

Two new species of *Dorymenia* (Mollusca: Solenogastres: Proneomeniidae) from the South Shetland Islands (Antarctica)

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This paper describes two new species from the genus *Dorymenia* (Mollusca: Solenogastres: Proneomeniidae): *D. hesperidesi* sp. nov. and *D. menchuescribanae* sp. nov., collected during the Spanish oceanographic expeditions for the study of Antarctic benthos, BENTART'94 and BENTART'95, carried out in the area of the Livingston Island (South Shetland Islands, Antarctica). A comparative study of main specific characteristics of species belonging to the genus *Dorymenia* found off the South Shetland Islands and in the Bransfield Strait (Antarctica), is also included.

INTRODUCTION

Of all the known species of the Solenogastres class, 44% come from Antarctic waters, due to the great number of oceanographic expeditions carried out in this area over the course of this century, during which important collections of this class of molluscs were obtained. The results may be attributed to the fact that, in this field, it is often easier to obtain financial support for projects to be carried out in faraway, exotic places than for research in areas closer to home.

The genus *Dorymenia* is one of the most diverse of this class, 21 species are currently known, 14 of which belong to the Antarctic or subantarctic domain (Salvini-Plawen, 1978a; García-Alvarez et al., 1998). With the two new species described herein, the number of species from the genus *Dorymenia* collected in the Antarctic or subantarctic is now total 16, nine of which were collected off the South Shetland Islands or in the waters near the Bransfield Strait, representing 40% of the species known from the genus: *D. hoffmani* Salvini-Plawen, 1978 (South Shetland Islands, 91–95 m depth; South Sandwich Islands, 148–201 m depth; James Ross Island, Graham Land (Weddel Sea), 125 m depth; Seymour Island, Graham Land, 150 m depth; South Pacific, 549 m depth; Davis Sea, 385 m depth). *Dorymenia usarpi* Salvini-Plawen, 1978 (Bransfield Strait (Graham Land), 311–426 m depth; South Orkney Islands, 485 m depth; Ross Sea, 728–732 m depth; Ross Sea (near Victoria Land), 530–549 m, 342–360 m, 344–351 m depth). *Dorymenia hesperidesi* sp. nov. (South Shetland Islands, 235 m depth). *Dorymenia menchuescribanae* sp. nov. (South Shetland Islands, 50–66 m depth). *Dorymenia cristata* Salvini-Plawen, 1978 (Bransfield Strait (Graham Land), 311–426 m depth; Bransfield Strait, 884–935 m depth; Drake Strait, South Shetland Islands, 1437 m depth; Ross Sea, Penell Shoal, 728–732 m depth). *Dorymenia troncosoi* García-Alvarez, Urgorri & Salvini-Plawen, 1998 (south of Livingston Island, South Shetland Islands, 65–66 m depth; north of Livingston Island, South Shetland Islands,

240 m depth). *Dorymenia acutidentata* Salvini-Plawen, 1978 (Bransfield Strait (Graham Land), 494–507 m depth; Drake Strait, South Shetland Islands, 1437 m depth). *Dorymenia paucidentata* Salvini-Plawen, 1978 (Bransfield Strait (Graham Land), 311–426 m depth; Anvers Island, Palmer Archipelago (Graham Land), 49–75 m depth; Falsa Bay (Kapland), 88 m depth). *Dorymenia singulatidentata* Salvini-Plawen, 1978 (Bransfield Strait (Graham Land), 662–1120 m depth). All this highlights the disparity that exists in the information available on the geographic distribution of this class of molluscs, since most of the species have been cited in a very restricted area.

MATERIALS AND METHODS

The species described are from collections made during the Spanish Expeditions for the study of Antarctic benthos (BENTART'94 and BENTART'95) with an Agassiz type trawl. The specimens studied were fixed and preserved in 70% alcohol. The spicules were studied by separating small pieces of the mantle from the mid-dorsal area of the body and the ventral groove. These pieces were treated with 5% sodium hypochlorite for 12 h to isolate the spicules. They were later rinsed with water, dried in a heater at 40°C and mounted using Eukitt. For the anatomical study, several specimens were decalcified in an EDTA solution for 12 h embedded in wax and serial sections at 10 µm. The staining method used was Azan (after Heidenhain) and the anatomy was reconstructed from the serial sections.

RESULTS

Order CAVIBELONIA Salvini-Plawen, 1978

Diagnosis

Hollow acicular spicules arranged in one or several layers (Salvini-Plawen, 1978a).

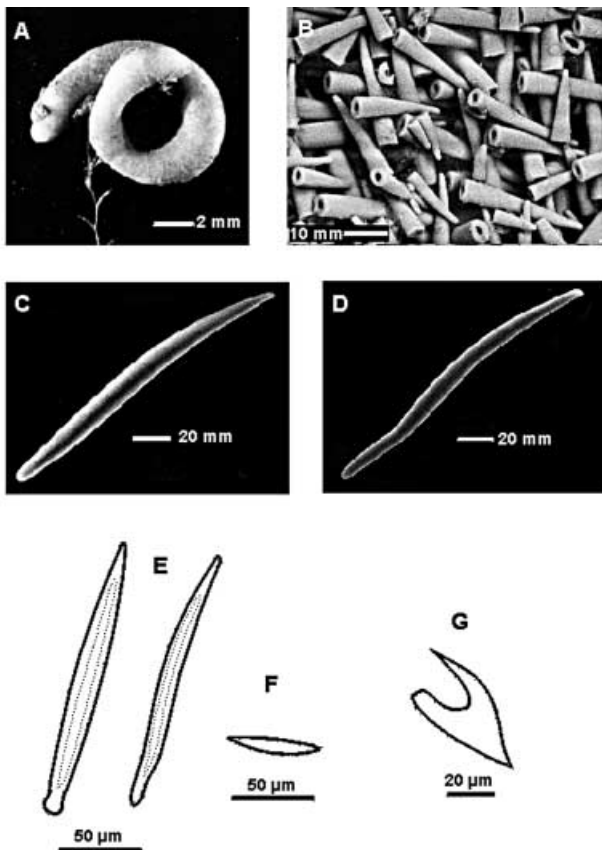


Figure 1. *Dorymenia hesperidesi* sp. nov. (A) Habitus; (B) mantle spicules; (C–E) hollow spicules; (F) spicules alongside the pedal groove; (G) radular tooth.

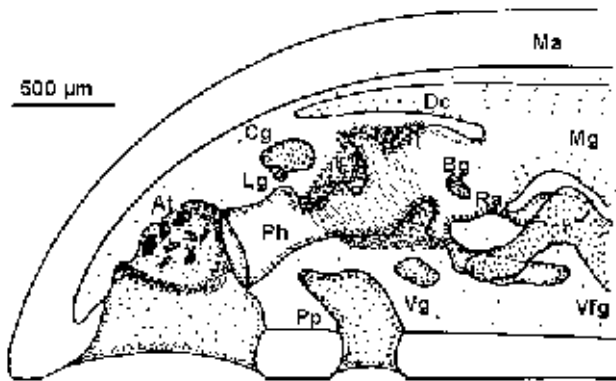


Figure 2. Schematic organization of the anterior body of *Dorymenia hesperidesi* sp. nov. At, atrial sense organ; Bg, buccal ganglion; Cg, cerebral ganglion; Dc, dorsal caecum; Lg, lateral ganglion; Ma, mantle; Mg, midgut; Ph, pharynx; Pp, pedal pit; Ra, radula apparatus; Vfg, ventral foregut glandular organ; Vg, ventral ganglion.

Family PRONEOMENIIDAE Simroth, 1893

Diagnosis

Radula polystich/polyserial; ventral foregut glandular organs type C; two seminal receptacles (Salvini-Plawen, 1978).

Genus *Dorymenia* Heath, 1911 (see Opinion 1185)

Synonym

Proneomenia Hubrecht (part)

Journal of the Marine Biological Association of the United Kingdom (2000)

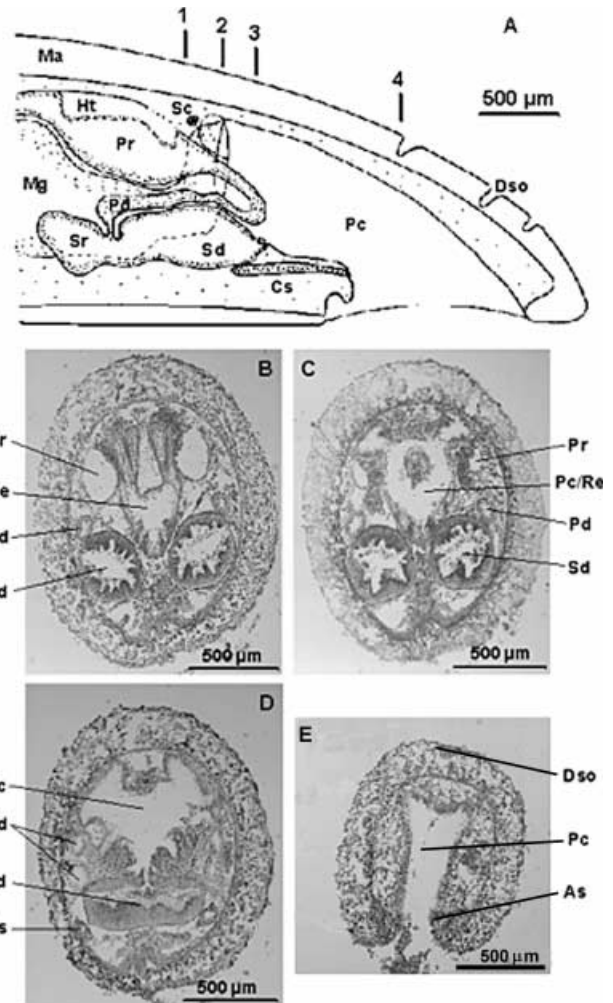


Figure 3. (A) Schematic cross-sections through posterior body of *Dorymenia hesperidesi* sp. nov. As, abdominal spicules; Cs, copulatory spicule; Dso, dorsoterminal sense organ; Ht, heart; Ma, mantle; Mg, midgut; Pc, pallial cavity; Pd, pericardioduct; Pr, pericardium; Re, rectum; Sc, suprarectal commissure; Sd, spawning duct; Sr, seminal receptacle. (B–E) Cross-section corresponding to lines 1–4.

Diagnosis

Body with thick cuticle and epidermic papillae. Hollow acicular spicules. Buccal opening at back of atrial sense organ. Polystichous radula. Type C epithelial ventral foregut glandular organs. Midgut with lateral constrictions. At least one dorsoterminal sense organ. One pair of seminal receptacles. Unpaired spawning duct outlet. One pair of copulatory spicules. No respiratory folds.

Type species

Dorymenia acuta Heath, 1911.

Dorymenia hesperidesi sp. nov.

Type material

Holotype measuring 24 mm in length, 2.2 mm wide (spicule slide, specimen in serial sections).

Type locality

South of Livingston Island (station A-19, BENTART'95) (South Shetland Islands, Antarctica) 62°43'43''S 60°31'27''W from a silt bottom at 235 m depth.

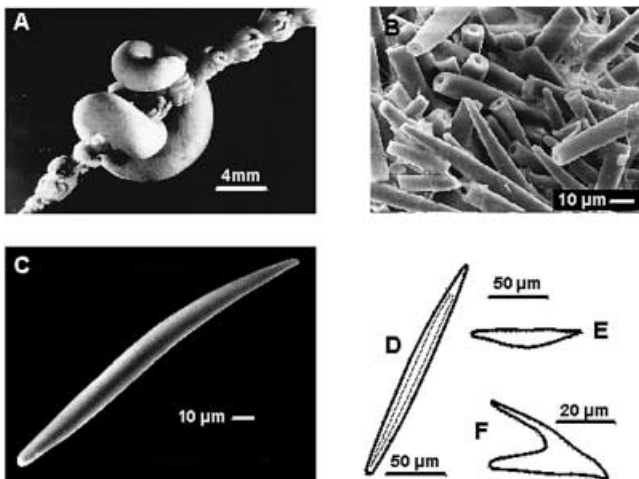


Figure 4. *Dorymenia menchuescribanae* sp. nov. (A) Habitus; (B) mantle spicules; (C,D) hollow spicules; (E) spicules alongside the pedal groove; (F) radular tooth.

Deposit and derivatio nominis

The holotype is deposited in the Museo Nacional de Ciencias Naturales of Madrid, number: MNCN 15.02/5. The species is dedicated to the Spanish oceanographic vessel ‘Hespérides’, and to the scientists and crew who participated in the first Spanish expeditions for the study of Antarctic benthos, the result of which are these two new species.

Diagnosis

Body measuring 24×2.2 mm, rounded, with no lumps or keel. Thick cuticle. Hollow acicular spicules. With pharyngeal subepithelial glands. Radula with 75–80 similar teeth with an elongated base and a hooked tip. The pallial cavity is made up of simple walls with two dorsolateral ear-shaped diverticula. The pallial cavity issues anteriorly a dorsal sac with pleated walls. Unpaired outlet of the spawning duct to the anterior sac of the pallial cavity. The spawning duct does not make up a part of the pallial cavity, in any case. One pair of round-shaped in cross-section copulatory spicules. Abdominal spicules in a pair of channels. Round or oval-shaped erythrocytes with granulations. Three dorsoterminal sense organs.

Description

Habitus. The body of the animal is elongated, cylindrical with no lumps or keel (Figure 1A). It has a smooth surface and the spicules do not protrude, and a well visible ventral groove. The colour of the animal is brown in alcohol.

Mantle. Cuticle between 180 and 250 μm thick; the papillae have a narrow neck and a spherical distal position. Hollow acicular spicules of up to 180 μm long (Figure 1B–E), some are slightly curved, with a wide interior cavity, arranged densely in several intertwined layers. In both sides of the pedal groove blade-shaped spicules up to 60 μm long are present (Figure 1F).

Pedal groove. The pedal groove has three folds, two small folds and a larger median one. More rearward, the small lateral folds flatten and only the median one remains and enters into the pallial cavity.

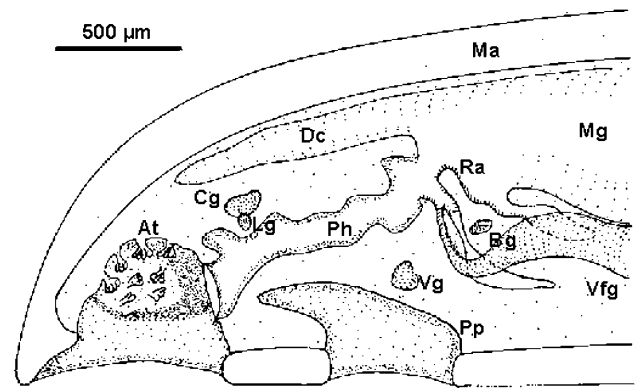


Figure 5. Schematic organization of the anterior body of *Dorymenia menchuescribanae* sp. nov. At, atrial sense organ; Bg, buccal ganglion; Cg, cerebral ganglion; Dc, dorsal caecum; Lg, lateral ganglion; Ma, mantle; Mg, midgut; Ph, pharynx; Pp, pedal pit; Ra, radula apparatus; Vfg, ventral foregut glandular organ; Vg, ventral ganglion.

Pallial cavity. The pallial cavity connects to the outside through a wide ventroposterior opening (Figure 3A & E). Running along each lateral edge of the pallial cavity opening, there is a channel, covered with a cuticle having muscle packs, where the abdominal spicules are located (Figure 3E). The epithelium of the pallial cavity is thick and ciliated. The walls of the posterior section are simple and have no folds. The pallial cavity has a large anterior sac (Figure 3A & D), with two dorso–lateral ear-shaped diverticula (Figure 3C,D). The ventral and ventrolateral walls of the sac have numerous folds (Figure 3C,D). The dorsal wall of the sac of the pallial cavity also has folds that are larger in the most anteriorly located area (Figure 3B). In this area, the ear-shaped diverticula separate from the rest of the pallial cavity, and continue along in a anterior direction like small sacs until they disappear. The anus opens into the anterior of the sac of the pallial cavity (Figure 3A & C). The spawning duct open into the ventral wall of the sac of the pallial cavity (Figure 3A & D). It has a pair of short, round-shaped in cross-section copulatory spicules (Figure 3A & D), with a retractive musculature that is not very strong.

Digestive system. The mouth is located in the posterior area of the atrio–buccal cavity (Figure 2). It continues in a long and wide pharynx (Figure 2), whose epithelium is covered by a fine cuticle. In the anterior area, the ventrolateral walls are smooth and fine, while the dorsal area is thick and pleated. In posterior area, the pharynx has a longitudinal, circular musculature that is well-developed, as well as bunches of subepithelial glands on the dorsal pharynx. It opens into the midgut at the meeting point with the dorsal caecum, which is flattened dorso–ventrally (Figure 2). The radula is polystich/polyserial. Each row is made up of 70–85 identically formed teeth which have a long base and a sharp, curved tip (Figure 1G). Each tooth measures up to 34 μm from the proximal area of the base to the distal area of the tip. The radular apparatus and radular sac are surrounded by circular musculature. The ventral foregut glandular organs are of type C (Salvini-Plawen, 1978a) and lead laterally into the pharynx before the beginning of the radular apparatus. They run below the midgut over the first third of the

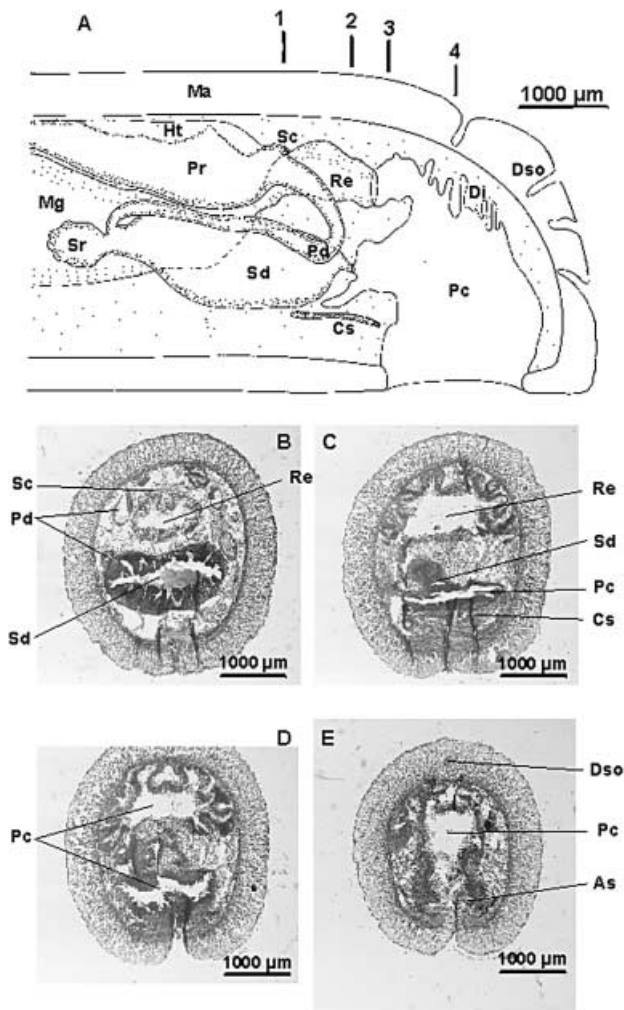


Figure 6. (A) Schematic cross-sections through posterior body of *Dorymenia menchuescribanae* sp. nov. As, abdominal spicule; Cs, copulatory spicule; Di, diverticle; Dso, dorso-terminal sense organ; Ht, heart; Ma, mantle; Mg, midgut; Pc, pallial cavity; Pd, pericardioduct; Pr, pericardium; Re, rectum; Sc, supra-rectal commissure; Sd, spawning duct; Sr, seminal receptacle. (B–E) Cross-section corresponding to lines 1–4.

body in the form of two parallel tubes (Figure 2). The rectum has several very high folds, which emerge from the rectum dorsally and continue in this way until they join the anterior sac of the pallial cavity into which the anus opens.

Nervous system and sense organs. The cerebral ganglion is located dorsally in the anterior area of the pharynx; it is oval-shaped and somewhat flattened dorso-ventrally (Figure 2). The two lateral ganglia are located very near the cerebral ganglion. The pair of large ventral ganglia (Figure 2), are interconnected by a commissure below the pharynx. The two buccal ganglia, also large and well visible (Figure 2), are located on either side of the pharynx in the radular region. In the posterior area of the body, over the rectum, there is a strong supra-rectal commissure (300 µm long by 30 µm thick) (Figure 3A).

The atrial sense organ is wide (Figure 2) and has a number of papillae, each one made up of groups of two to five papillae joined together by a stem and fixed to the atrial wall. They are found in the anterior half of the



Figure 7. Cross-sections through the posterior region of *Dorymenia* species from South Shetland Islands and Bransfield Strait. As, abdominal spicule; Cs, copulatory spicule; Di, diverticle; Pc, pallial cavity; Pd, pericardioduct; Re, rectum; Sd, spawning duct (after Salvini-Plawen, 1978; García-Alvarez et al., 1998).

dorsal wall and on the entire surface of the lateral walls. The posterior area of the dorsal wall of the atrium is thicker. The specimen has three dorso-terminal sense organs (Figure 3A), located over the mid-dorsal and terminal area of the body, at the level of the pallial cavity.

Circulatory system. The heart is a tubular chamber, located in the dorsal area of the pericardium (Figure 3A). The specimen has nucleated erythrocytes round or oval-shaped with granulations and with a diameter of approximately 10 µm.

Reproductive system. The paired gonad were full of spermatozoid and eggs. The eggs are formed in the median wall, while the spermatozoid are formed in the latero-ventral walls of the gonads. The pericardium is voluminous (Figure 3A). The two narrow pericardioducts are formed

Table 1. Comparative table of characteristics for species of *Dorymenia* from South Shetland Islands and Bransfield Strait. (After Salvini-Plawen (1978); García-Alvarez et al. (1998), expanded for the new species.)

	<i>D. hoffmani</i>	<i>D. usarpi</i>	<i>D. hesperidesi</i>	<i>D. menchuescribanae</i>	<i>D. cristata</i>	<i>D. troncosoi</i>	<i>D. acutidentata</i>	<i>D. paucidentata</i>	<i>D. singulaidentata</i>
Size	92 mm	25 mm	24 mm	58 mm	70 mm	22 mm	22 mm	10 mm	30 mm
Habitus	Rounded in cross-section	Rounded in cross-section	Rounded in cross-section	Rounded in cross-section at end	Crest along the back	Rounded in cross-section at end	Rounded in cross-section	Rounded in cross-section	Rounded in cross-section
Cuticle	600 µm	350 µm	180/250 µm	500 µm	350/600 µm	30/80 µm	175 µm	65 µm	150 µm
Foot	1 fold; into the pallial cavity	3-1 fold; up to the pallial cavity	3-1 fold; into the pallial cavity	1 fold; into the pallial cavity	1 fold; into the pallial cavity	1 fold; not into the pallial cavity	1 fold; up to the pre-pallial cavity	1 fold; not into the pallial cavity	1 fold; not into the pallial cavity
Dorso-terminal sense organ	2-3 above the pallial cavity	1-2 above the end of the pallial cavity	3 above the pallial cavity	3-4 above the pallial cavity	1 above the rear pallial cavity	1 above the mid pallial cavity	1 above the mid pallial cavity	1 above the rear pallial cavity	1(?) above the pallial cavity
Pharynx	Thin wall	Thick wall	Rear area thick and long	Long, thick wall	Short, thin wall	Short, thin wall	In the front short thin wall	Thick wall	Partially thick wall
Radula	Uniform long base 40-92 teeth	Uniform long base 40-88 teeth	Uniform long base 85 teeth	Uniform long base 100 teeth	2 central teeth with a short base 30-40 teeth	1 central tooth 4-5 lateral with a short base	22-26 sharp conical teeth	14-16 narrow teeth	14 sharp loose teeth
Erythrocytes	Oval cell with granules	Elongated drop without granules	Rounded and oval without granules	Elongated drop without granules	Elongated drop without granules	Elongated drop without granules	Elongated drop without granules	Elongated drop without granules	Elongated drop without granules
Outlet of spawning duct	Dorsal to the pallial cavity floor	Dorsal to the pallial cavity floor	Dorsal to the pallial cavity floor	Dorso-anterior into the ventral sac of the pallial cavity	Dorsal into the pallial cavity sac	Anter-central into the papillae	Dorso-terminal into the pallial cavity sac	Terminal	?
Pallial cavity	Several diverticula run down in latero-ventral direction	Simple. Two dorso-rostral ear sac	Several diverticula earshaped with dorsal sac having pleated walls	Several diverticula with dorsal and ventral sacs	Several terminal sacs with mid-anterior sacs	With four sacs	Cacuum sac with dorso-anterior folds, anterior sac	A pair of ventro-anterior sacs	A pair of ventro-anterior sacs
Copulatory spicules	Circular in cross-section; lateral to the pallial cavity	Circular in cross-section; ventral to the pallial cavity	Circular in cross-section; ventral to the pallial cavity	Circular in cross-section ventral to the pallial cavity	Circular in cross-section; ventral to the pallial cavity	Four-pointed star in cross-section in the distal zone	Circular in cross-section; ventro-lateral to the pallial cavity	Four-pointed star in cross-section in the distal zone; with lumps in the pallial cavity without abdominal spicules	Circular (in the tegmentum) in cross-section, at the end of the pallial cavity

in the terminal area of the pericardium, they bend forwards and they run on either side of the body, until they join the anterior part of the spawning ducts (Figure 3A). The pair of seminal receptacles are small and spherical and they connect to the anterior part of the spawning duct through a short, narrow duct (Figure 3A). The two spawning ducts (Figure 3A–C) have thick and glandular walls, and they fuse to form a single duct in the anal area. The single spawning duct is wide and flattened dorso–ventrally and runs below the anterior part of the pallial cavity sac (Figure 3A & D). The spawning duct does not make up a part of the pallial cavity, and opens, through an unpaired slit, into the ventral wall of the anterior sac of the pallial cavity (Figure 3A & D).

Dorymenia menchuescribanae sp. nov.

Type material

Holotype measuring 50 mm long by 4 mm wide (spicule slide, specimen in serial section). Paratypes: four specimens (paratypes 1–4) measuring 50–58×3.5–4.5 mm from south of Livingston Island (station 71-R, BENTART'94) (South Shetland Islands, Antarctica) 62°43'24"S 60°26'34"W; one specimen (paratype 5) measuring 45×3.5 mm (spicule slide, specimen in serial sections) from south of Livingston Island (station A-6-2, BENTART'95) (South Shetland Islands, Antarctica) 62°43'34"S 60°26'57"W from a bottom with silt at 66 m depth.

Type locality

South of Livingston Island (station 71-R, BENTART'94) (South Shetland Islands, Antarctica) 62°43'24"S 60°26'34"W on the gorgonian *Ophidiogorgia paradoxa* Bayar, 1980 at 50 m depth.

Deposit and derivatio nominis

The holotype and paratype 2 are deposited in the Museo Nacional de Ciencias Naturales in Madrid, number: MNCN 15.02/9. The species is named after Menchu Escribano, the wife of the first author, in appreciation of her help, encouragement and support.

Diagnosis

Body measuring up to 58×4.5 mm, round, with a very thick cuticle and no keel or lumps. Hollow acicular spicules. Radula with over 100 identical teeth with an elongated base and a hooked tip. The pallial cavity has diverticula and dorso–lateral folds with two anterior sacs: one dorsal and one ventral one. Unpaired outlet of the dorso–central spawning duct in the ventral sac of the pallial cavity. One pair of round-shaped in cross-section copulatory spicules. There are abdominal spicules in a pair of channels. Erythrocytes in the shape of elongated drops. Three or four dorsoterminal sense organs.

Description

Habitus. The animal has an elongated, cylindrical-shaped body which is narrower and more pointed at the posterior end (Figure 4A). With no lumps or keel. The body surface is smooth and the spicules do not project from it. The ventral groove is well visible. In alcohol the colour of the animal is brown.

Mantle. The cuticle is up to 500 µm thick and has papillae with a narrow neck and a spherical distal portion. The acicular spicules are hollow with a wide interior cavity and reach up to 280 µm in length (Figure 3B–D). They are densely arranged in several intertwined layers. In both sides of the pedal groove blade-shaped spicules measuring up to 80 µm in length (Figure 3E).

Pedal groove. The pedal groove has a short and ciliated fold that enters into the pallial cavity.

Pallial cavity. The pallial cavity connects to the outside through a wide ventro–posterior opening (Figure 6A & E). The terminal part of epithelium is ciliated and the rest is thick. There is a number of deep diverticula over the entire surface (Figure 6A & E). Along each lateral edge of the pallial cavity opening, there is a channel with thickened cuticle where the abdominal spicules are located (Figure 6E). The pallial cavity has two sacs in the anterior part: a smaller ventral sac and a larger dorsal one (Figure 6A & D). The wall of the ventral sac has few folds and the spawning duct opens into it, unpaired, anteriorly (Figure 6A,C & D). The dorsal sac has a large number of diverticula. The rectum opens anteriorly into the dorsal sac through a wide anus (Figure 6A,C & D). There are two short copulatory spicules round-shape in cross-section over its entire length (Figure 6A & C). There are several moderate muscle packs located below the ventral sac of the pallial cavity and the terminal part of the spawning duct.

Digestive system. The mouth is located in the posterior region of the atrio–buccal cavity (Figure 5). It continues in a long pharynx (Figure 5), with thick, pleated walls, with a strong, circular longitudinal musculature. The pharynx opens into the midgut at the meeting point with the wide dorsal caecum, which passes over the cerebral ganglion and extends into the anterior part of the body. (Figure 5). The radula is polystich/polyserial. Each teeth row is made up of over 100 identically formed teeth which have a long base with a pointed and curved tip (Figure 4F). Each tooth measures up to 50 µm from the proximal area of the base to the distal area of the tip. The radular apparatus and the radular sac are surrounded by circular musculature. The ventral foregut glandular organs are of type C (Salvini-Plawen, 1978a), they open into the pharynx laterally just in front of the radular apparatus and run below the midgut, like parallel tubes, for the first third of the body (Figure 5). The rectum is long straight and narrow with a ciliated epithelium, ending in a wide anus, which opens into the dorsal sac of the pallial cavity (Figure 6A–C). The gut bears a number of nematocysts of the Gorgonacea that feeds on.

Nervous system and sense organs. The cerebral ganglion is flattened dorsoventrally (Figure 5). The two lateral ganglia (Figure 5) are located on either side of the cerebral ganglion and are joined at cerebral ganglion by a connective measuring 250 µm in length. The pair of ventral ganglia (Figure 5) are interconnected by a commissure below the pharynx. The two large buccal ganglia (Figure 5) are located on either side of the radular apparatus. At the end of the body, there are two terminal ganglia, located

over the rectum, interconnected by a long supra-rectal commissure (750 μm in length) (Figure 6A,B).

The atrial sense organ is wide with numerous papillae made up of groups of two to five, emerging from the basal stem (Figure 5). The specimens examined have three or four dorsoterminal sense organs located on the region of the pallial cavity along the mid-dorsal line of the body (Figure 6A).

Circulatory system. The heart is small in diameter (Figure 6A), and is located in the dorsal area of the pericardium and open to the dorsal region. There are two types of blood cells: the first type consists of round granulocytes with a nucleus and a diameter of up to 15 μm ; the other type are made up of elongated drop-shaped erythrocytes, 16 μm in length with no granulations and the nucleus in a marginal position.

Reproductive system. The two gonads were full of spermatozoid and eggs. The voluminous pericardium was full of spermatozoid. The two narrow pericardioducts are formed in the terminal region of the pericardium, they bend forwards and they run on either side of the body, until they join the anterior part of the spawning ducts (Figure 6A & B). The pair of seminal receptacles, spherical in shape (Figure 6A), were full of spermatozoid and join the spawning ducts anteriorly by means of a narrow duct. The pericardioducts are connected dorsally to the anterior region of the spawning ducts, in the area where the narrow ducts that connect to the receptacles begin. The two spawning ducts fuse to form a single duct, this unpaired duct, which runs below the rectum, is very wide and flattened dorso-ventrally (Figure 6B) and it opens, unpaired, into the ventral sac of the pallial cavity (Figure 6A & C).

DISCUSSION

Taking into account the radular structure and the shape of the teeth (Salvini-Plawen, 1978a), the species of the genus *Dorymenia* may be classified into three general groups, all of which are represented in the species collected off the South Shetland Islands and in the Bransfield Strait. The first group, which has short radular teeth with a particularly curved apical tip and a long base consist of the following: *Dorymenia hoffmani* Salvini-Plawen, 1978, *Dorymenia usarpi* Salvini-Plawen, 1978, *Dorymenia hesperidesi* sp. nov., *Dorymenia menchuescribanae* sp. nov. The second group has a radula with teeth having a short base and one or two median teeth: *Dorymenia cristata* Salvini-Plawen, 1978, *Dorymenia troncosoi* García-Alvarez, Urgorri & Salvini-Plawen, 1998. In the third group the radular teeth present very elongated tips: *Dorymenia acutidentata* Salvini-Plawen, 1978, *Dorymenia paucidentata* Salvini-Plawen, 1978 and *Dorymenia singulatidentata* Salvini-Plawen, 1978.

In the first group of species mentioned above, several significant differences (Figure 7, Table 1). As regards the pallial cavity: *D. hoffmani* and *D. menchuescribanae* sp. nov. exhibit diverticula, whereas in *D. Menchuescribanae* sp. nov. the pallial cavity extends anteriorly into a ventral and dorsal sacs. *D. usarpi* presents characteristic ear-shaped sacs, in the dorso-anterior area of the pallial cavity, which are similar to those found in *D. hesperidesi* sp. nov.,

which also has a dorsal sac with folded walls. In terms of the spawning duct outlet: in *D. menchuescribanae* sp. nov. it is located dorsally to the ventral sac of the pallial cavity, while in the other three species of the group, it is located ventrally to the pallial cavity. Type and shape of the erythrocytes: *D. usarpi* and *D. menchuescribanae* sp. nov. have the elongated drop shape without granules; while in *D. hesperidesi* sp. nov. and *D. hoffmani* they are round or oval-shaped with granules.

In the second group (Figure 7, Table 1), *D. cristata* displays a pallial cavity into which the fold of the foot enters; it has several terminal sacs and a pair of mid-anterior sacs, whereas in *D. troncosoi* the pedal fold does not enter into the cavity, which is divided anteriorly into four characteristic sacs. In *D. cristata* the spawning duct outlet is located in the ventral region of the pallial cavity sac; however in *D. troncosoi* it is found in the center of a central-anterior papilla. As regards the cross-section shape of the copulatory spicules, they are round in *D. cristata* while in *D. troncosoi* they are in the shape of a four-pointed star.

The pallial cavity of the third group (Figure 7, Table 1), may be described as follows: *D. acutidentata* presents a dorso-anterior caecum sac with folds and an anterior sac; *D. paucidentata* has a pair of lateral sacs and a pair of ventro-lateral sacs and *D. singulatidentata* has a pair of ventro-lateral sacs. As far as the spawning duct outlet is concerned, in *D. acutidentata* it is located in the ventral area of the pallial cavity sac and in *D. paucidentata* it is generally located at the caudal end. The cross-section of copulatory spicules are round in *D. acutidentata* and *D. singulatidentata*, while in *D. paucidentata* they take on the shape of a four-pointed star.

The identification of Antarctic species entails a number of difficulties, especially in the study of young individuals (Salvini-Plawen, 1978a). This is why less conspicuous traits, such as the structure of the pallial cavity, must be taken into account (see the comparative Table 1).

Dorymenia hesperidesi sp. nov. and *D. menchuescribanae* sp. nov. are clearly differentiated from each other. In *D. hesperidesi* sp. nov. the pallial cavity has two dorso-anterior diverticula which are ear shaped and a anterior sac with folds, whereas in *D. menchuescribanae* sp. nov. the pallial cavity has a number of diverticula and two anterior sacs, one dorsal and the other ventral. The spawning duct in *D. hesperidesi* sp. nov. opens into the ventral wall of the pallial cavity through an unpaired genital pore on the dorso-terminal wall of the spawning duct, and in *D. menchuescribanae* sp. nov. the spawning duct outlet is found in the centre of the ventral sac of the pallial cavity. In *D. hesperidesi* sp. nov. the pedal groove presents three folds at its inception and the erythrocytes are round and oval-shaped with granules. In *D. menchuescribanae* sp. nov., however, the pedal groove has only one fold over its entire extension and the erythrocytes are elongated and without granules.

Dorymenia hesperidesi sp. nov. and *D. menchuescribanae* sp. nov. are related to *Dorymenia discoveryi* (Nierstrasz, 1908), *Dorymenia antarctica* (Thiele, 1913), *D. hoffmani* and *D. usarpi*, since they all have radular teeth with a long base and short tip with an apical curve. These species present a large number of radular teeth per row; *D. hoffmani* has between 40 and 92, *D. usarpi* from 40 to 88 (Salvini-Plawen, 1978a) and *D. hesperidesi* sp. nov. can have as many as 85, but in

D. menchuescribanae sp. nov. there are over 100 teeth per row. The size of the teeth of the radular teeth attain 50 µm in all the species except *D. hesperidesi* sp. nov., where they only measure 34 µm.

Moreover, these four species have different specific traits which separate them both from *D. hesperidesi* sp. nov. as well as from *D. menchuescribanae* sp. nov.

In relation to the two new species (Nierstrasz, 1908; Salvini-Plawen, 1978a), *D. discoveryi* shows differences in the radular teeth in that some of them have a curved back tip; in the pallial cavity there are two plugs which protrude in a posterior direction, one on top of the other, so that the pallial cavity outlet starts out paired anteriorly, and opening out through the union of these two plugs, is the unpaired genital pore. The pericardium is triple at the terminal end and has two dorso-terminal sense organs. Also, as compared to *D. hesperidesi* sp. nov., *D. discoveryi* has erythrocytes in the shape of an elongated drop without granules (Salvini-Plawen, 1978b) and has only one pedal fold which does not enter into the pallial cavity.

Dorymenia antarctica may be differentiated from the two new species (Thiele, 1913; Salvini-Plawen, 1978a) by the fact that the foregut continues behind the radula; the pallial cavity has a short anterior sac; the outlet of the spawning duct is unpaired opening into the ventral wall of the pallial cavity and has only one dorsoterminal sense organ. *Dorymenia hesperidesi* sp. nov., in particular, can be distinguished from *D. antarctica* by its pallial cavity with diverticula (Salvini-Plawen, 1978a) and its erythrocytes are of two types (Salvini-Plawen, 1978b): oval-shaped or in the shape of an elongated drop.

In *D. hoffmani* the spawning duct opens unpaired into the ventral wall of the pallial cavity and the pallial cavity does not have sacs (Salvini-Plawen, 1978a), these are traits that separate it from the two new species. As compared to *D. menchuescribanae* sp. nov., *D. hoffmani* may be distinguished by its two or three dorsoterminal sense organs and only oval-shaped erythrocytes (Hoffman, 1949; Salvini-Plawen, 1978a,b). The main characteristics distinguishing it from *D. hesperidesi* sp. nov., are that in *D. hoffmani* (Hoffman, 1949; Salvini-Plawen, 1978a) the pallial cavity has a number of diverticula and only one fold in the pedal groove.

Dorymenia usarpi can be differentiated from *D. menchuescribanae* sp. nov. and from *D. hesperidesi*

sp. nov. because the unpaired opening of the spawning duct leads into the ventral wall of the pallial cavity on a short seat and it has one or two dorso-terminal sense organs (Salvini-Plawen, 1978a). In *D. usarpi* the erythrocytes are elongated in shape and without granules (Salvini-Plawen, 1978b) as compared to *D. hesperidesi* sp. nov. where they are round and oval-shaped with granules. In *D. usarpi* the pallial cavity has (Salvini-Plawen, 1978a) a pair of dorsoanterior sacs, which are ear-shaped; they are absent in *D. menchuescribanae* sp. nov., but very similar to those of *D. hesperidesi* sp. nov. Moreover, *D. usarpi* does not have diverticula or the anterior sac found in *D. hesperidesi* sp. nov.

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