

A new species of Pheronematidae (Porifera: Hexactinellida: Amphidiscosida) from the Northwest Pacific Ocean

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Abstract

A new species of the family Pheronematidae is described in this study. Specimens were collected at Yap seamount and Caroline seamount in the Northwest Pacific Ocean. *Poliopogon distortus* sp. nov. contains oval macramphidiscs, three categories of amphidiscs, clavate monaxons and sceptres, making it distinguished from the eight known congeners easily. This is the fourth record of genus *Poliopogon* from the Northwest Pacific Ocean. We also used a partial sequence of 16S rDNA gene to confirm the family assignment of the new specimen.

Key words: deep sea, Hexactinellida, new species, *Poliopogon*

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1 Introduction

Poliopogon is a genus of Pheronematidae with a fan-like body in which the concave side represents the atrial cavity. Basalia include some monaxons with clavate distal ends and two-toothed anchors. Eight species of *Poliopogon* are known in the world: (1) *P. amadou* Thomson, 1878 is divided into two subspecies: *P. amadou amadou* Thomson, 1878 and *P. amadou pacifica* Tabachnick, 1988. *Poliopogon amadou amadou* was found at the depth of 2 480–4 022 m in the Atlantic Ocean (Tabachnick and Menshenina, 2002) and *P. amadou pacifica* was found at the depth of 3 800–4 270 m in the Pacific Ocean (Tabachnick, 1988); (2) *P. canaliculatus* Wang, Wang, Zhang and Liu, 2016 was found at the depth of 2 897 m in the Northwest Pacific Ocean (Wang et al., 2016); (3) *P. clavicularius* Tabachnick and Lévi, 2000 was found at the depth of 1 100–1 348 m in New Caledonia of the South Pacific Ocean (Tabachnick and Lévi, 2000); (4) *P. maitai* Tabachnick, 1988 was found at the depth of 1 690–2 000 m in the Pacific Ocean (Tabachnick, 1988); (5) *P. mendocino* Reiswig, 1999 was found at the depth of 2 332 m in California of the Northeast Pacific Ocean (Reiswig, 1999); (6) *P. micropentactinus* Tabachnick and Lévi, 2000 was found at the depth of 454–2 160 m in the South Pacific Ocean (Tabachnick and Lévi, 2000); (7) *P. zonecus* Tabachnick and Lévi, 2000 was found at the depth of 697–1 348 m in New Caledonia of the South Pacific Ocean (Tabachnick and Lévi, 2000); (8) *P. microuncinata* Kersken, Janussen and Martínez Arbizu, 2017 was found at the depth of 1 673.1 m in the Northeast Pacific Ocean (Kersken et al., 2017). Among the *Poliopogon* species, except for the subspecies of *P. amadou amadou* is distrib-

uted in the Atlantic Ocean, others are distributed in the Pacific Ocean (Fig. 1). Longitudinally, the genus of *Poliopogon* extends from 25°S (New Caledonia) to 40°N (California) in the Pacific and from 15°N to 29°N in the Atlantic. The greatest diversity of *Poliopogon* occurs between 20°N and 25°S in the Pacific Ocean. Outlying species occur in the Northeast Pacific and the Atlantic. The new species was found at the Northwest Pacific which located in the area with the greatest diversity scope of the *Poliopogon*.

2 Materials and methods

Sample collection. The sponge sample was collected by the submersible remotely operated vehicle (ROV) *Faxian* during the cruise of the R/V *Kexue* at the Yap trench in the Northwest Pacific Ocean. The sample was deposited in the Marine Biological Museum of the Chinese Academy of Sciences (MBM) in the Institute of Oceanology of the Chinese Academy of Sciences, Qingdao, China (IOCAS).

Spicule analysis. The methods of preparing, observing and measuring the spicules followed those of Gong et al. (2015).

16S rDNA amplification. DNA extraction method and the amplified procedure of a 481 bp segment of the 16S rDNA gene were according to Gong et al. (2014). The partial 16S rDNA sequence of the new species was submitted to GenBank.

3 Results

Taxonomy

Class Hexactinellida Schmidt, 1870

Subclass Amphidiscosiphora Schulze, 1886

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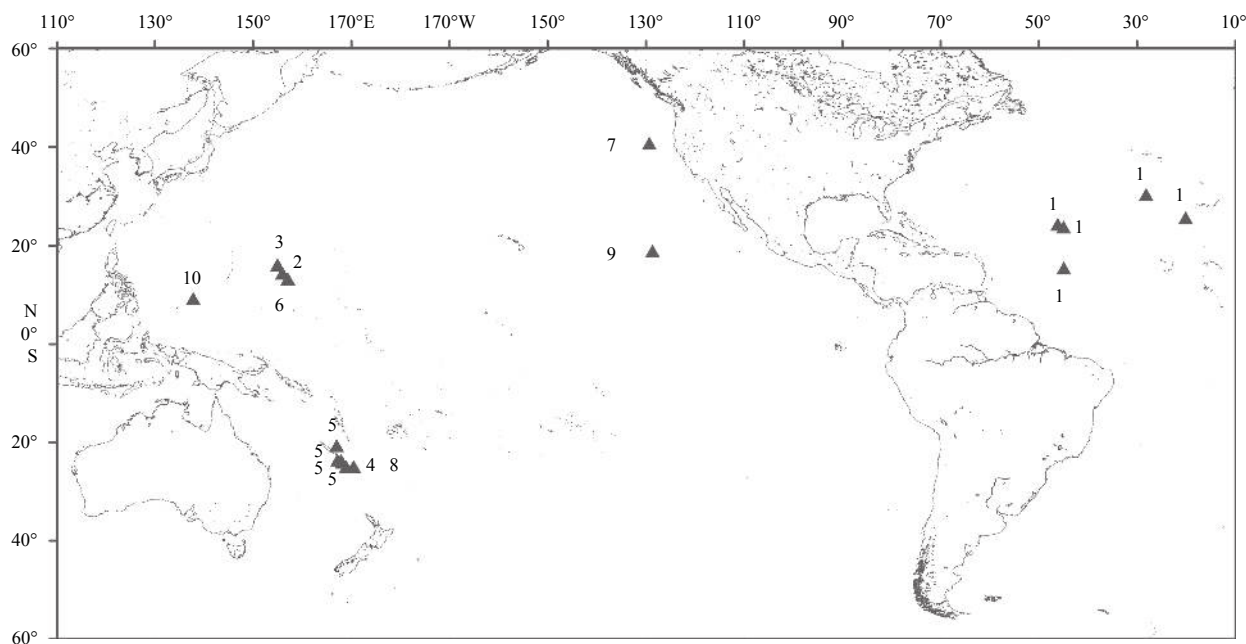


Fig. 1. World distribution of *Poliopogon*: 1. *Poliopogon amadou amadou* Thomson, 1878; 2. *Poliopogon amadou pacifica* Tabachnick, 1988; 3. *Poliopogon canaliculatus* Wang, Wang, Zhang and Liu, 2016; 4. *Poliopogon clavculus* Tabachnick and Lévi, 2000; 5. *Poliopogon micropentactinus* Tabachnick and Lévi, 2000; 6. *Poliopogon maitai* Tabachnick, 1988; 7. *Poliopogon mendocino* Reiswig, 1999; 8. *Poliopogon zonecus* Tabachnick and Lévi, 2000; 9. *Poliopogon microuncinata* Kersken et al., 2017; and 10. *Poliopogon distortus* sp. nov..

Order Amphidiscosida Schrammen, 1924

Family Pheronematidae Gray, 1870

Genus *Poliopogon* Thomson, 1878

Diagnosis. Pheronematidae with a fan-like body in which the concave side represents the atrial cavity. Basalia are in relatively broad tufts and include some monaxons with clavate distal ends and two-toothed anchors (Tabachnick and Menshenina, 2002).

Poliopogon distortus sp. nov.

(Figs 2–4, Table 1)

Material examined. Holotype: MBM286037, Yap seamount (8°51'02.147"N, 137°44.416 014 3'E), 15 December 2014, 932 m depth.

Paratype: MBM286528, Caroline seamount (10°31'34.577"N, 140°10'02.147"E), 26 August 2017, 775.3 m depth.

Description. Sponge of holotype is columnar with body length of 344 mm (not including basalia), maximal diameter is 76 mm and minimal diameter is 49 mm (Fig. 2a). The concave atrial area (Fig. 2d) and convex dermal area (Fig. 2e) are on opposite sides of the body. Color is beige after leaving the water. Sponge fixed at the stock with its basalia (length: 10 mm) (Fig. 2f). Top of the sponge presents an asymmetrical "C" curve (Fig. 2b) which is thinner than other body part. Both of the dermal and atrial area meshes are rectangle or triangle shape. Meshes of atrial area (of 0.2–0.8 mm diameter) (Fig. 3b) are bigger and more regular than dermal area (of 0.1–0.5 mm diameter) (Fig. 3a).

Sponge specimen of paratype is bigger than holotype, it can reach 750 mm (not including basalia), maximal diameter is 320 mm and minimal diameter is 70 mm (Figs 2g, h), its basalia is 43 mm in length.

Spicules: Pentactins (Figs 3c, d) with smooth rays make up choanosomal skeleton, the four tangential rays are usually unequal with 1 018.5–5 087.8 μm long, the proximal rays are always

very short, making them difficult to measure under a light microscopy. Dermalia and atrialia are pinular pentactins. The pinular rays of dermalia (Fig. 4d) are longer and spinier than atrialia (Fig. 4e), with length of 91.8–261.6 μm and 121.9–172.2 μm respectively. Both the tangential rays of atrialia (length: 37.4–76.6 μm) and dermalia (length: 43.1–72.1 μm) have small spines on their terminals, but the tangential rays of atrialia are straighter than that of dermalia. Prostalia are represented by basalia, sceptors and clavate monaxons. Basalia (Fig. 4m) have a smooth shaft and terminal anchor bearing two teeth. Sceptors (Fig. 3e), with smooth shaft and spiny terminals, are 534.5–1 112.7 μm long. Clavate monaxons mainly exist among the basalia and dermal area. Their clavate parts (26.0–58.2 μm) are smooth or have one to three spines (Figs 4a–c), their middle shafts are covered by spines, their distal ends have pointed terminations. There are two types of uncinate: macrouncinates and microuncinates. Macrouncinates are easily broken and can reach several millimeters in length (length: 2 490.2–4 876.2 μm). Microuncinates (Fig. 4l), covered with short spines, are 324.8–883.2 μm in length.

Microscleres contain three kinds of amphidiscs and micropentactins. Macramphidiscs are oval (Figs 4g, h), and the diameter of its umbel is bigger than length. Total length of macramphidiscs is 178.0–269.6 μm , umbel length is 80.2–129.5 μm , umbel diameter is 101.3–145.3 μm . The umbel of macramphidiscs has eight teeth, the terminals of the teeth are smooth (Fig. 4g) or contain small teeth (Fig. 4h). Mesamphidiscs (Fig. 4i) with shafts covered by spines, total length is 49.4–106.4 μm , umbel length is 15.7–35.1 μm , umbel diameter is 11.2–24.7 μm . Micramphidiscs (Fig. 4j) have the same shape with mesamphidiscs, total length is 33.2–49.0 μm , umbel length is 9.8–16.5 μm , umbel diameter is 7.5–12.8 μm . The rays of micropentactins (Fig. 4f) are covered by very short and minute spines, with length 37.9–87.6 μm . Measurement results of holotype spicules are provided in Table 1.

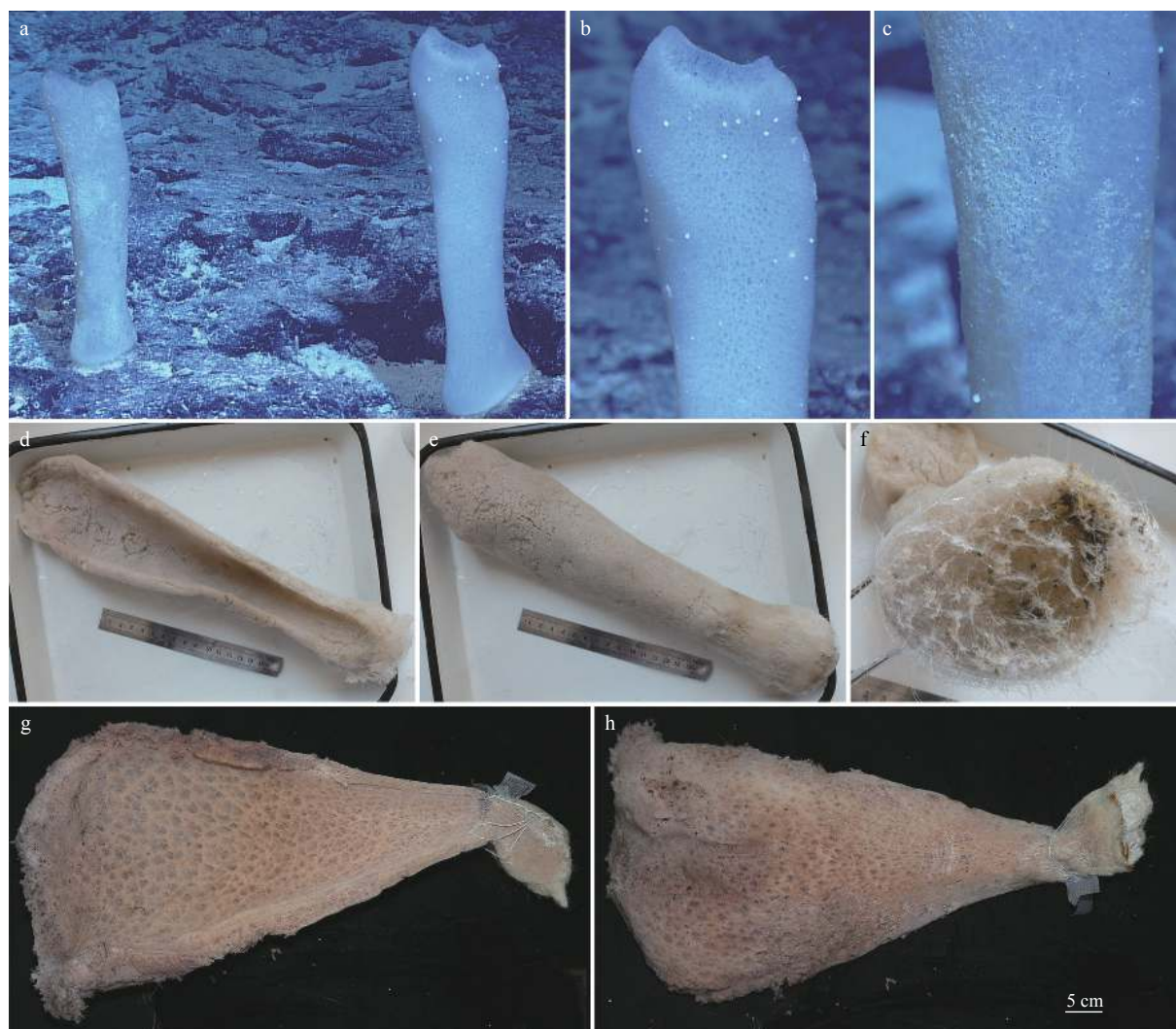


Fig. 2. *Poliopogon distortus* sp. nov.. a-f. Holotype: a-c. a photograph showing its natural growth form on the seabed, d. the external morphology of atrial areas, e. the external morphology of dermal areas, and f. the external morphology of the basalia. g and h. Paratype: g. the external morphology of atrial areas, and h. the external morphology of dermal areas.

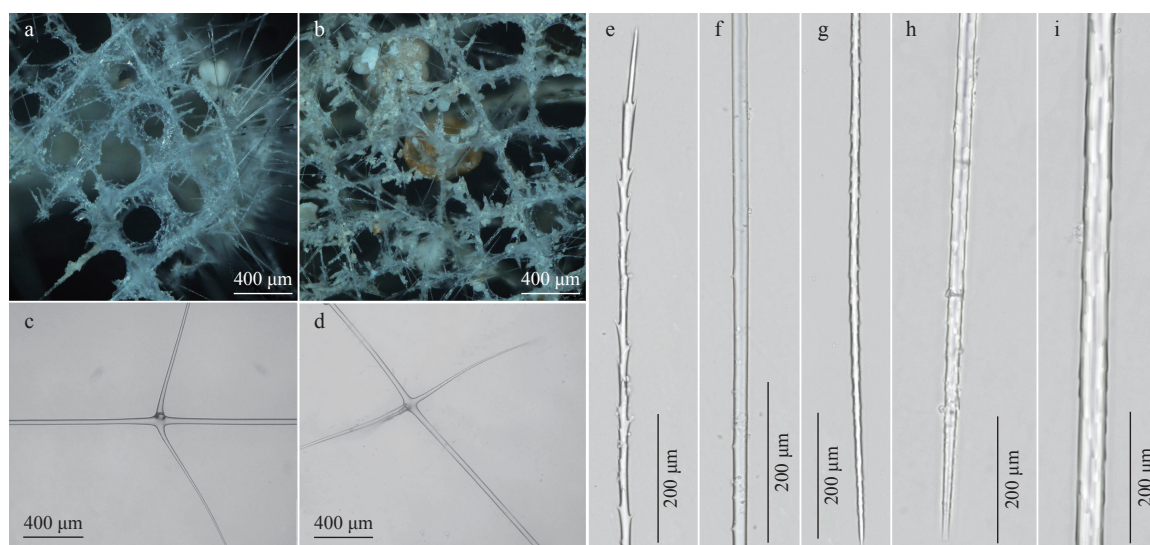


Fig. 3. *Poliopogon distortus* sp. nov. of holotype. a. Mesh structure of dermal areas, b. mesh structure of atrial areas, c and d. choanosomal pentactins, e-g. sceptor, and h-i. macrouncinate.

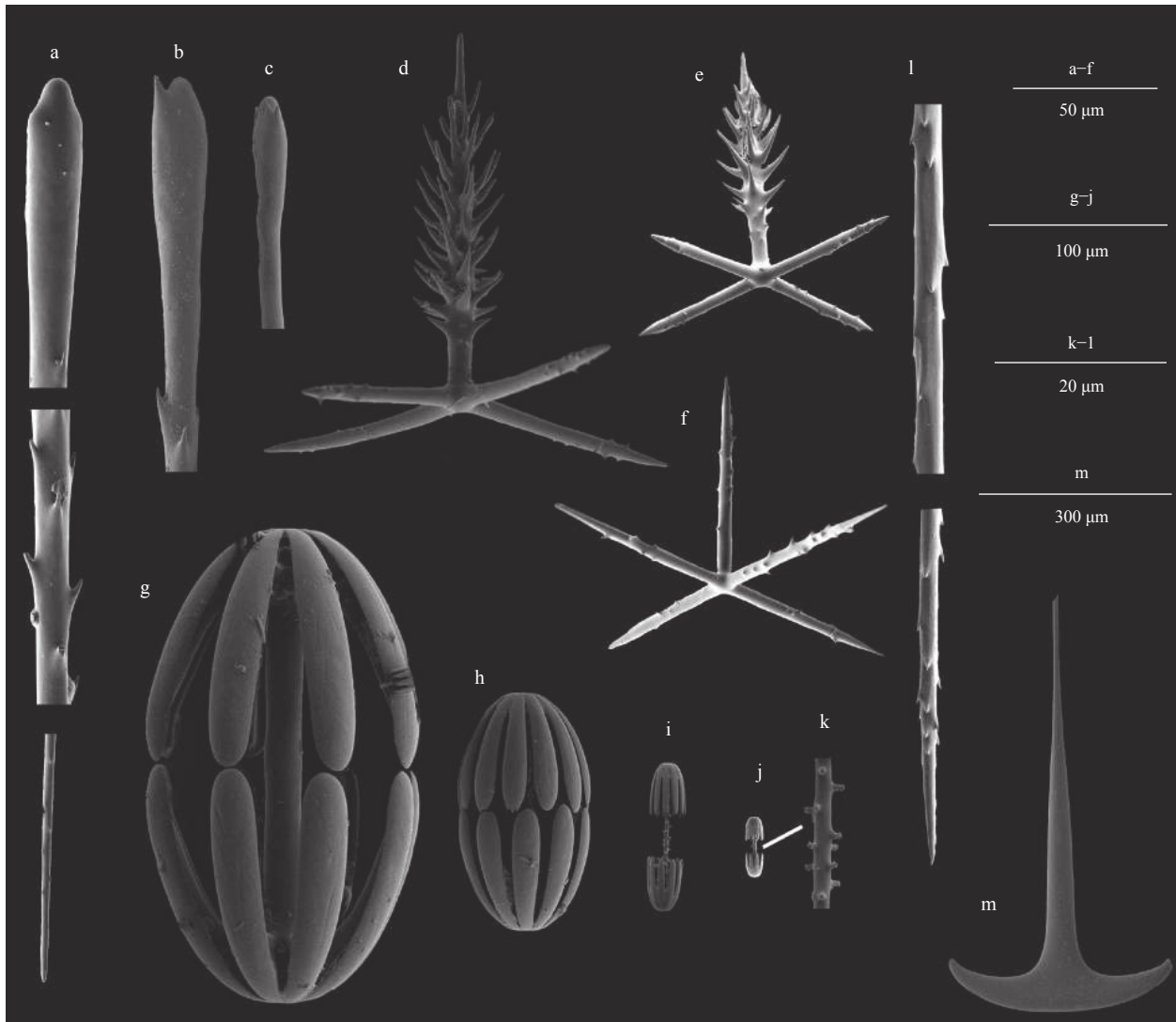


Fig. 4. SEM images of spicules of *Poliopogon distortus* sp. nov.. a–c. Clavate monaxon, d. dermal pinular pentactin, e. atrial pinular pentactin, f. micropentactin, g and h. macramphidisc, i. mesamphidisc, j. micramphidiscs, k. details of the shaft of micramphidisc, l. microuncinate, and m. details of the basalia.

Etymology. The specific name *distortus* is named after the Latin word “distortus”, meaning distorted, referring to the notably distorted body shape.

Genbank accession number: MF098799 (16S rDNA).

Remarks. Eight valid species of *Poliopogon* are reported in the world. Most species of *Poliopogon* are elongate columnar body shape and possess convex dermal areas and concave atrial cavities. By presenting the oval macramphidiscs, our new species and *P. clavicularis* can be distinguished from other *Poliopogon* species easily. Both species possess three categories of amphidiscs and clavate monaxons, but the new species has some notable differences: (1) the new species contains macrouncinates and microuncinates while *P. clavicularis* only contains microuncinates; (2) the new species possesses scepters which are absent in *P. clavicularis*; (3) the clavate monaxons of *P. distortus* sp. nov. are bigger than those of *P. clavicularis*. *Poliopogon mendocino* has an abroad flaring funnel body shape which differs from *P. distortus* sp. nov. drastically in the external morphology. *Poliopogon maitai*, *P. micropentactinus* and *P. zonecus* only contain one type of amphidiscs, *P. mendocino* and *P. amadou pacifica*

contain two types of amphidiscs, this makes them different from *P. distortus* sp. nov. Our new species contains clavate monaxons, both *P. canaliculatus* and *P. microuncinata* do not contain clavate monaxons. *Poliopogon amadou amadou* has longer clavate monaxons (40 mm) than the new species (average 1.7 mm). Based on these differences, we consider it is a new species.

4 Conclusions

Poliopogon are mainly distributed in the Pacific Ocean, but most studies did not describe its original substrate. The original growing substrate was only known in a few *Poliopogon* species (*P. amadou*, *P. microuncinata* and *P. canaliculatus*), and all of the three species grow on hard substrate. *Poliopogon amadou* were found have an aggregation at the depth of 2 700 m on the Great Meteor seamount, they were always found attaching to hard rocky substrate and never to the surrounding sandy substrate (Xavier et al., 2015). It is interesting that *P. distortus* sp. nov. is also attached to the surface of a rock. It is the third *Poliopogon* species found at a seamount. More work is needed to decide whether *Poliopogon* species are typical species grow on hard sub-

Table 1. Measurements of the spicules of *Poliopogon distortus* sp. nov. (in μm)

		<i>n</i>	Mean	Range	S. D.
Dermalia, pinular	pinular ray length	26	160.1	91.8–261.6	53.0
	pinular ray width	26	8.1	6.1–12.2	1.2
	tangential ray length	26	57.9	43.1–72.1	9.1
	tangential ray width	26	5.6	4.0–7.2	0.8
Atrialia, pinular	pinular ray length	30	144.0	121.9–172.2	16.2
	pinular ray width	30	9.1	7.4–11.4	1.0
	tangential ray length	30	55.2	37.4–76.6	9.8
	tangential ray width	30	5.5	4.7–6.6	0.5
Choanosomal, pinular	tangential ray length	9	2 725.9	1 018.5–5 087.8	1 548.8
	tangential ray width	9	29.0	18.5–44.7	8.7
Monaxon, clavate	length	30	1 740.9	1 092.5–2 274.5	224.0
	width	30	13.0	10.3–14.9	1.1
	head width	30	41.3	26.0–58.2	6.0
Macrouncinate	length	8	3 280.4	2 490.2–4 876.2	843.8
	width	8	10.3	7.0–12.3	1.6
Microuncinate	length	30	491.7	324.8–883.2	120.1
Sceptre	length	25	886.3	534.5–1 112.7	169.3
	width	25	4.4	3.2–6.2	0.8
Macramphidisc	length	30	232.0	178.0–269.6	20.5
	umbel length	30	109.1	80.2–129.5	12.8
	umbel diameter	30	130.4	101.3–145.3	8.3
Mesamphidisc	length	30	74.2	49.4–106.4	14.7
	umbel length	30	23.5	15.7–35.1	4.7
	umbel diameter	30	17.4	11.2–24.7	3.2
Micramphidisc	length	30	39.6	33.2–49.0	4.4
	umbel length	30	12.5	9.8–16.5	2.0
	umbel diameter	30	10.0	7.5–12.8	1.3
Micropentactin	tangential ray length	25	69.2	42.0–104.6	15.2

Note: *n* represents number of spicules measured, S.D. standard deviation, and range means the range from the minimum to the maximum.

strate with their basal tuft or whether if they have specific relation with seamount system.

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