

First records of Pseudocerotidae (Platyhelminthes: Polycladida: Cotylea) from Patagonia, Argentina

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Abstract

In this work we record two species belonging to the polyclad family Pseudocerotidae from the littoral zone of the Península Valdés (Patagonia, Argentina). This is the first record of members of Cotylea and the third of Polycladida from Argentina. The two new records are *Phrikoceros mopsus*, a species described for Brazil and Colombia and *Thysanozoon brocchii*, a cosmopolitan species. Morphological features of both species are presented. These two new records contribute to the knowledge of polyclads from Patagonia and to the general understanding of their biogeography in the Southwest Atlantic Ocean.

Key words: Turbellaria, *Phrikoceros*, *Thysanozoon*, Península Valdés

Introduction

Polyclad flatworms are free living organisms that are most commonly found in the rocky intertidal zone and on coral reefs. Their distribution seems to be controlled by temperature and the highest diversity occurs in tropical regions (Prudhoe 1985). However, some species can be found in extreme habitats such as deep-sea environments (Quiroga *et al.* 2006, 2008) and in temperate regions. Along the Atlantic Coast of America, most species have been recorded from North America (Pearse 1938; Hyman 1940), the Caribbean Sea (Verrill 1900, 1901; Hyman 1939a–c, 1955a, b; Marcus & Marcus 1968; Quiroga *et al.* 2004; Bolaños *et al.* 2006, 2007), Brazil (Marcus 1947, 1949, 1950, 1951, 1952, 1954; du Bois Reymond Marcus 1955, 1957, 1958; Corrêa 1949, 1957; Hyman 1955c; Smith 1960; Bahia & Padula 2009), and Uruguay (Hyman 1955c; Bulnes *et al.* 2003). In Argentina, the only species collected so far are *Adenoplana platae* Hyman 1955, from the coast of Buenos Aires, and *Discoprosthides patagoniensis* Faubel 1983 from southern Patagonia.

Because polyclads have a simple body plan, very few morphological characters can be used for their taxonomy; most of these are related to their reproductive anatomy and to the arrangement of their eyes, tentacles, and pharynx. Members of the Pseudocerotidae are conspicuous because of their exuberant coloration; in fact, their color pattern has been considered a useful taxonomic character for specific identification (Newman & Cannon 1995, Litvaitis & Newman 2001).

We report herein for the first time two species of pseudocerotid polyclads collected in the intertidal zone of Patagonia, Argentina.

Material and methods

The specimens were hand collected between 2003 and 2005, from the lower mesolittoral zone at the localities of Puerto Pirámides (42° 34'32.70''S, 64° 17'15.82''W) and Puerto Madryn (42° 46'36.04''S, 65° 02'12.89''W), Chubut, Argentina. The habitats are rocky with intertidal pools and coralline algae.

Specimens were fixed in 10% formalin and preserved in 70% ethanol. Body measurements were taken from the fixed animals (measurements given in mm as length x width) and then photographed. The segment containing the pharynx and the reproductive structures were dissected for histological preparation. Sagittal sections of about 7 µm of the reproductive system were obtained, stained with hematoxylin and eosin and mounted in Synthetic Canada Balsam. The rest of the specimens were dehydrated and cleared with xylene to observe the arrangement of the eyes. Taxonomic identifications were based on the classification system of Faubel (1984) and the modifications proposed by Newman & Cannon (1994, 1996). All material was deposited at the Museo de Ciencias Naturales de La Plata (MLP), Argentina.

Results

Suborder: Cotylea

Family: Pseudocerotidae Lang 1884

Genus: *Phrikoceros* Newman & Cannon 1996

Species: *Phrikoceros mopsus* (Marcus 1952) Quiroga, Bolaños & Litvaitis 2004 (Figs. 1–2)

Synonyms: *Pseudoceros mopsus* Marcus 1952

Material examined and localities. One mature specimen preserved in 70% ethanol (50 mm x 20 mm) MPL 5955. Collected 26 November 2003 at Puerto Pirámides (42° 34'32.70''S, 64° 17'15.82''W), Península Valdés, Chubut, Argentina. Two mature specimens as serial sagittal sections MPL 5956. Collected 1st March 2005 at the same locality.

One mature specimen as whole mount (25 mm x 12 mm) MPL 5957. Collected in March 2005 at Puerto Madryn (42° 46'36.04''S, 65° 02'12.89''W), Chubut, Argentina.

Distribution. The species is widely distributed throughout the Caribbean (SQ, personal observation) and has been described from Brazil (Marcus 1952) and Colombia (Quiroga *et al.* 2004).

Description. External features

Color: Dorsally, live specimens are brown with white spots over the entire surface. Along the mid-dorsal region the brown color is darker forming a longitudinal band. The margin is bordered by a thin black line which is interrupted along the apical region of the pseudotentacles. Anterior to the cerebral eye cluster there is a short longitudinal black line which disappears before the anterior end of the body. The ventral surface is beige (Fig. 1B).

Form: Live specimens are oval with undulated body edges. The sucker is large (1 mm diameter) located in the anterior half of the body, approximately 4.3 mm posterior to the female gonopore (Fig. 2B, E).

Tentacles: The pseudotentacles are square-shaped, formed by the folds of the anterior margin (Figs. 1, 2A–D).

Eyes: The cerebral eyes in live specimens are arranged in a triangular-shaped cluster of about 40–50 eyes (Figs. 1A, C, D, 2A, C). The dorsal pseudotentacular eyes are arranged in four longitudinal clusters of about 50 eyes each (Figs. 1C, D, 2C). The ventral pseudotentacular eyes occur in four clusters of about 80–100 eyes each (Figs. 1C–E, 2C, D).

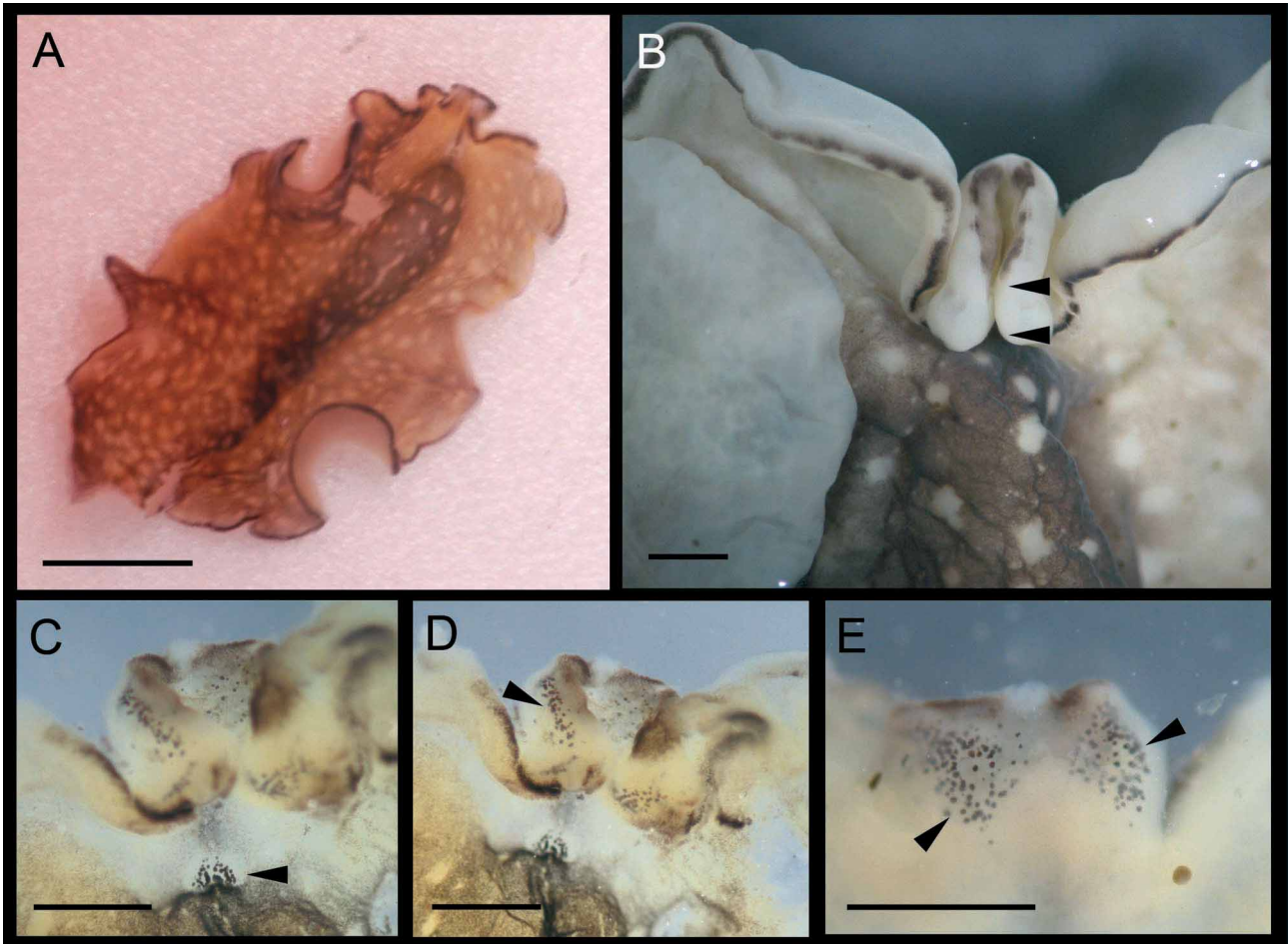


FIGURE 1. *Phrikoceros mopsus*. **A**, dorsal view of live specimen. **B**, detail of the anterior end. Arrow-heads show the interruption of the marginal black line at the apical region of the pseudotentacles. **C**, dorsal view of the anterior end with cerebral eyes (arrow-head). **D**, dorsal view of the anterior end; arrow head shows some of the ventral pseudotentacular eyes. **E**, ventral view of the anterior end with ventral pseudotentacular eyes (arrow heads). Scale bars: A: 5 mm; B–E: 1 mm.

Pharynx: The pharynx is ruffled with six simple folds (Fig. 2E), located in the anterior part of the body. The mouth is placed at the center of the pharynx about 5 mm from the anterior end of the body.

Gonopores: There is only one male gonopore immediately posterior to the pharynx. The female gonopore is separated by 2.3 mm from the male pore.

Internal features. **Body wall:** The epidermis is well developed on both surfaces of the body even though the ventral epithelium is taller (20–25 μm). In the dorsal epidermis there are conspicuous grains of black pigment. The body musculature is organized in three fine layers; the external one is formed by longitudinal fibers followed by circular muscles and the innermost is made up of diagonal fibers. The height of the ventral and dorsal musculature is 40–60 μm and 25 μm respectively.

Reproductive anatomy: *Male reproductive system* – single male system with an oblong, large and highly muscular seminal vesicle (610 μm long, 360 μm wide). The free prostatic vesicle is rounded and located anterior to the seminal vesicle (260 μm in diameter). The penis papilla bears a short, sclerotised stylet (120–150 μm long). The prostatic and ejaculatory ducts join at the penis papilla (Fig. 2E). *Female reproductive system* – The short vagina is ciliated and surrounded by numerous cement glands. The cement pouch is a shallow depression of the vagina next to the female gonopore (Fig. 2E). In mature specimens, usually the oviducts are expanded with a great number of eggs inside.

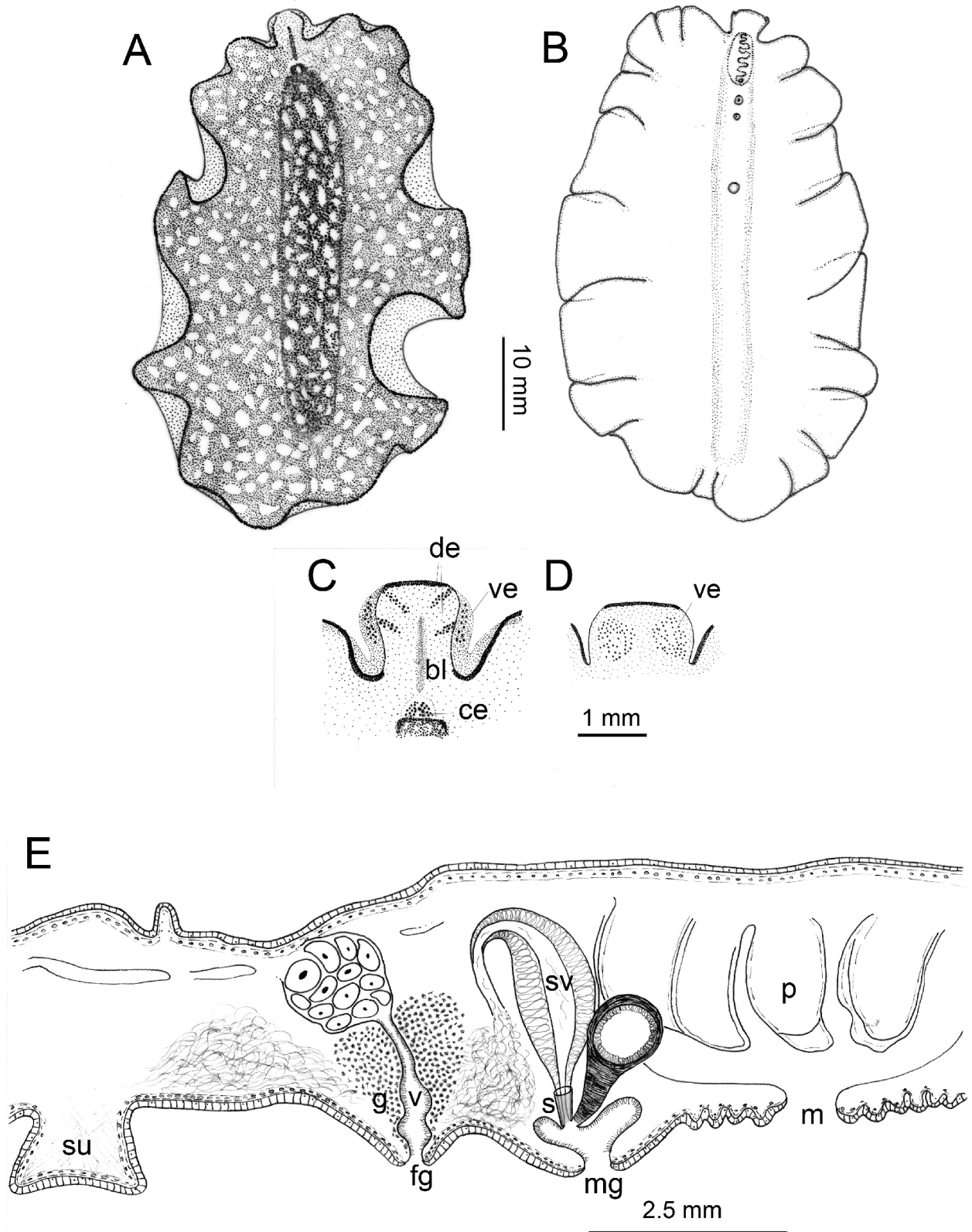


FIGURE 2. *Phrikoceros mopsus*. **A**, diagram of dorsal view. **B**, ventral morphology. **C**, dorsal view of pseudotentacles. **D**, ventral view of pseudotentacles. **E**, sagittal reconstruction of genital system portion. bl: black line; ce: cerebral eye; de: dorsal eyes of the pseudotentacle; fg: female gonopore; g: cement glands; m: mouth; mg: male gonopore; p: pharynx; su: sucker; s: stylet; sv: seminal vesicle; v: vagina; ve: ventral eyes of the pseudotentacles.

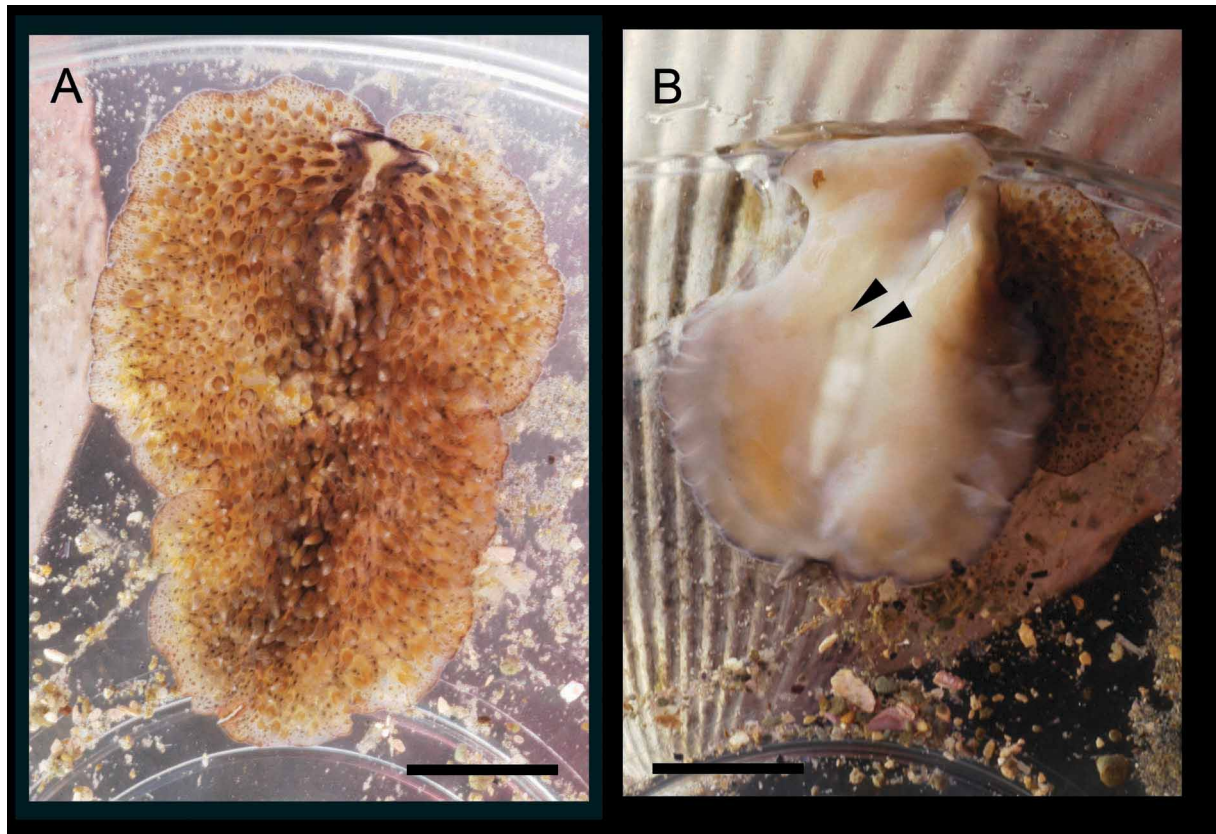


FIGURE 3. *Thysanozoon brocchii*. **A**, dorsal view of live specimen. **B**, ventral view of live specimen. Arrow heads show male gonopores.

Taxonomic remarks. *Phrikoceros* was described by Newman and Cannon (1996) who distinguish the genus from the rest of pseudocerotids mainly by the possession of both a simple ruffle pharynx as in *Pseudobiceros* Faubel 1984, and a single male reproductive system as in *Pseudoceros* Lang 1884. Among other characteristics they mentioned the presence of a horseshoe-shaped cerebral eye cluster which differs from the one in the species described herein. However, this characteristic can be variable among pseudocerotids. *Phrikoceros mopsus* had been described based on material from Isla de São Sebastião in Brazil, it was recorded from the Caribbean coast of Colombia by Quiroga *et al.* (2004). These authors also recognized that the species belonged to the genus *Phrikoceros* and formed a new combination.

The difference in the dorsal pattern of coloration (dotted with white spots, and net-like shape) between the Argentine flatworms and the others is due to the nutritional status of the animals (M. Litvaitis, personal communication). The reproductive differences, such as a considerably bigger and more muscular seminal vesicle and a longer stylet, are due to the larger size of the Argentine specimens.

Genus: *Thysanozoon* Grube 1840

Species: *Thysanozoon brocchii* (Risso 1818) Grube 1840

(Fig. 3)

Synonyms: *Tergipes brocchii* Risso 1818

Planaria brocchii (Risso) Risso 1826

Planaria tuberculata Delle Chiaje 1828

Planaria verrucosa Delle Chiaje 1829

Stylochus papillosus Diesing 1836
Thysanozoon diesingi Grube 1840
Thysanozoon papillosum (Diesing) Grube 1840
Thysanozoon tuberculatum (Delle Chiaje) Grube 1840
Planaria dicquemaris Delle Chiaje 1841
Planaria dicquemaris var. *verrucosa* (Delle Chiaje 1829) Delle Chiaje 1841
Thysanozoon dicquemaris (Delle Chiaje) Oersted 1844
Eolidiceros panormus Quatrefages 1845
Eolidiceros brocchii (Risso) Quatrefages 1845
Thysanozoon panormus (Quatrefages) Diesing 1850
Thysanozoon fockei Diesing 1850
Thysanozoon spec. Schultze 1854
Planeolis panormus (Quatrefages) Stimpson 1857
Thysanozoon spec. Moseley 1877
Thysanozoon brocchii var. *cruciatum* Laidlaw 1906
Thysanozoon lagidium Marcus 1949

Material examined and locality. One mature specimen (25 mm X 15 mm) preserved in alcohol and as serial sagittal sections of the pharynx and the reproductive structures MPL 5958. Collected in March 2005 at Puerto Pirámides (42° 34' 32.70''S, 64° 17' 15.82''W), Península Valdés, Chubut, Argentina.

Distribution. Cosmopolitan. In the western Atlantic this species is known from the Lesser Antilles (Marcus & Marcus 1968), the north coast of Brazil (Marcus 1949, 1952) and recorded in this paper for the Península Valdés.

Description. External features. Form and Color: Oval, the edges of the body are slightly undulated. Live specimens are dorsally yellowish brown with papillae covering the entire surface. The papillae along the midline of the body are longer and they diminish in size towards the periphery of the body. These papillae are darker than the rest. The margin lacks papillae and it is delineated by a thin and discontinuous black line; the apical region of the pseudotentacles is white. The pseudotentacles are pointed, ear-like, and their anterior dorsal region is dark brown. The pharynx is located in the first fourth of the body and is formed by 4–5 simple and shallow folds. The sucker is large and located in the first half of the body, posterior to the female gonopore.

Eyes: The cerebral eyes are arranged in a horseshoe-shaped cluster. The dorsal pseudotentacular eyes are arranged in four separate longitudinal clusters, across the pseudotentacles. The ventral pseudotentacular eyes occur in two clusters.

Gonopores: Two male gonopores are present just posterior to the pharynx, one on each side of the midventral line. A female gonopore is positioned on the midventral line, immediately posterior to the male gonopores.

Internal features. Epidermis and musculature: The body wall is thicker on the ventral surface than on the dorsal surface. The body musculature is organized in three well-developed layers. The external one, which is the thinnest, is longitudinal and followed by circular fibers and a developed innermost layer of diagonal muscles. These three layers are more developed on the ventral surface. It is also possible to observe dorsoventral fibers along the body. The epidermis is not well developed, however; the dorsal epidermis includes the formation of the papillae which are conical and more robust in the midline of the body and slender towards the margins.

Reproductive anatomy: *Male reproductive system* – Numerous testes (60 µm in diameter) along the ventral surface of the body are arranged in 3–4 rows. This species has double male reproductive structures and their configuration is the same as previously described by Marcus (1949, 1952). The prostatic vesicle is oval (300 µm long X 150 µm wide) and has a well-developed musculature, its duct joining the ejaculatory duct before the papilla ends. The penis papilla bears a stylet (230–250 µm long). *Female reproductive system* – It is typical of pseudocerotids having a short and ciliated vagina, directed backwards and surrounded by numerous cement glands. A large number of ovaries are scattered dorsally.

Taxonomic remarks. In terms of taxonomy, *Thysanozoon* is one of the most difficult genera among pseudocerotids. In general, the shape and distribution of the papillae and the coloration are the most useful characters for the identification of the different species. *T. brocchii* was initially described for the coast of Nice in the Mediterranean Sea (Risso 1818) and later recorded from the Western Atlantic. Marcus (1949, 1952) described *T. lagidium* from Ilha de São Sebastião, Brazil and considered it close to *T. brocchii* – to which he compared it. However, Marcus and Marcus (1968), after comparing specimens of *T. brocchii* from the Gulf of Naples with specimens of *T. lagidium* from Brazil and the Caribbean, and analyzing in detail internal and external features, concluded that the two nominal species were synonyms. The same criteria were applied by Faubel (1984) and followed by us herein. Prudhoe (1985), on the other hand, considers *T. lagidium* a separate species from *T. brocchii*.

Discussion

Polyclads are mostly restricted to tropical waters and their distribution seems to be controlled by temperature (Prudhoe 1985). *Thysanozoon brocchii* is a cosmopolitan species and its range along the Western Atlantic has now been extended to Patagonia. This species, like most polyclads, usually dwells underneath coral rubble or rocks in the littoral zone. The function of the papillae is not well known but they could be structures for flotation, helping in the dispersion of the species (Prudhoe 1985). They could also have other roles, e.g., they could be involved in gas exchange or in increasing the intestinal absorption surface.

The new records of *P. mopsus* and *T. brocchii* doubles the number of polyclads known from Argentina. Additionally, these new records contribute towards the understanding of the biogeography of polyclads in the Atlantic Ocean.

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