

The sea cucumber *Echinopsolus murrayi* Théel, 1886 n. comb. (Echinodermata: Holothuroidea) from the southwestern Atlantic, redescription of the holotype and description of new specimens

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Abstract: *Psolus murrayi* Théel, 1886 was one of the multiple species described from the specimens collected by the HMS Challenger Expedition. This species was placed in *Psolus*, genus with dorsal scales. Among holothuroids, there are some taxa that have a dense presence of dorsal ossicles, which gives them a psolid-like appearance. From the presence of different ossicles and the absence of scales on dorsal side, we here redescribe the species now, known as *Echinopsolus murrayi* (Théel, 1886) **n. comb.** This species has dorsal warts full of ossicles, ten tentacles and rectangular sole with three rows of podia. Body wall ossicles are plates and cups, and multilayered plates exclusively on dorsal body wall. For tentacles and podia, ossicles are curved and straight perforated bars.

Keywords: HMS Challenger; Psolidae; deep-sea; Natural History Museum of UK; *Museo Argentino de Ciencias Naturales*.

Resumen: *Psolus murrayi* Théel, 1886 fue una de las múltiples especies descritas a partir de los especímenes recolectados por la expedición del HMS Challenger. La especie fue asignada a *Psolus*, género que presenta escamas dorsales. Entre los holoturoideos, existen algunos taxa que presentan una alta densidad de osículos, lo que da un aspecto similar a un psolido. A partir de la presencia de osículos y la ausencia de escamas redescubimos la especie, conocida como *Echinopsolus murrayi* (Théel, 1886) **n. comb.** Esta especie presenta verrugas dorsales llenas de osículos, diez tentáculos y una suela rectangular con tres hileras de podios. Los osículos de la pared del cuerpo, son placas y copas, y placas multicapa sólo en la región dorsal de la pared del cuerpo. Para los tentáculos y los podios, los osículos son barras perforadas, curvas y rectas.

Palabras clave: HMS Challenger; Psolidae; mar profundo; *Natural History Museum of UK*; Museo Argentino de Ciencias Naturales.

INTRODUCTION

The HMS Challenger Expedition changes the way of marine science, and with it the studies of marine invertebrates. During that expedition, Théel (1882, 1886) described new taxa of Holothuroidea, including the order Elasipodida and seven species of *Psolus* (Family Psolidae Burmeister, 1837) from South America, including four new species: *Psolus incertus*; *Psolus tuberculosus*; *Psolus pourtalesi* and *Psolus murrayi*. The latter was originally described from a single specimen collected at 1000 m depth in the

southwest Atlantic (37°17'S, 53°52'W) (Fig. 1).

The genus *Psolus* belong to the Family Psolidae and has the dorsal body-wall covered with scales (see Martínez 2016). Although this character is very conspicuous and diagnostic, there are other taxa that have dorsal ossicles arranged in several layers and high density, which gives them a psolid-like appearance. An example of this is the genus *Echinopsolus* (Cucumariidae), in which the type species, *Echinopsolus acanthocola* Gutt, 1990 has multilayered ossicles in the dorsal body-wall. This could lead to misidentification, as it could be considered as part of *Psolus*.

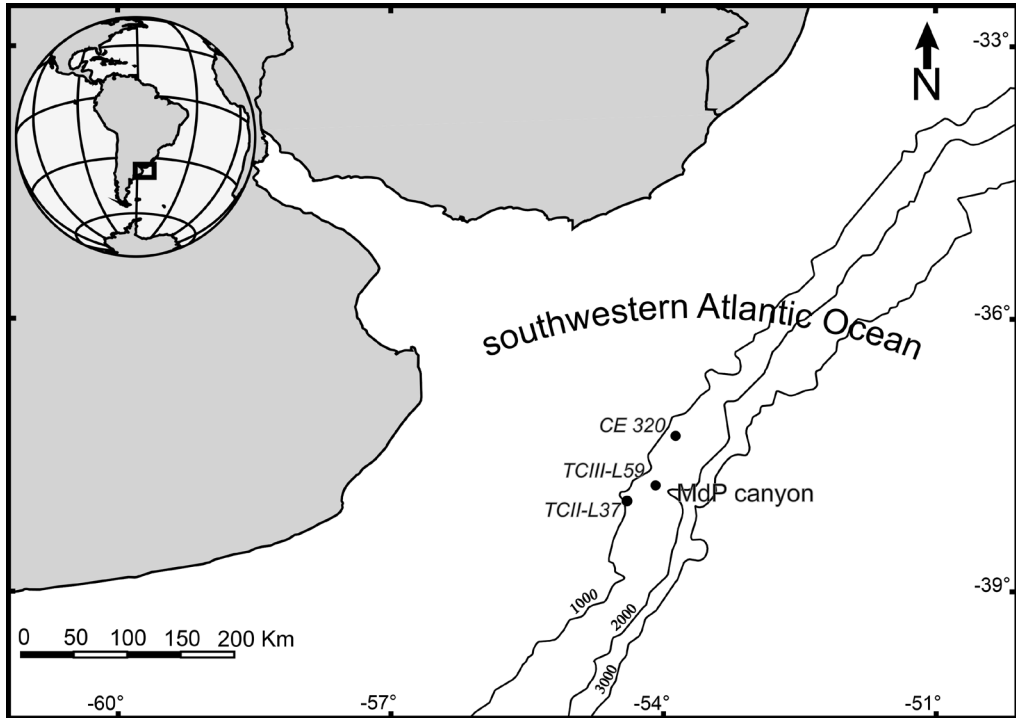


Fig. 1: Map showing the location of the holotype and the specimens analyzed on this study. MDP Canyon: Mar del Plata submarine canyon.

Bohn and Hess (2014) moved in several species (from different genera) to *Echinopsolus* after finding many characteristics in common. These characteristics were integrated into the diagnosis of the genus: all gonochoric; a genital papilla is present on the oral disc, females brood their offspring in five anterior interradial brood pouches; multiple spermatozoa always bundled to bunch-like spermatozoa and spermatozoa with a fusiform head and a hollow cylinder-like mid-piece encircling the anterior end of the flagellum. Those species were *Echinopsolus charcoti* (Vaney, 1906), *Echinopsolus koehleri* (Vaney, 1914), *Echinopsolus mollis* (Ludwig & Heding, 1935), *Echinopsolus splendidus* (Gutt, 1990), *Echinopsolus acutus* (Massin, 1992). In addition, Massin (1992, 2010), describe two species for the genus, *Echinopsolus parvipes* Massin, 1992 East Weddel Sea and *Echinopsolus excretiospinosus* (Massin, 2010). Recently Panina *et al.* (2020) re-described the genus and describe two new species, *Echinopsolus sanamyanorum* Panina, Stepanov, Smirnov & Martynov, 2020 and *E. onekotanensis* Panina, Stepanov, Smirnov & Martynov, 2020. From the ten species of *Echinopsolus*, almost all of them are from Antarctica, except from *E. sanamyanorum* and *E. onekotanensis*, which

both are from Kamchatka Peninsula area. All these references give us information to identify other *Echinopsolus* species and spotlight that may be several other species, could be included in this genus. New material have been collected in three cruises in the deep-sea of the southwestern Atlantic, *Talud I, II* and *III*, between 2012 and 2013. One of the species collected was *Psolus murrayi* (Theel 1886). This study is the first re-description, since Théel's work, with new material collected near the type locality site.

MATERIAL AND METHODS

Specimens were collected after the *Talud Continental* cruises (2012–2013) onboard the B/O Puerto Deseado using dredge trawlers and fishing nets, in the area of the Mar del Plata submarine canyon. All the specimens were preserved in ethanol 96%, analysed and dissected under a stereomicroscope. Digital photos of the specimens were taken using a Canon PowerShot SX110. The ossicles were digitalised using a Zeiss Axio Imager Z1 microscope with an Axiocam HRC digital camera and Axiovision software. The specimens collected, were compared with the type specimen, from the Natural History Museum of

UK(NHMUK) and based on the diagnosis made by Théel (1886). New specimens of this species were deposited at the *Museo Argentino de Ciencias Naturales Bernardino Rivadavia* (MACN).

RESULTS

Phylum Echinodermata Bruguère, Klein, 1734

Class Holothuroidea de Blainville, 1834

Subclass Actinopoda Ludwig, 1891

Order Dendrochirotida Grube, 1840

Family Cucumariidae Ludwig, 1894

Genus *Echinopsolus* Gutt, 1990

Echinopsolus Gutt, 1990: 112. Type species: *E. acanthocola* Gutt, 1990, by original designation.

Microchoerus Gutt, 1990: 105 [non Wood 1844]. Type species: *M. splendidus* Gutt, 1990, by original designation.

Diagnosis (after Panina *et al.* 2020): Tentacles 10, ventral pair smaller than others. Mouth and anus terminal. On the dorsal surface of the body present a few tube feet, papillae or warts, scatter about whole body. Ventral surface with a well-developed sole. Dorsal body wall contains one- to multilayered perforated plates. Scales are absent on the dorsal side.

Echinopsolus murrayi (Théel, 1886) **comb. nov.**

Psolus murrayi Théel, 1886: 85-86.

Diagnosis (modified from Théel, 1886) Body up to 28 mm, not depressed, elongate, cylindrical, with the posterior end tapered, caudiform. The elongated rectangular sole provided with three simple rows of pedicels, those in the middle row fewer and more distant from one another. Mouth and anus dorsal, tentacles ten, ventral pair smaller, males with genital papilla of up to 3 mm. Dorsal body wall thick with papillae full of ossicles. Body wall with plates and cups. Multilayered plates exclusively on dorsal body wall. Tentacles and podia with curved and straight bars.

Description: Elongate, cylindrical, with the posterior end tapered, caudiform, up to 26 mm, dorsal cover with scales, ventral well define sole. Body and tentacles, white and light brown. Mouth and anus dorsal, dorsal body wall with warts, tentacles 10, with two ventral 1/3 of the size, retracted in all the specimens, number and size observed by dissection. Sole well define with

3 simple rows, marginal podia present, one row (Fig. 2). Calcareous ring simple, one madreporite and one polian vesicle, left side from dorsal view. Retractor muscles wide, around twice the size of the anterior part of a calcareous ring piece. In gonad of specimen MACN-In 44139 (20.19 mm) oocytes of up 776 μm (547.77 ± 211.77 $n=8$). Male specimen MACN-In 44140 (26 mm) a genital papillae of 3 mm, present in between two most dorsal tentacles. Respiratory tree up to $\frac{2}{3}$ of body total length, right slightly longer than left. Ossicles from bodywall, multiperforated plates (110–207 μm) and cups (45–84 μm), and exclusively on dorsal bodywall, multilayered plates. From tentacles and podia, curved and straight perforated bars (100–408 μm) (Fig. 3).

Type locality: Sta 320 HMS Challenger Expedition; Southwestern Atlantic Ocean; 37°17'S, 53°52'W; 1097 m (600 fathoms) (Théel, 1886).

Distribution: southwestern Atlantic (37°17'S, 53°52'O; 54°29'S, 3°43'O), from 1097 to 1398 m depth (Théel, 1886 and herein).

Examined material: Holotype 28 mm, HMS 320, 14-Feb-1876, 37°17'S, 53°52'W, 1097 m, NHMUK 1886.10.2.87; 26 mm, L37 TCII, 25-May-2013, 38°00'S, 54°24'W, 1275 m, MACN-In 44140 (male); 21.81 mm (male), 20.19 mm (female), L59 TCIII, 10-Sep-2013, 37°50'S, 54°5'W, 1398 m, MACN-In 44139 (fig 2). (Table 1).

Habitat: Hard substrate.

DISCUSSION

The samples collected enlarge greatly the amount of samples of *Echinopsolus murrayi* **n. comb.**, until now with only one specimen. The specimens collected have the same diagnostic features of the type species (NHMUK 1886.10.2.87), dorsal warts, ten tentacles and rectangular sole with three rows of podia among other characters. In addition, the specimens herein were found near the type locality. The ossicles, also match with the one observed by Théel (1886), which are cups and multiperforated plates. Here we are also describing straight and curved bars from tentacles and podia. This species was also reported by Ludwig & Heding (1935) for Bovet Island (54°29'S, 3°43'W) at 567 m. According to the reference, these specimens have not podia in the middle ambulacra and five valves which are an important difference with the holotype described by Théel (1886) and the specimens studied herein. Because of this and the huge difference observed for the locality, these specimens

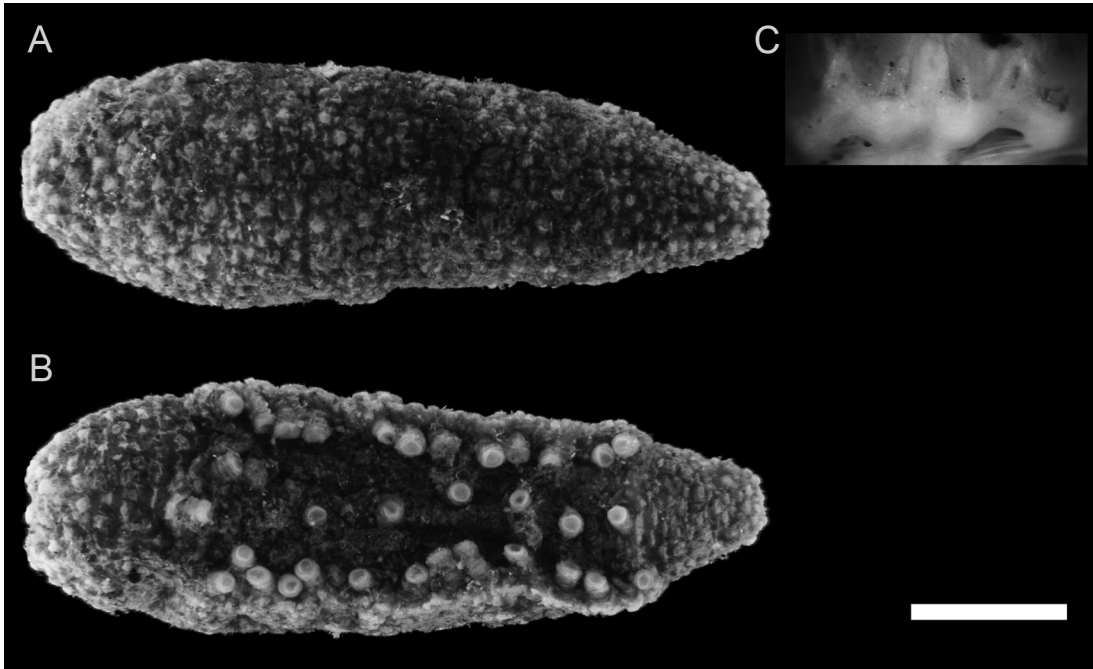


Fig. 2: Specimen MACN-In 44139 A. dorsal view, B. Ventral view C. Calcareous ring. Scale bar: 50 mm.

are not *E. murrayi*. A proper study, focus on these specimens will determine if they are members of *Echinopsolus* or not.

All the specimens studied lack dorsal scales which indicate that this species does not belong to Psolidae. Théel (1886) observed a dorsal side with multiple warts and cup ossicles, like the one observed herein. The dorsal warts full of ossicles could lead Théel (1886), to misjudge this character with the dorsal scales from *Psolus*. Although this similarity and other characteristics among *Psolus* and *Echinopsolus* are still on-going work (see Bohn & Hess 2014, Panina *et al.* 2020). In comparison with other *Echinopsolus*, *E. murrayi* and *E. acanthocola* has also dorsal processes with a heavy skeleton and no podia. These characters are quite diagnostic, and enable to separate these two species from their cogeneric. *E. acanthocola* has the ventro-lateral rows, joint on the posterior region and a few tube-feet on middle radii, in contrast with *E. murrayi* which has three clear and separate rows. In addition, *E. murrayi* has bars and cups, these ossicles are not present on *E. acanthocola*. Also, this species has multilayered plates on body wall, tube-feet and tentacles, in contrast with *E. murrayi* that has multilayered plates only in dorsal body wall.

The genus *Echinopsolus* has been associated with Antarctic waters (Bohn & Hess 2014). The

specimens found in this work came from the Mar del Plata submarine canyon area and it is the first species of this genus, off Argentina. Several reports have registered Antarctic currents, the Antarctic Intermediate Water (AAIW) and the Upper Circumpolar Deep Water (UCDW). These currents flow from south to north between 1000–2000 m in the area of the Mar del Plata submarine canyon (Preu *et al.* 2013, Voight *et al.* 2013). The deep range in which the specimens were found (1097–1398) could indicate how this species appear northern than the co-generic, and north of the Circumpolar Current which has been indicated to be an important barrier for several invertebrates (O’Loughlin *et al.* 2011). In addition, previous reports indicated the association between the Mar del Plata submarine canyon area and Antarctica (Martinez & Penchaszadeh 2017, Martinez *et al.* 2019). It is still a clue the association among these species and those from Kamchatka Peninsula area. Perhaps future steps could be focus on stablish if it is or not and association.

One male specimen observed has a genital papillae in between the dorsal pair of tentacles. According to Panina *et al.* (2020), this is not a diagnostic character for *Echinopsolus*, although several species of the genus have it, and reinforce the change of genus made it herein. The

Table 1. Specimens reported for *Echinopsolus murrayi*: catalogue number (Cat Num), station code (St Code), number of specimens analyzed (N spec), latitude (Lat), longitude (Long), depth (Depth), date of collection (Date) and reference (Ref).

Cat Num	St Code	N Spec	Lat (S)	Long (W)	Depth (m)	Date	Ref
NHMUK 1886.10.2.87	CE 320	1	37°17'	53°52'	1097	14-Feb-1876	Théel 1886
MACN-In 44140	TCII-L37	1	38°00'	54°24'	1275	25-May-2013	Herein
MACN-In 44139	TCIII-L59	2	37°50'	54°5'	1398	10-Sep-2013	Herein

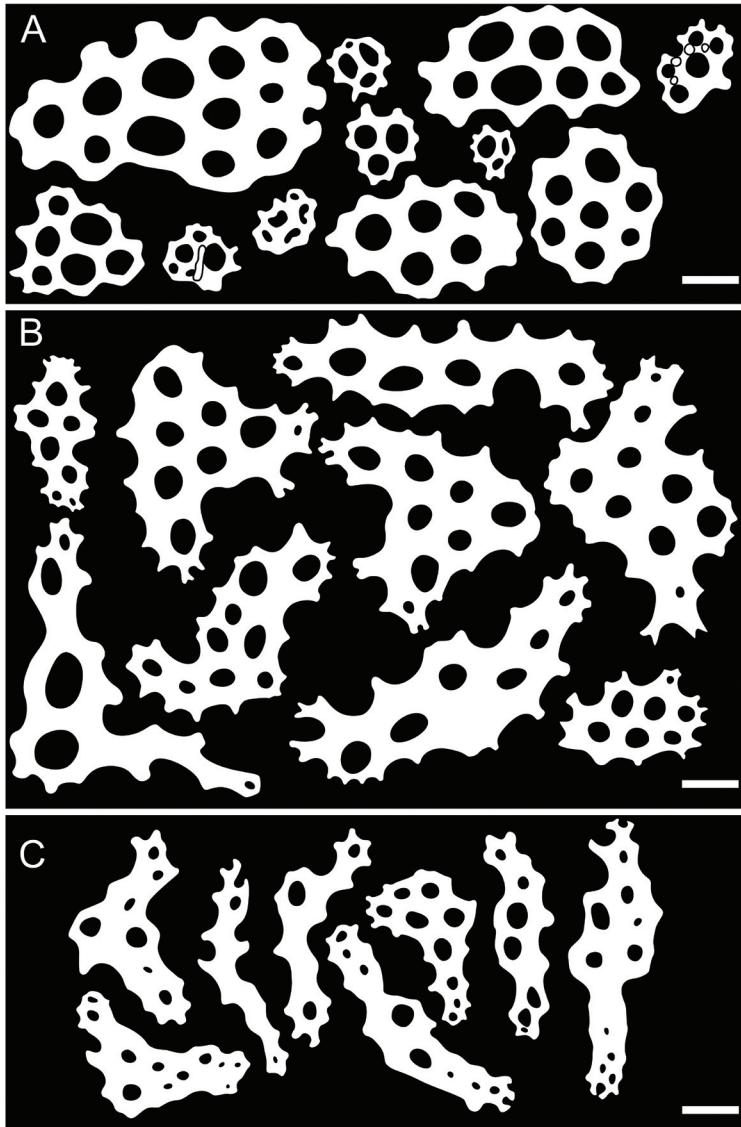


Fig. 3: Shapes of ossicles from A. bodywall, B. tentacles, C. podia. Scale bar: 50 μm .

female specimens observed, have not broods or any evidence of brood pouches or sacs/pockets, which have been reported for several

species of *Echinopsolus*. The low number of specimens analyzed here, is not enough to discharge the idea about brooding on this species.

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