New anatomical and biogeographical data on Solenogastres Cavibelonia from the Galician Continental Margin (NW Spain)

Nuevos datos anatómicos y biogeográficos de Solenogastros Cavibelonia del Margen Continental de Galicia (NW España)

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ABSTRACT

The present paper reports on new records of Solenogastres of the Order Cavibelonia from the Galician Continental Margin (NW Spain). New bathymetrical and geographical data, together with morphological and anatomical observations, are provided for five already known species: *Luitfriedia minuta*, *Unciherpia hirsuta* and *Urgorria compostelana,* all of them originally described from Galicia (NW Spain); *Anamenia gorgonophila*, previously found in several localities of the Mediterranean Sea and the North Atlantic, including the Galician bottoms; and *Rhopalomenia glandulosa*, which had been reported so far only from its type locality (Rockall Basin, NW Scotland). Furthermore, a revision of a specimen of *R. glandulosa* from Cape Peñas (N Spain), previously identified as *Rhopalomenia aglaopheniae,* is given.

RESUMEN

El presente artículo informa de nuevas citas de Solenogastros del Orden Cavibelonia del Margen Continental de Galicia (NW España). Se aportan nuevos datos batimétricos y geográficos, junto con observaciones morfológicas y anatómicas, de cinco especies ya conocidas: *Luitfriedia minuta*, *Unciherpia hirsuta* y *Urgorria compostelana*, todas ellas descritas de Galicia (NW España); *Anamenia gorgonophila,* previamente encontrada en varias localidades del Mediterráneo y del Atlántico Norte, incluyendo los fondos de Galicia; y *Rhopalomenia glandulosa*, especie que hasta ahora solo se había citado en su localidad tipo (Rockall Basin, NW Escocia). Además, se realiza una revisión de un espécimen de *R. glandulosa* del Cabo de Peñas (N España), previamente identificado como *Rhopalomenia aglaopheniae*.

INTRODUCTION

Solenogastres represent a small group (about 270 described species) of marine molluscs externally characterised by a mantle consisting of cuticle with aragonitic sclerites, a ventral pedal groove and a terminal or subterminal

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pallial cavity. Solenogastres are usually small-sized, from 0.8 to 15 mm in length, though larger species up to 30 cm also exist. Despite being present on all sea bottoms from the coast to the deep sea, our knowledge of this Molluscan group is still fairly fragmentary not only with respect to biological, developmental and physiological features, but even regarding pure faunistics, regional diversity, or biogeography (Salvini-Plawen, 2008). The known geographic distribution of most species is spotty and based on occasional findings and in general only one or a few specimens are sampled at any one time, which makes them rare representatives; many species are known from a single specimen and their reported distribution is usually limited to a restricted area.

The DIVA-Artabria project aims to study the benthic fauna of the Galician bottoms (NW Spain) to obtain baseline data about diversity, composition, and distribution of benthic assemblages (Parapar and Moreira, 2009). So far, this project has included four oceanographic expeditions: DIVA-Artabria I (2002 and 2003) and DIVA-Artabria II (2008 and 2009). Furthermore, other scientific cruises have been developed in Galician waters in order to cover the entire study area; the most important cruises associated with the DIVA-Artabria project are Vertidos 2004, A Selva 2008 and Forsagal 2009. With the aim of improving knowledge about the Solenogastres, the specimens of the DIVA-Artabria cruises and other associated expeditions are being studied as a starting point for a detailed inventory of the Solenogastres fauna off the Galician coast. In the DIVA-Artabria I (2002 and 2003) cruises alone, the study area of which includes the shelf and upper slope off Artabro Gulf located at the Galician Continental Margin (NW Spain), around 3000 specimens of Solenogastres were collected.

The aim of the present study was to analyze and identify 166 specimens of Solenogastres from the DIVA-Artabria I (2002 and 2003), DIVA-Artabria II (2008), Vertidos 2004 and A Selva 2008 oceanographic cruises. As a result of the study, these 166 specimens have been included in five known species of the Order Cavibelonia: *Luitfriedia minuta* García-Álvarez and Urgorri, 2001; *Unciherpia hirsuta* García-Álvarez, Salvini-Plawen and Urgorri, 2001; *Rhopalomenia glandulosa* Eisenhut and Salvini-Plawen, 2006; *Urgorria compostelana* García-Álvarez and Salvini-Plawen, 2001; and *Anamenia gorgonophila* (Kowalevsky, 1880). Simultaneously, the revision of a specimen of *R. glandulosa* collected from Cape Peñas (N Spain), and originally identified by García-Álvarez, Urgorri and Cristobo (2000) as *Rhopalomenia aglaopheniae* (Kowalevsky and Marion, 1887), has been carried out. The description of the main anatomical characters with additional morphological observation of each species is presented, along with photographs of the specimens and the most relevant histological sections. The great number of specimens, together with the good condition of the material studied, has allowed us to make some important new observations on their morphology. Furthermore, new biogeographical and bathymetrical data are provided for the poorly-know distribution of these species.

MATERIAL AND METHODS

166 specimens of Solenogastres were studied from 18 stations between 324 and 1499 m depth, sampled during the DIVA-Artabria I (2002 and 2003), DIVA-Artabria II (2008), Vertidos 2004 and A Selva 2008 cruises along the Galician Continental Margin (NW Spain). Specimens were fixed and preserved in 70% ethanol. They were then measured and photographed, their external anatomy was described and their sclerites were studied by taking out small pieces of the mantle for preparations that were observed using light microscopic and scanning electron microscope (SEM). After examination of the sclerites, some specimens were examined histologically. To that end, the specimens were decalcified in an Ethylenedi-

aminetetraacetic Acid (EDTA) solution for 12 h, embedded in paraffin or araldite and serial sectioned at 5 μm or 2 μm thick respectively; the histological examinations were done using an optical light microscope.

Other material examined for comparative study belongs to the private collection of the Departamento de Zooloxía e Antropoloxía Física, Universidade de Santiago de Compostela (Spain).

RESULTS

(Systematics following GARCÍA-ÁLVAREZ AND SALVINI-PLAWEN, 2007)

Order CAVIBELONIA Salvini-Plawen 1978
Family PRUVOTINIDAE Heath, 1911
Subfamily ELEUTHEROMENIINAE Salvini-Plawen, 1978
Genus *Luitfriedia* García-Álvarez and Urgorri, 2001

Epidermal papillae present. Mouth opening within common atrio-buccal opening. Radula missing. Secondary genital opening unpaired. Without copulatory stylets. With dorsoterminal sense organ. With respiratory folds.

Luitfriedia minuta García-Álvarez and Urgorri, 2001 (Fig. 1)

Material examined: 116 specimens collected in 14 stations of the DIVA-Artabria I (2002 and 2003), DIVA-Artabria II (2008), Vertidos 2004 and A Selva 2008 cruises. The external anatomy and the sclerites were examined on all specimens; from them, 26 were serially sectioned at 5 μm (24 specimens) or 2 μm thickness (2 specimens).

Diagnosis (amended): Body measures up to 2 mm long x 1 mm wide, dorsoventrally flattened; short and stout body. Without lumps or keels. Thick cuticle. Pedal groove with one fold not entering the pallial cavity; end of the pedal fold at the opening of the pallial cavity. Atrial papillae simple or paired. Rudimentary radular sack present. Midgut without anterodorsal caecum. With one pair of seminal receptacles at pericardioducts. Unpaired secondary genital opening with weak sphincter into a more or less pronounced ventroanterior pouch of the pallial cavity. Without prepallial spicules. With 10-12 respiratory folds.

Distribution: *L. minuta* was originally described from the Galicia Bank (W Galicia; NW Spain) (42º42'22"N; 42º43'00"N - 11º47'52"W; 11º45'47"W) on a bottom of the coral *Madrepora oculata* (Linnaeus, 1758), at 760-769 m depth. It was also found in the fishing ground "A Quiniela" (W Galicia, NW Spain) (43º17'22''N; 09º36'42''W), on a bottom with polymetallic nodules, calcareous slabs, coal slag and small stones of terrigenous origin, at 507 m depth (GARCÍA-ÁLVAREZ AND URGORRI, 2001). Other findings: 14 additional stations of the Galician bottoms, between 598 and 1191 m depth (this paper, see Table I).

Description: Habitus. Specimens studied here were dorsoventrally flattened, 0.6-2 mm in length and with a maximum width of 0.2-1 mm (Fig. 1A). Sclerites protruding from the body surface, giving the specimens a slightly bristly appearance; the size of the sclerites increases towards the posterior region of the body, forming a non-cuticular middorsal crest in the dorsal body region. The pedal groove is externally well-marked and the pallial cavity opens in ventral position (Fig. 1A). Colour from white to brown, before and after fixation and preservation in 70% ethanol.

Table I. Examined specimens of *Luitfriedia minuta* García-Álvarez and Urgorri, 2001.
Tabla I. Ejemplares examinados de Luitfriedia minuta *García-Álvarez y Urgorri, 2001.*

Station	Coordinates	Depth (m)	Substratum	Nº individuals	Size (mm)
DIVA-Artabria I (2002) AT-1000	43º57.003'N; 08º54.795'W 43º57.248'N; 08º54.133'W	1132-1191	stones and dead corals	7 (5 sectioned)	0.9-1.5 x 0.2-0.4
DIVA-Artabria I (2003) AT-1000	43º53.847'N; 08º57.324'W 43º54.621'N; 08º57.261'W	993-1004	stones and dead corals	19 (15 sectioned)	0.6-2 x 0.25-0.8
DIVA-Artabria I (2003) DRN-1000	43º53.575'N; 08º56.868'W 43º54.015'N; 08º56.959'W	965-974	stones and dead corals	10 (3 sectioned)	0.8-1.8 x 0.4-0.7
Vertidos 2004 GA DRN-1000	43º38.812'N; 09º07.949'W 43º39.841'N; 09º07.405'W	999-1001	-	1	1.9 x 0.45
A Selva 2008 DRN-7	44º11.652'N; 08º58.152'W 44º11.539'N; 08º57.574'W	908-1106	sand and corals	2	1-1.4 x 0.4-0.45
A Selva 2008 DRN-15.2	43º56.478'N; 08º54.199'W 43º55.934'N; 08º54.849'W	620-933	muddy sand and dead corals	2	1-1.2 x 0.42-0.44
DIVA-Artabria I (2002) AT-800	43º47.188'N; 08º53.053'W 43º55.312'N; 08º53.101'W	770-842	nodules and stones	2 (sectioned)	1.1-1.5 x 0.3-0.5
DIVA-Artabria I (2002) DRN-800	43º51.265'N; 08º54.480'W 43º51.498'N; 08º54.103'W	819-827	stones	1 (sectioned)	2 x 1
DIVA-Artabria I (2003) EBS-800	43º51.873'N; 08º53.683'W 43º53.301'N; 08º53.301'W	788-802	stones and dead corals	1	1.2 x 0.45
DIVA-Artabria I (2002) AT-600	43º53.457'N; 08º48.461'W 43º54.000'N; 08º48.524'W	629-631	nodules and stones	19	1-1.8 x 0.4-0.9
DIVA-Artabria I (2003) AT-600	43º48.514'N; 08º51.439'W 43º49.163'N; 08º51.157'W	616	stones	11	1-2 x 0.4-0.8
DIVA-Artabria I (2003) DRN-600	43º48.421'N; 08º51.453'W 43º49.160'N; 08º51.091'W	599-607	stones	19	0.9-2 x 0.4-0.6
DIVA-Artabria I (2003) EBS-600	43º48.587'N; 08º51.402'W 43º49.545'N; 08º51.497'W	598-610	sand	21	0.7-1.5 x 0.3-0.65
Vertidos 2004 GA EBS 600	43º36.544'N; 09º03.064'W 43º36.816'N; 09º01.339'W	601-619	-	1	1 x 0.32

Mantle. Thick cuticle (50 μm) with 4-5 layers of sclerites; with epidermal papillae on the base of the cuticle. Seven types of sclerites radially or obliquely inserted (Fig. 1B). Hollow hook-shaped sclerites (125-200 μm long, 6-8 μm wide) with a sharp tooth in the hook curvature, radially inserted in the dorsal body region. Two types of hollow acicular sclerites with a distal end flattened and serrated in their convex margin (6 or 8 teeth), obliquely inserted and pointing the concave part of the distal end towards the posterior body region: long sclerites, almost straight (225-350 μm long, 8-10 μm wide), obliquely inserted in the medial body region; and short sclerites, with a sigmoid proximal end (150-180 μm long, 6-8 μm wide) and radially or obliquely inserted in the anterior body end. Long and straight hollow acicular sclerites (180-400 μm long, 10-12 μm wide), radially or obliquely inserted in the posterior body region, where they protrude up to 200 μm. Hollow acicular sclerites slightly sigmoid near their proximal end (70-140 μm long, 6-8 μm wide). Hollow acicular sclerites curved in their medial region (100-180 μm long, 6-8 μm wide). And blade-shaped scales of the pedal groove (35-60 μm long, 15-30 μm wide).

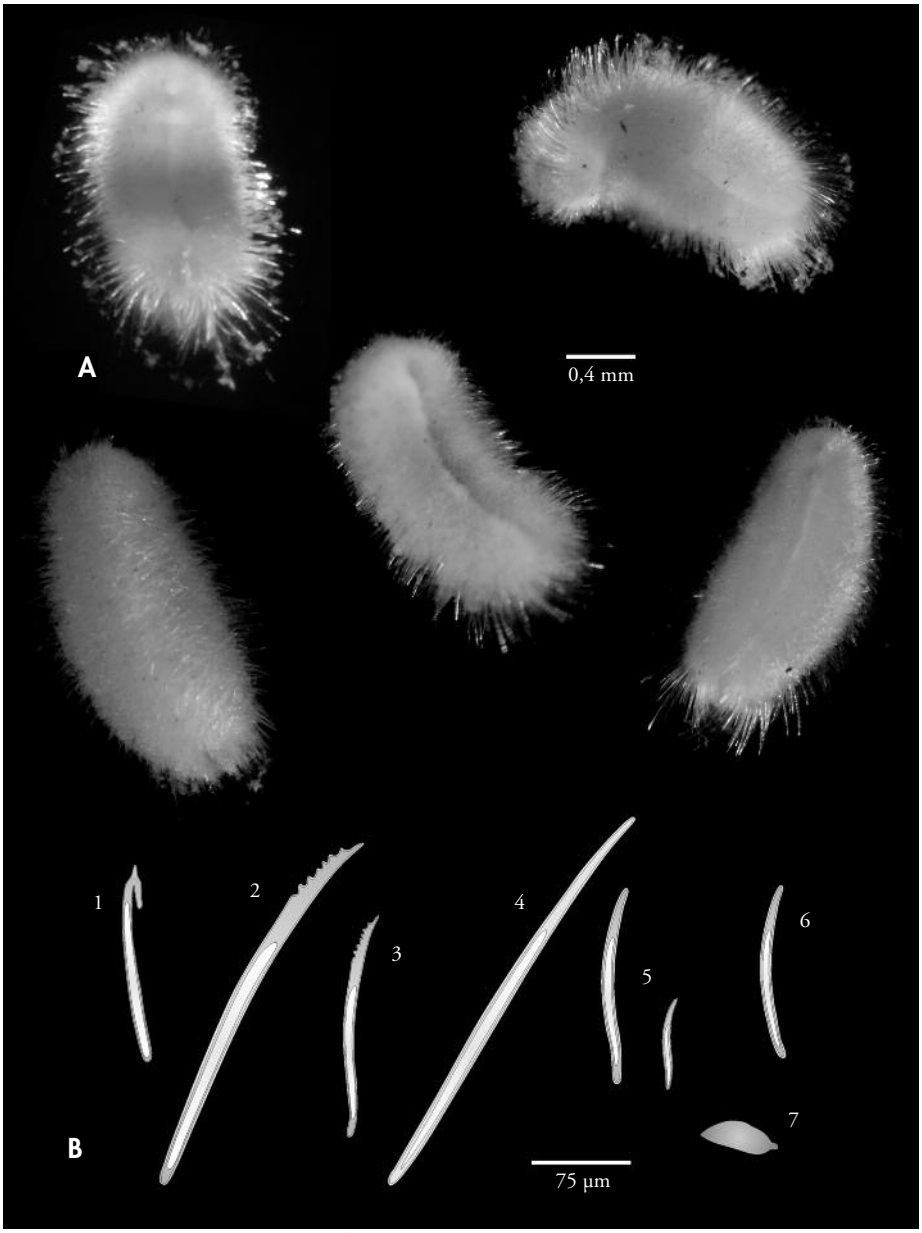


Figure 1. *Luitfriedia minuta* García-Álvarez and Urgorri, 2001. A: habitus; B: drawing of the sclerite types (1: hollow hook-shaped sclerite; 2: long hollow acicular sclerite distally serrated; 3: sigmoid hollow acicular sclerite distally serrated; 4: straight hollow acicular sclerite; 5: sigmoid hollow acicular sclerite; 6: hollow acicular sclerite medially curved; 7: pedal-groove scale).
Figura 1. Luitfriedia minuta *García-Álvarez y Urgorri, 2001. A: habitus; B: dibujo de los tipos de esclerites (1: esclerito hueco en forma de gancho; 2: esclerito acicular hueco largo con borde distal aserrado; 3: esclerito acicular hueco de forma sigmoidea y con borde distal aserrado; 4: esclerito acicular hueco recto; 5: esclerito acicular hueco de forma sigmoidea; 6: esclerito acicular hueco arqueado en su región media; 7: escama del surco pedio).*

Pedal pit and pedal groove. Deep pedal pit covered with a strongly glandular epithelium. Pedal fold formed shortly before the closing of the pedal pit and ending at the opening of the pallial cavity, not entering the cavity. Well-differentiated pedal glands: a pair of follicular and voluminous anterior pedal glands opens dorsally into the pedal pit; posterior pedal glands of variable size, but not very voluminous, opening along the pedal groove.

Pallial cavity. Pallial cavity with a narrow subterminal opening. A maximum of 12 respiratory folds stand out in the posterior region of the pallial cavity, the rectum opens in the dorsofrontal wall. The anterior region of the pallial cavity forms a wide ventroanterior pouch where the unpaired secondary genital orifice opens, provided with a weak sphincter. Neither pallial glands nor suprapallial glands are present. Without abdominal spicules.

Nervous system and sense organs. Cerebral ganglion situated dorsally to the pharynx; in some specimens, the posterior region of the cerebral ganglion shows a trilobed cross section. In the anterior region of the cerebral ganglion, two nerve cords leave from a pair of small anterior ganglia towards the atrium. From the medial region, a pair of cerebro-lateral connectives leaves laterally the cerebral ganglion, and posteriorly, the cerebro-buccal connectives ventrally. Due to the large development of the anterior pedal glands, the first pair of lateral ganglia could not be observed. Pair of buccal ganglia arranged posteriorly to the ventrolateral foregut glands; both buccal ganglia are connected to each other by a short commissure (10 μm long, 2 μm wide). First pair of ventral ganglia dorsal on the posterior region of the pedal pit and joined by a single commissure. Lateral cords terminate in a pair of posterior ganglia interconnected by a suprarectal commissure slightly anterior to the anus; two pairs of nerves leave from these ganglia: a pair of thick nerves running to the lateral areas of the body, possibly innervating the dorsoterminal sense organ, and a second pair running to the ventral region of the posterior body end.

The atrial sense organ bears simple and slender papillae, except for one of the examined specimens, where the papillae are basally bundled in pairs. With a terminally located dorsoterminal sense organ.

Digestive system. The mouth opens into the dorsoposterior region of the common atrio-buccal cavity and continues in a short pharynx, with an oval cross section and encircled by a thin coat of circular muscles. Despite lacking a radula, the presence of a vestigial radular sack can be observed in five specimens. With a pair of small ventrolateral foregut glands type A (according to Salvini-Plawen, 1978) or type *Pararrhopalia* (according to Handl and Todt, 2005) that opens laterally into the pharynx; they consist of two short ducts with extraepithelial (subepithelial) glandular cells and inner musculature. The pharynx opens ventrally into a midgut that lacks an anterodorsal caecum but shows serial lateral constrictions correlated to the dorso-ventral muscle bundles. The posterior region of the midgut becomes a narrow and ciliated rectum. The anus is situated in the dorsofrontal region of the pallial cavity, posterior to the secondary genital orifice.

Reproductive system. Long and tubular gonads with ova on the medial walls and spermatozoids on the lateral ones. Short gonopericardioducts opening frontally into a large pericardium, bearing in six specimens a pair of seminal vesicles wider and longer than the gonopericardioducts themselves and laden with spermatozoids. A bicameral heart hangs from the dorsal wall of the pericardium. Pericardioducts leaving from the posterior region of the pericardium to end at the anterior region of the spawning ducts; right before this union, a pair of globular and posteriorly bilobed seminal receptacles leaves from the pericardioducts. The bodies of the seminal receptacles are arranged between the pericardioducts and the spawning ducts, stretching pos-

teriorly to the pallial cavity. Spawning ducts fusing posteriorly in a wide duct that takes up the whole body width. The genital orifice, provided with a weak sphincter, opens into the ventroanterior pouch of the pallial cavity.

Remarks: *Luitfriedia* is a monotypic genus of the Subfamily Eleutheromeninae represented by the type species *Luitfriedia minuta* García-Álvarez and Urgorri, 2001 (GARCÍA-ÁLVAREZ AND URGORRI, 2001). The present specimens come from the Galician Atlantic region, the same geographical area of the type locality of *L. minuta* (Galicia Bank, NW Galicia-Spain) and their anatomy agrees with the original description, although they show some unknown characteristics that we have included in the diagnosis of the species: the presence of a ventroanterior pouch of the pallial cavity where the genital orifice opens; and the position of the end of the pedal fold at the opening of the pallial cavity. Both characters are evident in the specimens internally examined in this research (with the exception of those specimens in poor histological conditions); however, it is likely that these features were not observed in the type specimens because they were cut into thicker sections (10 μm). Furthermore, some specimens are larger in body size than those previously described, with a maximum length of 2 mm and a maximum width of 1 mm (type material: up to 1.8 mm x 0.6 mm). On the other hand, the voluminous posterior pedal glands which are indicated in the original diagnosis should not be considered as a specific characteristic as they were not observed in any of the specimens histologically examined herein; this character has been removed from the diagnosis.

The first and only prior report on *L. minuta* was based on 18 specimens from two stations of two different localities in Galicia (NW Spain). With the present record, based on the study of 116 new specimens, the geographic distribution of the species is extended to 14 new stations of the bathyal bottoms of Galicia and its known bathymetric distribution is established between 507 and 1191 m depth.

Subfamily UNCIHERPIINAE García-Álvarez, Salvini-Plawen and Urgorri, 2001

Genus *Unciherpia* García-Álvarez, Salvini-Plawen and Urgorri, 2001

Cuticle thin, with epidermal papillae. Sclerites acicular, hook-shaped, and harpoon-shaped, arranged in one layer. Mouth opening within common atrio-buccal opening. Radula missing. Midgut with constrictions. Secondary genital opening unpaired. Without copulatory stylets. With dorsoterminal sense organ. With respiratory folds.

Unciherpia hirsuta García-Álvarez, Salvini-Plawen and Urgorri, 2001 (Fig. 2)

Material examined: 37 specimens collected from 9 stations of the DIVA-Artabria I (2002 and 2003) and DIVA-Artabria II (2008) cruises (see Table II). External anatomy and sclerites were studied in all the specimens; 21 were cut in serial cross sections at 5 μm (20 specimens) or 2 μm thick (1 specimen).

Diagnosis (amended): Bristly appearance. Body measuring up to 13.5 mm long by 1.6 mm wide. Without keels or lumps. Tips of longest epidermal sclerites of the posterior body mostly harpoon-shaped. Pedal groove with one fold that does not enter the pallial cavity, ending at the opening of the pallial cavity. Sixteen circumpharyngeal extraepithelial-follicular glands surrounding the pharynx. Anterodorsal midgut caecum rostrally paired. Secondary genital opening unpaired in the ventroanterior pouch of the pallial

cavity. It may show suprapallial glands. One dorsoterminal sense organ. With 8-10 respiratory folds.

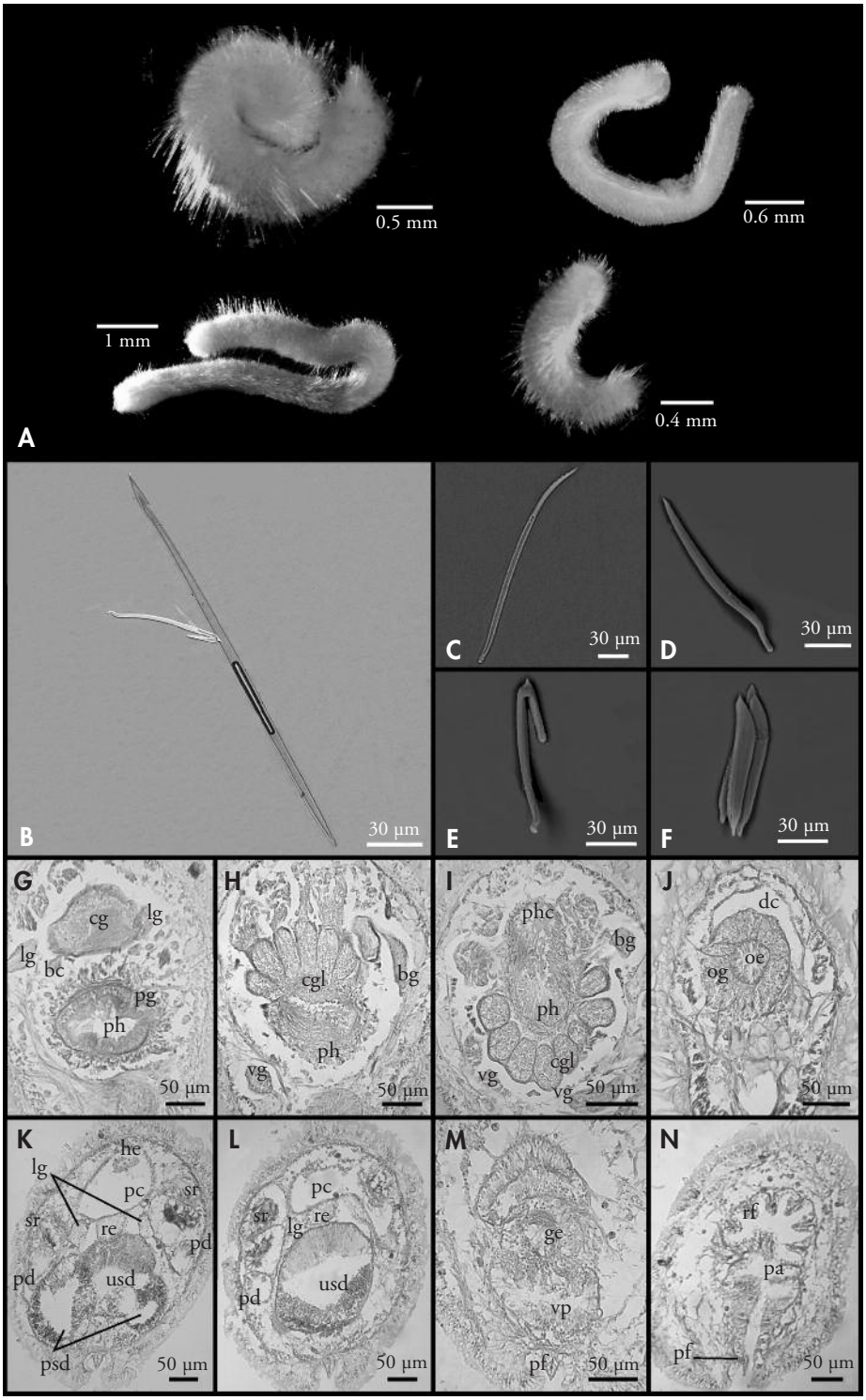
Distribution: The species was originally described from the Galicia Bank (NW Galicia; NW Spain) (42º42'22''N; 42º43'00''N - 11º47'52''W; 11º45'47''W), where it was found on the coral *Madrepora oculata* (Linnaeus, 1758) at 760-769 m depth (García-Álvarez, Salvini-Plawen and Urgorri, 2001). It is also found in 9 additional stations of the Galician coast (present report, see Table II), from 579 to 1499 m depth. Moreover, it has been recently recorded from the Alboran Sea, at 349-365 m depth (Pedrouzo, Cobo, García-Álvarez, Rueda, Gofas and Urgorri, 2014).

Description: Habitus. Both the size and the shape of the examined specimens is quite variable, but all of them show a very characteristic bristly appearance given by the spicules widely protruding from the body surface (Fig. 2A; Table II). The pedal groove is externally well-marked and the pallial cavity opens in ventral position. The specimens were white or grey-brown after fixation and preservation in 70% ethanol.

Mantle. There are epidermal papillae on the base of the cuticle. The cuticle is 30-50 μm thick with sclerites arranged

(Right page) Figure 2. *Unciherpia hirsuta* García-Álvarez, Salvini-Plawen and Urgorri, 2001. A: habitus; B-F: sclerites; B-C: photographs with Optical Microscope of some types of sclerites; B: hollow acicular sclerites with a harpoon tip and hollow hook-shaped sclerite; C: hollow acicular sclerite distally serrated; D-F: photographs with Scanning Electron Microscope of some types of sclerites; D: sigmoid hollow acicular sclerite; E: hollow hook-shaped sclerite; F: pedal-groove scale; G-N: body cross sections; G: anterior pharynx with extraepithelial pharyngeal glandular cells; H-I: middle pharynx with circumpharyngeal glands; J: detail of the oesophagus, with a thick coat of extraepithelial oesophageal glands, and the anterodorsal midgut caecum; K: dorsal fusion of the spawning ducts; L: unpaired spawning duct; M: ventroanterior pouch of the pallial cavity with the opening of the unpaired genital orifice; N: posterior region of the pallial cavity showing respiratory folds and the ending of the pedal fold at the opening of the pallial cavity. Abbreviations, bg: buccal ganglion; bc: cerebro-buccal connective; cg: cerebral ganglion; cgl: circumpharyngeal glands; dc: anterodorsal midgut caecum; ge: genital orifice; he: hearth; lg: lateral ganglion; oe: oesophagus; og: oesophageal glands; pa: pallial cavity; pc: pericardium; pd: pericardioduct; pf: pedal fold; pg: pharyngeal glands; ph: pharynx; phc: pharyngeal caecum; psd: paired spawning duct; re: rectum; rf: respiratory fold; sr: seminal receptacle; usd: unpaired spawning duct; vg: ventral ganglion; vp: ventroanterior pouch of the pallial cavity.

(Página derecha) Figura 2. Unciherpia hirsuta *García-Álvarez, Salvini-Plawen y Urgorri, 2001. A: habitus; B-F: escleritos; B-C: fotografías con Microscopio Óptico de algunos tipos de escleritos ; B: esclerito acicular hueco con punta en forma de arpón y esclerito hueco en forma de gancho; C: esclerito acicular hueco con borde distal aserrado; D-F: fotografías al Microscopio Electrónico de Barrido de algunos tipos de escleritos; D: esclerito acicular hueco sigmoideo; E: esclerito hueco en forma de gancho*; *F: escama del surco pedio; G-N: cortes transversales de diferentes regiones corporales; G: región anterior de la faringe con envuelta de glándulas faríngeas extraepiteliales; H-I: región media de la faringe con glándulas circunfaríngeas; J: detalle del esófago, con gruesa envuelta de glándulas esofágicas extraepiteliales, y del ciego anterodorsal del intestino; K: fusión dorsal de los conductos de desove; L: conducto de desove impar; M: bolsa ventroanterior de la cavidad paleal con la abertura del orificio genital impar; N: región posterior de la cavidad paleal mostrando los pliegues respiratorios y final del pliegue del surco pedio en la abertura de la cavidad paleal. Abreviaturas, bg: ganglio bucal; bc: conectivo cerebro-bucal; cg: ganglio cerebroideo; cgl: glándulas circunfaríngeas; dc: ciego anterodorsal del intestino; ge: orificio genital; he: corazón; lg: ganglio lateral; oe: esófago; og: glándulas esofágicas; pa: cavidad paleal; pc: pericardio; pd: pericardioductos; pf: pliegue del surco pedio; pg: glándulas faríngeas; ph: faringe; phc: ciego faríngeo; psd: conducto de desove par; re: recto; rf: pliegue respiratorio; sr: receptáculo seminal; usd: conducto de desove impar; vg: ganglio ventral; vp: bolsa ventroanterior de la cavidad paleal.*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in two layers. With blade-shaped scales (75-90 μm long, 12-14 μm wide) on both sides of the pedal groove and four types of hollow sclerites radially arranged or leaning towards the posterior body region: hook-shaped sclerites (110-180 μm long, 7-9 μm wide) with a pointed tooth in the hook curvature and a curved proximal end; long and straight acicular sclerites with a harpoon tip (360 to 520 μm long, 8-14 μm wide); sigmoid acicular sclerites (120-160 μm long, 5-7 μm wide); and slightly curved acicular sclerites (230-300 μm long, 8-10 μm wide) distally serrated, with a variable number of 6 to 9 small teeth, appearing only in the anterior body region (Fig. 2B-F).

Pedal pit and pedal groove. A single pedal fold originates in the ciliated pedal pit and ends at the opening of the pallial cavity (Fig. 2M-N).

Pallial cavity. Pallial cavity with a narrow ventral opening (Fig. 2N); up to 10 respiratory folds are arranged in its posterior region. The rectum opens frontodorsally into the anterior region of the pallial cavity. A short anteroventral pouch of the pallial cavity receives the narrow opening of the unpaired spawning duct, which is provided with a sphincter (Fig. 2M). The presence of suprapallial glands around the respiratory folds, filling the space between pallial cavity and body wall, has been observed in four of the specimens internally examined herein.

Sense organs and nervous system. Cerebral ganglion oval in cross section; two pairs of anterior ganglia are located close to the anterior region of the cerebral ganglion. First pair of lateral ganglia arranged laterally to the cerebral ganglion (Fig. 2G). Thick cerebro-ventral connectives leave lateroventrally from the medial region of the cerebral ganglia and run to the pedal ganglia; the cerebro-buccal connectives leave the cerebral ganglion ventrolaterally. Buccal ganglia dorsolaterally placed at the medial region of the pharynx (Fig. 2H). The foremost pedal ganglia are located laterally to the pedal pit and joined by a single commissure (Fig. 2H-I).

The terminal lateral ganglia (Fig. 2K-L) are interconnected to each other by a thin suprarectal commissure discernible above the rectum, anterior to the anus.

As sense organs, it shows atrial papillae, simple or basally bundled in pairs, in the common atriobuccal cavity and a dorsoterminal sense organ located medially above the posterior end of the pallial cavity.

Digestive system. The mouth opens into the dorsoposterior region of the common atriobuccal cavity. Anterior region of the pharynx with a thin coat of extraepithelial pharyngeal glandular cells (Fig. 2G). In the medial pharyngeal region, this glandular envelope is replaced by sixteen circumpharyngeal extraepithelial-follicular glands with a globular appearance: six dorsal, six ventral and four lateral (Fig. 2H-I). The posterior region of the pharynx makes up a dorsal caecum. Oesophagus provided with a thick and dense coat of extraepithelial oesophageal glandular cells (Fig. 2J). Pharynx and oesophagus with a folded epithelium internally covered by a cuticular layer and encircled by a layer of circular muscles; this muscular coat is distinguishable but not very strong. The oesophagus opens ventrally into a midgut provided with lateral serial constrictions and a short anterodorsal caecum that is rostrally paired and dorsally placed to the posterior half of the oesophagus. A narrow and ciliated rectum opens dorsofrontally into the pallial cavity through the anus.

Reproductive system. Hermaphrodite gonads joining the anterior region of the pericardium by a pair of gonopericardioducts. The heart is an invagination of the dorsal pericardial wall and its posterior region is bilobed. The pericardioducts leave from the posterior region of the pericardium and open laterally into the anterior region of the spawning ducts; a pair of seminal receptacles, with sperm, open distally into the pericardioducts and stretch posteriorly up to the pallial cavity (Fig. 2K-L). Spawning ducts with oval cross section and a strongly glandular colum-

Table II. Examined specimens of *Unciherpia hirsuta* García-Álvarez, Salvini-Plawen and Urgorri, 2001. *Tabla II. Ejemplares examinados de* Unciherpia hirsuta *García-Álvarez, Salvini-Plawen y Urgorri, 2001.*

Station	Coordinates	Depth (m)	Substratum	Nº. individuals	Size (mm)
DIVA-Artabria II (2008) EBS-27	42º45.900'N; 09º41.680'W 42º47.000'N; 09º42.120'W	1373-1499	muddy sand	1 juvenile	2.2 x 2.3
DIVA-Artabria I (2002) AT-1000	43º57.030'N; 08º54.795'W 43º57.248'N; 08º54.133'W	1132-1191	stones and dead corals	16 adults (9 sectioned) 3 juveniles (sectioned)	4-12 x 0.4-0.8 1.3-2 x 0.2-0.3
DIVA-Artabria I (2003) AT-1000	43º53.847'N; 08º57.324'W 43º54.621'N; 08º57.261'W	993-1004	stones and dead corals	1 adult 1 juvenile (sectioned)	6 x 0.45 2 x 0.4
DIVA-Artabria I (2002) DRN-1000	43º53.823'N; 08º56.151'W 43º52.837'N; 08º55.597'W	920-988	stones and dead corals	1 adult (sectioned)	5 x 0.5
DIVA-Artabria I (2003) DRN-1000	43º53.575'N; 08º56.868'W 43º54.015'N; 08º56.959'W	965-974	live and dead corals	4 juveniles (1 sectioned)	1.8-2 x 0.4-0.5
DIVA-Artabria I (2002) AT-800	43º47.188'N; 08º53.053'W 43º55.312'N; 08º53.101'W	770-842	nodules and stones	4 adults (sectioned)	7-9 x 0.4-0.7
DIVA-Artabria I (2003) EBS-800	43º51.873'N; 08º53.683'W 43º53.120'N; 08º53.301'W	788-802	clay and stones	1 juvenile (sectioned)	2.2 x 0.4
DIVA-Artabria I (2003) EBS-600	43º48.587'N; 08º51.402'W 43º49.545'N; 08º51.497'W	598-610	sand	2 adults 2 juveniles	4.8-6 x 0.45-0.6 2.3-2.4 x 0.3
DIVA Artabria I (2002) DRN-600	43º48.340'N; 08º51.485'W 43º48.819'N; 08º51.602'W	579-688	nodules and stones	1 adult (sectioned)	4.2 x 0.5

nar epithelium. In their posterior half, the spawning ducts fuse dorsally forming a single and voluminous duct that opens dorsally into the ventroanterior pouch of the pallial cavity through a genital orifice with sphincter (Fig. 2M).

Remarks: *Unciherpia* is a monotypic genus of the Subfamily Unciherpiinae that contains only the species *Unciherpia hirsuta* García-Álvarez, Salvini-Plawen and Urgorri, 2001 (GARCÍA-ÁLVAREZ *ET AL.*, 2001). The new studied specimens of *U. hirsuta* show a high variability in body shape and size, but their morphological variability does not match any relevant anatomical variability. They present the essential characters of the species (as the 16 circumpharyngeal glands, constant feature) and were collected in the same zoogeographical area as the type specimens, in more northeasterly stations than the type locality. However, the examined animals show a series of unknown characters not included in the original description that must be added to the diagnosis of *U. hirsuta*: it may show suprapallial glands; the number of respiratory folds varies from 8 to 10 (just 8 respiratory folds in the type material); it presents a ventroanterior pouch of the pallial cavity where the genital orifice opens; and the pedal fold ends at the opening of the pallial cavity. The presence of a ventroanterior pouch and the precise position of the end of the pedal fold, regarding the pallial cavity opening, were probably not observed in the type specimens because they were cut in thicker cross sections (10 μm). Other minor differences observed in the new specimens are: the presence of a sphincter in the genital orifice; and the opening of the pallial cavity in a ventral position instead of terminally, a character which may possibly vary according to the contraction of the body.

The present specimens represent the first findings after the original description of the species. They thus enlarge the geographical distribution of *U. hirsuta* in Galicia to 9 new stations, and extend the bathymetric limit of the species to 1499 m depth.

Family Rhopalomeniidae Salvini-Plawen, 1978
Genus *Rhopalomenia* Simroth, 1893

Mouth separated from the atrium. Without radula, but sheath may be present. With two pair of ventrolateral foregut glands: type A/*Pararrhopalia* and type C/*Epimenia*. Midgut with constrictions. Secondary genital opening unpaired. Without copulatory stylets. Without respiratory organs. With dorsoterminal sense organ.

Rhopalomenia glandulosa Eisenhut and Salvini-Plawen, 2006 (Fig. 3)

Material examined: One specimen (21 mm long) in 5 μm thick serial cross sections, collected during the DIVA-Artabria I 2002 cruise, station DIVA-Artabria I (2002) DRN-600 station (43º48.340'N; 08º51.485'W - 43º48.819'N; 08º51.602'W), on a stone bottom rich in hydrozoa and gorgonacea at a depth of 579-688 m.
Other material examined for comparison: One specimen (12.2 mm long) in 10 μm thick serial cross sections from W Cape Peñas (N Spain) identified as *Rhopalomenia aglaopheniae* (Kowalevsy and Marion, 1887) in García-Álvarez *et al.* (2000) and deposited in the private collection of the Departamento de Zooloxía e Antropoloxía Física, Universidade de Santiago de Compostela.

Diagnosis (amended): Body up to 21 mm long x 1.66 mm wide. Cuticle moderately thick without bulge or keel formations; with epidermal papillae. Pedal groove with one fold, not entering the pallial cavity. Pallial cavity with suprapallial glands. Foregut subdivided by the radula sheath (without a radula) into pharynx and a very long oesophagus; with subepithelial pharyngeal glands; two pairs of ventrolateral foregut glands (type A/*Pararrhopalia* and type C/*Epimenia*) with common outleading duct at each side into the radular sheath and a common muscular coat including radula sheath. One pair of atrial nerves with ganglionic bulges from cerebral ganglion. Pericardioducts with one pair of proximal seminal vesicles and one pair of small, distal seminal receptacles. With terminally located dorsoterminal sense organ. Cnidaria-vorous.

Distribution: The species was originally described from the Rockall Basin (NW Scotland) at 1270 m depth (Eisenhut and Salvini-Plawen, 2006). It is also found in the Atlantic Spanish bottoms: Cape Peñas (N Spain), at 122-124 m, as *Rhopalomenia glandulosa* (García-Álvarez *et al.*, 2000); NW Galicia (NW Spain), at 579-688 m depth (this paper).

Description (DIVA-Artabria I specimen): Habitus. The animal measured 21 mm in length and 1.66 mm in width, with circular body cross section, rounded body ends and retracted openings. It was coiled up on a thecate Hydrozoa (Fig. 3A). Without keels or lumps. Sclerites with tangential insertion (skeletal sclerites) forming small angles with the body surface; they are interwoven, spicules that cross each other appearing as a mesh on the body surface. Colour in life white.

Mantle. Thick cuticle, up to 100 μm wide. With epidermal papillae the distal bodies of which are arranged at different levels on the cuticle; each epidermal papilla has a narrow stalk and a rounded or cup-shaped distal body (Fig. 3I). With several types of sclerites (Fig. 3B-E) located in 6-8 layers closely interwoven: hollow acicular sclerites slightly sigmoid and with wide walls (100-200 μm long, 10-15 μm wide); hollow acicular sclerites with wide walls curved at middle portion (100-200 μm long, 12.5-15 μm wide); small hollow acicular sclerites flattened at middle portion (45-65 μm long, maximum width of 3-5 μm), which are abundant in the ventral body half; and with blade-shaped scales (60-80 μm long, 12-15 μm wide) at both sides of the pedal groove.

Pedal pit and pedal groove. Pedal pit separated from the buccal opening by a tissue area without cuticle. The cili-

Table III. Main differences between the species of the genus *Rhopalomenia* Simroth, 1893.
Tabla III. Principales diferencias entre las especies del género Rhopalomenia *Simroth, 1893.*

	R. aglaopheniae	***R. glandulosa***
Distribution	Mediterranean Sea Atlantic Ocean: Roscoff and British Isles 50-137 m	Atlantic Ocean: Rockall Basin (NW Scotland), 1270 m NW Galicia (NW Spain), 579-688 m Cape Peñas (N Spain), 122-124 m
Buccal cavity	yes	no
Ventrolateral foregut glands type C with ciliated epithelium	no	yes
Muscle coating around the radular sheath and the two common outleading ducts of the ventrolateral foregut glands	no	yes
Seminal vesicles	yes	no
Seminal receptacles	at spawning ducts	at pericardioducts

ated pedal pit gives rise to a single longitudinal pedal fold that ends in the opening of the pallial cavity.

Pallial cavity. Small pallial cavity with narrow subterminal opening; lacking any respiratory folds and encircled by suprapallial glands that fill up the space between the pallial cavity and the posterior body end. The rectum opens dorsally into the pallial cavity whereas the unpaired secondary genital orifice opens frontally.

Sense organs and nervous system. Cerebral ganglion unpaired, with an oval outline in cross section and giving rise to the connectives separately. There is a pair of anterior ganglia adjacent to the cerebral ganglion innervating the atrial sense organ. First pair of ventral ganglia arranged posteriorly to the pedal pit and connected to each other by two commissures. Thin suprarectal commissure (100 μm long) arranged dorsally to the rectum at the level of the beginning of the pericardioducts.

Atrial sense organ with slender papillae basally bundled into pairs or groups of three papillae. The single dorsoterminal sense organ is located in the posterior body end.

Digestive system. Mouth opening independently from the atrium, but lacking a developed buccal cavity. A long and narrow pharynx is internally covered by a thin cuticular layer and externally by a weak coat of circular muscles. There are extraepithelial pharyngeal glandular cells and a ventral radular sheath (without radular plates).

With two pairs of ventrolateral foregut glands (Fig. 3F-H): type A and type C according to SALVINI-PLAWEN (1978) or type-*Pararrhopalia* and type-*Epimenia* respectively according to HANDL AND TODT (2005). The glands type C, or type-*Epimenia*, are exoepithelial glands with short ducts leading to globular glands with a wide lumen lined by a strongly ciliated glandular epithelium with intraepithelial glandular cells (Fig. 3G); each organ is arranged dorsolaterally to the pharynx and stretches anteriorly from the radular sheath up to the anterior part of the pharynx. The ventrolateral foregut glands type A, or type-*Pararrhopalia,* are exoepithelial organs made up of a pair of ducts surrounded by a muscular coat and extraepithelial glandular cells opening intercellularly into the ducts (Fig. 3H); the ducts of these organs are long and narrow and placed laterally to the oesophagus. The glands type A/*Pararrhopalia* and type C/*Epimenia* of

each body side open through a non-glandular common outleading duct into the anterior region of the radular sheath. The radular sheath, together with both outleading ducts of the ventrolateral foregut glands, is encircled by a common coating of circular muscles (Fig. 3G).

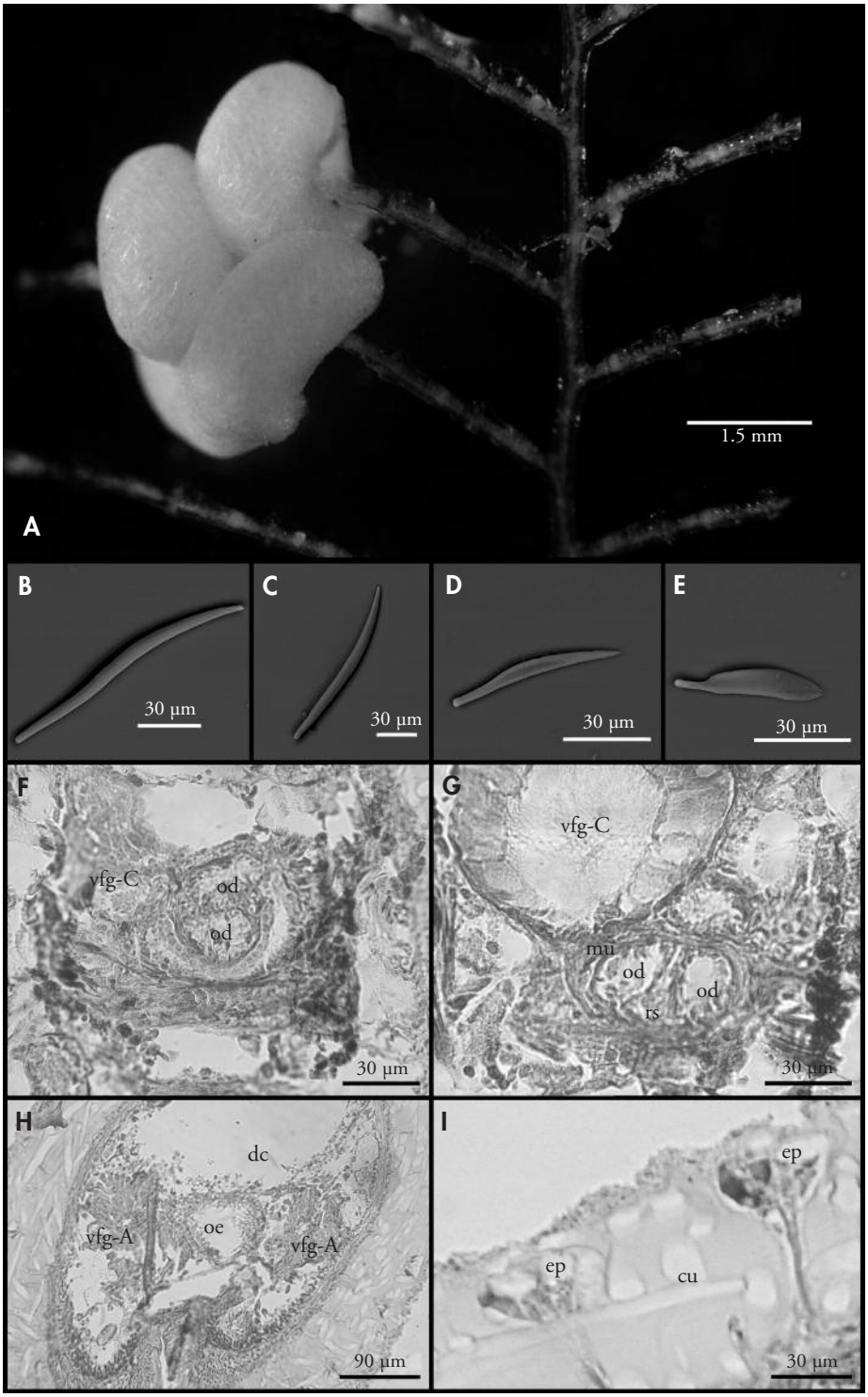
The oesophagus is long and lacks glandular cells. An anterodorsal midgut caecum, rostrally paired, extends up to the atrial region. The midgut shows serial lateral constrictions every 50-70 μm. The ciliated rectum opens dorsally into the pallial cavity.

Reproductive system. The sectioned specimen possesses a pair of hermaphrodite gonads and is sexually mature, showing spermatozoids on the lateral walls and eggs (up to 100 μm in diameter) on the medial walls. Long gonopericardioducts open frontally into pericardium. Pericardioducts are completely ciliated and leave from the posterior region of the pericardium; they run anteriorly to open dorsally into the spawning ducts. A pair of small seminal vesicles with spermatozoids opens proximally into the pericardioducts, at the curve of the pericardioducts. In addition, each pericardioduct shows a seminal receptacle at their distal end, with their body (full of sperm) located anteriorly to the spawning ducts. The spawning ducts are covered with a glandular columnar epithelium along their whole length; they fuse in their posterior region to open through a single genital orifice into the frontal wall of the pallial cavity.

Remarks: Among the Cavibelonia, the genus *Rhopalomenia* is particularly

(Right page) Figure 3. *Rhopalomenia glandulosa* Eisenhut and Salvini-Plawen, 2006. A: habitus; B-E: photographs of the sclerite types with Scanning Electron Microscopy; B: hollow acicular sclerite slightly sigmoid and with wide walls; C: hollow acicular sclerite with wide walls curved at middle portion; D: small hollow acicular sclerite flattened at middle portion; E: pedal-groove scale; F-I: details of cross sections through different regions of the body; F: common outleading ducts of the ventrolateral foregut glands of each body side; G: common outleading ducts and radular sheath surrounded by a mutual muscular coat, and detail of a ventrolateral foregut gland type C (according to SALVINI-PLAWEN, 1978) or type *Epimenia* (according to HANDL and TODT, 2005); H: detail of the oesophagus and the ventrolateral foregut glands type A (according to SALVINI-PLAWEN, 1978) or type *Pararrhopalia* (according to HANDL and TODT, 2005); I: cuticle with pedunculate epidermal papillae. Abbreviations, cu: cuticle; dc: anterodorsal midgut caecum; ep: epidermal papillae; mu: musculature; od: common outleading duct of the ventrolateral foregut glands (type A/*Pararrhopalia* and type C/*Epimenia*) of each body side; oe: oesophagus; rs: radular sheath; vfg-A: ventrolateral foregut gland type A/*Pararrhopalia*; vfg-C: ventrolateral foregut gland type C/*Epimenia*.

(Página derecha) Figura 3. Rhopalomenia glandulosa *Eisenhut y Salvini-Plawen, 2006. A: habitus; B-E: fotografías de los tipos de escleritos con Microscopio Electrónico de Barrido; B: esclerito acicular hueco ligeramente sigmoideo y de paredes anchas; C: esclerito acicular hueco de paredes anchas y curvado en la región media; D: esclerito acicular hueco pequeño, ensanchado en su región media; E: escama del surco pedio; F-I: detalle de secciones transversales de diferentes regiones corporales; F: conductos eferentes comunes de los órganos glandulares ventrolaterales de la faringe de cada lado corporal; G: conductos eferentes comunes y vaina radular rodeados por una envuelta muscular común, y detalle de un órgano glandular ventrolateral de la faringe tipo C (según SALVINI-PLAWEN, 1978) o tipo* Epimenia *(según HANDL y TODT, 2005); H: detalle del esófago y de los órganos glandulares ventrolaterales de la faringe tipo A (según SALVINI-PLAWEN, 1978) o tipo* Pararrhopalia *(según HANDL y TODT, 2005); I: cutícula con papilas epidérmicas pedunculadas. Abreviaturas, cu: cutícula; dc: ciego anterodorsal del intestino; ep: papila epidérmica; mu: musculatura; od: conducto eferente común de los órganos glandulares ventrolaterales de la faringe (tipo A/*Pararrhopalia *y tipo C/*Epimenia*) de cada lado corporal; oe: esófago; rs: vaina radular; vfg-A: órgano glandular ventrolateral de la faringe tipo A/*Pararrhopalia*; vfg-C: órgano glandular ventrolateral de la faringe tipo C/*Epimenia.


A
1.5 mm
B
30 µm
C
30 µm
D
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E
30 µm
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ep
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cu
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defined by the presence of two different types of ventrolateral foregut glands (type A/*Pararrhopalia* and type C/*Epimenia*) simultaneously (EISENHUT AND SALVINI-PLAWEN, 2006; GARCÍA-ÁLVAREZ AND SALVINI-PLAWEN, 2007). The specimen from the Galician Continental Margin shows well-defined generic characters and an almost identical organisation to *R. glandulosa*, including the particular ciliated structure of the ducts of the ventrolateral foregut glands type C/*Epimenia,* the muscular coating around the radular sheath with the outleading ducts of the ventrolateral foregut glands and the presence of both seminal vesicles and seminal receptacles at the pericardioducts (EISENHUT AND SALVINI-PLAWEN, 2006). Just as the holotype, the present specimen has a pedal fold that continues up to the pallial cavity opening.

The genus *Rhopalomenia* Simroth, 1893 includes two species (see Table III): *R. glandulosa* described originally from NW Scotland at 1270 m depth (EISENHUT AND SALVINI-PLAWEN, 2006); and *Rhopalomenia aglaopheniae* (Kowalevsky and Marion, 1887) known from several localities of the Mediterranean Sea, from Roscoff and from the British Isles (KOWALEVSKY AND MARION, 1887; PRUVOT, 1891; NIERSTRASZ AND STORK, 1940; SALVINI-PLAWEN, 1972, 1997). *Rhopalomenia aglaopheniae* was also reported from Cape Peñas (N Spain) by GARCÍA-ÁLVAREZ *ET AL*. (2000). However, a re-examination of this last material, which is kept in the Departamento de Zooloxía e Antropoloxía Física of the Universidade de Santiago de Compostela, identifies it clearly as *R. glandulosa*: it lacks a developed buccal cavity; the seminal receptacles are distal formations of the pericardioducts; the ventrolateral foregut glands type C/*Epimenia* of the revised specimen also show a ciliated epithelium; and there is a common muscular coating for the outleading ducts of the ventrolateral foregut glands and the radular sheath. In addition, unlike what was indicated by GARCÍA-ÁLVAREZ *ET AL*. (2000), it is not possible to conclude that the pedal fold does extend into the pallial cavity. Consequently, the revised specimen from Cape Peñas (N Spain) is here ascribed to *R. glandulosa.*

These new records of *R. glandulosa* from off Galicia (597-688 m) and Cape Peñas (122-124 m) significantly enlarge the known geographic range of the species, extending its distribution to the north and northwest cost of Spain and to shallower bottoms (depth of the type locality, 1270 m). It must be pointed out that both specimens have suprarectal commissures that are shorter (specimen from Galicia: 100 μm; specimen from Cape Peñas: 150 μm) than those reported on the type material (holotype, 500 μm; paratype, 400 μm); therefore, the presence of a long suprarectal commissure is here considered as an intraspecifically variable character and has been removed from the amended diagnosis of the species.

Genus *Urgorria* García-Álvarez and Salvini-Plawen, 2001

Body with a thick cuticle and hollow acicular spicules. Mouth within common atrio-buccal opening. Without radula. Ventral foregut glands type C/*Epimenia*. Midgut with constrictions. Secondary genital opening unpaired. Without copulatory stylets. Without respiratory folds. With dorsoterminal sense organ.

Urgorria compostelana García-Álvarez and Salvini-Plawen, 2001 (Figs. 4, 5)

Material examined: 11 specimens collected at 3 stations of the DIVA-ARTABRIA I (2002 and 2003) and A-SELVA cruises (see Table IV). After examination of the external anatomy and the sclerites of all specimens, 7 specimens were serial sectioned at 5 μm (6 specimens) and 2 μm (1 specimen).

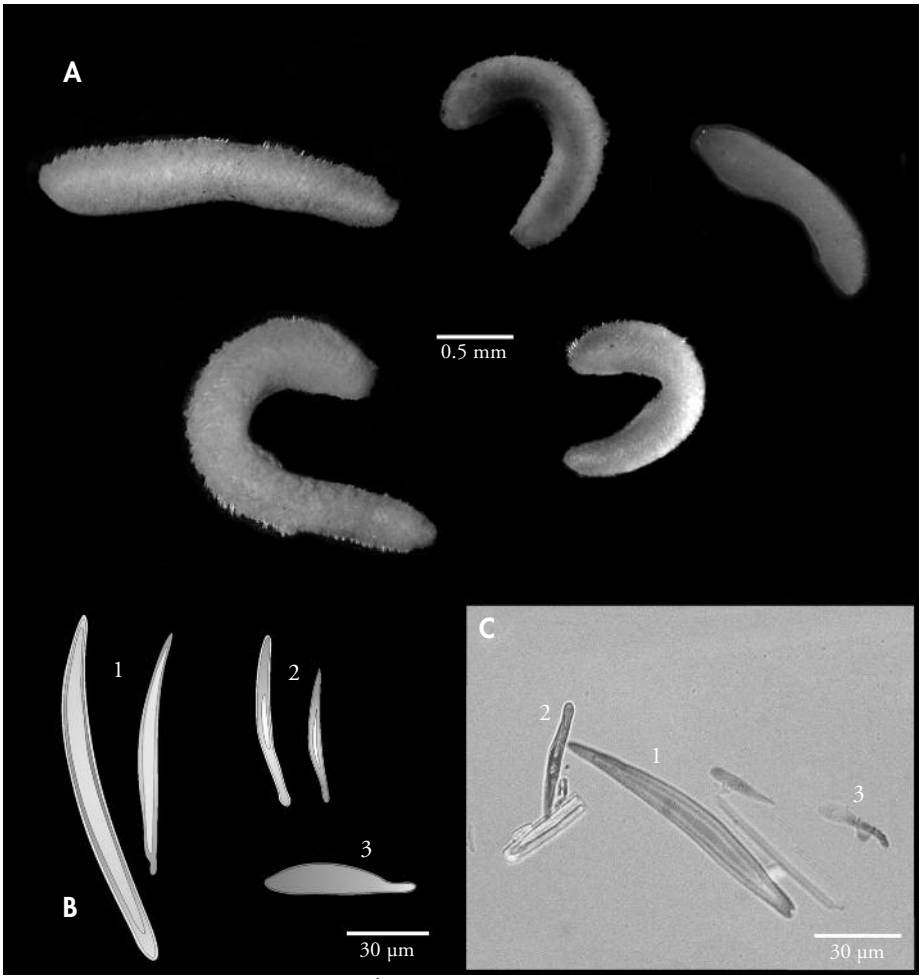

Figure 4. *Urgorria compostelana* García-Álvarez and Salvini-Plawen, 2001. A: habitus; B-C: sclerites (1: long hollow acicular sclerite medially curved; 2: small hollow acicular sclerite medially curved; 3: pedal-groove scale).

Figura 4. Urgorria compostelana *García-Álvarez y Salvini-Plawen, 2001. A: habitus; B-C: escleritos (1: esclerito acicular hueco grande y curvado en su región media; 2: esclerito acicular hueco pequeño y curvado en su región media; 3: escama del surco pedio).*

Diagnosis (amended): Body measuring up to 7.2 mm long by 0.9 mm wide. With a middorsal cuticular keel (sometimes negligible) provided with a characteristic middorsal crest of hollow acicular, radially arranged sclerites. Pedal groove with two identical folds reduced to one at the end of the body, entering the pallial cavity. No radular sack. Small ventrolateral foregut glands with intraepithelial glandular cells (type C/*Epimenia*). Without oesophagus. Midgut with a large dorsal caecum, which is paired in its anterior region. Without seminal vesicles. One pair of seminal receptacles at the anterior region of the spawning ducts. Unpaired secondary genital orifice with a weak sphincter. Dorsoterminal sense organ in a terminal position.

Table IV. Examined specimens of *Urgorria compostelana* García-Álvarez and Salvini-Plawen, 2001. *Tabla IV. Ejemplares examinados de* Urgorria compostelana *García-Álvarez y Salvini-Plawen, 2001.*

Station	Coordinates	Depth (m)	Substratum	Nº individuals	Size (mm)
DIVA-Artabria I (2002) AT-1000	43º57.030'N; 08º54.795'W 43º57.248'N; 08º54.133'W	1132-1191	stones and dead corals	5 adults (sectioned)	2.8-4.3 x 0.45-0.9
DIVA-Artabria I (2003) AT-1000	43º53.847'N; 08º57.324'W 43º54.621'N; 08º57.261'W	993-1004	stones and dead corals	5 adults (2 sectioned)	2.4-4.5 x 0.4-0.6
A Selva 2008 AT-13	44º06.496'N; 08º23.522'W 44º07.160'N; 08º23.201'W	324-337	nodules and sand	1 adult	7.2 x 0.9

Distribution: The species was originally described from the Galicia Bank (W Galicia, NW Spain) (42º42'22"N; 42º43'00"N - 11º47'52"W; 11º45'47"W) on a coral bottom of cold water *Madrepora oculata* (Linnaeus, 1758), at 760-769 m depth (García-Álvarez and Salvini-Plawen, 2001). Present contribution: three additional stations of the Galician coast, 324-1191 m depth (see Table IV). It has been recorded also from the Gulf of Cadiz at an unspecified depth (García-Álvarez and Salvini-Plawen, 2007, 2011).

Description: Habitus. Vermiform specimens with oval cross-section. Body of studied specimens measuring from 2.4 up to 7.2 mm in length and 0.45-0.9 mm in width, with slightly narrower body ends. A characteristic middorsal crest of hollow acicular sclerites that are radially arranged (Fig. 4A) protrudes from the dorsal body region; the rest of the body surface is covered with interwoven skeletal sclerites making up a mesh and slightly protruding from the cuticle. The anterior pedal pit and the midventral pedal groove are externally well-marked and the pallial cavity opens ventrally. Colour grey-brown after fixation and preservation in 70% ethanol.

Mantle. The cuticle is thick (40-65 μm) and regularly pierced by granulated epidermal papillae. The sclerites are tangentially inserted and interwoven in 3-4 layers , except for the dorsal body area, where they insert radially to make up a crest of sclerites; in some specimens, the cuticle of the dorsal body region rises and makes up a small middorsal keel (40-70 μm thick) where these sclerites are concentrated.

The most abundant sclerites are hollow acicular with thick walls, wide and rectilinear or slightly curved medially, showing two sizes, large (120-200 μm long, 10-15 μm wide) and small (50-80 μm long, 5-6 μm wide). Small hollow acicular sclerites with thin walls and wider medially (40-70 μm long, 3.5-5 μm wide) are more abundant in the ventral body region. Blade-shaped scales (35-50 μm long by a maximum width of 8-12 μm) are present beside the pedal groove (Fig. 4B-C).

Pedal pit and pedal groove. The pedal pit is located ventrally to the anterior region of the pharynx. It is a high and ciliated pit that makes up two ciliated folds that continue in the midventral pedal groove (Fig. 5A); the two folds fuse posteriorly to a single fold that extends into the pallial cavity.

Pallial cavity. Small pallial cavity with a narrow ventral opening; it lacks respiratory folds. The anus opens dorsally into the frontal wall of the pallial cavity whereas the secondary genital orifice opens medially.

Sense organs and nervous system. Cerebral ganglion above the beginning of the pharynx. At least two anterior nerves leave frontally from the cerebral ganglion to innervate the atrio-buccal cavity. The three pairs of cerebral connectives leave the cerebral ganglion separated, but adjoin each other: firstly, the cerebro-ventral connectives (5 μm diameter) leave the cerebral ganglion lateroventrally, and just behind, the

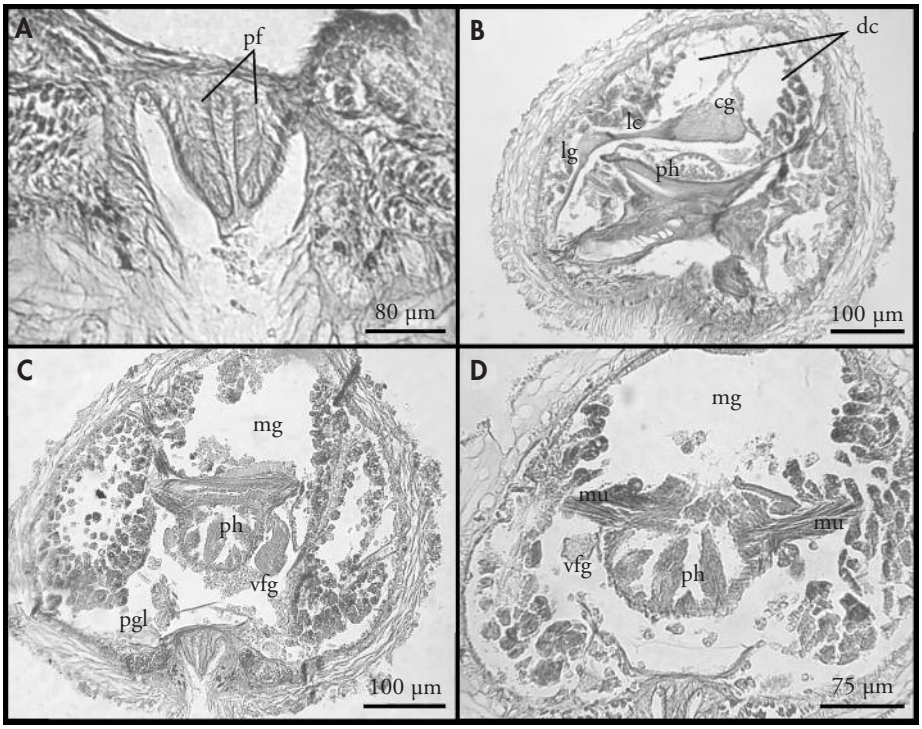

Figure 5. Cross sections through different regions of the body of *Urgorria compostelana* García-Álvarez and Salvini-Plawen, 2001. A: detail of the anterior region of the pedal groove with two ciliated folds; B: cross section through the anterior body showing the cerebral ganglion, a lateral ganglion and the rostrally paired anterodorsal midgut caecum; C-D: posterior region of the foregut. Abbreviations, cg: cerebral ganglion; dc: anterodorsal midgut caecum; lc: cerebro-lateral connective; lg: lateral ganglion; mg: midgut; mu: musculature; pf: pedal fold; pgl: pedal gland; ph: pharynx; vfg: ventrolateral foregut gland.

Figura 5. Secciones transversales de diferentes regiones corporales de Urgorria compostelana *García-Álvarez y Salvini-Plawen, 2001. A: detalle de la región anterior del surco pedio con dos pliegues ciliados; B: sección transversal correspondiente a la región anterior corporal mostrando el ganglio cerebroideo, un ganglio lateral y el ciego anterodorsal del intestino, par en su región rostral; C-D: región posterior de la faringe. Abreviaturas, cg: ganglio cerebroideo; dc: ciego anterodorsal del intestino; lc: conectivo cerebro-lateral; lg: ganglio lateral; mg: intestino; mu: musculatura; pf: pliegue del surco pedio; pgl: glándula pedia; ph: faringe; vfg: órgano glandular ventrolateral de la faringe.*

cerebro-buccal connectives (3 µm diameter) leave ventrolaterally; posteriorly, the short cerebro-lateral connectives (20 µm length, 5 µm diameter) leave the cerebral ganglion lateroventrally. First pair of lateral ganglia laterally to the cerebral ganglion; buccal ganglia placed laterally to the terminal region of the pharynx. From the first pair of lateral ganglia (35 µm de length, 25 µm high, 50 µm wide) arise a pair of connectives that runs to the first pair or ventral ganglia, these last placed dorsolaterally to the posterior region of the pedal pit (Fig. 5B) and connected to each other by a thin commissure (2 µm diameter). Last pair of lateral ganglia interconnected below the end of the pericardium by a short and slender suprarectal commissure (60 µm length, 3 µm wide).

Table V. Main differences between the species of the genus *Urgorria* García-Álvarez and Salvini-Plawen, 2001.
Tabla V. Principales diferencias entre las especies del género Urgorria *García-Álvarez y Salvini-Plawen, 2001.*

	U. compostelana	*U. monoplicata*
Distribution	Atlantic Ocean: Galicia (NW Spain), 324-1191 m Gulf of Cadiz (SW Spain)	Mediterranean Sea: Costa Brava (NE Spain), 35 m
Maximum observed body length (mm)	7.2	2.2
Middorsal crest of hollow acicular sclerites	yes	no
Pedal folds	2	1
Heart ventricle as a free tube	no	yes
Dorsoterminal sense organ	terminal	dorsal

The atrial sense organ is delimited by a horseshoe-shaped ledge of ciliated cells and bears numerous single and long papillae. A single dorsoterminal sense organ is located terminally.

Digestive system. The mouth opens dorsally in the posterior region of the common atriobuccal cavity and leads to the pharynx that is narrower in its anterior half. The pharyngeal epithelium is folded and internally covered by a thin cuticular layer and externally by a weak coat of fibres of circular musculature. Both radula and radular sheath lacking. The ventrolateral foregut glands are exoepithelial organs with narrow ducts lined by intraepithelially arranged glandular cells encircled by musculature (type C, according to SALVINI-PLAWEN, 1978; type *Epimenia* according to HANDL & TODT, 2005). The ducts of the ventrolateral foregut glands open separately into the posterolateral region of the foregut (Fig. 5C-D). In its posterior end, the foregut is attached to the body wall through a pair of dorsolateral muscle bundles (Fig. 5D).

Midgut with a long anterodorsal caecum that is rostrally paired and reaches anteriorly to the sensory region of the common atrio-buccal cavity (Fig. 5B). The midgut shows well-marked lateral constrictions, scarcely correlated to the dorso-ventral muscle bundles. The rectum opens dorsally into the front wall of the small pallial cavity.

Reproductive system. The tubular gonads stretch dorsally along the whole midgut, showing eggs with a diameter up to 40 μm. Narrow gonopericardioducts, opening dorsofrontally into the voluminous pericardium. Bicameral heart as an invagination of the dorsal wall of the pericardium. Ciliated pericardioducts leave the pericardium posteriorly to open laterally into the anterior region of the spawning ducts. A pair of seminal receptacles, made up of a globular body with spermatozoids and a narrow duct, opens dorsally into the anterior end of the spawning ducts. The spawning ducts fuse posteriorly to a single duct that opens into the middle of the front wall of the pallial cavity through a genital orifice with sphincter.

Remarks: The genus *Urgorria* includes also the Mediterranean species *Urgorria monoplicata* Salvini-Plawen, 2003, described from the Costa Brava (NE Spain) (SALVINI-PLAWEN, 2003), from which *U. compostelana* clearly differs in the presence of a middorsal crest of sclerites and by having two pedal folds instead of the single fold present in *U. monoplicata*, among other specific characters that are shown in Table V. A detailed comparison of the new specimens with the original description of *U. compostelana* revealed a clear correspondence (GARCÍA-ÁLVAREZ AND SALVINI-PLAWEN, 2001). Minor differences are the presence of a thinner

cuticle (type material, 40-100 μm thick; present specimens, 40-65 μm thick) and a middorsal cuticular keel absent or less marked than in the type material (present specimens, 40-70 μm thick or absent; type material, up to 115 μm thick), but always preserving the characteristic middorsal crest of sclerites (Fig. 4A). Also, the maximum size of the new specimens is slightly larger than in the type material. These two last characters (maximum body size and variability of the cuticular keel) have been added to the diagnosis of the species.

The present specimens were collected in the same geographical area as those studied in the original description (Galicia, NW Spain), but in localities located more north-eastwards. Our records confirm the abundance of *U. compostelana* in Galician waters and extend their known bathymetric distribution, now established in a depth range between 324 and 1191 m.

Family STROPHOMENIIDAE Salvini-Plawen, 1978
Genus *Anamenia* Nierstrasz, 1908

Epidermal papillae often pseudoepithelially arranged. Mouth within common atrio-buccal cavity. Radula present, pectinate. Midgut with constrictions. Secondary genital opening generally paired. Without copulatory stylets. With dorsoterminal sense organ (s). Without respiratory organs.

Anamenia gorgonophila (Kowalevsky, 1880) (Fig. 6)

Material examined: 1 specimen collected in the DIVA-Artabria I (2002) AT-1000 station (43º57.003'N; 08º54.795'W - 43º57.248'N; 08º54.133'W), at 1132-1191 m depth. Bottom of live and dead corals, including the following species of Octocorallia: *Acanthogorgia armata* Verrill, 1878; *Narella bellissima* (Kükenthal, 1915); and *Swiftia* sp.

Diagnosis: Body up to 65 mm long x 2.2 mm wide. Thick cuticle (up to 220 μm). Without lumps or keels. Pedal groove with a ciliated medial fold that does not get into the pallial cavity. Atrial papillae single or in groups. Long and muscular pharynx; with extraepithelial pharyngeal glandular cells and a pair of long ventral foregut glands type B / *Imeroherpia*. Pectinate radula with 2 x 8-12 denticles. Without oesophagus. With a long anterodorsal midgut caecum. Without seminal vesicles. Seminal receptacles in bundles of 6-15. Genital opening paired or unpaired. Pallial cavity with glandular diverticles and a short ventroanterior pouch. With prepallial spicules. With one or two dorsoterminal sense organs in a terminal position. On different species of Gorgonacea.

Distribution: *A. gorgonophil*a was originally described from La Calle-Algeria (KOWALEVSKY, 1880) and since them it has been recorded at several localities of the Mediterranean Sea, from the Maltese Islands to the Alboran Sea, in a bathymetrical range from 70 to 240 m depth (NIERSTRASZ AND STORK, 1940; PRUVOT, 1891; SALVINI-PLAWEN, 1986, 1972, 1997; TEMPLADO, GARCÍA-CARRASCOSA, BARATECH, CAPACCIONI, JUAN, LÓPEZ-IBOR, SILVESTRE AND MASSÓ, 1986; GARCÍA-ÁLVAREZ, URGORRI AND CRISTOBO, 1999; MIFSUD, MASTROTOTARO AND TAVIANI, 2008; PEDROUZO *ET AL*., 2014). Furthermore, it has also been reported in Atlantic European bottoms, including: the Gorringe Bank at 65-90 m (LELOUP, 1947; SALVINI-PLAWEN, 1972, 1997); the Gulf of Cadiz, at 564-945 m depth (PEDROUZO *ET AL*., 2014); Azores Islands at 845 m (LELOUP, 1947; SALVINI-PLAWEN, 1972, 1997); and Galician waters, in a bathymetrical range from 507 to 1191 m depth (GARCÍA-ÁLVAREZ *ET AL*., 1999; this paper).

Description: Habitus. Vermiform specimen coiled up, 22 mm long by 1.2 mm

wide, with rounded body ends (Fig. 6A). Lacking keels or lumps; interwoven sclerites arranged in small angles relative to the body surface. Pallial cavity with ventral opening and pedal groove well-marked externally. White colour after fixation and preservation in 70% ethanol.

Mantle. With stalked epidermal papillae with spherical bodies. The mantle produces a thick cuticle (up to 200 μm thick) and two main types of sclerites arranged in 6-7 layers closely interwoven: hollow acicular sclerites with wide walls and slightly curved medially (125-325 μm long, 15-20 μm wide) (Fig. 6B); and blade-shaped scales (50-75 μm long, 13-14 μm wide) (Fig. 6C) arranged on both sides of the pedal groove.

Pedal pit and pedal groove. Entire pedal pit with long cilia. A pair of anterior pedal glands opens dorsally in its anterior region and stretches from the anterior region of the body to the posterior region of the pedal pit. The pedal groove has a single pedal fold ending before the opening of the pallial cavity, with which it has no connection.

Pallial cavity. Opening of the pallial cavity located ventrally. The examined specimen shows prepallial spicules arranged in the cuticle of the walls of the pallial cavity opening. Posterior region of the pallial cavity with a ciliated and folded epithelium. Anterior region of pallial cavity with a short and narrow ventroanterior pouch covered with an epithelium lacking cilia, while the medial part of the anterior pallial cavity, which receives the paired genital outlet, shows small glandular diverticles; the rectum opens into the dorsal area of the anterior region of the pallial cavity (Fig. 6G).

Sense organs and nervous system. Cerebral ganglion dorsal to the atriobuccal cavity; anteriorly, the cerebral ganglion has a trapezoidal cross section and posteriorly it keeps the bilobed character. Two anterior ganglia, from which two nerves leave towards the atriobuccal cavity, are located frontally to the cerebral ganglion. Short cerebro-lateral connectives come out laterodorsally from the posterior region of the cerebral ganglion. Cerebro-buccal connectives emerging ventrolaterally, in front of the lateral ones. Buccal ganglia arranged laterally to the radular region of the pharynx and interconnected by a thin commissure. First pair of ventral ganglia located dorsally to the posterior area of the pedal pit; both ganglia are joined to each other by a single commissure. The most terminal of the lateral ganglia are situated ventrolaterally to the rectum and are interconnected by a long suprarectal commissure (250 μm long). A nerve leaves from each of these ganglia; these nerves point ventrally.

Atrial sense organ with slender papillae in bundles of up to five. Single dorsoterminal sense organ at the rear of the body.

Digestive system. Mouth opening into the dorsoposterior region of the common atriobuccal cavity. Long pharynx with a thick, folded and cuticularized epithelium and lined by circular muscles. At its medial region, the pharyngeal tube shows a thin coating of extraepithelial glandular cells. A small radular apparatus is located in the posterior region of the pharynx, consisting of a short radular sack and a small pectinate radula; the number of denticles per radula plate could not be specified. Long ventrolateral foregut glands of type B according to Salvini-Plawen (1978) or type *Imeroherpia* according to Handl and Todt (2005): exoepithelial glands with extraepithelial glandular cells and an inner and outer musculature. The ducts of the ventrolateral foregut glands open laterally into the pharynx at the beginning of the radular region (Fig. 6D).

A long anterodorsal midgut caecum extends anteriorly to the region of the posterior part of the pedal pit. Midgut with serial lateral constrictions originating from the packages of dorsoventral musculature. The ciliated rectum opens dorsally into the anterior region of the pallial cavity, before the paired opening of the spawning ducts.

Reproductive system. Long gonads containing eggs (up to 45 μm in diameter) joined to the medial walls and for-

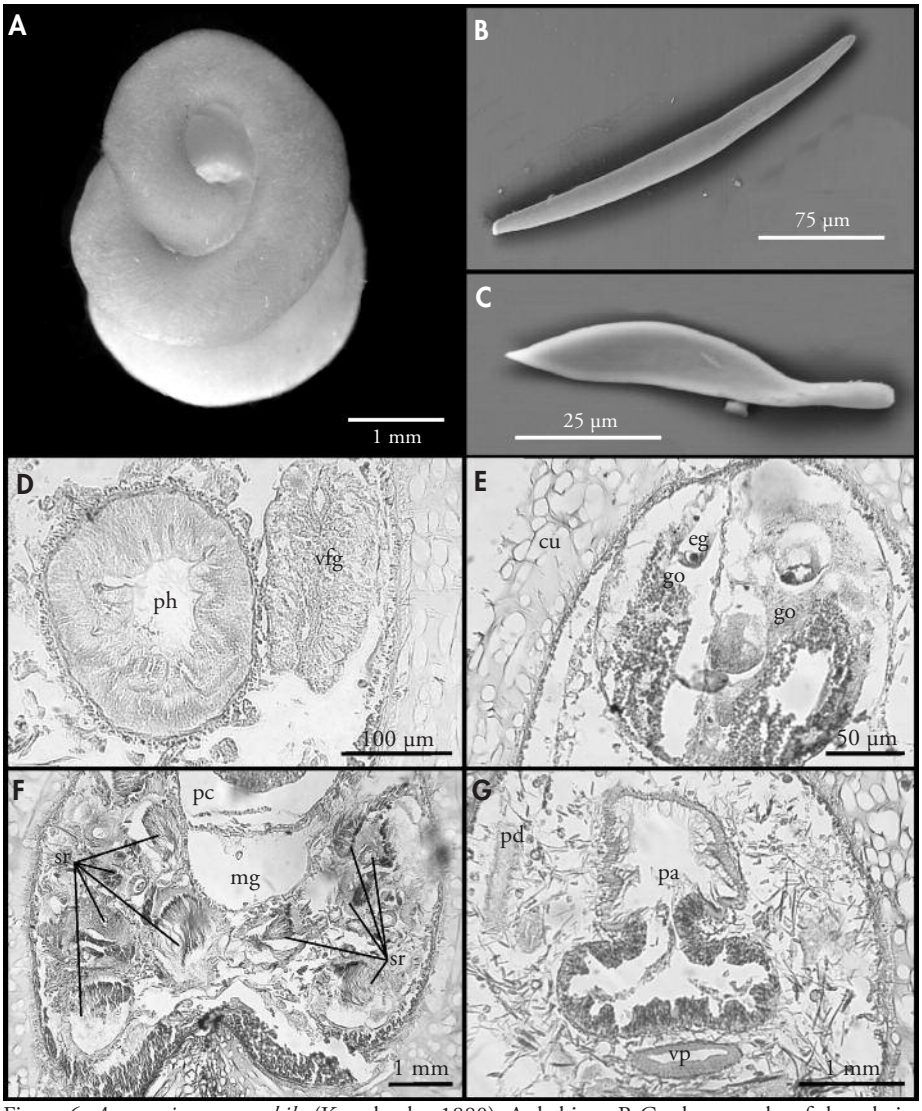

Figure 6. *Anamenia gorgonophila* (Kowalevsky, 1880). A: habitus; B-C: photographs of the sclerite types with Scanning Electron Microscopy; B: hollow acicular sclerite; C: pedal-groove scale; D-G: detail of body cross sections; D: pharynx and ventrolateral foregut gland type B (according to SALVINI-PLAWEN, 1978) or type *Imeroherpia* (according to HANDL AND TODT, 2005); E: gonads; F: bundles of seminal receptacles; G: detail of the anterior region of the pallial cavity. Abbreviations, cu: cuticle; eg: egg; go: gonad; mg: midgut; pa: pallial cavity; pc: pericardium; pd: pericardioduct; ph: pharynx; sr: seminal receptacle; vfg: ventrolateral foregut gland; vp: ventroanterior pouch of the pallial cavity. *Figura 6.* Anamenia gorgonophila *(Kowalevsky, 1880). A: habitus; B-C: fotografías al Microscopio Electrónico de Barrido de los tipos de escleritos; B: esclerito acicular hueco; C: escama del surco pedio; D-G: detalle de diferentes secciones transversales corporales; D: faringe y órgano glandular ventrolateral de la faringe de tipo B (según SALVINI-PLAWEN, 1978) o tipo* Imeroherpia *(según HANDL AND TODT, 2005); E: gónadas; F: haces de receptáculos seminales; G: detalle de la región anterior de la cavidad paleal. Abreviaturas, cu: cutícula; eg: huevos; go: gónada; mg: intestino; pa: cavidad paleal; pc: pericardio; pd: pericardioducto; ph: faringe; sr: receptáculo seminal; vfg: órgano glandular ventrolateral de la faringe; vp: bolsa ventroanterior de la cavidad paleal.*

mative masculine tissue on the lateral walls (Fig. 6E). Gonopericardioducts continuous with pericardium, which contains a large bicameral heart joined to its dorsal wall. The pericardioducts leave the pericardium laterotерminally; they are lined by a completely ciliated epithelium, lack seminal vesicles, and open laterally into the anterior region of the spawning ducts. With seven pairs of seminal receptacles arranged in two bundles, one per body side (Fig. 6F); each receptacle is made up of a globular body full of spermatozoids and a narrow duct that opens independently into the anterior end of the corresponding spawning duct. Spawning ducts with a ciliated epithelium and an oval cross section in their anterior region; posteriorly, with a highly glandular epithelium and a circular cross section.

The spawning ducts are paired throughout and open separately in the medial area of the front of the pallial cavity.

Remarks: Although the exact number of denticles of the radular plates could not be determined due to the condition of the serial sections, the morphological and anatomical characteristics identify the specimen, without any doubt, as *Anamenia gorgonophila* (Kowalevsky, 1880). It shows a thick cuticle (200 μm) without middorsal keel. The pedal groove has a single pedal fold that does not gets into the pallial cavity, although Leloup (1947) points out that this reaches the bottom of the pallial cavity. Its pallial cavity bears glandular diverticles and a short ventroanterior pouch. The muscular pharynx has extraepithelial glandular cells. The midgut has a long anterodorsal caecum. Our specimen has two bundles of seven seminal receptacles, which is within the variation range of between six and fifteen receptacles per bundle that has been indicated in the different descriptions of *A. gorgonophila* (Nierstrasz and Stork, 1940; Leloup, 1947; Salvini-Plawen, 1972; García-Álvarez *et al*., 1999; Saito and Salvini-Plawen, 2010) and related to the sexual maturity status. In the present specimen, the spawning ducts open separately. It has prepallial spicules, although these may not always be present (Nierstrasz and Stork, 1940). The animal at hand has a single dorsoterminal sense organ, although some authors point out the presence of a second organ (Nierstrasz and Stork, 1940; Salvini-Plawen, 1972).

The presence of *A. gorgonophila* in waters off Galicia had already been registered by García-Álvarez *et al.* (1999), but at a more south-western locality (fishing ground "A Quiniela") and at shallower bottoms (507 and 650 m; present contribution, 1132-1191 m). With the present record, a new northern limit of distribution of the species is established, along with a new bathymetrical limit that is increased to a depth of 1191 m.

Anamenia gorgonophila is a typical example of an epibenthic solenogastre and it has been frequently reported upon octocorals, such as different species of the genera *Acanthogorgia*, Gray, 1857, *Paramuricea* Koelliker, 1865 or *Eunicella* Verrill, 1869, amongst others (Kowalevsky, 1880; Nierstrasz and Stork, 1940; Leloup, 1947; Templado *et al*., 1986; Pruvot, 1891; Salvini-Plawen, 1972, 1997, 1986, 1997; García-Álvarez *et al*., 1999; Mifsud *et al*., 2008; Pedrouzo *et al*., 2014). Even though the present specimen was not collected attachached to a gorgonian, it is worth noting that it was found on a bottom rich in the octocorals *Acanthogorgia armata* Verrill, 1878, *Narella bellissima* (Kükenthal, 1915) and *Swiftia* sp., which could act as host species.

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