

A new subspecies of *Phascolion* Théel, 1875 (Sipuncula: Golfingiidae) from Indian waters

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The genus *Phascolion* Théel, 1875 is one of the better known genera of sipunculan worms by marine biologists, since many of their representatives have been collected in discarded shells of molluscs and tubes of polychaetes (Stephen & Edmonds, 1972; Hendrix, 1975; Gibbs, 1985; Cutler, 1994). Interestingly enough, phascolionids show certain degrees of anatomical asymmetry concerning nephridium, retractors and gonads placement (Stephen & Edmonds, 1972; Cutler, 1994), apparently for a better adaptation to the life in the interior of the helical shell of gastropods. Other singular character is the presence of holdfast or attachment papillae present in many species of this genus along the midtrunk area. As its name indicates, many taxonomists (Stephen & Edmonds, 1972; Cutler, 1994) envisaged a first attachment function to anchor the worm to the internal part of the mollusc shell, but Hylleberg (1975) observed that holdfast papillae keep the inside of the shelter clean in the better known species of the genus, *Phascolion strombus* (Montagu, 1804). With those biological traits, Cutler & Gibbs (1985) erected a new family named Phascolionidae to accommodate the genera *Phascolion* Théel, 1875 and *Onchnesoma* Koren & Danielssen 1876. However, the family Phascolionidae Cutler & Gibbs, 1985, was recently synonymised with Golfingiidae Stephen & Edmonds, 1972, by Kawauchi et al. (2012) after applying detailed genetic techniques in the classification.

On the other hand, the genus *Phascolion* Théel, 1875, is one of the most species-rich genera in sipunculans (Murina, 1984; Gibbs & Cutler, 1987) and their representatives are well distributed along the world's oceans (Murina, 1975). Haldar (1975) and Hylleberg (1994) produced detailed lists of species occurrences, focusing on the Indian Ocean. However, Cutler (1994) noted that waters near the Indian subcontinent seemed to be unsuitable for *Phascolion*, and in fact Haldar (1991) was unable to compile any species of *Phascolion* in his comprehensive monograph of sipunculans from

the Indian coast. Here, we report for the first time the presence of the genus *Phascolion* in Indian waters, and propose the classification of a new subspecies of this genus.

The new subspecies is described below. Types are deposited in the National Institute of Oceanography (NIO, Regional Centre Mumbai, India)

Taxonomy

Phascolion pacificum denticulatum, new subspecies

(Figs. 1A-F)

Material examined.

- Malvan, India; geographical coordinates: 16°02'23.97"N 73°26'15.3"E; depth: 15 m; date: 21.03.2012 and 02.04.2013; bottom ecology: silty substratum; Vijapure leg. 9 specimens.

- Ratnagiri, India; geographical coordinates: 17°00'08.64"N 73°13'47.11"E.; depth: 20 m; date:08.04.2013; bottom ecology: silty substratum, 8 specimens.

Holotype.- NIO/MUM/3/2012/1

Paratypes.- NIO/MUM/3/2012/2

Etymology.

The subspecific epithet *denticulatum* refers to the presence of tooth-like projections in the free border of the holdfast papillae.

Description

Type series are small worms with a length of 2-5 mm, including the introvert (Fig. 1A). Introvert slightly longer than the trunk. Skin smooth and translucent. Colour cream in preserved worms, somewhat darker at both ends of the trunk. Elongated bulbous papillae 17-35 µm tall (Fig. 1E) on the anterior part of the trunk. Triangular shaped holdfast papillae (Fig. 1B-C) 50-100 µm tall, scattered in the middle of the trunk region. The free edges of the holdfast papillae are pigmented in brown colour and directed toward the anterior end of the body. A prominent tooth-like projection or spine is well developed in the larger holdfast papillae (Fig. 1B-C). They are 7-35 µm tall and 7-18 µm wide at the base. At the trunk end there are conspicuous digitate papillae about 10 µm high (Fig. 1F). Small scattered, spine-like hooks about 20 µm in height (Fig. 1D), slightly curved at the end. Tentacles absent, not developed. Internally, the longitudinal musculature is continuous. A single fused retractor with two or three roots attached to the trunk end (Fig. 2A–B). Esophagus detaches from the retractor prior to any subdivision. Gut organized in a few loose loops. Rectal caecum not

observed. A single nephridium is present on the right side of the nerve cord and it is attached to the body wall for most of its length. Nephridiopore behind the anus. Ventral nerve cord ends just before the attachment of the retractor muscles. Gonads not observed at the base of retractors.

Remarks

The studied specimens show a single retractor divided only at the posterior end with the oesophagus detaching from the retractor column before any division. Those taxonomic characters correspond to the subgenus *Montuga* Gibbs 1985. By now, this subgenus contains only two deep-water species: *Phascolion lutense* Selenka, 1885 and *P. pacificum* Murina, 1957. The presence of hardened holdfast papillae along the midtrunk area related the studied specimens with the last species. However, there was a distinctive feature characterizing the collected specimens from *Phascolion pacificum* Murina, 1957: the presence of a prominent tooth-like projection or spine in the median part of the free border of the holdfast papillae. Our interpretation is that this anatomical character is denoting a subspecific status from the nominal form.

Stephen & Edmonds (1972) used several times the presence/absence of teeth in the attachment papillae in their key to identification of species of the genus *Phascolion*. Later on, Cutler & Cutler (1985) restricted the use of tooth-like projections or spines in the free border of the holdfast papillae to *Phascolion (Lesenka) collare* Selenka & de Man, 1883, in which there are cases of 1-4 tall strongly chitinized teeth/points on the holdfast papillae. *Phascolion (Montuga) pacificum denticulatum* can be easily differentiated from *P. collare* by the subgeneric character: retractor column divided only at posterior end vs. complete fusion of the retractor muscles in *P. collare*.

From the several species characterized in Stephen & Edmonds (1972) with pointed tips on the holdfast papillae, one, *P. ikedai* Satô, 1930 is externally similar to our proposed subspecies. The validity of the species was under suspect in several revisions of the Japanese material of Sipuncula (Cutler & Cutler, 1981; Cutler et al., 1984). Finally, the species was moved to the list of Incertae Sedis or Species Inquirendum in the review of the genus *Phascolion* by Cutler & Cutler (1985). The main differences of our proposed new subspecies and *P. ikedai* Satô, 1930 are: (i) the minute body size; (ii) the absence of tentacles; (iii) and the place of the nephridiopore in relation to the anus: behind in *P. pacificum denticulatum* vs. far anterior to the anus in *P. ikedai*.

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This paper is contribution # at NIO

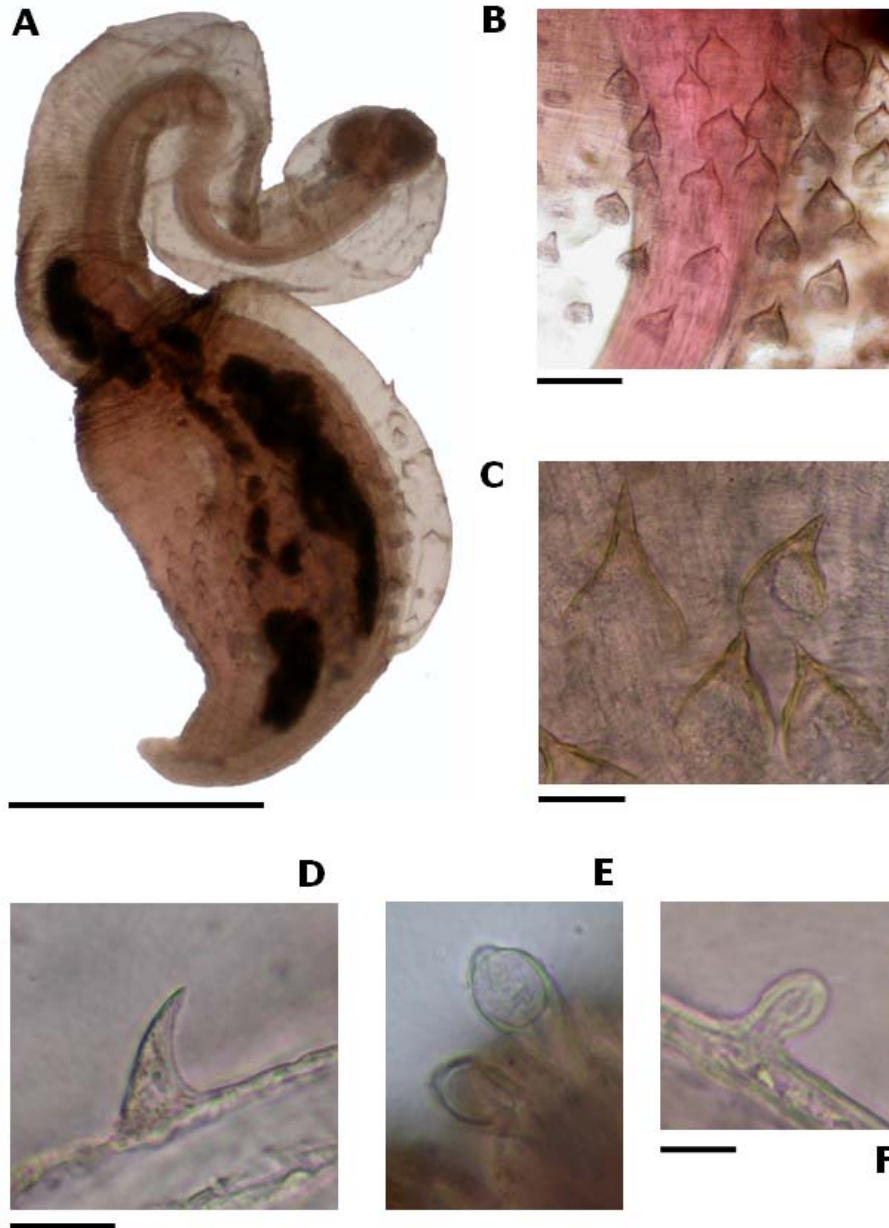
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CAPTION TO FIGURE

FIGURE 1. *Phascolion (Montuga) pacificum denticulatum* new subspecies: A, External view; B, Holdfast papillae showing long spines; C, detail of holdfast papillae; D, Hook; E, Papillae in the anterior part of the trunk; F, Papillae at the trunk end.

Scale bars: A = 0.5 mm; B = 60 μ m; C = 35 μ m; D = 25 μ m; E, F = 10 μ m



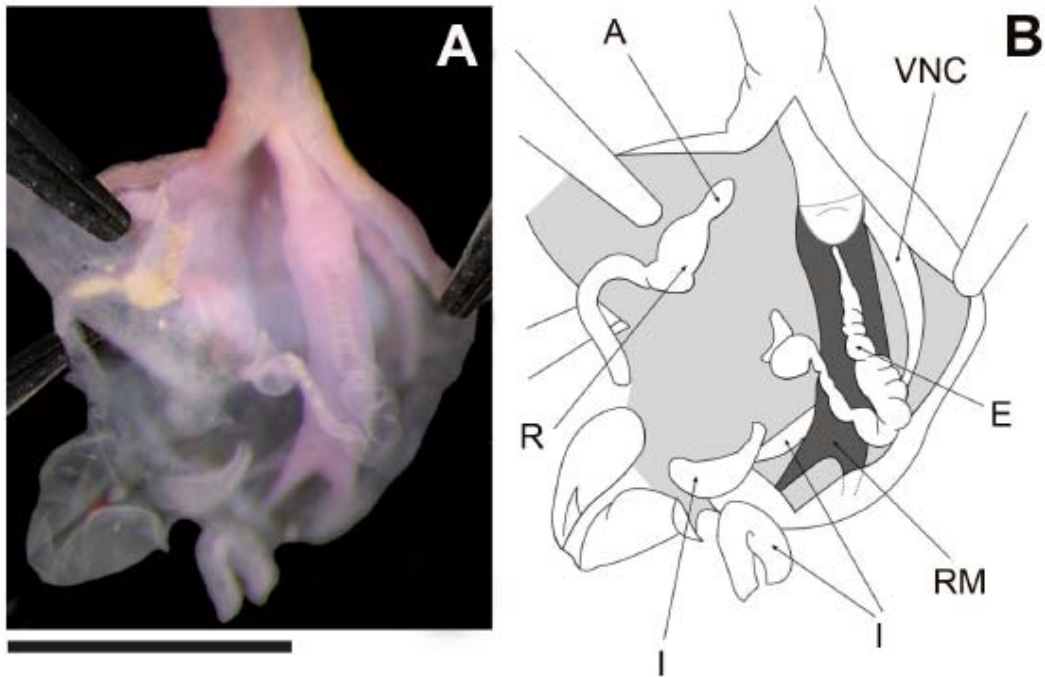


FIGURE 2. Internal anatomy of *Phascolion (Montuga) pacificum denticulatum* new subspecies: A, Dissection showing the retractor column; B, Details of the different organs. The intestinal loops and nephridium were damaged during dissection. Scale bar: 1 mm. Abbreviations: A, anus; E, esophagus; I, intestine; R, rectum; RM, retractor muscle; VNC, ventral nerve cord