



New Acanthomeniidae (Solenogastres, Cavibelonia) from the abyssal Angola Basin *

ESTHER GIL-MANSILLA⁽¹⁾, ÓSCAR GARCÍA-ÁLVAREZ⁽²⁾ & VICTORIANO URGORRI⁽³⁾

¹Instituto de Acuicultura. Universidade de Santiago de Compostela. E-15782 Santiago de Compostela. Spain.

E-mail: esthergilmansilla@hotmail.com

²Departamento de Zooloxía e Antropoloxía Física. Facultade de Bioloxía. Universidade de Santiago de Compostela. E-15782 Santiago de Compostela. Spain

³Estación de Bioloxía Mariña da Graña. Universidade de Santiago de Compostela. A Graña. E-15590 Ferrol. Spain.

*In: Martínez Arbizu, P. & Brix, S. (Eds) (2008) Bringing Light into Deep-sea Biodiversity. *Zootaxa*, 1866, 1–574.

Abstract

Solenogastres are a small class of vermiform Mollusca that present a mantle with calcareous sclerites and a ventral pedal groove. During the expedition Me48/1 DIVA 1, carried out in the abyssal Angola Basin between 5100–5500 m depth, several specimens of Solenogastres were collected. Their study has made possible to describe two new species and a new genus of the family Acanthomeniidae Salvini-Plawen, 1978, whose anatomical features have caused the modification of the family definition.

Key words: Solenogastres, Mollusca, Acanthomeniidae, abyssal Angola Basin, systematics

Resumen

Los solenogastros son una pequeña clase de moluscos vermiformes que presenta un manto con escleritos calcáreos y un surco pedio ventral. Durante la campaña Me48/1 DIVA 1, realizada en la Cuenca Abisal de Angola entre 5100 y 5500 m de profundidad, se recolectaron varios especímenes de solenogastros. Su estudio ha permitido describir dos nuevas especies y un nuevo género de la familia Acanthomeniidae Salvini-Plawen, 1978, cuyos caracteres anatómicos han llevado a modificar la definición de la familia.

Introduction

Solenogastres are a small class of Mollusca that include about 255 species. These vermiform animals present a mantle with calcareous sclerites, a ventral pedal groove and a terminal or subterminal pallial cavity. The family Acanthomeniidae Salvini-Plawen, 1978 (Solenogastres Cavibelonia) is characterized by the fact that its species present a cuticle with hollow acicular sclerites, scale-shaped sclerites and ventrolateral foregut glandular organs type A (according to Salvini-Plawen 1978) or type *Acanthomenia* (corresponding to Handl & Todt's definition 2005). Hitherto, only two genera of this family were known: the genus *Acanthomenia* Thiele, 1913, with two species *Acanthomenia gaussiana* Thiele, 1913, from the Davis Straight (Antarctica) at 3398 m depth and *Acanthomenia arcuata* Scheltema, 1999, from the western European Basin at 2081–4381 m depth; and the genus *Amboherpia* Handl & Salvini-Plawen, 2002, with one species, *Amboherpia heterotecta*, Handl & Salvini-Plawen, 2002, collected at Scandinavian fjords at 250–610 m depth. During the expedition Me48/1 DIVA 1 on board the Meteor in August 2000, some solenogastres belonging to two new species and a new genus of the family Acanthomeniidae (*Amboherpia dolichopharyngeata* n. sp. and *Veromenia singula* n. gen. n. sp.) were collected in the abyssal Angola Basin at 5300–5500 m depth.

Material and methods

Nineteen specimens were studied. These come from 4 of the 12 stations sampled in the abyssal Angola Basin during the expedition Me48/1 DIVA 1, between 5387 and 5415 m depth: (station 340, 3 specimens; station 344, 5 specimens; station 348, 10 specimens; station 350, 1 specimen).

The sediment where the specimens were collected, showed a white to light beige colour. It presented a high percentage of mud (between 95–99%) and contained high amount of globularian foraminiferans. The temperature measured on the bottom was 2.48° C and the salinity was 34.8 (Kröncke & Türkay 2003).

Solenogastres were collected by an epibenthic sledge. Samples were fixed and preserved in 70% ethanol. Specimens were separated from the sediment under stereoscopic microscope. They were then measured and photographed, their external anatomy was described and their sclerites were studied taking out small pieces of the mantle to make preparations which were observed under the optical microscope and scanning electron microscope (SEM). The anterior and posterior regions of eight specimens of *Amboherpia dolicopharyngeata* n. sp. and two of *Veromenia singula* n. sp. n. gen. were put into paraffin to get 5 µm thick serial transverse sections. These were stained with Mallory's trichromic or Heidenhein's azan stain and the reconstruction of their internal anatomy was done.

Systematics

Acanthomeniidae Salvini-Plawen, 1978

Thin cuticle. With hollow acicular sclerites and scale-shaped sclerites. Monoserial or absent radula. With ventrolateral foregut glandular organs type A or type *Acanthomenia*.

Amboherpia Handl & Salvini-Plawen, 2002

Mouth opening within common atrio-buccal opening. Monoserial radula with one pair of denticles per tooth. Tubular ventrolateral foregut glandular organs with bundles of glandular cells that come out at the end of each duct (type A according to Salvini-Plawen 1978 or type *Acanthomenia* according to Handl & Todt 2005) Midgut without constrictions. Secondary genital opening unpaired. Without copulatory stylets. Without respiratory folds. With a dorsoterminal sense organ.

Type species: *Amboherpia heterotecta* Handl & Salvini-Plawen, 2002

Amboherpia dolicopharyngeata new species

Body to 2.6–4.5 mm x 0.4–0.8 mm, posterior region 0.1 mm thinner. Thin cuticle (8 µm), without epidermal papillae, with different types of sclerites in one layer: straight and curved acicular hollow sclerites; rimmed and unrimmed solid scales; blade-shaped scales on both sides of the pedal groove. Common atrio-buccal cavity. Pedal groove with a small fold that does not reach the pallial cavity. Monoserial radula with two dorsolateral hollow denticles. Ventrolateral foregut glandular organs type A (according to Salvini-Plawen 1978) or type *Acanthomenia* (according to Handl & Todt 2005). Midgut without constrictions. With a pair of seminal vesicles. Single opening of the spawning duct. Without respiratory folds. Without copulatory stylets. With a dorsoterminal sense organ.

Types: Holotype and paratypes 1–6 (cut in serial sections) and paratypes 7–12 and 15 are deposited in the Zoologische Staatssammlung München (ZSM Mol 20070743). Paratypes 13 and 14 were used to get the radula, therefore the specimens were destroyed.

Type locality: Abyssal Angola Basin (SW Africa) (station 350 – Me48/1 DIVA 1; 16°14'18" S 05°26'48" E – 16°14'54" S 05° 26'42" E; 5389 m depth).

Other localities: Abyssal Angola Basin (SW Africa): Paratypes 1, 2 and 15 (station 340 – Me48/1 DIVA 1; 18°18'18" S 04° 41'18" E – 18°19'24" S 04°41'54" E; 5395 m depth); Paratypes 3–5 (station 344 – Me48/1 DIVA 1; 17° 06'12" S 04°41'42" E – 17°07'30" S 04°42'18" E; 5415 m depth); Paratypes 6–14 (station 348 – Me48/1 DIVA 1; 16°18'6" S 05° 27'12" E – 16°19'18" S 05°27'12" E; 5390 m depth).

Etymology: Greek: *dolico*, long; Greek: *pharynx*, throat; latin: *-atus*, provided with; with reference to its long pharynx.

Description:

Habitus: 2.6–4.5 mm long and 0.3–0.8 mm thick specimens, posterior region 0.1 mm thinner. Round body in cross section, no lumps or keels. Sclerites present oblique insertion into the cuticle and protrude from it. Marked pedal groove. Specimens, observed after fixation and preserved in 70° ethanol, are white (figure 1A).

Mantle: Thin cuticle (8 µm) without epidermal papillae. Different types of sclerites in one layer (figure 1B): curved hollow acicular sclerites with elliptical section (60–220 µm x 4–5 µm); rectilinear hollow acicular sclerites (50–140 µm x 4–5 µm), in which the hollow represents a 28–45 % of the its length; unrimmed solid scale-shaped sclerites, with pointed distal end and wider proximal end (maximal width 75–95 µm x 12–15 µm); rimmed solid scale-shaped sclerites with a sharp distal end and a round and wider proximal end (maximal width 75–95 µm x 8–10 µm); blade-shaped sclerites (60 µm x 15 µm) present on both sides of the pedal groove.

Pedal groove and pallial cavity: The pedal groove originates in a pedal pit (85 µm x 50 µm x 30 µm) with numerous long cilia and a large opening to the outside (figure 1C, 1D). The pedal groove has a small ciliated fold that does not get into the pallial cavity. It ends before a pouch (figure 1E, 3D) that contains prepallial spicules (there are at least 10). The anterior region of this pouch is unpaired, with musculature and glands. Its posterior region presents two lobes. The pallial cavity has a small size, lacks respiratory folds and opens in the ventral side (figure 1E). Its epithelium is ciliate and presents glandular cells. The anus opens into the dorsoanterior region of the pallial cavity, whereas the spawning duct opens in the anteroventral side of this cavity (figure 1E).

Digestive system: The narrow mouth opens into the dorsoposterior region of the common atrio-buccal cavity. It continues by a long and protruding pharynx, provided with glandular epithelium. The pharynx presents two regions: one anterior narrow region (150 µm x 45 µm) and one posterior region, longer and wider (400 µm x 85 µm) (figure 1C). The radular apparatus consists of a monoserial radula with 6–7 tooth rows, a radular support of very large and vacuolized cells and a short radular sheath, in which 1 or 2 teeth can be observed. Without a differentiated radular sac. Each tooth is 23 µm high and presents a rectangular base (15 µm wide, 11 µm high) without lateral protuberances and two dorsolateral denticles, whose distal ends are separated 20 µm. The denticles are hollow internally and their transversal section is circular. The hollow of each denticle originates from the tooth base, where it opens to the outside and continues along the denticle interior to its distal end (figure 2D). The ventrolateral foregut glandular organs consist of two large ducts encircled by musculature and open into the pharynx at the radula level. At the posterior region of each duct there are bundles of glandular cells that pour their secretions into the ducts (figure 1C, 2A, 2B). They are subepithelial (type A according to Salvini-Plawen 1978) or exoepithelial glandular organs with extraepithelial glandular cells (type *Acanthomenia* according to Handl & Todt 2005). The pharynx continues with a short oesophagus with glandular unicellular cells; this oesophagus begins in the dorsoposterior region of the pharynx, continues to the anterior region and opens into the midgut (figure 1C). The midgut presents a dorsoanterior caecum situated above the posterior region of the pharynx. The epithelium of the midgut is thin, without folds or constrictions. Some nematocysts may be observed inside the midgut. The posterior region of the midgut becomes a narrow ciliated rectum. The anus is situated in the dorsoanterior region of the pallial cavity (figure 1E).

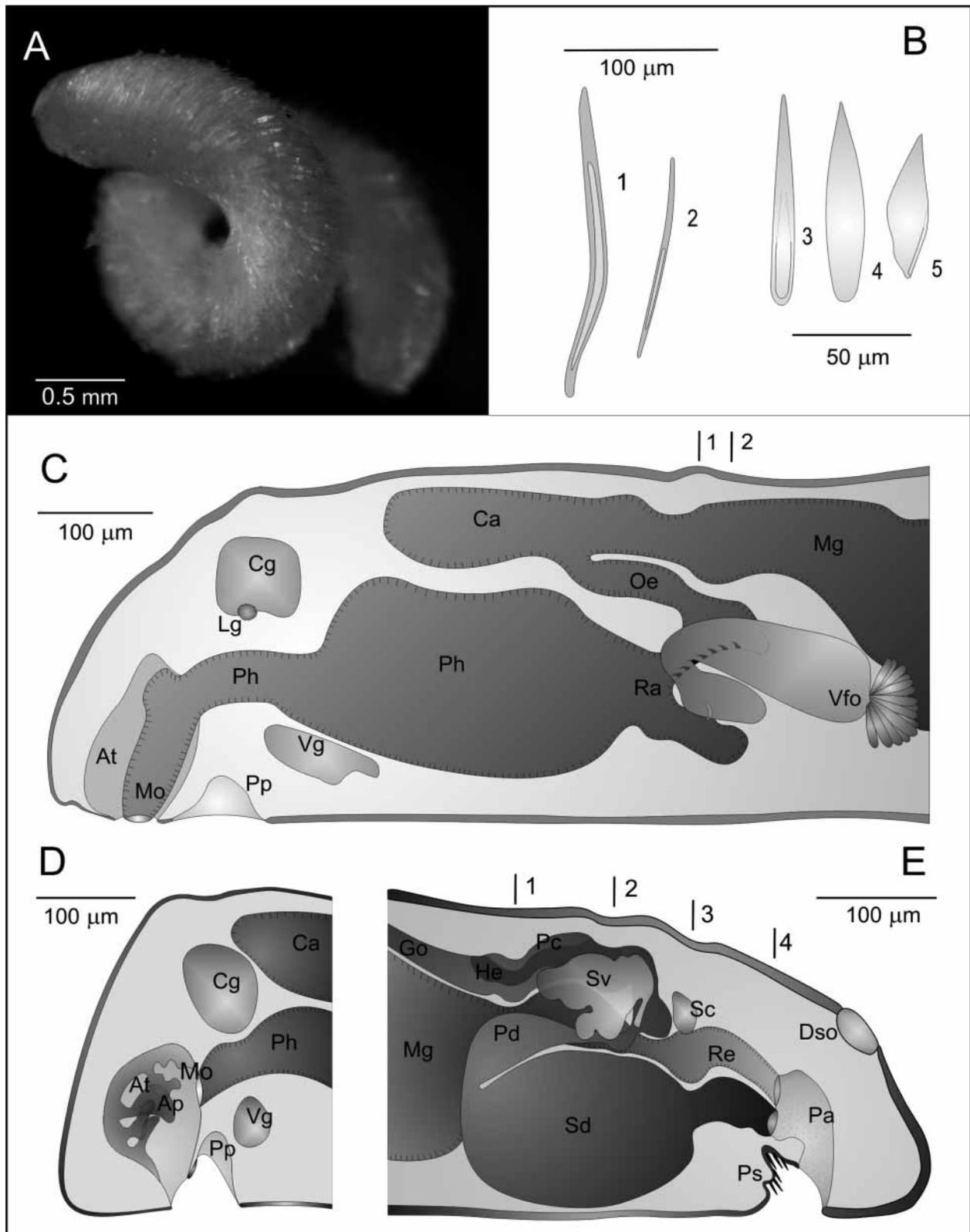


FIGURE 1. *Amboherpia dolichopharyngeata* n. sp. **A.** Habitus. **B.** Sclerites (1. Curved hollow acicular sclerite. 2. Rectilinear hollow acicular sclerite. 3. Rimmed solid scale-shaped sclerite. 4. Unrimmed solid scale-shaped sclerite. 5. Blade scale-shaped sclerite). **C–E.** Anatomical reconstructions from histologic sections of the anterior (C, D) and posterior region (E). Lines 1 and 2 in C indicate the position of the transversal sections in figure 2A, C. Lines 1–4 in E indicate the position of the transversal sections in figure 3(A–D). (Ap) atrial papillae, (At) atrium, (Ca) dorsal caecum, (Cg) cerebral ganglion, (Dso) dorsoterminal sense organ, (Go) gonad, (Lg) lateral ganglion, (He) heart, (Mg) midgut, (Mo) mouth, (Oe) oesophagus, (Pa) pallial cavity, (Pc) pericardium, (Pd) pericardioduct, (Ph) pharynx, (Pp) pedal pit, (Ps) prepallial spicules, (Ra) radula, (Re) rectum, (Sc) supra-rectal commissure, (Sd) spawning duct, (Sv) seminal vesicle, (Vg) ventral ganglion, (Vfo) ventrolateral foregut glandular organs.

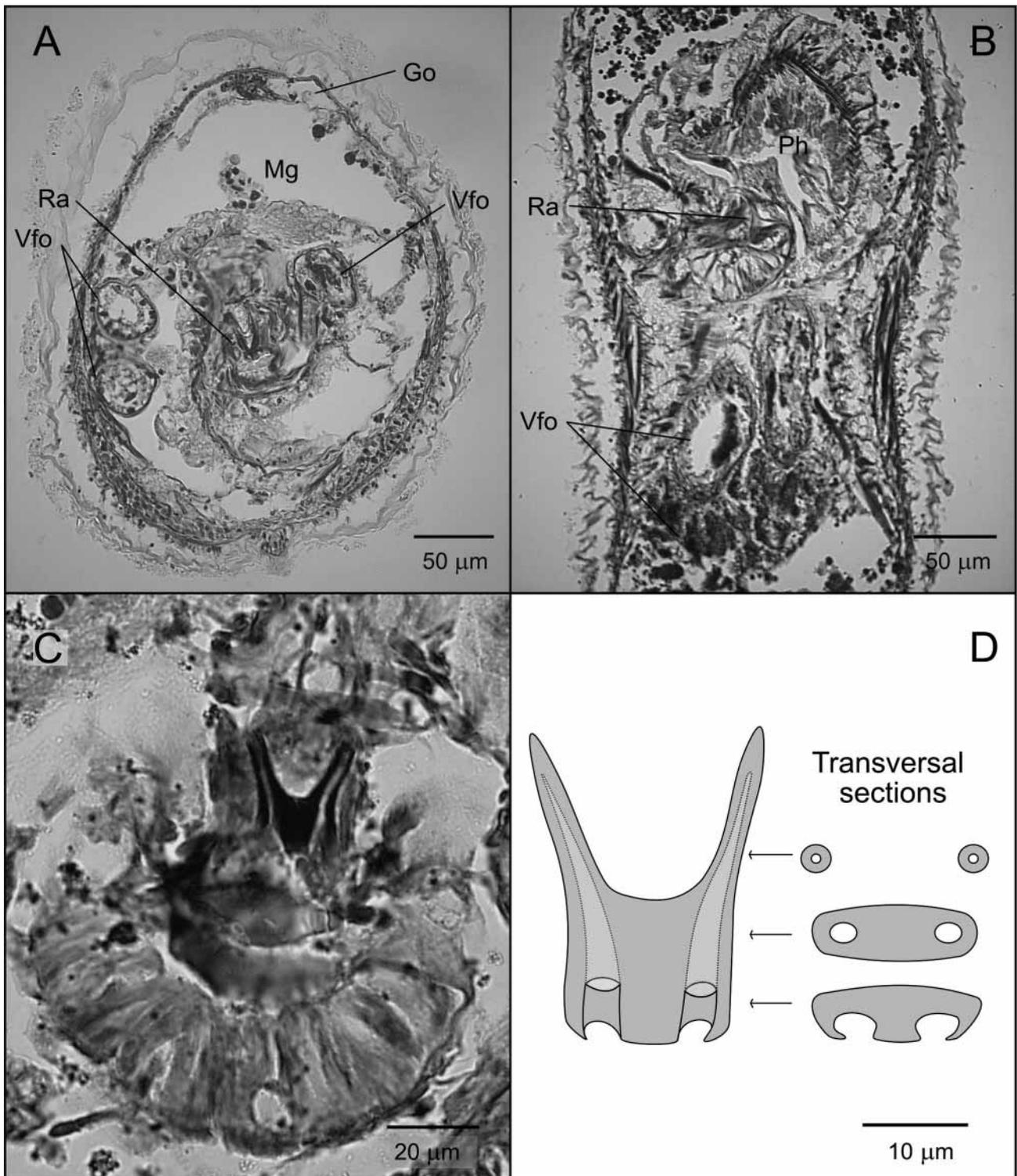


FIGURE 2. *Amboherpia dolichopharyngeata* n. sp. **A** and **C.** Sections through the ventrolateral foregut glandular organs and radula corresponding to lines 1 and 2 in figure 1C. **B.** Sections through the ventrolateral foregut glandular organs and radula. **D.** Drawing of a radular tooth. (Go) gonads, (Mg) midgut, (Ra) radula, (Vfg) ventrolateral foregut glandular organs.

Nervous system and sense organs: The cerebral ganglion (80 µm x 100 µm x 60 µm) presents a trapezoidal transverse section and is situated above the anterior region of the pharynx. On each side of this ganglion, there are two small lateral ganglia. Each ventral ganglion (90 µm x 100 µm x 40 µm) is situated above the dorsal region of the pedal pit and they join by a commissure. A very developed supra-rectal commissure can be observed above the rectum. The atrial sense organ is ciliated in its back part and presents 7–10 simple papil-

lae. There is a dorsoterminal sense organ in the dorsoposterior region of the body, above the pallial cavity (figure 1C, 1D, 1E).

Circulatory system: The pericardium (200 μm x 60 μm x 40 μm) contains a tubular heart in its interior, free in most of its length, which joins in its front and back ends to the dorsal wall of the pericardium. Blood cells (8-12 μm diameter) are round and nucleated.

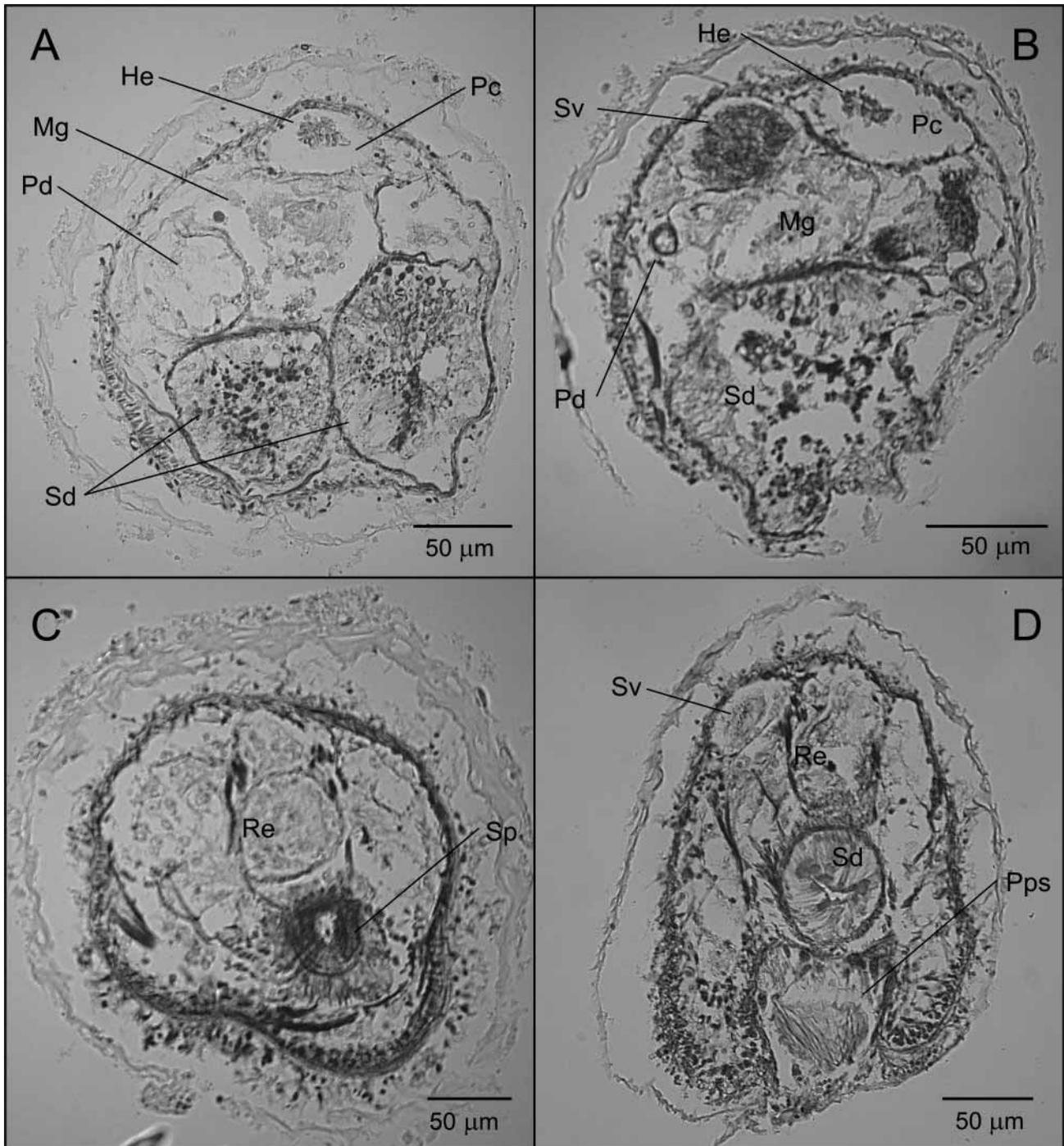


FIGURE 3. *Amboherpia dolichopharyngeata* n. sp. **A–D.** Sections through the reproductive system corresponding to lines 1–4 in figure 1E. (He) heart, (Mg) midgut, (Pc) pericardium, (Pd) pericardiodyct, (Pps) pouch of the prepallial spicules, (Re) rectum, (Sd) spawning duct, (Sp) sphincter, (Sv) seminal vesicle.

Reproductive system: Gonads are long, tubular and are placed above the dorsal region of the midgut. The spermatogonia can be observed in the anterior region of the gonads. Some ova (30–45 μm diameter) can

be observed in the middle area of the gonad, the posterior region is full of large spermatozooids (8.5 µm long) with a thick flagellum. The gonads continue along a pair of short gonopericardioducts, whose end part is fused and full with spermatozooids. They open into the anterior region of the pericardium, which contains spermatozooids inside. The posterior region of the pericardium narrows and continues in a wide bag, from which each pericardioduct starts. Two large seminal vesicles, which are full of spermatozooids (figure 1E, 3B), come out into the proximal region of each pericardioduct. The anterior region of the the pericardioducts are narrow, but they widen in their posterior region, before they open into the spawning duct. The spawning duct epithelium presents many secretory cells with different contents. The anterior region of the spawning duct is paired in 1/5 of its total length (figure 3A); its end region (1/4 of the posterior region of the duct) is separated from the rest of the duct by a very developed muscular sphincter (figure 3C) and has no secretory cells. The spawning duct narrows and finishes through a unpaired opening into the anteroventral region of the pallial cavity. It presents no copulatory stylets.

Discussion:

Amboherpia dolichopharyngeata n. sp. is included in the order Cavibelonia Salvini-Plawen, 1978 because it presents hollow acicular sclerites and is classified in the family Acanthomeniidae Salvini-Plawen, 1978, as it has a thin cuticle, a monoserial radula and a pair of ventrolateral foregut glandular organs type A (according to Salvini-Plawen 1978) or type *Acanthomenia* (according to Handl & Todt 2005). The new species is classified within the genus *Amboherpia* due to the presence of a common atrio-buccal cavity, a monoserial radula with a pair of denticles and the lack of respiratory folds (Handl & Salvini-Plawen, 2002). So far, the genus *Amboherpia* has been represented by one species, *Amboherpia heterotecta* (Handl & Salvini-Plawen 2002). There are several significant differences between *Amboherpia dolichopharyngeata* n. sp. and *Amboherpia heterotecta* (table 1). The hollow acicular sclerites of *Amboherpia dolichopharyngeata* n. sp. are more curved, and it presents unrimmed solid scale-shaped sclerites. The pharynx is narrow in its anterior region, wide in its posterior region and twice as long as the pharynx of *Amboherpia heterotecta* (Handl & Salvini-Plawen 2002). It has no preradular muscular sphincter, but presents an oesophagus. The radular teeth in *Amboherpia dolichopharyngeata* n. sp. lack lateral protuberance on the base and the denticle hollows are not U-shaped. The ventrolateral foregut glandular organs of *Amboherpia dolichopharyngeata* n. sp. have a glandular association situated at the posterior region of each duct and each of them opens laterally into the pharynx at the level of the anterior region of the radula, whereas in *Amboherpia heterotecta* they present several glandular associations and the ducts open into the ventral region of the pharynx, in the preradular region, just before the beginning of the radula. The paired part of the spawning duct in *Amboherpia dolichopharyngeata* n. sp. is just 1/5 of its length, while it represents 1/3 in *Amboherpia heterotecta*. Finally, the posterior region of the spawning duct in *Amboherpia dolichopharyngeata* n. sp. has a muscular sphincter that *Amboherpia heterotecta* does not present.

TABLE 1. Main differences between the species of the genus *Amboherpia*.

	Unrimmed solid scales	Preradular sphincter	Radular tooth with lateral protuberance on the base	Radular teeth with U-shaped hollow	Oesophagus	Spawning duct with sphincter
<i>A. heterotecta</i>	No	Yes	Yes	Yes	No	No
<i>A. dolichopharyngeata</i> n. sp.	Yes	No	No	No	Yes	Yes

***Veromenia* new genus**

Thin cuticle, without epidermal papillae. Hollow acicular sclerites and scale-shaped sclerites in one layer. Common atrio-buccal cavity. Without radula. Tubular ventrolateral foregut glandular organs with bundles of glandular cells that come out at the end of each duct (type A according to Salvini-Plawen 1978, or type *Acanthomenia* according to Handl & Todt 2005). Unpaired secondary genital opening. Without copulatory stylets. Without respiratory folds. With a dorsoterminal sense organ.

Type species: *Veromenia singula* n. sp.

Etymology: The genus is dedicated to Vernica Alonso Ferreira ('Vero'), because of her bond of friendship with the first author.

***Veromenia singula* new species**

Body to 2.3–3.5 mm x 0.75 mm in its anterior region and 0.4–0.55 mm in its posterior region. Thin cuticle, without epidermal papillae. Several types of sclerites in one layer, with oblique insertion, protruding from the cuticle: hollow acicular sclerites; scale-shaped sclerites with folded side rims; solid rimmed scale-shaped sclerites; blade-shaped sclerites of scale type, only in the ventral part of the specimen. Common atrio-buccal cavity. Pedal groove without fold. Without radula. Ventrolateral foregut glandular organs type A (according to Salvini-Plawen 1978) or *Acanthomenia* (according to Handl & Todt 2005). Midgut without constrictions. With a pair of seminal receptacles. Unpaired secondary genital opening. Without respiratory folds. Without copulatory stylets. With a dorsoterminal sense organ.

Types: Holotype and paratype 1 and 2 (cut in serial sections) are deposited in the Zoologische Staatssammlung München (ZSM Mol 20070750).

Type locality: Abyssal Angola Basin (SW Africa) (station 344 – Me48/1 DIVA 1; 17° 06'12" S 04°41'42" E – 17°07'30" S 04°42'18" E; 5415 m depth).

Other localities: Abyssal Angola Basin (SW Africa): Paratype 1 (station 348 – Me48/1 DIVA 1; 16°18'6" S 05° 27'12" E – 16°19'18" S 05°27'12" E 5390 m depth); Paratype 2 (station 340 – Me48/1 DIVA 1; 18°18'18" S 04° 41'18" E – 18°19'24" S 04°41'54" E; 5395 m depth).

Etymology: Latin: *singulus*, simple, what makes reference to the simplicity of its internal anatomy.

Description:

Habitus: 2.3–3.5 mm long specimens, 0.75 mm thick in their anterior region and 0.4–0.55 mm in their posterior region. Elongated body with a circular transverse section, without lumps or keels. Marked pedal groove. White specimens after fixation and preserved in 70° ethanol (figure 4A).

Mantle: Thin cuticle (8 µm), without epidermal papillae, with several types of sclerites in one layer, with oblique insertion and protruding from the cuticle (figure 4B, 4C, 4D): curved hollow acicular sclerites, with pointed ends (320 µm x 7–8 µm) (the hollow represents 81–89% of their length); scale-shaped sclerites with pointed distal and blunt proximal ends, with folded lateral rims forming a groove (maximal width 160 µm x 25 µm); rimmed solid scale-shaped sclerites, with pointed distal and blunt proximal ends (maximal width 70 µm x 15 µm); blade-shaped sclerites of scale-type (maximal width 80–85 µm x 25 µm) only in the ventral part of the specimen.

Pedal groove and pallial cavity: Pedal pit (90 µm x 70 µm x 85 µm) with long cilia on all its surface; two large pedal glands that open into its anterior region and stretch from the anterior part of the body to the posterior part of the pedal pit (figure 5A). The pedal groove presents no folds. The pallial cavity is small, its opening is posteroventral and has a high and ciliate epithelium. The anus opens into its dorsoanterior region, whereas the spawning duct opens into the ventroanterior region (figure 4F). It lacks any respiratory folds.

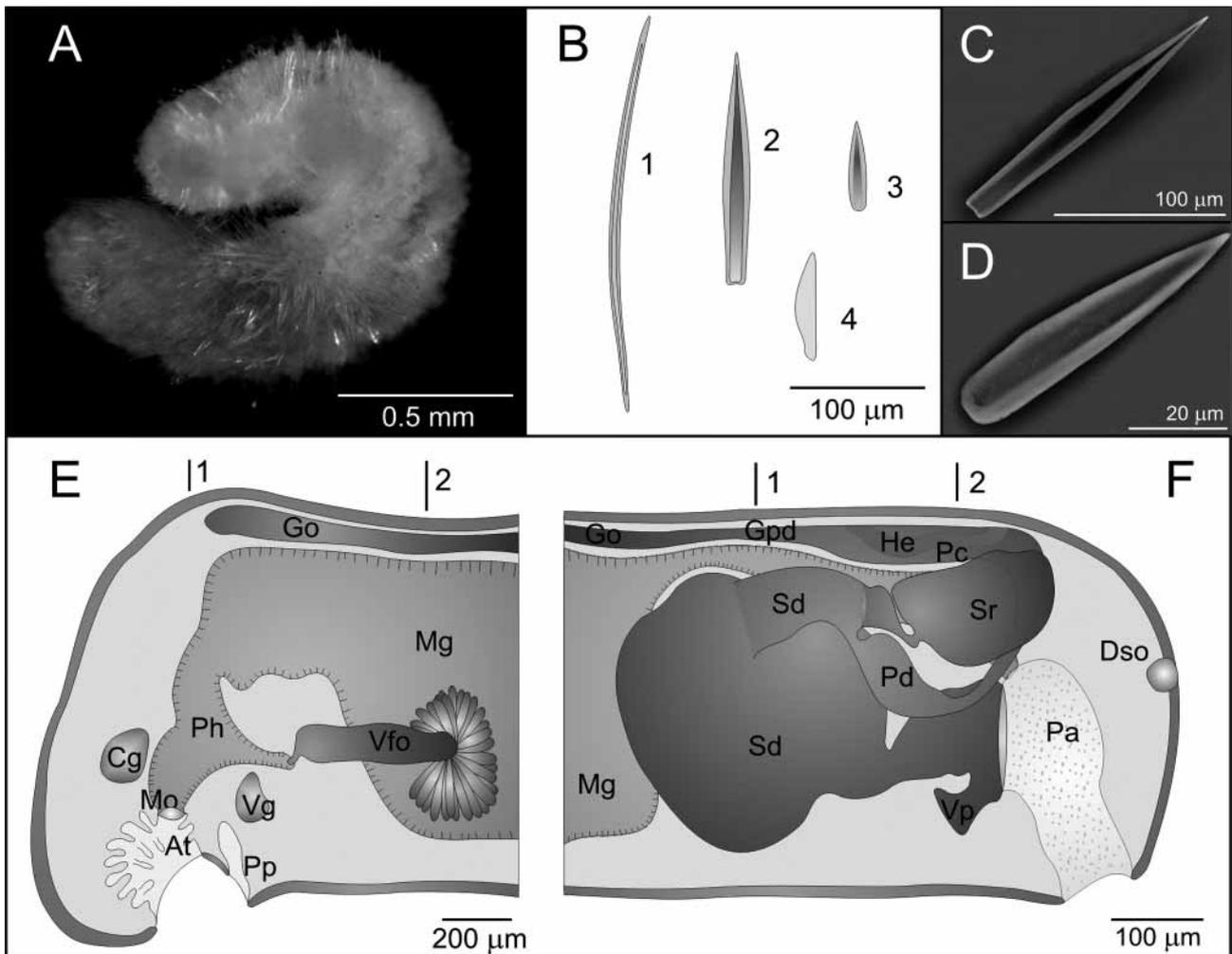


FIGURE 4. *Veromenia singula* n. sp. n. gen. **A.** Habitus. **B.** Sclerites (1. Curved hollow acicular sclerite. 2. Scale-shaped sclerite with folded lateral edges that form a groove. 3. Rimmed solid scale-shaped sclerite. 4. Blade scale-shaped sclerites). **C.** Photograph of a scale-shaped sclerite with folded lateral edges. **D.** Photograph of a rimmed solid scale-shaped sclerite. **E–F.** Anatomical reconstructions from histologic sections of the anterior (E) and posterior region (F). Lines 1 and 2 in E indicate the position of the transversal sections in figure 5A, B. Lines 1 and 2 in F indicate the position of the transversal sections in figure 5C, D. (At) atrium, (Cg) cerebral ganglion, (Dso) dorsoterminal sense organ, (Go) gonad, (Gpd) gonopericardioduct, (He) heart, (Mg) midgut, (Mo) mouth, (Pa) pallial cavity, (Pc) pericardium, (Pd) pericardioduct, (Ph) pharynx, (Pp) pedal pit, (Sd) spawning duct, (Sr) seminal receptacle, (Vfo) ventrolateral foregut glandular organs, (Vg) ventral glangion, (Vp) ventral pouch.

Digestive system: The mouth opens into the dorsal region of the common atrio-buccal cavity. It continues with a narrow pharynx, in which medioventral part the radular sac opens. There is no radula. The ventrolateral foregut glandular organs consist of a pair of 160 µm long tubes encircled by musculature, into whose terminal region a mass of glandular cells comes out (type A according to Salvini-Plawen 1978, or type *Acanthomenia* according to Handl & Todt 2005). These organs come out through a duct into the terminal region of the radular sac (figure 4E, 5A, 5B). The pharynx continues in the midgut, it lacks oesophagus. The midgut lacks constriction and takes up most of the corporal space. The rectum is narrow and ciliate (figure 5D). The anus opens in the dorsoanterior region of the pallial cavity.

Nervous system and sense organs: The cerebral ganglion (350 µm x 250 µm x 70 µm) is situated above the atrial region. It is oval and bilobar in its ventroanterior region. The ventral ganglia (70 µm x 80 µm x 60 µm) are situated on both sides of the pedal pit. The atrial sense organ or atrium (125 µm x 200 µm x 180 µm) is completely ciliated and has numerous simple papillae (figure 4E, 5A). A dorsoterminal sense organ is present.

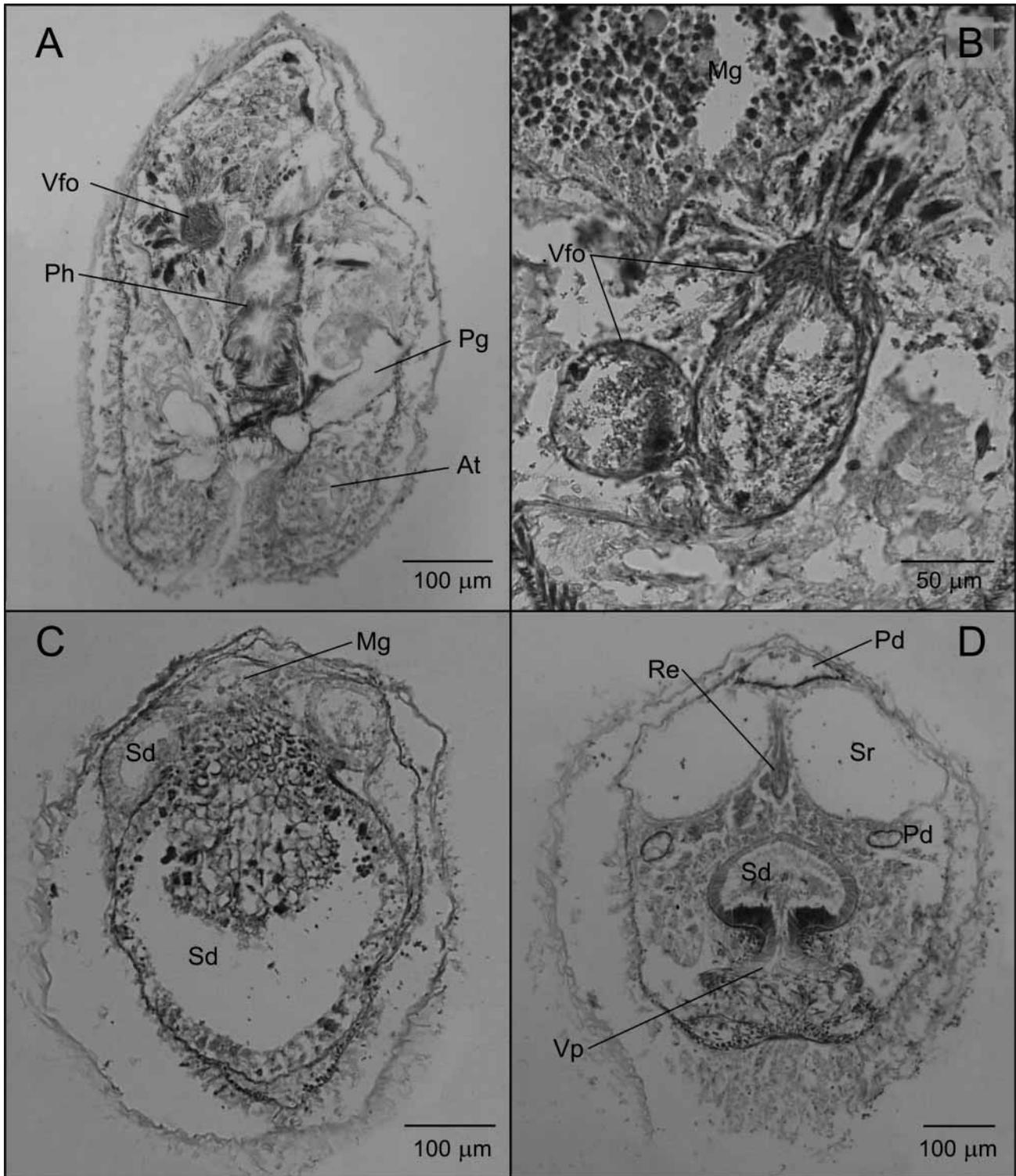


FIGURE 5. *Veromenia singula* n. sp. n. gen. **A.** Section through the pharynx corresponding to line 1 in figure 4E. **B.** Detail of the ventrolateral foregut glandular organs corresponding to line 2 in figure 4E. **C, D.** Section through the reproductive system corresponding lines 1, 2 in figure 4F. (At) atrium, (Mg) midgut, (Pc) pericardium, (Pd) pericardioduct, (Ph) pharynx, (Pg) pedal gland, (Re) rectum, (Sd) spawning duct, (Sr) seminal receptacle, (Vfo) ventrolateral foregut glandular organs, (Vp) ventral pouch.

Reproductive system: The gonads are tubular, long and are situated above the midgut (figure 4F). In the front area, they contain precursor cells of the gametes. Ova and spermatozooids can be seen together in the middle area of the gonad. Spermatozooids can be observed also in the end part of the gonad. The ova (32 µm

diameter) get together on the walls that separate the gonads. The spermatozooids are situated on the side walls of the gonads. The gonopericardioducts are two very narrow ducts that end to the pericardium. The pericardium is small and presents a tubular heart, whose ends join to the dorsal wall of the pericardium. Both pericardioducts come out in the posteroventral part of the pericardium, their diameter increases from their beginning to their end region. Each pericardioduct ends into the paired part of the spawning duct (figure 5C), where a seminal receptacle also joins through a narrow tube (figure 4F, 5D). These receptacles are situated on both sides of the rectum. The spawning duct presents an epithelium of high ciliate cells (figure 4F, 5D). Its posterior region is narrower and presents a ventral pouch (figure 4F, 5D), into which a glandular mass comes out. The spawning duct opens in the middle anterior region of the pallial cavity through the unpaired opening.

Discussion:

Veromenia singula n. sp. belongs to the order Cavibelonia Salvini-Plawen, 1978 because of the presence of hollow acicular sclerites on its cuticle. Within this group, it is included in the family Acanthomeniidae Salvini-Plawen, 1978, due to its thin cuticle, scale-shaped sclerites on all its surface and the type of ventrolateral foregut glandular organs (type A according to Salvini-Plawen 1978, or type *Acanthomenia* according to Handl & Todt 2005). The two genera of this family known so far (*Acanthomenia* Thiele, 1913 and *Amboherpia* Handl & Salvini-Plawen 2002) present a monoserial radula with two denticles (Thiele 1913; Handl & Salvini-Plawen 2002). As *Veromenia* n. gen. lacks radula, the definition of the family Acanthomeniidae should be modified as follows: Thin cuticle. With hollow acicular sclerites and scale-shaped sclerites. Monoserial or absent radula. With ventrolateral foregut glandular organs of type A (according to Salvini-Plawen 1978) or *Acanthomenia* (according to Handl & Todt 2005). Differences among the three genera are shown in table 2.

TABLE 2. Differences among the genus of the family Acanthomeniidae.

	Atrio-buccal cavity	Radula	Respiratory folds	Dorsoterminal sense organ
<i>Acanthomenia</i>	Partially separated	Present	Present	Absent?
<i>Amboherpia</i>	Common	Present	Absent	Present
<i>Veromenia</i> n. gen.	Common	Absent	Absent	Present

Veromenia singula n. sp. presents some differences with the species of the family Acanthomeniidae. The species of the genus *Acanthomenia*, *Acanthomenia gaussiana* Thiele, 1913, and *Acanthomenia arcuata* Scheltema, 1999, have the atrium and the mouth partially separated, they present an anterodorsal midgut caecum and respiratory folds in the pallial cavity (Thiele 1913; Scheltema 1999), features that are not present in *Veromenia singula* n. sp. In addition, *Acanthomenia arcuata* presents a fold in the pedal pit and its spawning duct is bilobed in the anterior region (Scheltema 1999). On the other hand, the species of the genus *Amboherpia*, (*Amboherpia heterotecta* and *Amboherpia dolichopharyngeata*) present a fold in the pedal pit, a dorsal midgut caecum, a ventral bag that is previous to the pallial cavity with prepallial spicules and a pair of seminal vesicles (Handl & Salvini-Plawen 2002), whereas *Veromenia singula* n. sp. has a pair of large seminal receptacles that the species of *Amboherpia* lack. Besides, there is a sphincter in the pharynx and several associations of glands in the ventrolateral foregut glandular organs of *Amboherpia heterotecta* whereas the pharynx has a much greater length and a sphincter in the posterior third of the spawning duct in *Amboherpia dolichopharyngeata*.

It should be pointed out that *Veromenia singula* n. sp. presents solid scale-shaped sclerites with folded lateral rims forming a groove and a ventral pouch situated under the posterior region of the spawning duct. None of the species of the genera *Acanthomenia* and *Amboherpia* present these features.

Acknowledgements

The cruise M48/1 (DIVA-1) and M63/2 (DIVA-2) was financed by the German Science Foundation (DFG). We are in debt to Dr. M. Türkay, Prof. Wägele and Prof. Martínez Arbizu for inviting one of us (Prof. V. Ugorri) to participate in this cruise. We also thank to Pr. Luitfried Salvini-Plawen, for his help to improve this work. This publication is a contribution to the Census of Marine Life project Census of Abyssal Marine Life (CeDAMar), to the FPU Programme (M.E.C.- Spanish government) and is also part of the research projects: 'DIVA-Artabria I' (Xunta de Galicia - PGIDT01PXI20008PR) and 'DIVA-Artabria II' (M.E.C – Spanish government CTM-2004-00740; Dirección Xeral de I+D+i, Xunta de galicia – PGIDIT07PXIB200120PR).

Literature

- Handl, C. & Salvini-Plawen, L.v. (2002) New records of Solenogastres-Cavibelonia (Mollusca) from Norwegian fjords and shelf waters including three new species. *Sarsia*, 87, 423–450.
- Handl, C. & Todt, C. (2005) Foregut Glands of Solenogastres (Mollusca): Anatomy and Revised Terminology. *Journal of Morphology*, 265, 28–42.
- Krncke, I. & Türkay, M. (2003) Structural and functional aspects of the benthic communities in the deep Angola basin. *Marine Ecology Progress Series*, 206, 43–53.
- Salvini-Plawen, L.v. (1978) Antarktische und subantarktische Solenogastres-Eine Monographie: 1898–1974. *Zoologica* (Stuttgart), 128, 1–315.
- Scheltema, A. H. (1999) New eastern atlantic neomenioid aplacophoran molluscs (Neomeniomorpha, Aplacophora). *Ophelia*, 51(1), 1–28.
- Thiele, J. (1913) Antarktische Solenogastren. Deutsche Sdpolar Expedition 14, *Zoologie*, 6(1), 35–65.