Three new species of *Spiralix (Burgosia)* (Gastropoda, Moitessieriidae) from the northern Iberian Peninsula

Tres nuevas especies de *Spiralix (Burgosia)* (Gastropoda, Moitessieriidae) del norte de la Península Ibérica

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ABSTRACT

The species of the genus *Spiralix*, considered in the subgenus *Burgosia* from the north of the Iberian Peninsula are analysed, with the description of three new species; these are compared with the type species of the genus and those geographically closer species. The differential characters are described and shown, among them the microsculpture of the protoconch.

RESUMEN

Se analizan las especies del género *Spiralix*, pertenecientes al subgénero *Burgosia* del norte de la Península Ibérica, con la descripción de tres nuevas especies, que se comparan con la especie tipo del género y las geográficamente más próximas. Se describen y muestran caracteres diferenciales, destacando entre ellos la microescultura de la protoconcha.

INTRODUCTION

The family Moitessieriidae includes species of small size and with a stygobiotic habitat. In Spain, this family is represented by five genera: *Moitessieria*, *Spiralix*, *Palaospeum*, *Baldufa* and *Sardopaladilhia* (Boeters, 2003; Rolán & Martínez Ortí, 2003; Alba *et al*., 2010, 2011). The family is distinguished from Hydrobiidae mostly on the basis of anatomical characters (detailed in Boeters & Gittenberger, 1990).

The genus *Spiralix* is at present represented in Spain by seven species or subspecies, of which five are described from the Valencian Community: *Spiralix gloriae* (Rolán & Martínez-Ortí, 2003), *Spiralix valenciana valenciana* Boeters, 2003, *Spiralix valenciana castellonica* Boeters, 2003, *Spiralix pequenoensis* Boeters, 2003 and *Spiralix calida* Corbella *et al*., 2014.

Boeters (2003) created the subgenus *Burgosia* within the genus *Spiralix* on the basis of conchological and anatomical differences, with the description of two species: *Spiralix (Burgosia) burgensis* Boeters, 2003 (Figure 1) present in the area of Cantabria and Castilla and Leon, and *Spiralix* (*Burgosia*) *affinitatis* Boeters,

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2003 (Figure 2) present only in Castilla and Leon.

The present work analyses the differences among the known species of the genus present in the Spain, and describes three taxa considered to be new for science.

MATERIAL AND METHODS

The shells of the species here represented were collected from sediment and shell grit. For *Spiralix asturica* spec. nov. the collection was carried out in 3 localities in Asturias: Trubia, a spring close to the railway [30TTP50], Fuente de los Tres Caños, Las Caldas [30TTP60], and a spring at Priorio [30TTP60]. For *Spiralix clarae* spec. nov., there was a single station in Cantabria: the spring of la Covachona, Cohiño [30TVN18], and for or *Spiralix mieraensis* spec. nov., the spring of Fuente Encalada at Liérganes. [30TVN49]. Sediments were later sorted under the optical stereomicroscope and specimens separated for determination.

Abreviations:

CACTI Centro de Apoyo Científico y Tecnológico a la Investigación, Universidad de Vigo
CACTUS Centro de Apoyo Científico y Tecnológico, Universidad de Santiago de Compostela
MNCN Museo Nacional de Ciencias Naturales, Madrid
MVHN Museu Valencià d'Historia Natural, Alginet
MZB Museu de Ciències Naturals de Barcelona
MHNS Museo de Historia Natural of the University, Santiago de Compostela
CHB Collection of H. Boeters, Germany
SEM Scanning Electron Microscopy
s shell
H height
W width
n height of the last whorl

RESULTS

Genus *Spiralix* Boeters, 1972
Subgenus *Burgosia* Boeters, 2003

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

Remarks: The microsculpture of the shell of the type species of the genus, and that of *Spiralix affinitatis* are illustrated here for the first time.

Spiralix (Burgosia) burgensis Boeters, 2003 (Figs. 1A-E, 6A)

Type material (Boeters, 1993): Holotype RMNH 93735, shell; Paratypes, RMNH 93733, 16 shells; RMNH 93732, numerous live-collected animals, in Naturalis Biodiversity Center, Leiden; Paratypes BOE 1509, 3 shells in H. Boeters' private collection.
Type locality: Cueva de la Torcona, Merindad de Sotoscueva, Hornillayuso, Burgos (Spain), 700 m altitude [UTM VN504625].

Spiralix (Burgosia) affinitatis Boeters, 2003 (Figs. 2A-D, 6B)

Type material (Boeters, 1993): Holotype RMNH 93738, shell; Paratypes RMNH 93737, numerous shells, in Naturalis Biodiversity Center, Leiden; Paratypes BOE 1510, 3 shells, in H. Boeters' private collection.
Type locality: Villarcayo, 1.2 km SE of Escanduso, spring at E bank of Rio Nela (interstitial water), altitude 700 m [UTM VN494555].

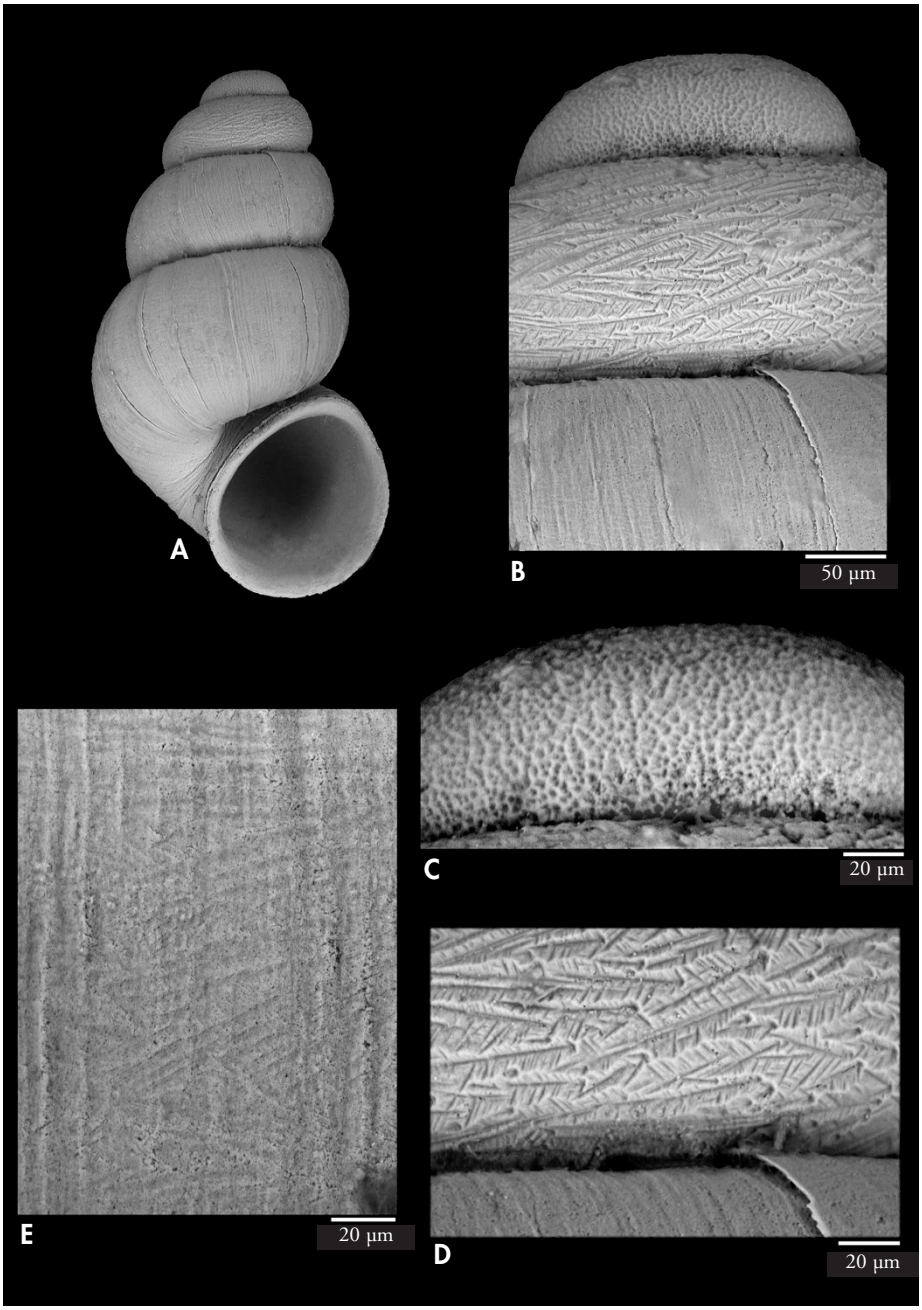

Figure 1. *Spiralix (Burgosia) burgensis* Boeters, 2003. A: shell, 1.28 mm, Cueva de Fuente Sagrero, Cereceda, Burgos; B: protoconch; C, D: detail of the microsculpture of the protoconch; E: detail of the microscupture of the teleoconch.

Figura 1. Spiralix (Burgosia) burgensis *Boeters, 2003. A: concha, 1,28 mm, Cueva de Fuente Sagrero, Cereceda, Burgos; B: protoconcha; C, D: detalle de la microescultura de la protoconcha; E: detalle de la microescultura de la teleoconcha.*

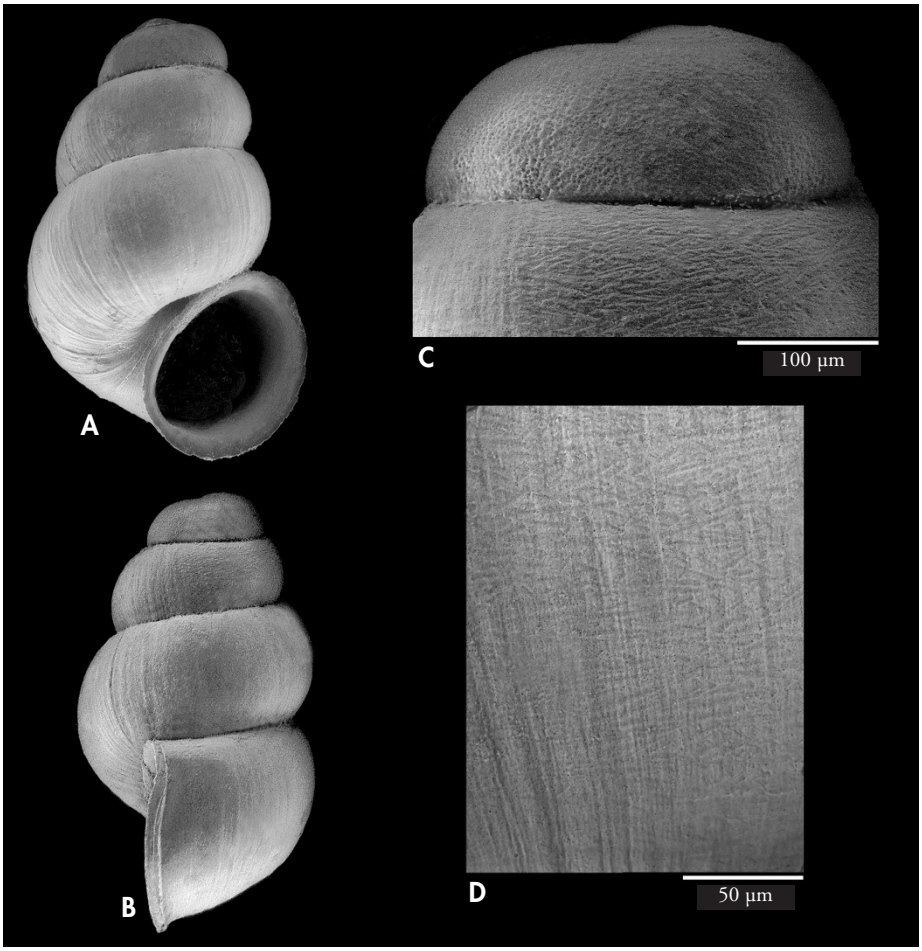

Figure 2. *Spiralix (Burgosia) affinitatis* Boeters, 2003. A, B: shells, 1.16 mm, Cueva de Fuente Sagrero, Cereceda, Burgos; C: protoconch; D: microsculpture of the teleoconch.
Figura 2. Spiralix (Burgosia) affinitatis *Boeters, 2003. A, B: conchas, 1,16 mm, Cueva de Fuente Sagrero, Cereceda, Burgos; C: protoconcha; D: microescultura de la teleoconcha.*

Spiralix* (*Burgosia*) *asturica spec. nov. (Figs. 3A-G, 6E-I)

Type material: Holotype (Figs. 3A) in the MNCN (15.05/60173); Paratypes: (Fig. 3B) in MHNS 100623, 1 shell; MNHN IM-2014-6072, 1 shell; CHB, 2 shells from the type locality; MZB 2016-3145, 1 shell, and MVHN 270416ST01, 1 shell, Las Caldas, Fuente de los Tres Caños.
Type locality: Trubia (Oviedo), road to Las Caldas and Fusio by Caces, a spring close to the railway, at 2.8 Kms of the Trubia train Station and 1.7 km of the way to Pintoria [30TTP50].
Etymology: The specific name refers to Asturias, the Spanish community where the species was found.

Description: Shell ovoid-conical, fragile, colourless, translucent when in good condition, with about four or a little more whorls and a deep suture. Protoconch of about 1 ¾ whorls, with a diameter of 360-380 μm and a nucleus of

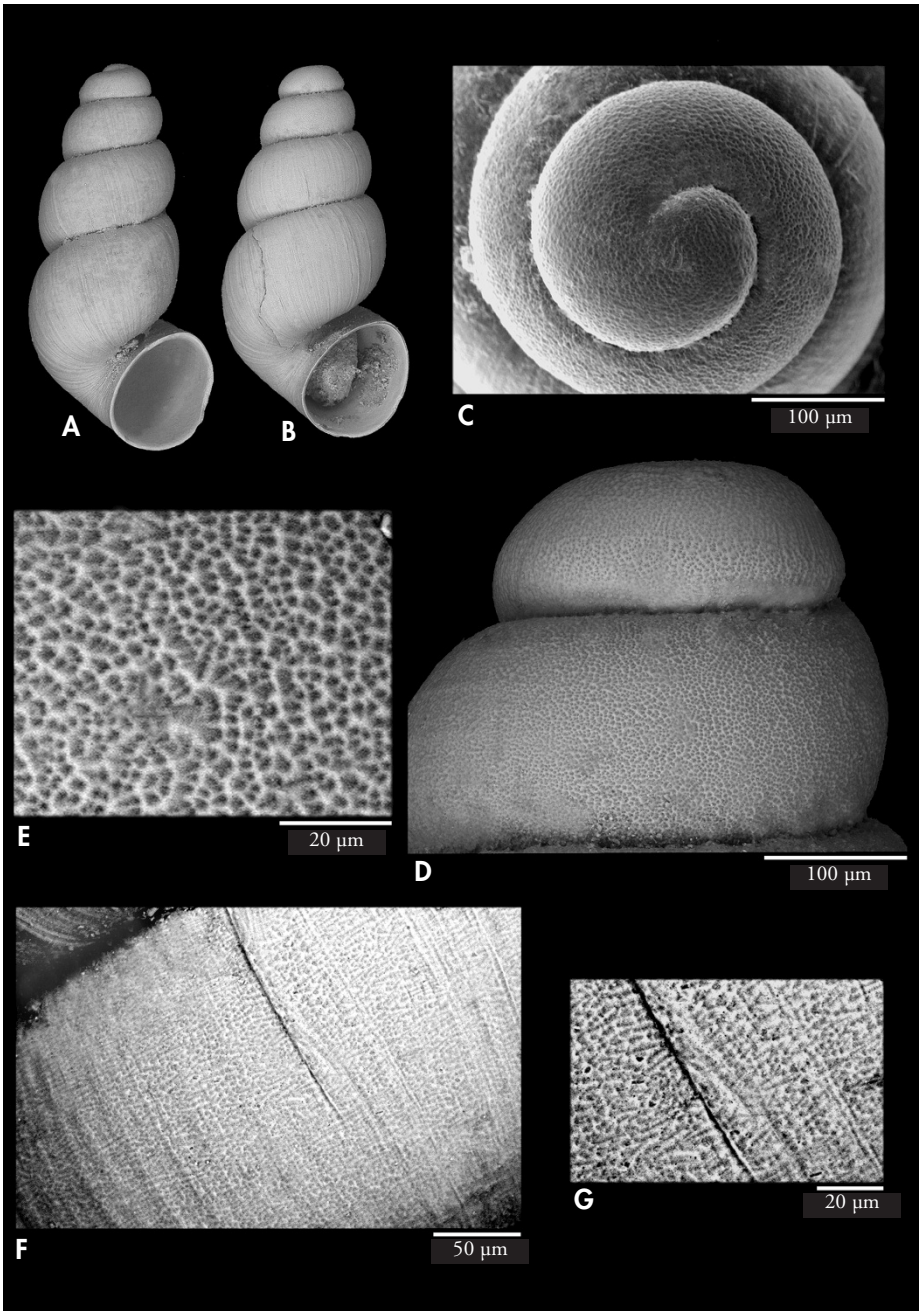

Figure 3. *Spiralix (Burgosia) asturica* spec. nov. A: holotype, 1.46 mm, from Trubia to Caces (TP50), Asturias (MNCN); B: paratype. 1.4 mm (MNCN), same locality; C: protoconch; D, E: microsculpture of the protoconch; F, G: microsculpture of the teleoconch and detail.
Figura 3. Spiralix (Burgosia) asturica *spec. nov. A: holotipo, 1,46 mm, de Trubia a Caces (TP50), Asturias (MNCN); B: paratipo. 1,4 mm (MNCN), la misma localidad; C: protoconcha; D, E: microescultura de la protoconcha; F, G: microescultura de la teleoconcha y detalle.*

100 μm. The sculpture of this part is very characteristic (Fig. 3D-E), formed by a very fine irregular reticle with depressions, forming very numerous rounded punctures. Teleoconch with about 3 whorls or a little less, quickly increasing in width, very convex; it lacks any macroscopic sculpture except prosocline growth lines on which there are a rough surface with minute, scarcely evident oblique scars. Aperture oval, peristome continuous, detached from the previous whorl, outer lip thin.

Dimensions: The holotype is 1.46 x 0.69 mm; height of the last whorl 0.89 mm. The measurement of 6 shells gave a medium height of 1.31 mm, and of 0.62 mm in diameter. The ratio H/D is 2.11.

Distribution: Only known from the type locality (Trubia, Oviedo) and from Fuente de los Tres Caños, Las Caldas and a spring from Priorio.

Remarks: In 1992, the third author collected empty shells in some localities of Cantabria and the Basque Country (Vizcaya and Álava provinces), which allowed the description of a new species (Rolán & Ramos, 1995) with the name of "*Paladilhiopsis" septentrionalis* (Figs. 6C-D). The assignation to this genus was tentative because neither live snails nor specimens containing soft parts were found. This usually represents a problem for classification of stygobiotic molluscs. The description of the species was then based on the shell morphology and SEM observation of the microsculpture.

Years later, new samplings in several localities of areas close to Trubia were also made by the same author, finding shells of a species which, at first sight, was found similar to those known from Álava (Rolán & Arconada, 2003) despite the large distance separating this population from those on which the description of the species was based.

We have examined samples of the type species of *Spiralix (Burgosia)* Boeters, 2003 collected in Cueva de Fuente Sagrero (Burgos) and think that, on the basis of the protoconch microsculpture, "*Paladilhiopsis" septentrionalis* should be better placed there, and the same applies for the other three new species now described.

Revising material from the type locality and from Lendoño (Vizcaya) of *Spiralix (Burgosia) septentrionalis*, the microsculpture of the protoconch shows an irregular reticulate sculpture with elevated areas which are anastomosed, enclosing depressions which are not punctured. Conversely, in *Spiralix (Burgosia) asturica* spec. nov., the microsculpture is finer than that of *S. (B.) septentrionalis*. At a high magnification, it can be seen that there are numerous small rounded pits, like punctures, in the mesh of this reticulate areas (Figs. 3C-D) which are even more evident under even higher magnification (Fig. 3E). These differences in the microsculpture between these two species are very meaningful, and allow us to hypothesize that they are not conspecific. This seems in accordance with the large distance with the type locality of *S. septentrionalis*, and makes more sense than considering them as two distant populations of the same species.

Spiralix* (*Burgosia*) *clarae spec. nov. (Figs. 4 A-G, 6 J-K)

Type material: Holotype (Figs. 4A-B) in MZB 2016-2269. Paratypes in MVHN 190416RY01, 1 shell, and in MNCN 15.05/60174, 1 shell.
Type locality: Spring of La Covachona, Cohiño, Arenas de Iguña (Cantabria, Spain), 206 m. [30TVN18]
Etymology: The specific name is after Clara Ruiz, daughter of the second author.

Localization and geologic context: The karst upwelling of La Covachona is a medium sized spring, open at the edge of the valley excavated by the Valdeiguña stream, a tributary of the river Besaya. It is located at the base of a vertical rocky cliff of about 20 meters fall, of structural origin. The cavity is about 9 meters long

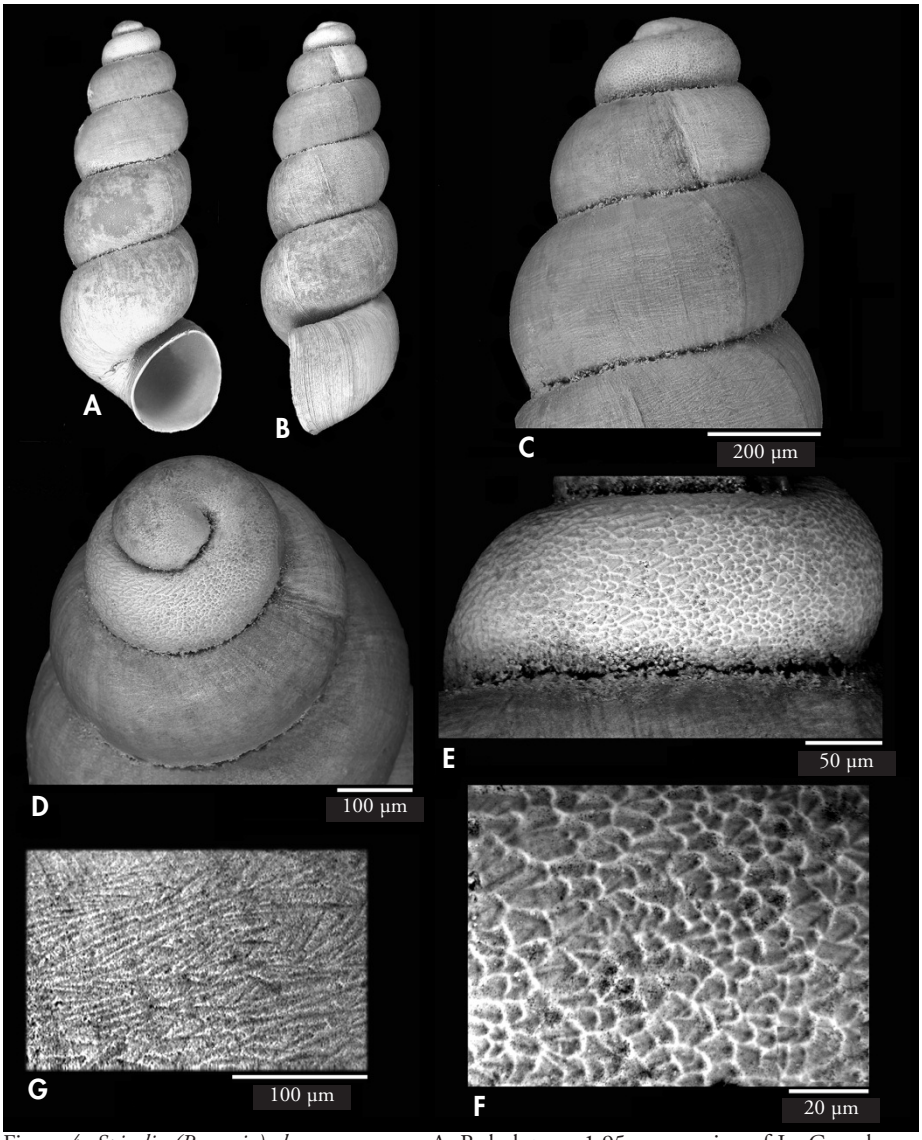

Figure 4. *Spiralix (Burgosia) clarae* spec. nov. A, B: holotype, 1.95 mm, spring of La Covachona, Arenas de Iguña (MZB); C, D: apex and protoconch; E, F: microsculpture of the protoconch and detail; G: microsculpture of the teleoconch.

Figura 4. Spiralix (Burgosia) clarae *spec. nov. A, B: holotipo, 1,95 mm, Fuente de La Covachona, Arenas de Iguña (MZB); C, D: ápice y protoconcha; E, F: microescultura de la protoconcha y detalle; G: microescultura de la teleoconcha.*

and between 0.80 and 1.20 meters high. The bottom is covered by medium sized boulders, limestone gravels and clayey silts. The average temperature of the running water coming out of the spring is about 12.1º and an average pH of 7.15. Dissolved oxygen values in water are estimated in 55-65% saturation.

Description: Shell subcylindrical, fragile, with about 5-6 whorls and a deep suture. Protoconch with a little more than 1 ½ whorls, with a diameter of about 360 μm and a nucleus of 110 μm. The sculpture of the first part is very characteristic (Figs. 4 E-F), formed by an irregular reticle in which the curved edges are towards the right part and the angular edges, pointing towards the left part. This sculpture is changed at the end of the protoconch for very elongate scars which finally disappear. Teleoconch with a little more than 4 very convex whorls, slowly increasing, without sculpture except prosocline growth lines, occasionally very marked, and slightly curved near the end of the spire, and irregular oblique scars (Fig. 4G). Aperture oval; peristome continuous, without contact with the previous whorl, outer lip thin.

Dimensions: The holotype is 1.95 mm x 0.73 mm; height of the last whorl 0.93 mm. The measurement of 10 shells gave a maximum height of 2.36 x 0.94 mm in diameter, and a minimum of 1.79 x 0.79 mm in diameter. The ratio H/D is 2.67.

Distribution: Only known from the type locality.

Remarks: In comparison with the other north Iberian congeneric species, we can mention the following differences:

S. septentrionalis (Rolán & Ramos, 1995) is smaller (although sometimes isolated shells can reach similar dimensions) and usually has one whorl less of teleoconch; the suture is less inclined; the microsculpture of the protoconch is finer; and there is no definite direction within the reticulate microsculpture. In contrast, the reticle of *P. clarae* has a wide pattern, with the convex lines towards the right of the spire.

S. asturica spec. nov. is smaller, has at least one whorl less, has a smaller spire, and the last whorl is about 60% of the total height. The protoconch is a little larger and its microsculpture is formed by a finer, irregular reticle, with more depressions and with rounded pits or perforations.

Spiralix* (*Burgosia*) *mieraensis spec. nov. (Figs. 5A-F, 6L-M)

Type material: Holotype (Fig. 5A) in MNCN 15.05/60182; paratypes (Fig. 5B) in MZB 2016-4125.
Type locality: Fuente Encalada, Liérganes, Cantabria. 180m. [30TVN49]
Etymology: The specific name refers to the river basin of the Miera river, where the fountain is found.

Localization and geologic context: The type locality is a karstic spring of small size, which flows from a non-accessible crevice about 3 m wide and 0,4 m high in the middle course of the Miera River. It does not get dry at any time of the year. It opens in the lower part of a high cliff which has developed by the erosion of the Miera River on very compact, Aptian reef limestones. The system's refill area is located on large dolines in the summit of Peña Herrera massif, in the north part, with altitudes of about 400-600 m, while the system maximum altitude is about 900 m in the western part of the massif (Fernández Acebo, 1994). The average temperature of water, measured during the study, was of 12.6ºC within the spring, and the pH was of 7.55. On the other hand, Notenboom & Meijers (1985) took these measurements for the very same spring in November 1993: pH 8,00; Temperature 11.2ºC; Conductivity 0.245 μS/cm; Dissolved oxygen: 10.6 mg/l:, Chlorides: 20 mg/l. It can be concluded that this is an environment of well oxygenated water, with temperatures ranging between 11.2 and 12.6ºC and slightly basic pH.

Description: Shell ovoid-conical, fragile, colourless, with about four or slightly more whorls and a deep suture. Protoconch of about 1 ¾ whorls, with a diameter of about 400 μm. The sculpture of this part is very characteristic (Fig. 5

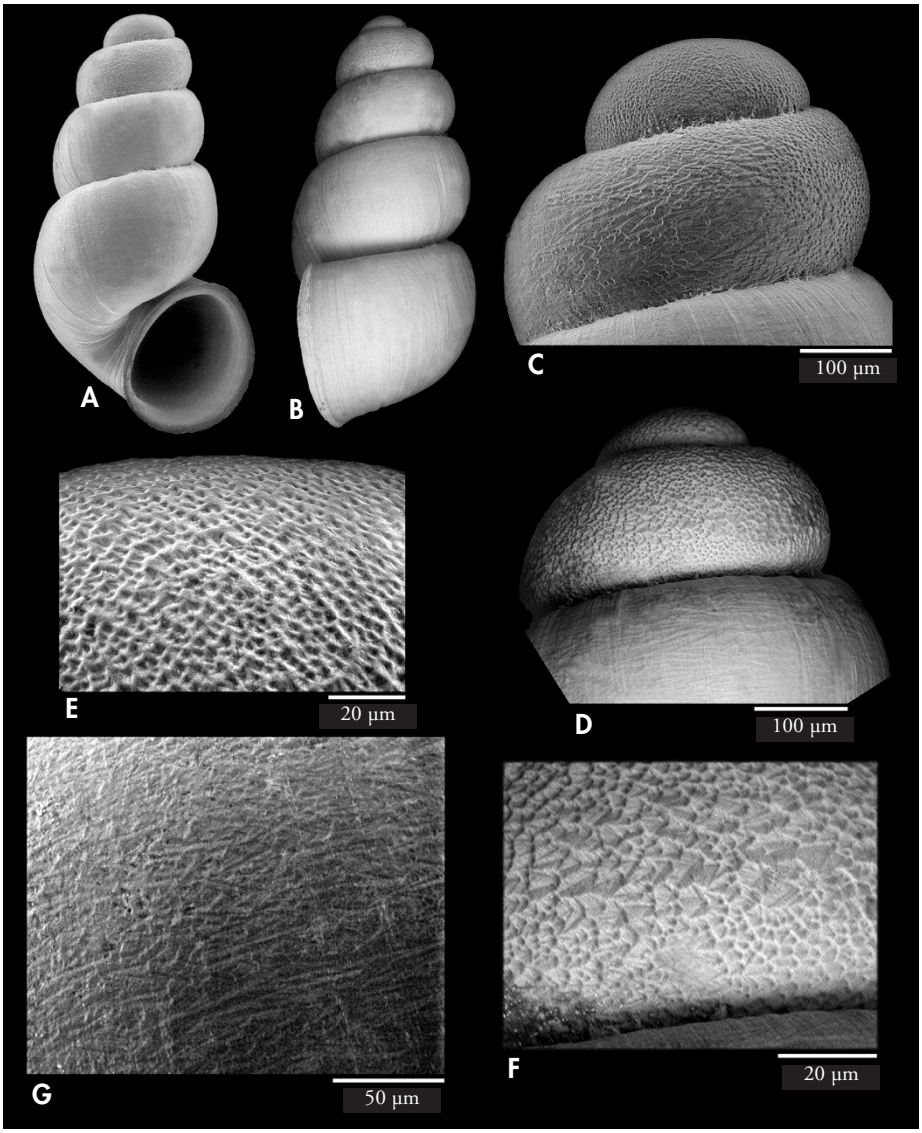

Figure 5. *Spiralix (Burgosia) mieraensis* spec. nov. A: holotype, Fuente Encalada, Liérganes, Cantabria (MNCN); B: paratype; C: protoconch of the holotype; D: protoconch of the paratype; E, F: microsculpture of the protoconch; G: microsculpture of the teleoconch.
Figure 5. Spiralix (Burgosia) mieraensis *spec. nov. A: holotipo, Fuente Encalada, Liérganes, Cantabria (MNCN); B: paratipo; C: protoconcha del holotipo; D: protoconcha del paratipo; E, F: microescultura de la protoconcha; G: microescultura de la teleoconcha.*

C-D), formed by a very fine irregular reticle with many depressions on its first part, while the terminal part presents irregular depressions but a pointed edge in direction to the teleoconch. Teleoconch with about 3 whorls or a little less, quickly increasing in width, with a very convex profile; it lacks any macro-

scopic sculpture except prosocline growth lines and a rough surface with a microsculpture of oblique, scarcely evident scars. Aperture oval, peristome continuous, a little everted, detached from the previous whorl, outer lip thin.

Dimensions: Holotype 1.45 mm in height x 0.61 mm in diameter. H/D = 2.37.

Distribution: Only known from the type locality Fuente Encalada, Liérganes, Cantabria.

Remarks: *Spiralix mieraensis* spec. nov. has the typical form and sculpture of the subgenus. It can be differentiated from *S. septentrionalis* because the latter is larger, and the microsculpture at the end of its protoconch is different, with a more elongate pattern of the mesh.

Spiralix asturica spec. nov. has its distribution area very far, and is more fragile, the peristome is not everted, and the microsculpture of the protoconch has deeper punctures inside the mesh.

Spiralix clarae spec. nov. is larger, with more whorls, the peristome is not everted, and the sculpture of the teleoconch is more distinct.

DISCUSSION

Three new species of the genus *Spiralix* are described from the north of the Iberian Peninsula. These three species are added to the previously known taxa in the Iberian Peninsula, which were also found in springs in karstic areas. As frequently occurs, no live specimens were collected. The examination of the microsculpture of the protoconch with SEM allows seeing important differences that, added to other morphological shell characters, make possible the differentiation of the new species. This seems to be a useful character for future classifications of the genus. In addition, the microsculpture of the teleoconch is not regular, very minute and, in consequence, different from most of the known *Moitessieria* species.

The SEM study of the protoconch of specimens coming from the previously known populations of *Spiralix septentrionalis*, the type locality and the one assigned to this species from Asturias, shows that the similarity mentioned in Rolán & Arconada (2003) was probably due to the fact that the protoconchs were not properly cleaned, and therefore no differences were found among them. The present comparative study, however, shows that the microsculptures are in fact different, and diagnose two different species. This is not completely surprising, given the large distances from the collecting points and the difficulties for genetic flow among stygobiotic species within distant populations.

The distribution area of *S. septentrionalis* (Rolán & Ramos, 1995) as stated by Rolán & Arconada (2003) is here restricted for two reasons. First, because the population found in Asturias is not this species but *S. asturica* spec. nov. as discussed before. Second, because the material from one of the localities mentioned in the original description (La Coventosa, Fuente Cuvera, Cantabria), turned out to be *Spiralix burgensis* Boeters, 2003. In consequence, the distribution area of *S. septentrionalis* is reduced to Alava, Vizcaya and Burgos provinces.

Comparing with other genera from the family Moitessieriidae present in Spain, the most similar *Palaospeum* has a larger and more conical shell, *Sardopaladilhia* in turn has a different microsculpture, the upper part of the peristome is attached to the previous whorl, and the aperture is much more oval in shape (Rolán & Martínez-Ortí, 2003). Regarding other genera not present in Spain, *Bythiospeum* has almost no microsculpture at all, and *Paladilhia* has a sculpture made of longitudinal and spiral striae (Bertrand, 2003, Girardi, 2009a, Girardi, 2015). Some species of Hydrobiidae have some similarities, but are not present in Spain: *Palacanthiliopsis* for example has longitudinal thin striae (Girardi, 2009b).

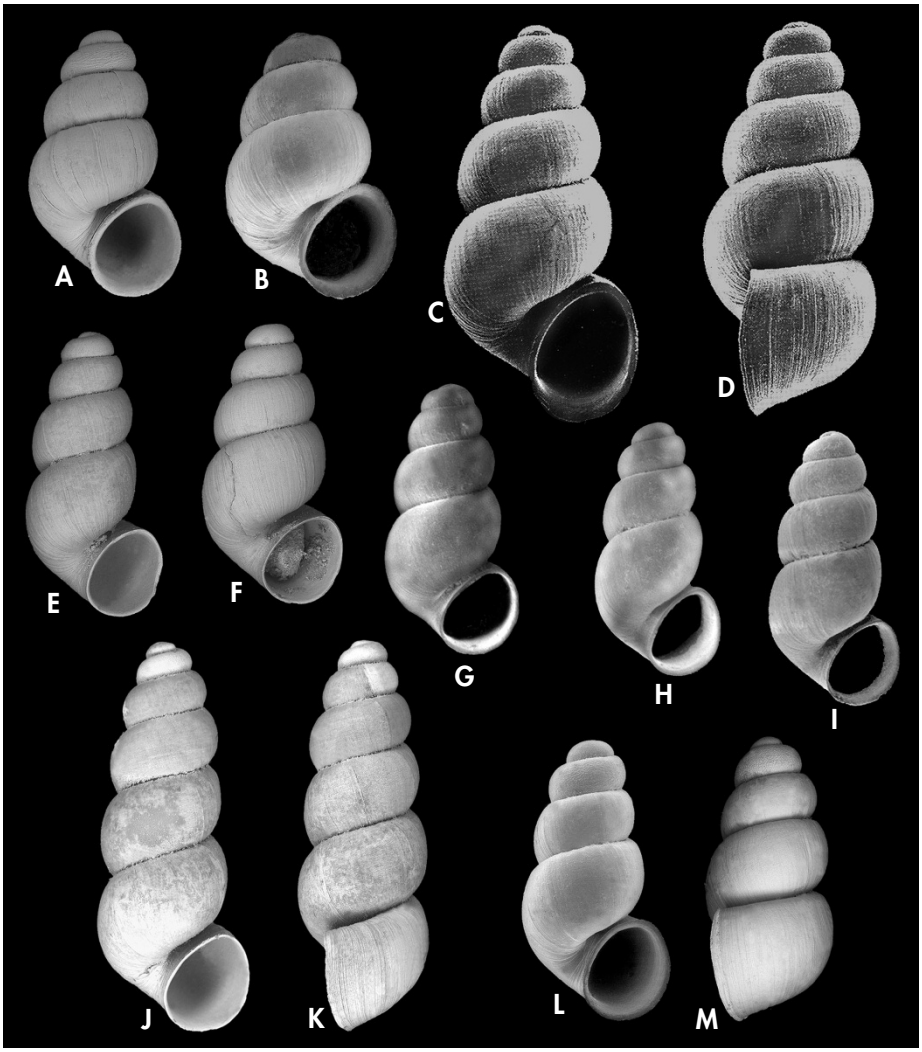

Figure 6. Comparison of the shells of *Spiralix (Burgosia*): A: *S. (B.) burgensis* Boeters, 2003, Cueva de Fuente Sagrero, Cereceda, Burgos; B: *S. (B.) afinitatis* Boeters, 2003, shell, 1,16 mm, Cueva de Fuente Sagrero, Cereceda, Burgos; C, D: *S. (B.) septentrionalis* (Rolán & Ramos, 1995); C: holotype, 1.95 mm, Aguiñiga, Álava (MNCN); D: paratype, 1.9, same locality; E-I: *S. (B.) asturica* spec. nov.; E: holotype, 1.46 mm, from Trubia to Caces, Asturias (MNCN); F: paratype, 1.4 mm (MNCN), same locality; G-I: shells, 1.3, 1.2, 1.4 mm, type locality. J, K: *S. (B.) clarae* spec. nov., holotype, 1.95 mm, spring of La Covachona, Arenas de Iguña (MNCN); L: *S. (B.) mieraensis* spec. nov. holotype, 1.45 mm from Fuente Encalada, Liérganes (MNCN); M: paratype 1.47 mm (MZB), same locality.

Figura 6. Comparación de las conchas de S. (B.)*: A:* S. (B.) burgensis *Boeters, 2003, concha, 1,28 mm. Cueva de Fuente Sagrero, Cereceda, Burgos; B:* S. (B.) afinitatis *Boeters, 2003, concha, 1,16 mm, Cueva de Fuente Sagrero, Cereceda, Burgos; C-D:* S. (B.) septentrionalis *(Rolán & Ramos, 1995); C: holotipo, 1,95 mm, Aguiñiga, Álava (MNCN); D: paratipo, 1,9 mm, la misma localidad; E-I:* S. (B.) asturica *spec. nov. E: holotipo, 1,46 mm, de Trubia a Caces, Asturias (MNCN); F: paratype, 1,4 mm (MNCN), la misma localidad; G-I: conchas, 1,3, 1,2, 1,4 mm, localidad tipo. J, K:* S. (B.) clarae *spec. nov., holotipo, 1,95 mm, La Covachona, Arenas de Iguña (MNCN); L:* S. (B.) mieraensis *spec. nov. holotipo, 1,45 mm de Fuente Encalada, Liérganes (MNCN); M: paratipo 1,47 mm (MZB), misma localidad.*

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BIBLIOGRAPHY

ALBA, D.M, TARRUELLA, A., PRATS, L., GUILLÉN, G. & CORBELLA, J. 2010. Els moitessièrids (Gastropoda: Moitessieridae) de Rellinars (el Vallès Occidental, Catalunya, Espanya). *Spira*, 3 (3-4), 159-186.

ALBA, D.M, TARRUELLA, A., PRATS, L., GUILLÉN, G. & CORBELLA, J. 2011. Nova llista actualitzada dels mol·luscos continentals de Catalunya. *Spira*, 4 (1-2), 39-69.

BERTRAND, A. 2003. *Paladilhia jamblussensis* (Gastropoda: Moitessieriidae) Espèce nouvelle du Quercy (Francia). *Documents Malacologiques*, 4: 37-39.

BOETERS, H.D. 2003. Supplementary notes on Moitessieriidae and Hydrobiidae from the Iberian Peninsula (Gastropoda, Caenogastropoda). *Basteria*, 67: 1-41.

BOETERS, H.D. & GITTENBERGER, E. 1990. Once more on the Moitessieriidae (Gastropoda Prosobranchia), with the description of *Clameia brooki* gen. et spec. nov. *Basteria*, 54, (1-3): 123-129.

CORBELLA, J. GUILLÉN, G. PRATS, LL. TARRUELLA, A. & ALBA, D. 2014. *Spiralix calida* sp. nov. (Gastropoda: Moitessieriidae), una nova espècie de gastròpode estigobi de Toga (l'Alt Millars, País València, Espanya). *Spira*, 5: 111-120.

FERNÁNDEZ ACEBO, V. 1994. El karst del Miera. *Boletín Cántabro de Espeleología 10*. Santander.

GIRARDI, H. 2009a. *Paladilhia vernierensis*, nouvelle espèce de la grotte de Vernière à Mialet, Gard, France (Mollusca: Caenogastropoda: Moitessieriidae). *Documents Malacologiques*, hors Série 3: 105-108.

GIRARDI, H. 2009b. *Palacathilhiopsis carolinae*, nouvelle espèce, *Palacanthilhiopsis kuiperi*, nouvelle espèce (description originale et anatomie), *Palacanthilhiopsis vervierii* Bernasconi, 1988 (variation, polymorphisme et répartition), dans le sud de la France (Mollusca: Caenogastropoda: Hydrobiidae: Belgrandiinae). *Documents Malacologiques*, hors Série 3: 89-104.

GIRARDI, H. 2015. *Paladilhia castaneaensis*, nouvelle espèce stygobie de la frotte des Châtaigniers à Saint-Martin-de-Londres, Hérault, France. Comparaison avec les autres espèces du genre *Paladilhia* Bourguignat, 1865, du secteur Héraultais. (Mollusca: Caenogastropoda: Moitessieriidae). *Avenionia*, 1: 21-29.

NOTENBOOM,J & MEIJERS, I. 1985. Research of the groundwater fauna of spain: List of stations and first results. *Verslagen en technische gegevens, Instituut voor taxonomische Zoölogie (Zoölogisch Museum), Universiteit van Amsterdam* 42. 93 pp.

ROLÁN, E. & ARCONADA, B. 2003. Nueva información sobre *Paladilhiopsis septentrionalis* (Molusca, Prosobranchia). *Iberus*, 21 (2): 141-143.

ROLÁN, E. & MARTÍNEZ-ORTÍ, A. 2003. Nuevas especies de la familia Hydrobiidae (Mollusca: Orthogastropoda) de la Comunidad Valenciana (España). *Iberus*, 21 (1): 191-206

ROLÁN, E. & RAMOS, M.A. 1995. Una nueva especie de Hydrobiidae (Mollusca, Prosobranchia) del norte de la Península Ibérica. *Iberus*, 13 (2): 119-127.