

# Description of three new stygobiont snails of the families Hydrobiidae and Moitessieriidae from the southwestern Iberian Peninsula

José Francisco Martín Álvarez<sup>1</sup>, Sergio Quiñonero-Salgado<sup>2\*</sup>, Joaquín López-Soriano<sup>2</sup>, Han (J.G.M.) Raven<sup>3</sup> & Peter Glöer<sup>4</sup>


1. La Redondela, Huelva, Spain.

2. Associació Catalana de Malacologia, Museu Blau, Barcelona, Spain.


3. Research Associate, Naturalis Biodiversity Center, Leiden, P.O. Box 9517, 2300 RA Leiden, The Netherlands.

4. Schulstrasse 3, D-25491, Hettingen, Germany.

José Francisco Martín Álvarez  <https://orcid.org/0009-0000-9005-9388>

Sergio Quiñonero-Salgado  <https://orcid.org/0009-0000-9602-7184>

Joaquín López-Soriano  <https://orcid.org/0000-0002-5374-2222>

Han (J. G. M.) Raven  <https://orcid.org/0000-0002-5305-0795>

\* Correspondence concerning this article should be addressed to Sergio Quiñonero-Salgado, Associació Catalana de Malacologia, Museu Blau, Plaça Leonardo da Vinci 4-5, 08019 Barcelona, Spain. E-mail: sergioqs85@hotmail.com

Knowledge of stygobiont molluscs has dramatically increased in the last years with the description of a plethora of new genera and species. However, some regions have received little attention to date.

In the present paper three new stygobiont species are described for the SW Iberian Peninsula, including the first stygobiont mollusc ever described for Portugal, a new hydrobiid genus, and the first Moitessieriidae for Andalusia.

These discoveries highlight the gaps of knowledge in this field.

**Keywords:** Gastropoda, stygobiont, freshwater, endemism, Andalusia, Portugal.

## Descripció de tres caragols estigobis nous de les famílies Hydrobiidae i Moitessieriidae del sud-oest de la península Ibèrica

El coneixement dels mol·luscs estigobis s'ha incrementat notablement durant els darrers anys, amb la descripció d'un conjunt de nous gèneres i noves espècies. Tot i això, algunes regions han rebut molt poca atenció fins ara.

En el present article es descriuen tres noves espècies de mol·luscs estigobis pel sud-oest de la península Ibèrica, incloent-hi el primer mol·lusc estigobi mai descrit a Portugal, un nou gènere d'hidròbid, i el primer Moitessieriidae per a Andalusia.

Aquests descobriments demostren el buit de coneixement que hi ha encara en aquest àmbit.

**Paraules clau:** gastròpodes, estigobis, aigua dolça, endemisme, Andalusia, Portugal.

Since the beginning of this century, research on freshwater snails has dramatically increased the number of known species in Europe and the Iberian Peninsula. Hydrobiidae, which includes representatives in springs and stygobitic habitats, is the family with the highest number of continental aquatic species in Europe, and is widespread in the Iberian Peninsula (Glöer, 2022a, 2022b). The Moitessieriidae, which include only strict stygobiont

species, has a number of species in different parts of the peninsula, but not a single known species in most of its lower half, including the whole Autonomous Community of Andalusia and some adjacent territories, such as Portugal.

In the present paper, we describe the first species of Moitessieriidae for Andalusia and two new freshwater Hydrobiidae, including the first stygobiont mollusc known from Portugal.

## Material and methods

The different localities were visited between 2015 and 2023. To obtain the material, shells were separated from their substrates by sieving sediments from the springs through mesh diameters of 5.0, 1.0 and 0.25 mm. Shells were later dried, and examined under stereomicroscope. Some specimens were kept in 80% ethanol for anatomical studies.

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, 10KV voltage and 30 Pa pressure, except for Fig. 7A, C which were taken in high vacuum representing a palladium coated specimen.

Abbreviations: Naturalis: Naturalis Biodiversity Center (Leiden); SEM: Scanning Electron Microscopy; a. s. l.: above sea level; s: shell.

## Results

### Systematics

#### Family MOITESSIERIIDAE Bourguignat, 1863

Genus *Spiralix* Boeters, 1972

Subgenus *Burgosia* Boeters, 2003

Type species: *Spiralix (Burgosia) burgensis* Boeters 2003 by original designation.

#### *Spiralix (Burgosia) aenigmatica* sp. nov.

(Figs. 1-2)

**Type material.** Holotype RMNH.MOL.350846 (Naturalis). Paratypes: 4 s. in RMNH.MOL.350847 (Naturalis), 5 s. in SQS coll. 12 s. in JFMA coll.

**Type locality.** Fuente de Sevilla, Zufre (Huelva); 29S X734085 Y4190034. 05/10/2022; 16/12/2022; 09/01/2023; 14/05/2023, JFMA leg. 375 m a. s. l. (Fig. 10A). The spring of the type locality flows out of limestone, and is collected in an artificial vaulted basin, which eventually feeds an irrigation pool “alberca” used for water supply to a neighbouring orchard.

**Etymology.** The specific name refers to the enigma represented by the large gap in the distribution range of the subgenus, until now only known from the Cantabrian Mountains and surrounding areas, in the north of Spain, very far from the locality where the new species was found.

**Description.** Shell small, translucent, fragile, subcylindrical and turruculated, with deep sutures and 3–3.5 convex whorls with orthocline growth lines. Size of about 1.0 mm high and 0.5 mm wide. Teleoconch microsculpture formed by irregularly arranged cuneiform marks. Protoconch microsculpture formed by angular depressions, irregularly arranged. Umbilicus deep. Aperture oval, aligned with the vertical axis, 0.4 mm high and 0.3 mm wide.

**Dimensions.** Holotype 0.90 mm high and 0.52 mm wide. For complete size ranges see Table 1 and Fig. 3. This is the smallest species in this genus.

**Habitat.** Stygobitic.

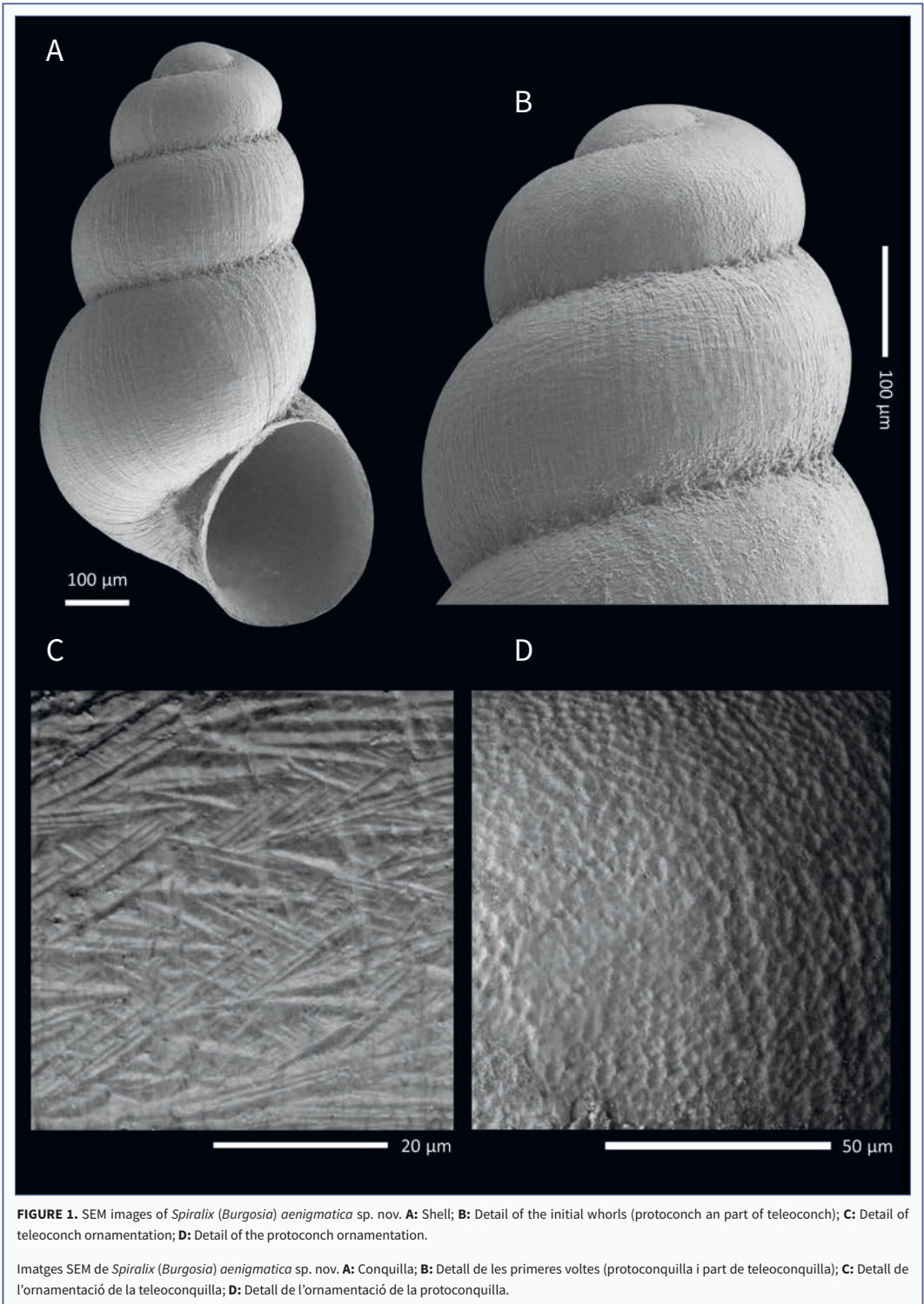
**Differentiating characters.** *Spiralix (Burgosia) burgensis* Boeters, 2003 has a similar shape, but has larger whorls, making it higher (1.24–1.44 mm compared to 0.86–1.01 mm) and wider (apex 0.73–0.85 mm compared to 0.47–0.64 mm; last whorl 0.88–0.96 mm vs. 0.58–0.71 mm). The ovoid aperture is slanted instead of vertical.

*Spiralix (Burgosia) affinitatis* Boeters, 2003 is quite different, having much more inflated whorls, resulting in an overall ovoid outline. Its length (1.07–1.24 mm) and width (apex 0.66–0.76; last whorl 0.78–0.93 mm) fit in between *Spiralix aenigmatica* sp. nov. and *S. burgensis*. This species also has a slanted aperture.

Boeters (2003) did not elaborate on the microsculpture of the species he described, but Quiñonero-Salgado *et al.* (2017) presented SEM images of the six then-known species, including the two species mentioned above. From this, it is evident that the microsculpture of the shell of *S. aenigmatica* sp. nov. is characteristic for the subgenus *Burgosia*: irregular cuneiform marks on the teleoconch, best seen on the first teleoconch whorls, and the protoconch with a pitted sculpture of angular depressions.

Some other species in the nominal genus *Spiralix* from the eastern Iberian Peninsula have to some degree similar marks at the initial whorl of the teleoconch (see Corbella *et al.*, 2014), but they are much less apparent and developed than in *Burgosia* (detailed conchological redescription of this genus by Quiñonero-Salgado *et al.*, 2017). So, the subgenus classification of the new species should be considered as tentative, until new evidence (anatomical or molecular) allows for more reliable criteria.

**Remarks.** The family Moitessieriidae includes only



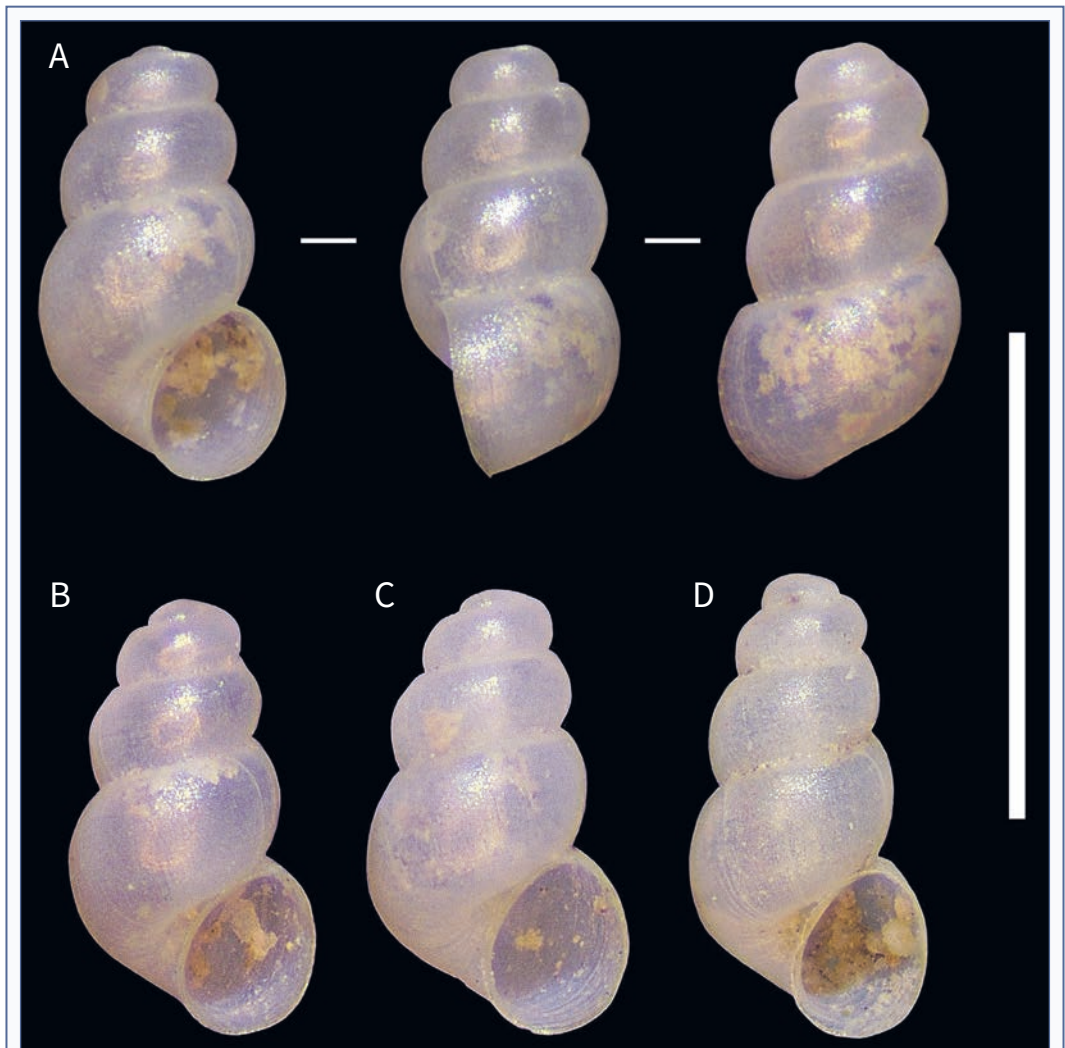
**FIGURE 1.** SEM images of *Spiralix (Burgosia) aenigmatica* sp. nov. **A:** Shell; **B:** Detail of the initial whorls (protoconch and part of teleoconch); **C:** Detail of teleoconch ornamentation; **D:** Detail of the protoconch ornamentation.

Imatges SEM de *Spiralix (Burgosia) aenigmatica* sp. nov. **A:** Conquilla; **B:** Detall de les primeres voltes (protoconquilla i part de teleoconquilla); **C:** Detall de l'ornamentació de la teleoconquilla; **D:** Detall de l'ornamentació de la protoconquilla.

strict stygobiont species. Within this family, in Spain the genus *Spiralix* Boeters, 1972 is represented by nine species or subspecies in the Valencian Community, all included in the nominate subgenus *Spiralix*, and another seven species of the subgenus *Burgosia* Boeters, 2003 restricted to the north of the Iberian Peninsula. Of these seven species in the second subgenus, two are endemic to Asturias (Quiñonero-Salgado *et al.*, 2018a), two are from Cantabria, another two are exclusively found in the province of Burgos (northern part of the Castilla y León Autonomous Community), and one

more is found both in Burgos and the Basque Country. While many other Moitesseriidae species are known in Catalonia, Aragón and the Valencian Community, little is known about this family in the rest of Spain, to date with no known representatives in the whole centre and southern part.

The finding of a species of the subgenus *Burgosia* in Andalusia enlarges its distribution range about 600 km to the south from all previously known species. Such a big gap is quite surprising for a subgenus that presumably has very limited dispersion capability.



**FIGURE 2.** *Spiralix (Burgosia) aenigmatica* sp. nov. **A:** Holotype; **B-D:** Paratypes. All specimens from Fuente de Sevilla (Zufre, Huelva province). Scale: 1mm.

*Spiralix (Burgosia) aenigmatica* sp. nov. **A:** Holotip; **B-D:** Paratips. Espècimens de la Fuente de Sevilla (Zufre, província de Huelva). Escala: 1mm.

Further exploratory research is needed to determine whether there is a biogeographic explanation for this distribution, or if it is caused by a lack of knowledge of the stygobiont malacofauna in a large part of the Iberian Peninsula. The huge increase in our knowledge of stygobiont molluscs in Iberia over the last two decades makes the second explanation more likely.

The present finding is surprising not only for the huge distance from the previously known distribution of the subgenus *Burgosia*, but also because the spring is far from any karst system, where this subgenus is usually found. Even in the hypothetical case that the new species should be ascribed to *Spiralix* s. s., the geographic gap would be equally astonishing.

		SH	SW	LW	PH	PW
<i>S. aenigmatica</i> Fuente de Sevilla, Zufre (Huelva) (n=15)	<b>HOLOTYPE</b>	<b>0.90</b>	<b>0.52</b>	<b>0.62</b>	<b>0.36</b>	<b>0.28</b>
	min	0.86	0.47	0.58	0.31	0.27
	max	1.01	0.64	0.71	0.44	0.34
	mean	0.93	0.53	0.64	0.38	0.30
	st. dev.	0.050	0.059	0.040	0.035	0.023
<i>S. affinitatis</i> Cueva de Fuente Sagrero, Cereceda (Burgos) (n=10)	min	1.05	0.66	0.78	0.45	0.40
	max	1.24	0.76	0.93	0.53	0.52
	mean	1.14	0.71	0.85	0.48	0.44
	st. dev.	0.063	0.036	0.037	0.025	0.037
<i>S. burgensis</i> Cueva de Fuente Sagrero, Cereceda (Burgos) (n=14)	min	1.24	0.73	0.88	0.51	0.42
	max	1.44	0.85	0.96	0.58	0.50
	mean	1.36	0.78	0.92	0.54	0.46
	st. dev.	0.052	0.034	0.026	0.022	0.025

**TABLE 1.** Measurements (in mm) of *Spiralix aenigmatica* sp. nov. shells in comparison with *S. affinitatis* and *S. burgensis*. SH: shell height; SW: shell width; LW: last whorl height; PH: aperture height; PW: aperture width.

Mesures (en mm) de la conquilla de *Spiralix aenigmatica* sp. nov. comparades amb *S. affinitatis* i *S. burgensis*. SH; alçada de la conquilla; SW: amplada de la conquilla; LW: alçada de la darrera volta; PH: alçada de l'obertura; PW: amplada de l'obertura. Mesures en mm.

		SH	SW	PH	PW
<i>Onubiella suberensis</i> Fuente de Sevilla, Zufre (Huelva) (n=20)	<b>HOLOTYPE</b>	<b>0.62</b>	<b>1.11</b>	<b>0.49</b>	<b>0.44</b>
	min	0.37	1.02	0.38	0.42
	max	0.52	1.25	0.46	0.50
	mean	0.45	1.14	0.42	0.47
	st. dev.	0.037	0.059	0.019	0.024
<i>Onubiella suberensis</i> Fuente del Corcho, La Corte-Cortegana (Huelva) (n=3)	min	0.44	0.96	0.36	0.28
	max	0.52	1.04	0.45	0.41
	mean	0.48	1.00	0.39	0.34
	st. dev.	0.040	0.040	0.049	0.065
<i>Corbellaria celtiberica</i> Ciria (Soria) (n=31)	min	0.41	0.94	0.37	0.37
	max	0.57	1.37	0.47	0.50
	mean	0.48	1.14	0.41	0.43
	st. dev.	0.039	0.081	0.022	0.026

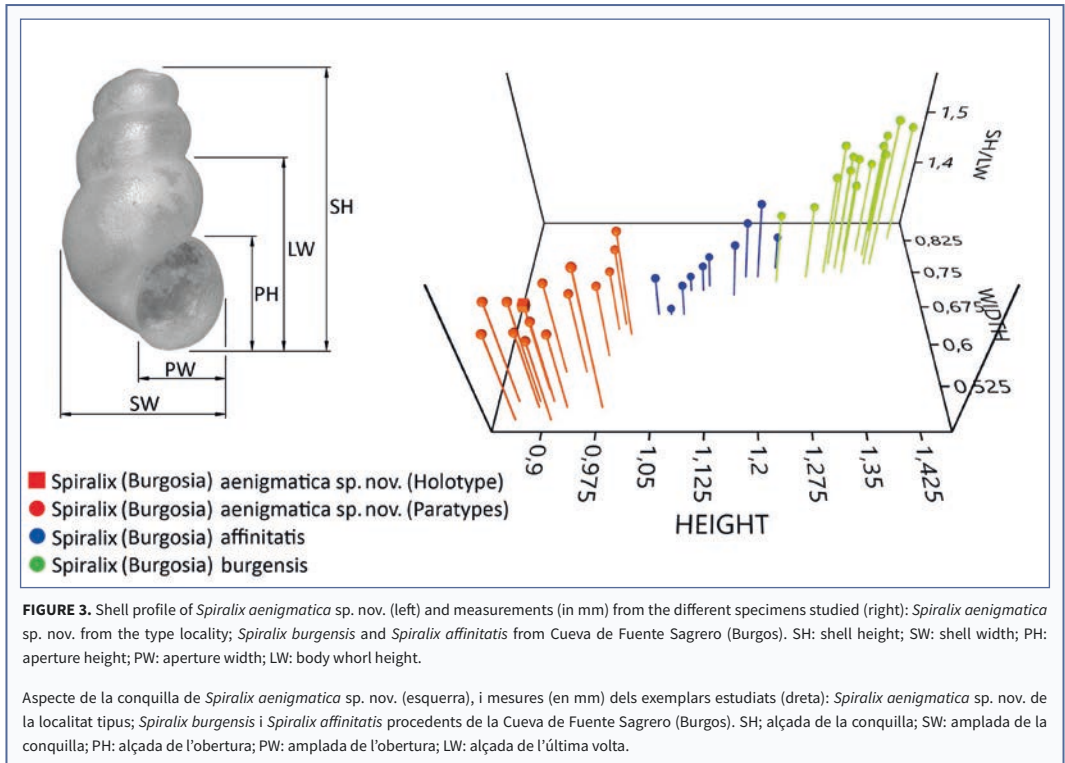
**TABLE 2.** Measurements (in mm) of *Onubiella suberensis* sp. nov. shells in comparison with *C. celtiberica*. SH: shell height; SW: shell width; PH: aperture height; PW: aperture width.

Mesures (en mm) de la conquilla de *Onubiella suberensis* sp. nov. comparades amb *C. celtiberica*. SH; alçada de la conquilla; SW: amplada de la conquilla; PH: alçada de l'obertura; PW: amplada de l'obertura.



It is remarkable that Boeters (2003) cited three unidentified species of the genus *Moitessieria* in his seminal work on Iberian freshwater snails: one of them in Jaén province (Andalusia) and two others in Catalonia and Aragón, but without formal description. This old finding, in addition to the results reported in the

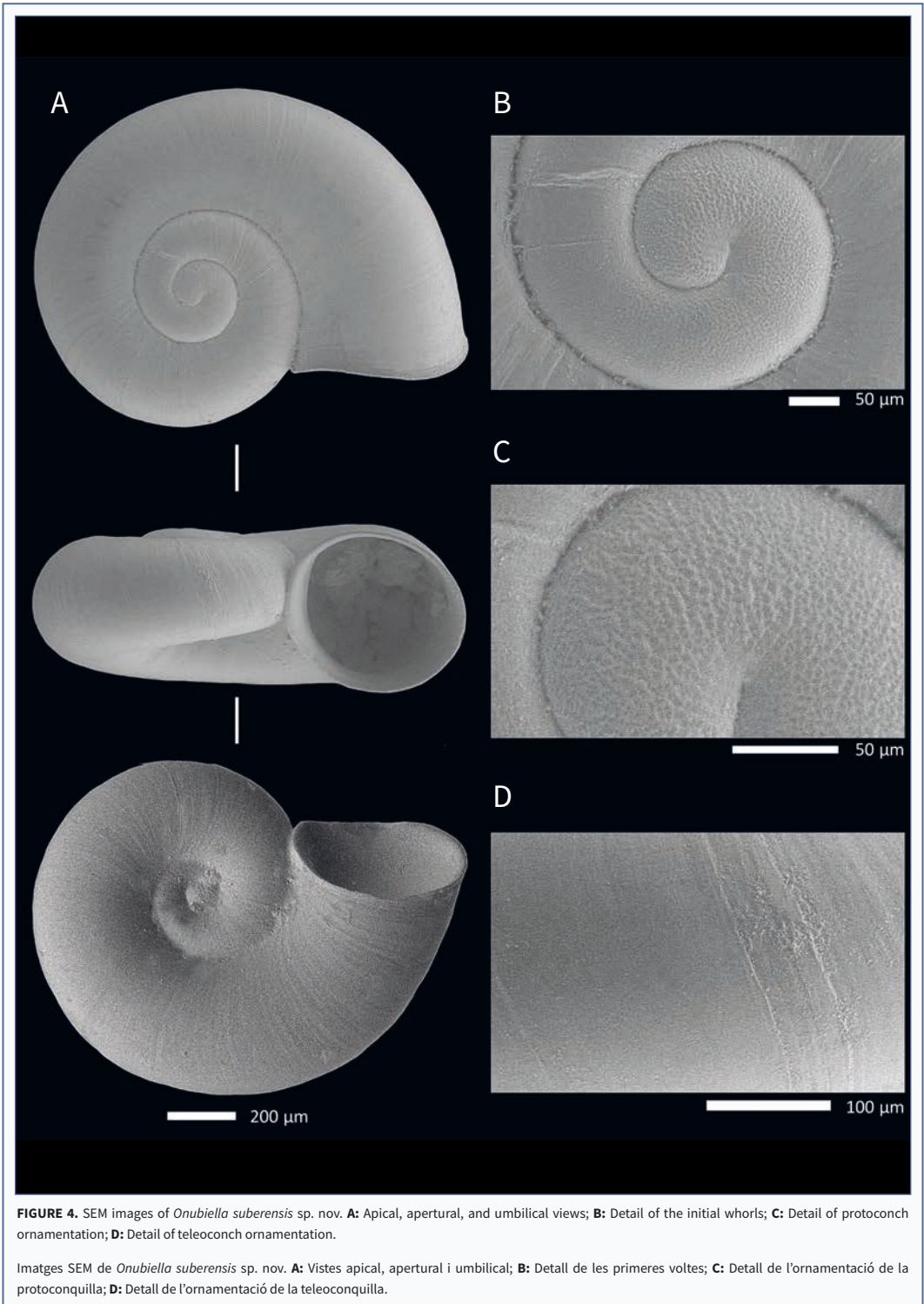
present paper, suggest that the Moitessieriidae could be much more widespread in the Iberian Peninsula than presently reported. During the last twenty years, research has brought to light many new species of this family, including a few new genera. Still a big portion of Iberian territory (most of the central, southern and

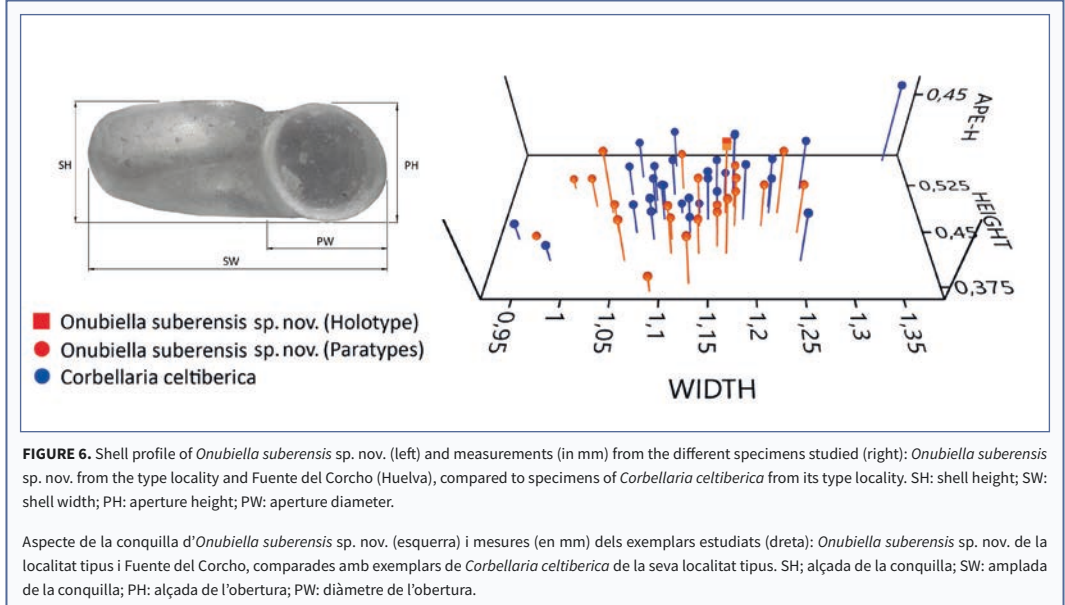
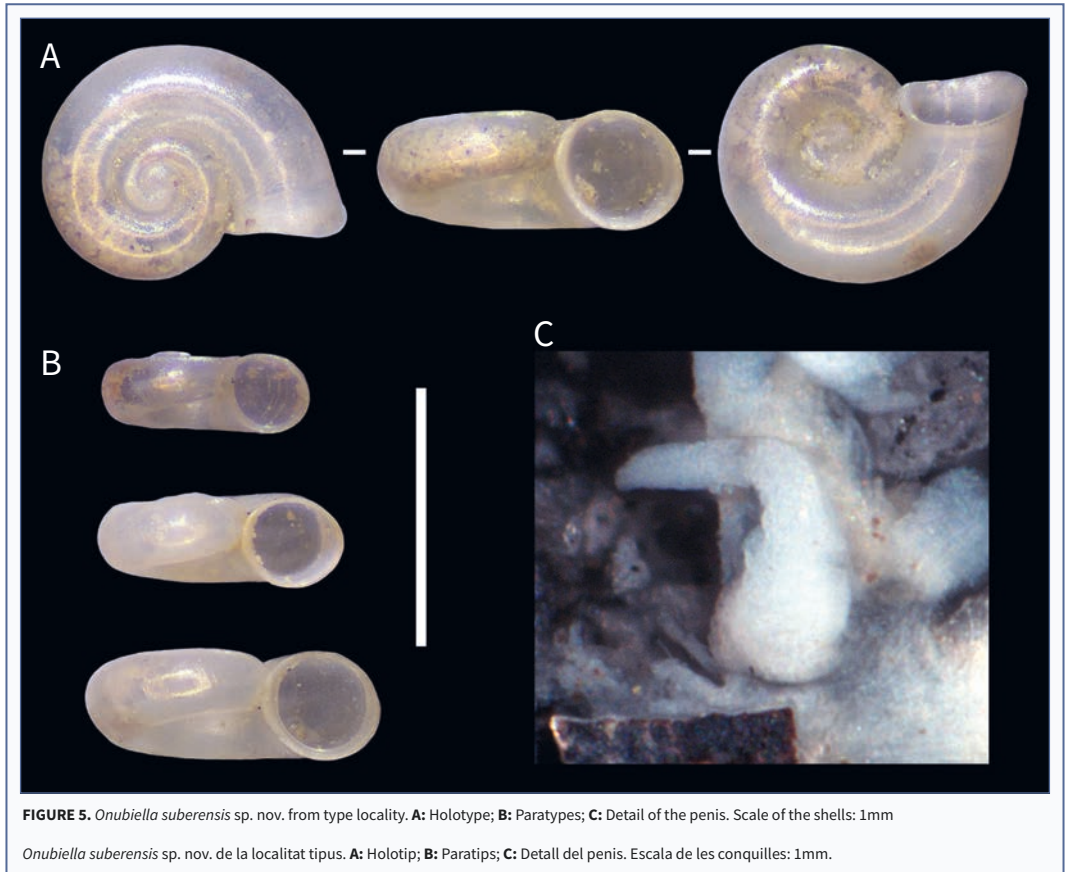


		SH	SW	LW	PH	PW
<i>G. algarvensis</i> Fonte do Cadoiço, Loulé (Algarve) (n=19)	HOLOTYPE	1.75	0.69	0.97	0.51	0.46
	min	1.43	0.59	0.83	0.43	0.36
	max	1.79	0.70	0.97	0.51	0.46
	mean	1.63	0.64	0.91	0.47	0.41
	st.dev.	0.111	0.034	0.034	0.020	0.028
<i>G. pilelongata</i> Sanlúcar de Guadiana, Huelva (Andalusia) (n=18)	min	1.81	0.69	1.02	0.51	0.42
	max	2.36	0.85	1.29	0.63	0.52
	mean	2.01	0.76	1.14	0.57	0.47
	st.dev.	0.139	0.045	0.067	0.032	0.027

**TABLE 3.** Measurements (in mm) of *Guadiella algarvensis* sp. nov. shells in comparison with *G. pilelongata*. SH: shell height; SW: shell width; LW: last whorl height; PH: aperture height; PW: aperture width.

Mesures (en mm) de la conquilla de *Guadiella algarvensis* sp. nov. comparades amb *G. pilelongata*. SH: alçada de la conquilla; SW: amplada de la conquilla; LW: alçada de la darrera volta; PH: alçada de l'obertura; PW: amplada de l'obertura.







western parts of the peninsula including Portugal) has not yet been thoroughly explored, so new findings can be expected as a result of targeted searching for stygobiont snails.

### Family HYDROBIIDAE Stimpson, 1865

#### Genus *Onubiella* gen. nov.

Type species *Onubiella suberensis* sp. nov.

**Diagnosis.** Very small, valvatiform, planispiral or very low spire, 3 convex whorls with clear suture (especially dorsal side) and very open umbilicus. Protoconch mottled with very fine pits, otherwise smooth with growth lines. Aperture round, peristome slightly reflected. Penis simple without any outgrowth.

**Remarks.** The genus differs from other valvatiform hydrobiids in the narrow neck between the last whorl and the slightly reflected peristome. Besides this, the genus *Iberhoratia* Arconada & Ramos, 2007 has a much higher spire, deeper sutures and a deeper and narrower umbilicus (Arconada *et al.*, 2017). Note that besides shell morphology, Callot-Girardi & Boeters (2012) used the anatomy of *Corbellaria* Callot-Girardi & Boeters, 2012 to differentiate it from other valvatiform genera. Such information is not yet available for *Onubiella*, except for the penis.

**Species included.** Thus far the only species is *Onubiella suberensis* sp. nov.

**Etymology.** *Onub-* refers to Onuba, the Phoenician name for the province of Huelva where the genus has been found; *-iella* is a diminutive ending. Gender feminine.

#### *Onubiella suberensis* sp. nov.

(Figs. 4-6)

**Type material.** Holotype RMNH.MOL.350848 (Naturalis) (Fig. 5A). Paratypes: 5 s. RMNH.MOL.350849 (Naturalis); 20 s. in JFMA collection; 20 s. in PG collection.

**Type locality.** Fuente de Sevilla, Zufre (Huelva province): 29S X734085 Y4190034; 05/10/2022; 16/12/2022; 09/01/2023; 14/05/2023, JFMA *leg.* 375 m a.s.l. (Fig. 10A). See description of the type locality in the species described above, *Spiralix aenigmatica* sp. nov.

**Description.** Very small, valvatiform, planispiral or very low spire. Protoconch of about 1.5 whorls, teleoconch about 1.5 convex whorls with clear suture (especially dorsal side) and wide umbilicus. The whorls attach to the lower part of the previous whorl, without any

overlap, remaining about flat on the dorsal side, whereas difference in whorl height is clearly reflected on the ventral side. Protoconch mottled with very fine, irregularly-arranged pits, teleoconch smooth with growth lines. Aperture round, peristome slightly reflected.

**Anatomy.** Penis simple without any outgrowth, broad at the basis and slim at the distal end. Female sex tract unknown.

**Etymology.** *suber* (Latin=cork), refers to the Fuente del Corcho (=Cork Spring) in which the species was discovered.

**Dimensions.** See Table 2 and Fig. 6.

**Habitat.** Stygobitic.

**Other localities.** Fuente del Corcho, La Corte-Cortegana (Huelva province); 29S X690054 Y4202569. 25/03/2018; 22/05/2021; 21/06/2021. 580 m a.s.l. (Fig. 10B).

**Distribution.** Only known from the two localities mentioned above.

**Differentiating characters.** The shell of *Corbellaria celtiberica* Callot-Girardi & Boeters, 2012, described from the province of Soria in northern Spain, is very similar but does not have the narrow neck (note the reflected peristome is only present in fully grown specimens). Also, the shell is slightly higher and height increases with width, whereas in *Onubiella* gen. nov. it is constant. In *Corbellaria* aperture height increases with width, in *Onubiella* gen. nov. also, but less. Anatomically, *Onubiella suberensis* sp. nov. has a simple penis without any outgrowth, while *C. celtiberica* has a simple lobe (Callot-Girardi & Boeters, 2012, Fig. 10D).

#### Genus *Guadiella* Boeters, 2003

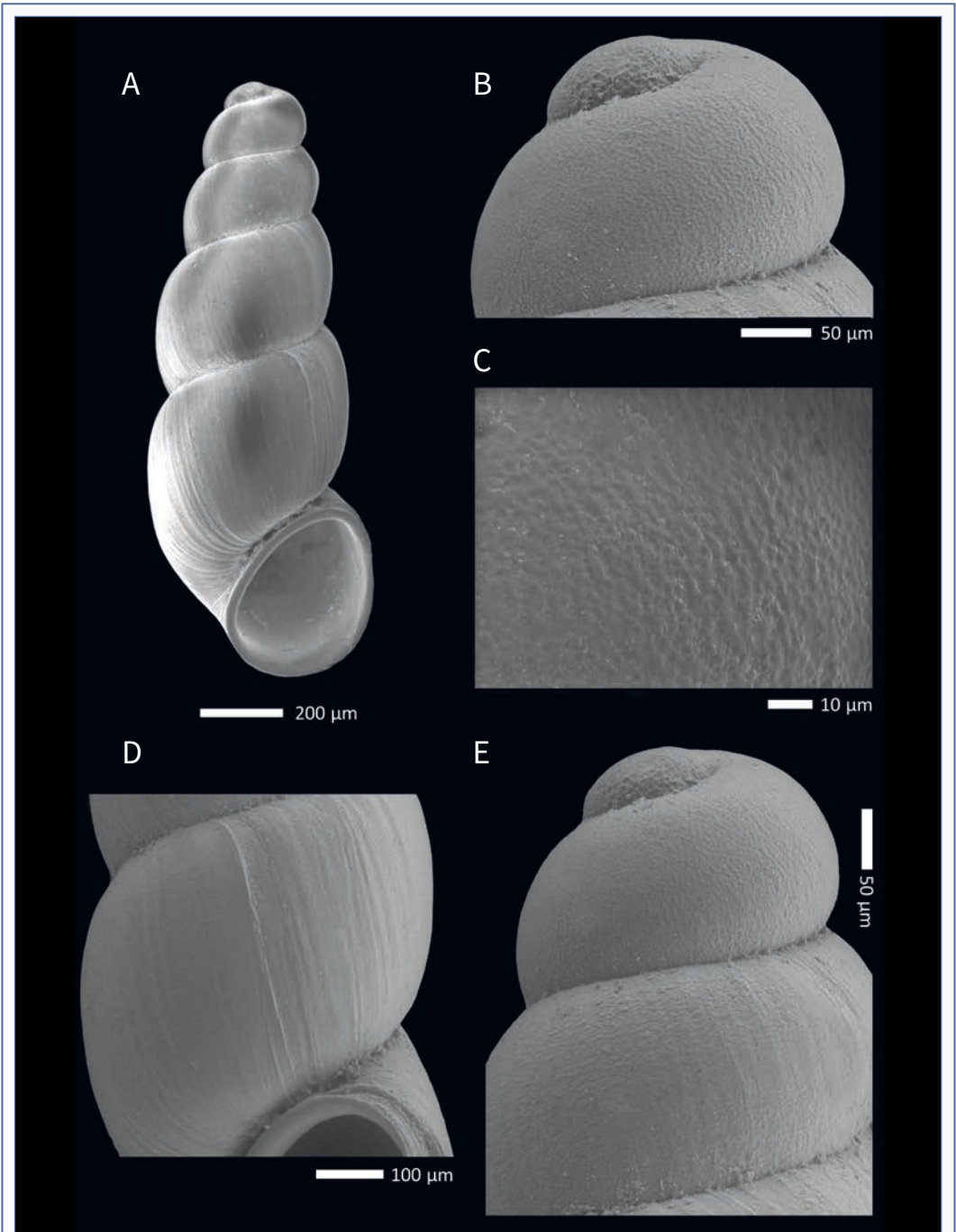
Type species: *Belgrandiella andalucensis* Boeters, 1983 by original designation

#### *Guadiella algarvensis* sp. nov.

(Figs. 7-8)

**Material.** Holotype RMNH.MOL.350850 (Naturalis) (Fig. 8A); Paratypes: 1 s. in RMNH.MOL.350851 (Naturalis); 2 s. in SQS col. 10 s in JFMA coll.

**Type locality.** Fonte do Cadoiço, Loulé (Algarve, Portugal); 29S X586876 Y4110284. 15/10/2022; 20/11/2022. JFMA *leg.* 169 m a.s.l. (Fig. 10C). The spring is located in a vertical wall of rock with a cavity where water effluxes and is collected in a small artificial basin, which releases excess water into a ravine.



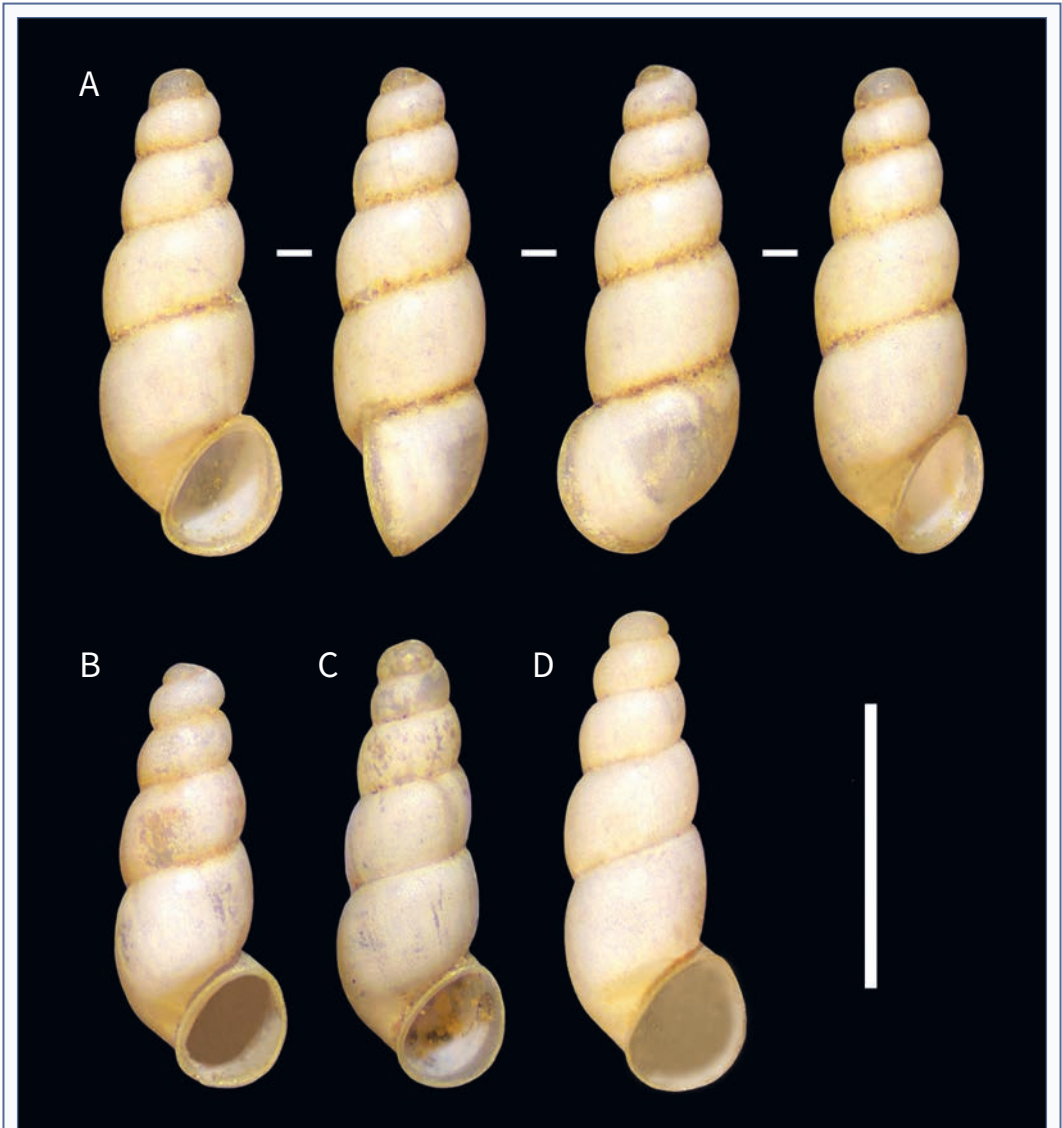
**FIGURE 7.** SEM images of *Guadiella algarvensis* sp. nov. **A:** Shell; **B, E:** Details of the protoconch; **C:** Detail of protoconch ornamentation; **D:** Detail of teleoconch ornamentation.

Imatges SEM de *Guadiella algarvensis* sp. nov. **A:** Conquilla; **B, E:** Detall de la protoconquilla; **C:** Detall de l'ornamentació de la protoconquilla; **D:** Detall de l'ornamentació de la teleoconquilla.

**Description.** The shell is elongated, with somewhat inflated whorls that gradually increase in size; last whorl is rather flat; deep, well-defined suture. Protoconch with 2.5 whorls with a marked microsculpture of fine, irregularly shaped pits (size  $\sim 2\ \mu\text{m}$ ). Teleoconch with 3 whorls, surface with irregular growth lines and microsculpture of irregular, very fine and shallow pits. Some small cuneiform marks are observed in the

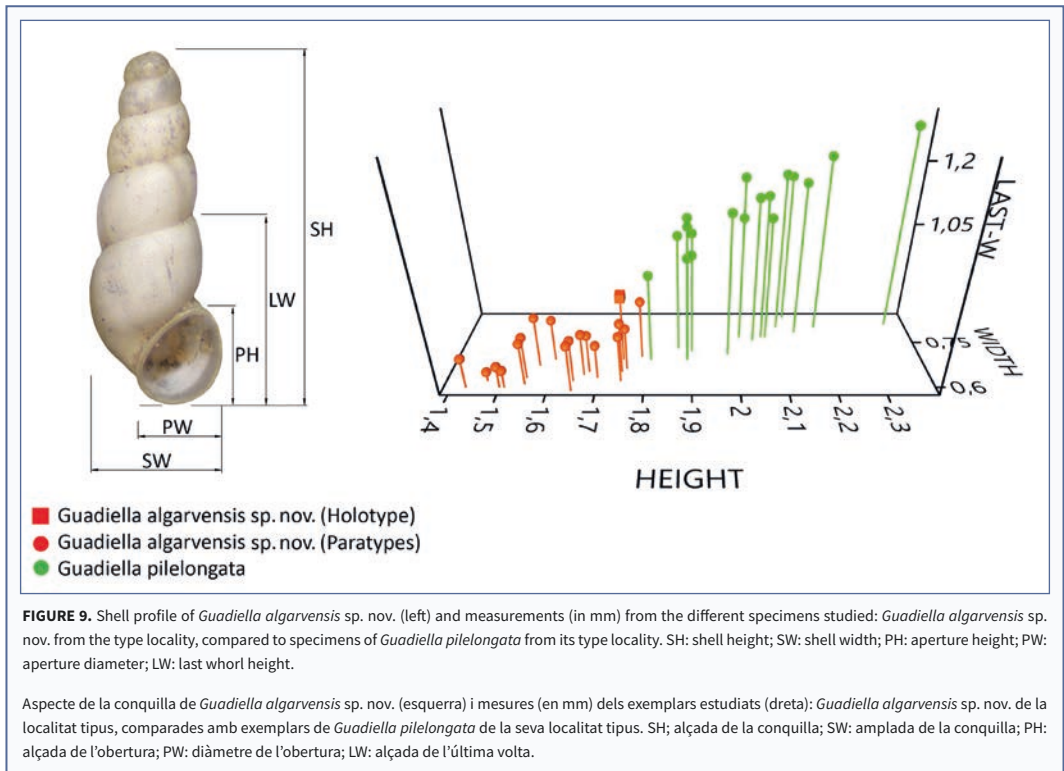
teleoconch near the protoconch, along with the suture (Fig. 7E). Outer part of the aperture round, but where it approaches the previous whorl almost straight, edge reflected. The final part of the last whorl is very slightly decollated, forming a narrow umbilical groove between aperture and penultimate whorl.

**Etymology.** The name derives from the region where the species has been found (Algarve).



**FIGURE 8.** *Guadiella algarvensis* sp. nov. **A:** Holotype; **B-D:** Paratypes. All specimens from the type locality. Scale 1 mm.

*Guadiella algarvensis* sp. nov. **A:** Holotip; **B-D:** Paratips. Espècimens de la localitat tipus. Escala 1 mm.



**Dimensions.** See Table 3, Fig. 9.

**Habitat.** Stygobitic.

**Distribution.** Only known from the type locality.

**Differentiating characters.** The shape of *G. algarvensis* sp. nov. is similar to that of *Guadiella pilelongata* Quiñonero-Salgado, Martín Álvarez, López-Soriano & Rolán, 2018, described from Sanlúcar de Guadiana in Huelva, Spain. However, the shell is markedly smaller and relatively narrower (Fig. 9); the same applies to the aperture (Fig. 9). Although the shell of *G. algarvensis* is smaller, the relative height of the last whorl is very similar to that in *G. pilelongata*. The microsculpture of the protoconch is very much finer (in *G. pilelongata* the pits measure ~ 5 µm; Quiñonero-Salgado *et al.*, 2018b: Fig. 1C).

**Remarks.** To our knowledge, this is the first stygobiont mollusc ever described from Portugal. All the other previously recorded Hydrobiidae from this country appear to be crenobiont.

The closest species in the genus *Guadiella*, *G. pilelongata*, has only been recorded from a single locality in Spain, but its distribution range is unknown.

Although these localities are only about 60 km apart, the differences are clear enough to consider both different species.

## Discussion

In this paper, a new Moitessieriidae and two new Hydrobiidae species are described for the SW Iberian Peninsula. *Spiralix (Burgosia) aenigmatica* sp. nov. is the first Moitessieriidae ever formally described in Andalusia, and it unexpectedly enlarges the distribution range of this subgenus more than 600 km to the south. At the same time, *Guadiella algarvensis* sp. nov. is the first stygobiont mollusc ever described in Portugal. Also, a new genus, *Onubiella* gen. nov., is described, showing the richness of stygobiont malacofauna in Andalusia, where little work has been done in this field so far.

The western part of Andalusia, particularly Huelva province, has not been thoroughly examined for its malacological fauna, both marine and continental. However, it has a very high biodiversity, as evidenced by new research, for example by the presence of





**FIGURE 10.** Localities of the new species described in this article. **A:** Fuente de Sevilla, Zufre (Huelva province), type locality of *Spiralix aenigmatica* sp. nov. and *Onubiella suberensis* sp. nov.; **B:** Fuente del Corcho, La Corte-Cortegana (provincia de Huelva), segunda localitat de *O. suberensis* sp. nov.; **C:** Fonte do Cadoiço, Loulé (Algarve, Portugal), type locality of *Guadiella algarvensis* sp. nov.

Localitats de les noves espècies descrites al present article. **A:** Fuente de Sevilla, Zufre (provincia de Huelva), localitat tipus de *Spiralix aenigmatica* sp. nov. i *Onubiella suberensis* sp. nov.; **B:** Fuente del Corcho, La Corte-Cortegana (provincia de Huelva), segona localitat de *O. suberensis* sp. nov.; **C:** Fonte do Cadoiço, Loulé (Algarve, Portugal), localitat tipus de *Guadiella algarvensis* sp. nov.

many Heterobranchia in the coastal marine habitats (Martín-Álvarez *et al.*, 2023), or the discovery of the first stygobiont freshwater gastropod (Quiñonero-Salgado *et al.*, 2018b). The freshwater habitats of this province, and neighbouring Sevilla province as well, have never been the subject of exhaustive campaigns, usually more oriented to the extremely rich habitats in the eastern provinces (Delicado *et al.*, 2012, 2013; Miller, 2021), with many endemic crenobiont species already described.

The Iberian Peninsula is a hotspot of biodiversity, including a very rich malacofauna in freshwater ecosystems. Along with Italian and Balkanic peninsulas, these territories have become evolutionary centres for Hydrobiidae (Arconada & Ramos, 2003). However, many regions from Spain and Portugal have never been adequately explored to identify their complete malacofauna, particularly of the very difficult to find stygobiont snails. Recent research proves a much richer malacofauna, both crenobiont and stygobiont, than previously known. The PASCALIS project, which studied the stygobiont fauna in six European countries, already suggested this gap of knowledge, with a forecast of description of new species well over 40% (Deharveng *et al.*, 2009). The present paper evidences this hidden richness, with the inclusion on a new genus which highlights its degree of endemism, and the enlargement of the distribution areas of previously known genera.

In times of severe chronic drought and climate change, overexploitation of underground waters is not an option, as this action could bring to extinction many unique species, many of them still to be discovered. This is well known in the area surrounding Doñana National Park, part of which belongs precisely to the province of Huelva (Montes-Vega *et al.*, 2023; MITERD, 2024). Research and sensible management of these ecosystems are urgently needed, before it is too late for these unique creatures.

### Acknowledgements

Bertie Joan van Heuven (Naturalis) supervised usage of the SEM. The present article has been written in the context of the study “Investigación taxonómica de los moluscos de la provincia de Huelva” by JFMA, with explicit authorization of Consejería de Sostenibilidad, Medio Ambiente y Economía Azul (Junta de Andalucía), expediente number GB-150-23. Special thanks to Dr Carlos E. Prieto (Euskal Herriko



Unibersitate) for helping in the elaboration of excellent graphs. Our acknowledgment to Jordi Corbella and an anonymous reviewer for comments that helped improve the manuscript.

## References

- Arconada, B. & Ramos, M. A. (2003).** The Ibero-Balearic region: one of the areas of highest Hydrobiidae (Gastropoda, Prosobranchia, Rissooidea) diversity in Europe. *Graellsia*, 59(2-3), 91–104.
- Arconada, B., Delicado, D. & Ramos, A. M. (2017).** A new genus and two new species of Hydrobiidae (Mollusca, Caenogastropoda) from the Iberian Peninsula. *Journal of Natural History*, 41(29-32), 2007–2035.
- Boeters, H. D. (2003).** Supplementary notes on Moitessieriidae and Hydrobiidae from the Iberian Peninsula (Gastropoda, Caenogastropoda). *Basteria*, 67, 1–41.
- Callot-Girardi, H. & Boeters, H. D. (2012).** *Corbellaria celtiberica* gen. et sp. nov. (Gastropoda: Hydrobiidae), mollusque valvatiforme stygobie de la province de Soria (Péninsula Ibérique). *Spira*, 4(3-4), 149–160.
- Corbella, J., Guillén, G., Prats, L., Tarruella, A. & Alba, D. M. (2017).** *Spiralix calida* sp. nov. (Gastropoda: Moitessieriidae), una nova espècie de gastròpode estigobi de Toga (l'Alt Millars, País Valencià, Espanya). *Spira*, 5, 111–120.
- Deharveng, L., Stoch, F., Gibert, J., Bedos, A., Galassi, D., Zagmajster, M., Brancelj, A., Camacho, A., Fiers, F., Martin, P., Giani, N., Magniez, G. & Marmonier, P. (2009).** Groundwater biodiversity in Europe. *Freshwater Biology*, 54, 709–726.
- Delicado, D., Machordom, A. & Ramos, M. A. (2012).** Underestimated diversity of hydrobiid snails. The case of *Pseudamnicola* (*Corrosella*) (Mollusca: Caenogastropoda: Hydrobiidae). *Journal of Natural History*, 46, 25–89.
- Delicado, D., Machordom, A. & Ramos, M. A. (2013).** Living on the mountains: Patterns and causes of diversification in the springsnail subgenus *Pseudamnicola* (*Corrosella*) (Mollusca: Caenogastropoda: Hydrobiidae). *Molecular Phylogenetics & Evolution*, 68, 387–397.
- Glöer, P. (2022a).** *The Freshwater Gastropods of the West-Palaearctis. Volume 2. Moitessieriidae, Bythinellidae, Stenothyridae.* Ed. P. Glöer, Hettingen.
- Glöer, P. (2022b).** *The Freshwater Gastropods of the West-Palaearctis. Volume 3. Hydrobiidae.* Ed. P. Glöer, Hettingen.
- Martín-Álvarez, J. F., Quiñero-Salgado, S. & López-Soriano, J. (2023).** Primeras citas de diversas especies de Heterobranchia (Mollusca: Gastropoda) para la provincia de Huelva (SO de la Península Ibérica). *Spira*, 9, 27–38.
- Miller, J. P. (2021).** *Systematics, biogeography and evolutionary patterns of the Hydrobiidae family (Mollusca: Caenogastropoda).* [Ph. D. Thesis] Autonomous University of Madrid.
- MITERD. (2024).** *Informe de situación del Marco de Actuaciones para Doñana (Enero de 2024).* Ministerio para la Transición Ecológica y Reto Demográfico, informe técnico inédito. <https://www.miteco.gob.es/content/dam/miteco/es/ministerio/planes-estrategias/marco-actuaciones-donana/Informe%20situaci%C3%B3n%20Do%C3%B1ana%20enero%202024.pdf>
- Montes-Vega, M. J., Guardiola-Albert, C. & Rodríguez-Rodríguez, M. (2023).** Calculation of the SPI, SPEI, and GRDI Indices for historical climatic data from Doñana National Park: Forecasting climatic series (2030–2059) using two climatic scenarios RCP 4.5 and RCP 8.5 by IPCC. *Water*, 15, 2369. <https://doi.org/10.3390/w15132369>
- Quiñero-Salgado, S., Ruiz-Cobo, J. & Rolán, E. (2017).** Three new species of *Spiralix* (*Burgosia*) (Gastropoda, Moitessieriidae) from the northern Iberian Peninsula. *Iberus*, 35(1), 59–70.
- Quiñero-Salgado, S., Alonso, Á. & Rolán, E. (2018a).** *Spiralix* (*Burgosia*) *vetusta* (Gastropoda: Moitessieriidae) a new species from Asturias (North of Spain). *Nemus*, 8, 95–100.
- Quiñero-Salgado, S., Martín Álvarez, J. F., López Soriano, J. & Rolán, E. (2018b).** A new species of the genus *Guadiella* Boeters, 2003 (Gastropoda: Hydrobiidae) from SW Spain. *Iberus*, 36 (1), 61–65.