ModelFinder options (Kalyaanamoorthy et al., 2017). A Maximum Likelihood tree was performed in iq-tree v3.1.1. using Ultrafast Bootstrap options (1,000 bootstrap replicates) (Minh et al., 2013) and a search was conducted for the best scoring tree using the hky+f+i+r3 model.

Anatomical analyses. — For the anatomical studies, the shells of the adult specimens were first removed using a decalcifying aqueous solution of saturated ethylenediaminetetraacetic acid (edta) prior to the dissection of the soft bodies. Specimens were dissected in distilled water in a Petri dish containing a paraffin-wax-charcoal layer. The specimens were examined and dissected using an Optika szm-2 stereomicroscope (0.7-4.5 ×). To expose the penis, the mantle was withdrawn with the help of two tungsten pins.

SYSTEMATICS

Family Hydrobiidae Stimpson, 1865

Genus *Kulyiella* gen. nov.

urn:lsid:zoobank.org:act:1960BA7F-49EE-4AD3-8C89-2EFF77CF439D

Type species: *Kulyiella marginata* spec. nov.

Derivatio nominis. — Derives from Kulya (also spelled as Qülla), the Arabic name of the municipality of Cúllar, type locality of the genus. It means top of a hill, or elevated terrain.

Diagnosis. — Shell valvatoid, very small (approximately 0.8 mm in length and 1.1 mm in width) and depressed, 4 whorls, sutures very deep, creating a marked furrow between the whorls, umbilicus very wide and deep, with last half whorl covering less than half the width of preceding whorl; aperture rounded, widest below the periphery, prosocline (angle 35° from vertical), no varix. Operculum has a subcentral nucleus and lacks any outgrowth on the inner surface.

Anatomy. — Same as for the type species.

Species included. — *Kulyiella marginata* spec. nov.

Remarks. — dna analysis clusters this taxon with some other valvatiform genera from the Iberian Peninsula, with which it has morphological similarities, including both stygobiont and crenobiont genera, which are: *Tarraconia* M. A. Ramos & Arconada, 2000, *Spathogyna* Arconada & M. A. Ramos, 2022 and *Siuraniella*. Thus, the clade is represented in most of the eastern part of the Peninsula, including species with different ecological adaptations.

Kulyiella marginata gen. nov. spec. nov.

Figs 1-6

urn:lsid:zoobank.org:act:19A283C5-B3EC-4568-86AF-8CFE0A52EF91

Holotype: El Caño del Margen (Fig. 13), El Margen-Cúllar, Granada, Andalusia, Spain [30SWG386656], 885 m a.s.l.,

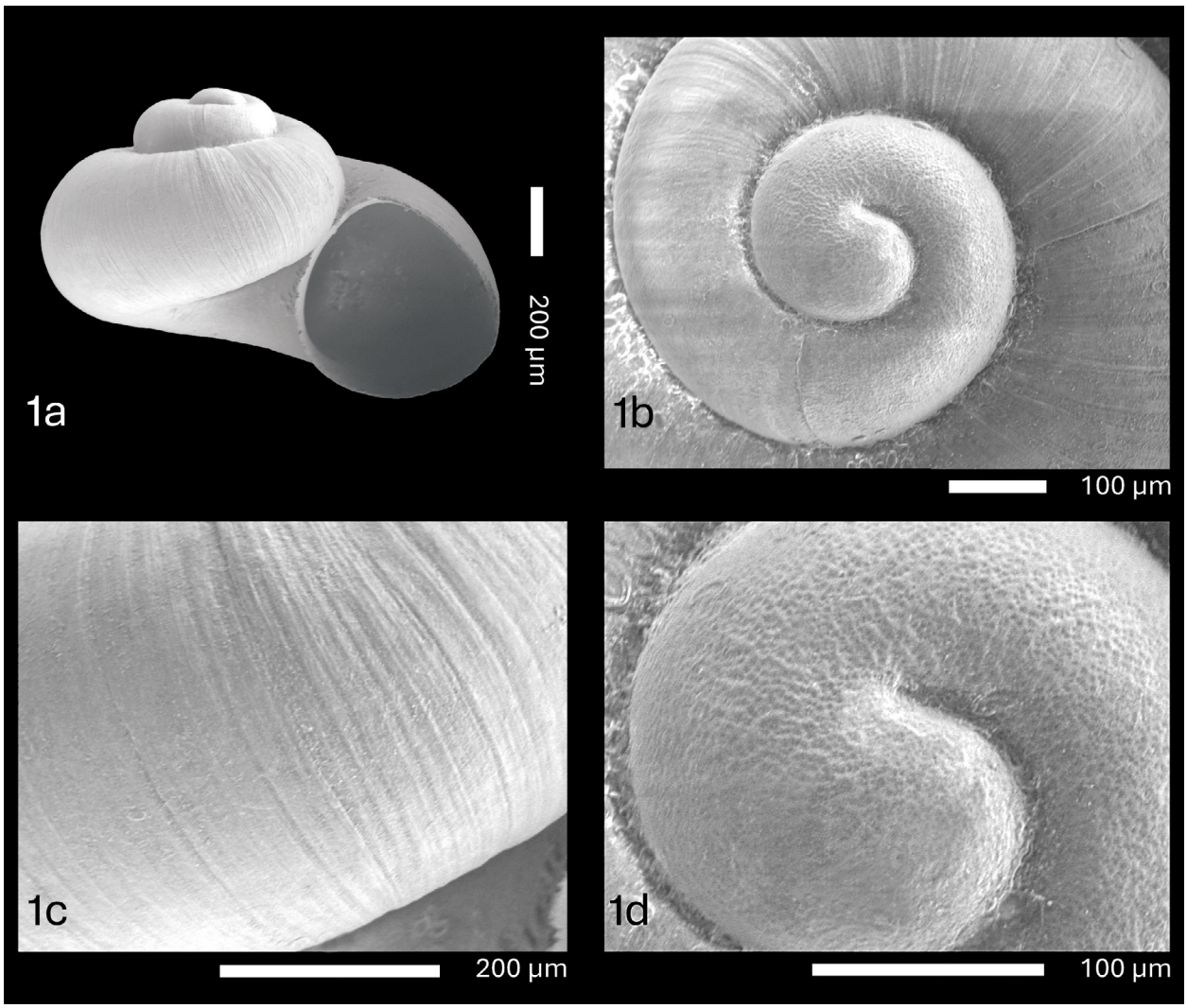


Fig. 1. SEM images of *Kulyiella marginata* gen. nov. spec. nov. Different views of a paratype. **1a.** Frontal view. **1b.** Protoconch apical view. **1c.** Detail of the teleoconch. **1d.** Detail of the protoconch.

leg. JFMA 02.i.2024 (Naturalis RMNH.MOL.653789, Fig. 2).

Paratypes. — As type locality, 02.i.2024; 10.vi.2025 (RMNH.MOL.653790, 1 s; JFMA collection, 12 s; SQS collection, 10 s).

Etymology. — Latinised epithet for El Margen (thus, *marginata*), type locality of the species.

Description — Shell valvatoid, very small and depressed, 4 whorls, sutures very deep, creating a wide furrow between the whorls, whorls attached to lower half of preceding whorl, umbilicus wide and deep, in which preceding whorls are only partially visible; aperture rounded, widest below the periphery, appearing slightly compressed vertically, prosocline (angle 35° from vertical) in ventral view lower part whorl strongly concave, upper part convex, only widened over the umbilical skirt, no varix. Shells translucent, with a whitish to straw colour.

Operculum has a subcentral nucleus and lacks any outgrowth on the inner surface.

Dimensions. — See Table 1.

Pigmentation and anatomy: Body characteristically reddish to salmon-pink in living specimens, turning pale or whitish after preservation in ethanol. Body surface with small, scattered white speckles. Male genitalia conspicuous and simple, consisting of a large, robust penis, broad at its base and tapering distally into a small apical tip/papilla. The penial duct runs the external surface of the penis and presents a distinct zigzag course in its middle third, while the proximal and distal portions remain comparatively straight (Fig. 18). Two out of eight examined females presented a simple pseudopenis, short and small, without the development observed in males similar to those reported in *Spathogyna fezi* (Altimira, 1960).

Habitat. — Possibly crenobiont, since it has eyes and red pigment. However, it cannot be discarded that it has stygophile behaviour.

Figs 2-6. Type specimens of *Kulyiella marginata* gen. nov. spec. nov. from the type locality. **2.** Different views of the holotype. **3-6.** Four different paratypes in frontal view. Scale: 1 mm.

***Kulyiella marginata* spec. nov.** (n = 12)	**SH**	**SW**	**LWH**	**PH**	**PW**
Holotype	0.67	1.08	0.63	0.51	0.47
MEAN	0.78	1.19	0.71	0.57	0.54
MIN	0.63	1.07	0.58	0.51	0.47
MAX	0.90	1.29	0.81	0.63	0.59
ST DEV	0.093	0.069	0.080	0.036	0.038
***Ganduliella irippensis* spec. nov.** (n = 40)	**SH**	**SW**	**LWH**	**PH**	**PW**
Holotype	1.11	0.99	0.92	0.58	0.53
MEAN	1.40	1.15	1.17	0.73	0.63
MIN	1.11	0.99	0.92	0.58	0.53
MAX	1.68	1.26	1.33	0.84	0.71
ST DEV	0.156	0.068	0.106	0.058	0.043

Table 1. Measurements in mm of *Kulyiella marginata* gen. nov. spec. nov. and *Ganduliella irippensis* gen. nov. spec. nov. shells. SH: shell height; SW: shell diameter; LWH: last whorl height; PH: aperture height; PW: aperture width. Measurements of *G. irippensis* spec. nov. comprise 20 specimens of each known population.

Differentiating characteristics. — *Tarraconia* has a higher shell, shallower sutures, much narrower umbilicus, orthocline aperture and characteristic varix on the outer lip. *Spathogyna fezi* is most similar, but has a higher shell with more stepped whorls, less whorls (3.2-3.5), whereas the aperture is more rounded and more vertical (prosocline at 30º from vertical). *Siuraniella montsantensis* Quiñonero-Salgado, López-Soriano, Raven, Pascual, G. García, Solé & O. Sánchez, 2025 attaches the whorls slightly higher, resulting in an even flatter shell with wider umbilicus in which previous whorls are fully visible (partially visible in *Kulyiella* gen. nov.); the whorls are less prosocline (30º from vertical) and in apertural view the abapical part is further out from the adapical part, giving it an inclined ellipsoid shape. *Deganta azarum* (Boeters & Rolán, 1988) from the north of the Peninsula attaches the whorls lower below the periphery, resulting in a more closely wound, higher shell with a very narrow umbilicus. The whorls are more evenly rounded, equally high as wide.

This species is anatomically distinguished from other taxa of its clade by their characteristic reddish colour and the morphology of the male genitalia. Unlike *Tarraconia* and *Spathogyna*, it possesses a simple penis, devoid of glandular appendages or accessory projections. It differs from *Siuraniella montsantensis*, which has a slender penis with a distinct subapical thickening, by presenting a much thicker and robust penis of nearly constant width along most of its distal two thirds.

Genetic results. — Samples assigned to *Kulyiella marginata* spec. nov. based on shell morphology formed a well-supported group with a high bootstrap support (i.e., 100%) located within a clade composed of *Siuraniella montsantensis*, *Tarraconia rolani* M. A. Ramos, Arconada & D. Moreno, 2000, *T. gasulli* (Boeters, 1981) and *Spathogyna fezi*. The sequence divergence of CO1 for *Kulyiella marginata* spec. nov. and the congeners of its clade ranged between 10.8% with *S. fezi* and 13.2% with *Si. montsantensis*.

Conservation status. — As with many other freshwater snails, its limited distribution area (thus far it is only known from a single population at the type locality) and the endangered habitats (overexploitation of springs, contamination of groundwater, presence of invasive species) suggest it should have some degree of protection. A long-term program for assessing the status of its population(s) and a sensible management of the water in this area are highly desirable.

Genus *Ganduliella* gen. nov.

urn:lsid:zoobank.org:act:97A6C420-DD70-4256-91C7-48A8E40A6F23

Type species: *Ganduliella irippensis* spec. nov.

Derivatio nominis. — It derives from Gandul, locality close to Alcalá de Guadaíra (type locality of the genus), as this population allowed confirmation of the new genus assignment. "Gandul" is a popular word in Spanish meaning lazy or slacker, which perfectly describes the moments of relax in between the otherwise harsh field work campaigns for the finding of stygobiont gastropods.

Diagnosis. — Shell valvatoid, very small (approx. 1.4 mm in length and 1.1 mm in width), protoconch with 1.5 whorls with irregular pitted sculpture, intersection with teleoconch orthogonal near suture, becoming strongly prosocline towards base; 2.5 elevated globose teleoconch whorls, smooth except for irregular growth lines that are orthocline near suture, but faintly S-shaped prosocline below, each attached over a short distance, at about ¼ from the base of the preceding whorl, resulting in deep sutures creating a narrow furrow, umbilicus narrow but deep; aperture rounded, slightly narrower near top, widest below periphery, rounded at base, prosocline (angle 20° from vertical), umbilical skirt and part touching preceding whorl slightly broadened, no varix. The shell has a white colour and is translucent.

Species included. — *Ganduliella irippensis* spec. nov.

Remarks. — DNA analysis clusters this taxon with some other valvatiform genera from the Iberian Peninsula, including different crenobiont species, which are: *Aretiana wolfi* (Boeters & Glöer, 2007) and *Iberhoratia morenoi* Arconada, Delicado & M. A. Ramos, 2007. Thus, the clade is represented in most of the southern part of the Iberian Peninsula.

***Ganduliella irippensis* gen. nov. spec. nov.**

Figs 7-12

urn:lsid:zoobank.org:act:A7CD789B-1CEB-43E9-A912-F0961A4436BF

Holotype. — Subterranean spring (Fig. 14) located at Camino de la Huerta de la Peñuela, Alcalá de Guadaíra, Sevilla, Andalusia, Spain, [30STG480356], 32 m a.s.l., leg. JFMA 06.vii.2024 (Naturalis RMNH.MOL.653791, Fig. 8).

Paratypes. — As type locality, 06.vii.2024; 02.iv.2026 (RMNH.MOL.653792, 1 s; JFMA collection, 20 s; SQS collection, 20 s).

Other material. — Fuente Alta, Pruna (Sevilla province). [30SUF028978], 599 m a.s.l., 27.ix.2024; 02.iv.2026, leg. JFMA (coll. JFMA, 20 s).

Etymology. — Derived from the Tartessian name for the locality of Alcalá de Guadaíra; Irippo.

Description. — Shell valvatoid, very small, protoconch 1.5 whorl with irregular pitted sculpture, intersection with teleoconch orthogonal near suture, becoming strongly prosocline towards base; 2.5 elevated globose teleoconch whorls,

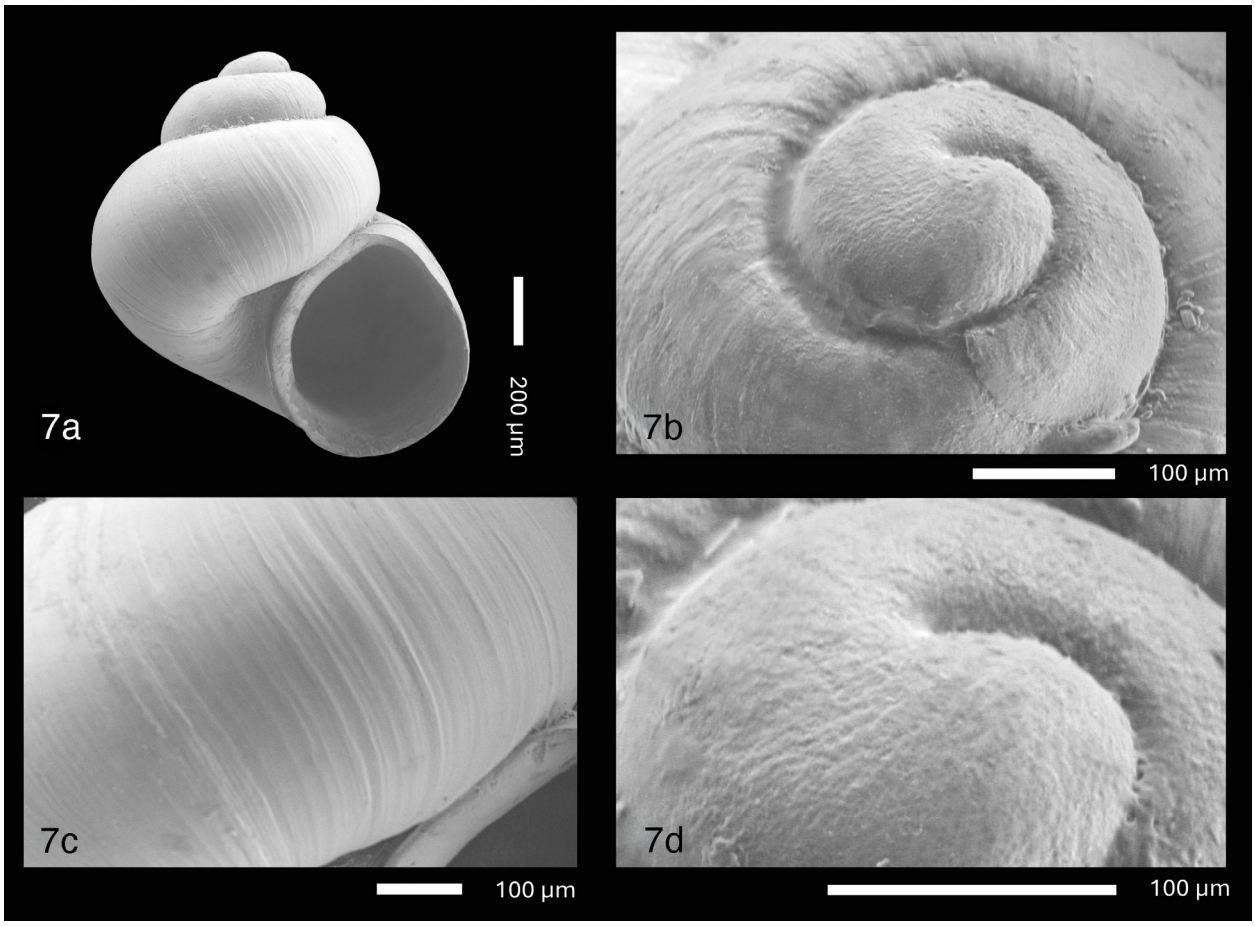
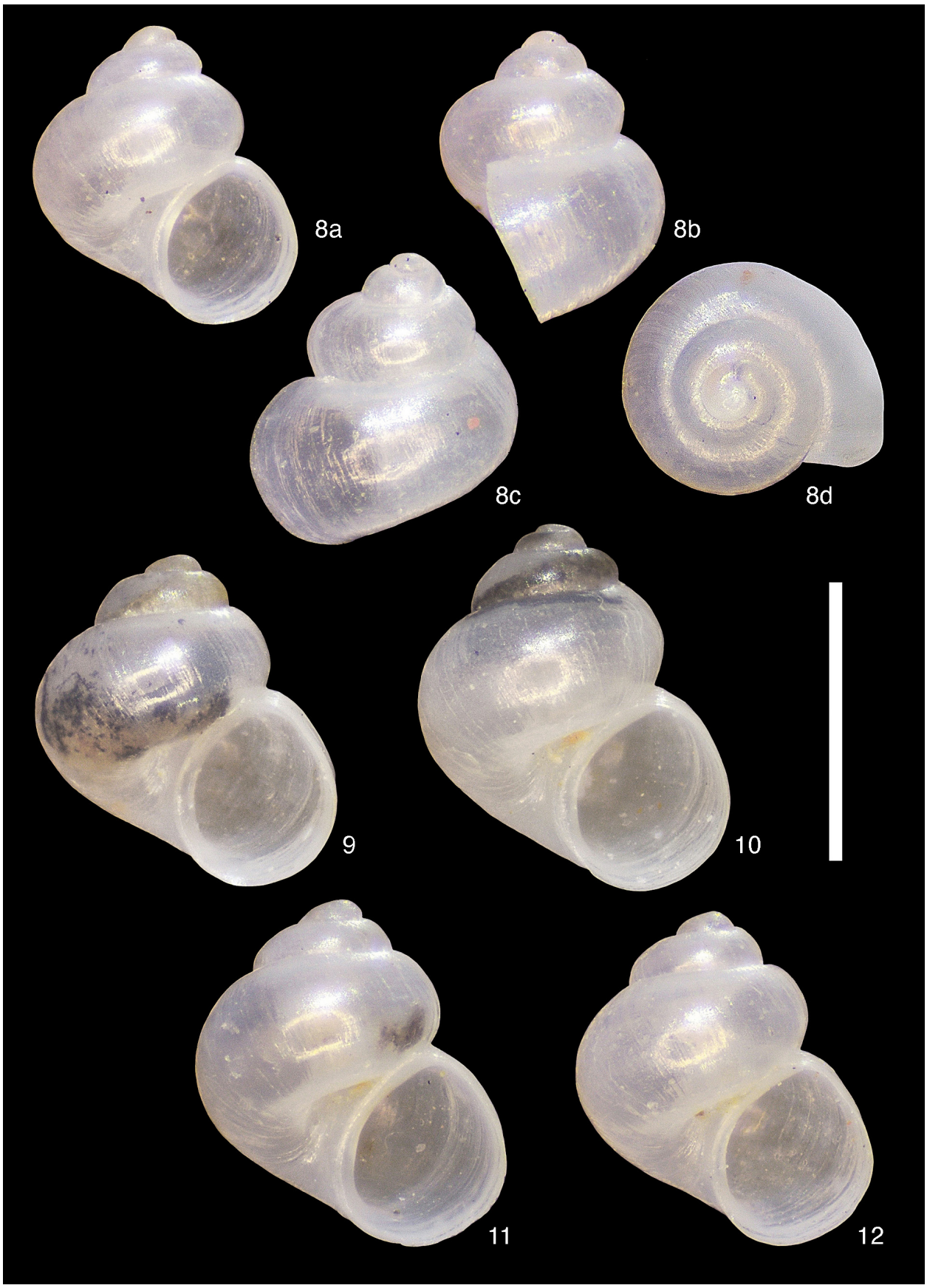
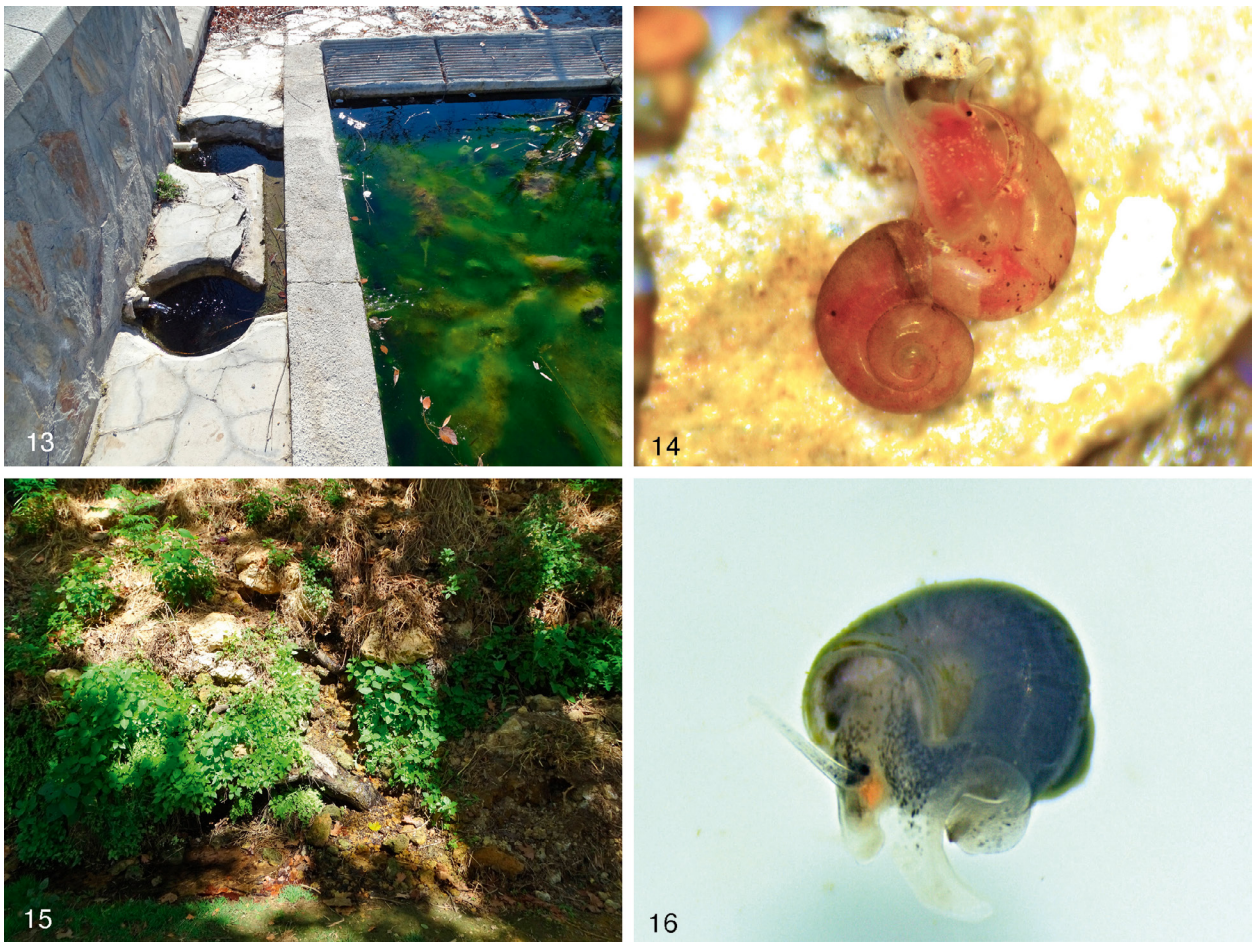


Fig. 7. SEM images of *Ganduliella irippensis* gen. nov. spec. nov. Different views of a paratype. **7a.** Frontal view. **7b.** Protoconch apical view. **7c.** Detail of the teleoconch. **7d.** Detail of the protoconch.



Figs 8-12. Type specimens of *Ganduliella irippensis* gen. nov. spec. nov. from the type locality. **8.** Different views of the holotype. **9-12.** Four different paratypes in frontal view. Scale: 1 mm.



Figs 13-16. Type localities of the newly described species. **13-14.** El Caño del Margen, El Margen-Cúllar (Granada province), type locality of *Kulyiella marginata* gen. nov. spec. nov. **15-16.** Spring at Camino de la Huerta de la Peñuela, Alcalá de Guadaíra (Sevilla province), type locality of *Ganduliella irippensis* gen. nov. spec. nov.

smooth except for irregular growth lines near suture; deep sutures creating a narrow furrow, umbilicus narrow but deep; aperture rounded, prosocline, umbilical skirt and part touching preceding whorl slightly broadened, no varix. The shell has a white colour and is translucent.

Shells from Fuente Alta (Pruna) were significantly bigger in size compared to type locality (1.53 vs. 1.27 mm length), and slightly more elevated, despite having the same sequences than the other population. This shows the intraspecific morphological variation of the shell, a common trait within Hydrobiidae, which often makes complex the identification of most of its taxa by only relying in shell shape.

Dimensions. — See Table 1.

Pigmentation and anatomy. — Living specimens are dark greyish, with conspicuous darker pigmented patches in the ocular region and at the base of the tentacles. The penis is mostly weakly pigmented, bearing only fine, scattered dark speckles, except for the distal apex, which is markedly darker. Male genitalia are conspicuous and formed by a flattened penis, strongly broadened at the base and gradually tapering distally into a narrow neck-like portion. The distal end forms a dark, flame-shaped apex, resembling the tip of a brush. In some specimens (2 out of 10), a small, non-glandular subapical projection is present near the distal end of the penis. The penial duct follows a straight course along the outer edge of the penis.

Habitat. — Crenobiont. The animals were found in a subterranean spring, in the groundwater. Presence of dark pigmentation in the mantle and well-developed eyes confirm it is not a strict stygobiont, despite its finding in subterranean water, a case also reported for a related species, *Iberhoratia gatoa* (Boeters, 1980), an inhabitant of a deep cave. Its potential presence in groundwater in the hyporheic of rivers and streams cannot be discarded.

Differentiating characteristics. — The species is closest related to *Iberhoratia morenoi* Arconada, Delicado & M. A. Ramos, 2007 and *Aretiana wolfi* (Boeters & Glöer, 2007).

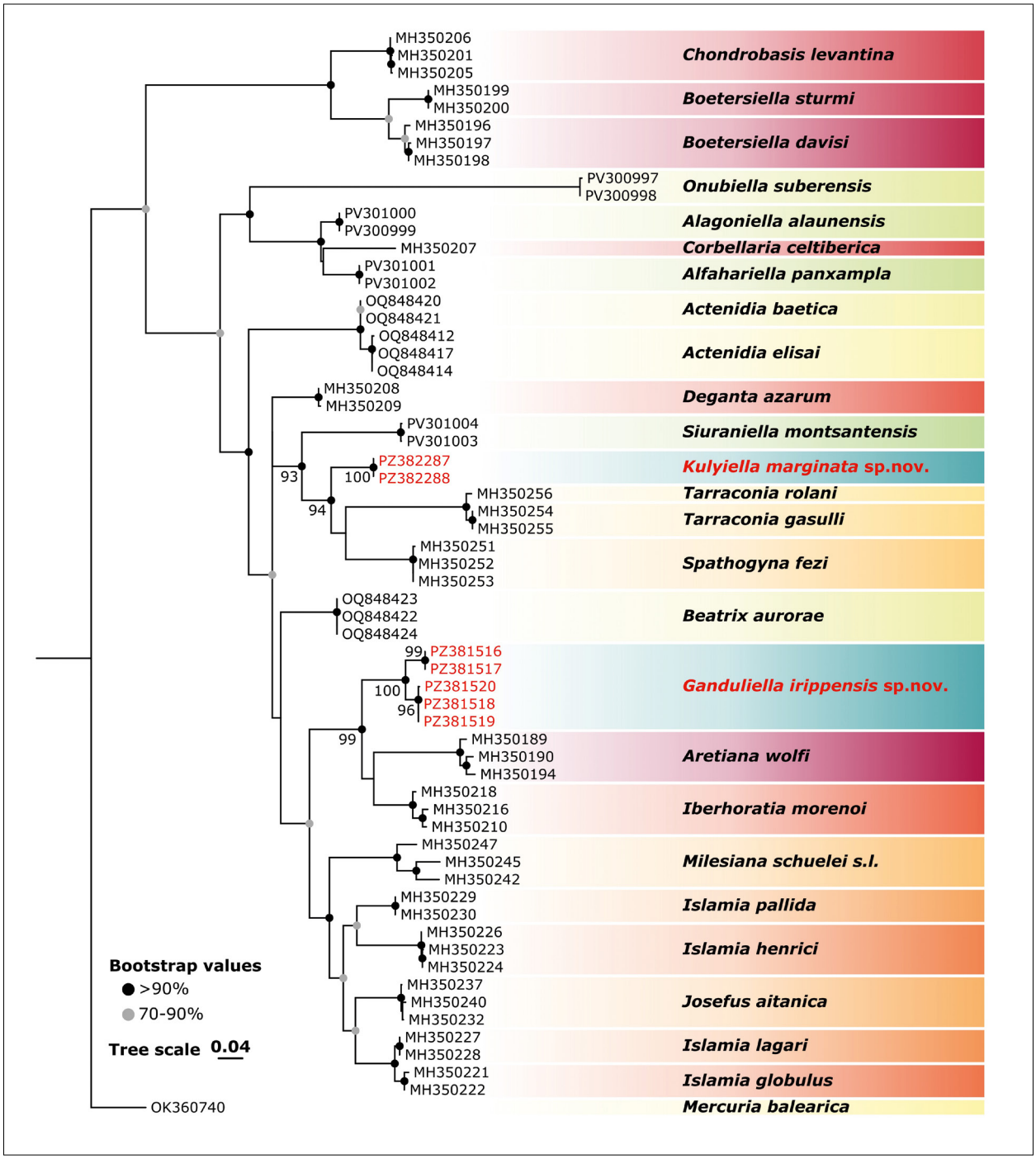
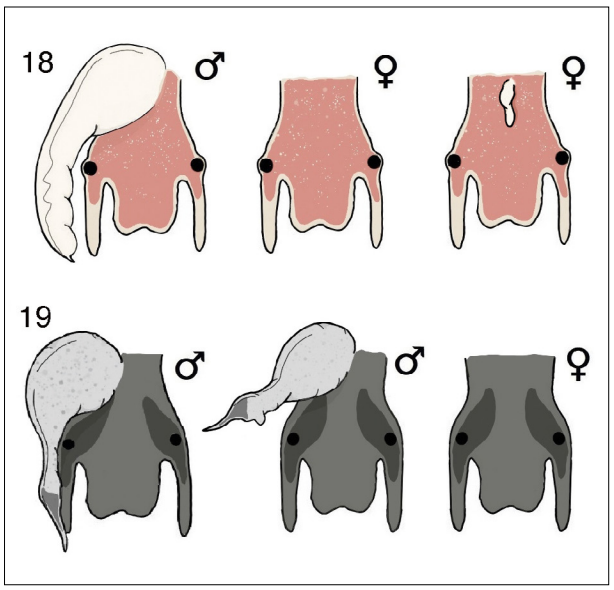


Fig. 17. Maximum likelihood phylogeny inferred using the COI dataset in IQ-TREE. Ultrafast bootstrap values are provided at relevant nodes. GenBank accessions numbers are listed adjacent to each scientific name. Each color represents a different species. The new sequences are highlighted in red.

Iberhoratia morenoi has a much more planispiral shape and also wider umbilicus and less whorls (<3.5), compared to the more turriculated shell seen in the newly described species. The new species also has pitted or malleated protoconch microsculpture. *Aretiana wolfi* has only 3.5 whorls, a much lower spire and less deep sutures.

The anatomy of this species closely resembles that of the other two species of its clade. However, it can be distinguished from *I. morenoi* by having a penis strongly broadened at its base and tapering distally into a narrow neck-like region, which gives the apex its distinctive brush-shaped tip (Fig. 19). It further differs from *A. wolfi* by the same combi-



Figs 18-19. Anatomies of two valvatiform species of Hydrobiidae. **18.** *Kulyiella marginata* gen. nov. spec. nov. Male showing the robust penis, broad at the base and tapering into a small apical papilla, and females, including one with a pseudopenis. **19.** *Ganduliella irippensis* gen. nov. spec. nov. Males showing the characteristic penis, strongly broadened at the base and tapering into a narrow neck-like portion with a brush-shaped apex.

nation of characters, since in *A. wolfi* the penis maintains a constant shape and width and lacks both the pronounced basal enlargement and the narrowed distal neck.

Genetic results. — Samples assigned to *Ganduliella irippensis* spec. nov. based on shell morphology formed a well-supported group with a high bootstrap support (i.e., 100%) located within a clade composed of *A. wolfi* and *I. morenoi*. Sequences from specimens collected at the type locality and those from Fuente Alta, Pruna, showed a genetic divergence of 4.3%. The sequence divergence of CO1 for *Ganduliella irippensis* spec. nov. and the congeners of its clade ranged between 9.5% with *I. morenoi* and 12.9% with *A. wolfi*.

Conservation status. — As with many other freshwater snails, its limited distribution area and the endangered habitats (overexploitation of springs, contamination of groundwater, presence of invasive species) suggest it should have some degree of protection. A long-term program for assessing the status of its populations and a sensible management of the groundwater in this area are highly desirable. The fact that this species has traits of a crenobiont species suggests it may live in the only suitable and remaining habitat in the groundwater, due to extinction on surface habitats in springs and fountains by recent drastic habitat alterations.

DISCUSSION

Search for valvatiform Hydrobiidae snails at springs in the southern Iberian Peninsula yielded a couple of new taxa, which were analysed by molecular markers, showing very distinctive sequences. They were compared with previously reported sequences of similar and geographically nearby species, suggesting they both belong to new genera.

The phylogenetic analysis (Fig. 17) revealed a close relationship of *Kulyiella* gen. nov. with other Iberian hydrobiids, such as the stygobiont genus *Siuraniella*, but also the crenobiont genera *Spathogyna* and *Tarraconia,* the last one being somehow stygophile due to it peculiar habitat at the deep Ullals lagoons. Genetic affinities thus draw a group distributed along the Mediterranean part of the Peninsula, but clearly separated from another cluster with presence of only stygobionts and widely distributed all along the Peninsula, the "*Corbellaria*" clade (Quiñonero-Salgado et al., 2025b), which partially overlap in their distribution ranges.

Genetically, *Ganduliella irippensis* spec. nov., is most closely related to *I. morenoi* and *A. wolfi*. The first species has been recorded from the provinces of Cádiz, Málaga, Almería, and a single locality in Sevilla (Coripe). The latter locality is situated in a different river basin (Guadalete) than the newly described species (Guadalquivir). *Aretiana wolfi* has been recorded from Huelva and Badajoz. However, shell morphology, molecular distinctiveness and anatomy of *Ganduliella irippensis* spec. nov. confirm it to be a separate species and genus.

It has been suggested that active plate tectonics and the upraising of the Baetic Cordillera in the south of the Iberian Peninsula in the last 10 My, generated a new hydrological network favouring vicariant events in surface waters resulting in the recent speciation within the genus *Corrosella* (Delicado et al., 2015). This may have also favoured vicariant speciation among stygobiont and crenobiont Hydrobiidae genera in all this area, but there is not yet enough information available regarding these organisms. Our results, however, tend to confirm this hypothesis and an extreme richness of Hydrobiidae in southern Spain.

In conclusion, our results unveil the presence of two new Hydrobiidae species in Granada and Sevilla provinces (S Spain), both attributed to new genera, on the basis of shell morphology, anatomy and sequence differences with previously described taxa in Iberia. This new discovery highlights the richness of Iberian freshwater systems, which may host an additional number of yet undescribed species, making it a worldwide hotspot of freshwater diversity. Our results may also partially clarify unexpected phylogenetic relationships among these organisms. This emphasises the urgency for deploying sound strategies for the strict protection and conservation of these unique species and habitats.

ACKNOWLEDGEMENTS

Bertie Joan van Heuven (Naturalis) supervised usage of the SEM. We thank TAXUS Medio Ambiente S.L. for sequencing the specimens used in this study. This study was funded by the "MACROSEK" project (IDE/2024/000544), awarded by the Sekuens Agency (Asturias, Spain).

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