

Research Article

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Corresponding author:

Vinicius da Rocha Miranda;

Email: vinicius.ghostty@gmail.com

A new species of *Pisione* (Annelida, Sigalionidae) from Palk Bay, India

Perumal Murugesan¹, Vinicius da Rocha Miranda² ,

Rengasamy Punniyamoorthy¹ and Gopalan Mahadevan¹

¹Centre of Advanced Study in Marine Biology, Faculty of Marine Sciences, Annamalai University, Parangipettai 608 502, Tamilnadu, India and ²Universidade Federal Rural do Rio de Janeiro, Instituto de Ciências Biológicas e da Saúde – Programa de Pós-graduação em Biologia Animal, CEP 23851-970, Seropédica, RJ, Brazil

Abstract

Pisione Grube, 1857 was considered rare animals, but its numbers have increased in recent decades. New species have been described, mainly from the Indo-Pacific region. In this study, we described *Pisione balasubramaniani* sp. nov., from Tamil Nadu, southeastern coast of India. The new species resembles other species in the ‘*remota* complex’ in the shape of the copulatory organs, elongated ventral cirri on the first segment and a short dorsal cirrus on the second segment. It can be distinguished from members of this group by having protruding notoacacula from the anteriormost to the very last chaetigers, three pairs of copulatory organs on chaetigers 15–17 and variances in the morphology of the copulatory organ. We also provide an updated comparison between all known species of *Pisione* based on key morphological characters. We also present a discussion of species of this genus in India and nearby regions.

Introduction

Pisione Grube, 1857 is a genus of scaleless scale worms commonly inhabiting shallow sandy bottoms on sea coasts (Rouse and Pleijel, 2001; Gonzalez *et al.*, 2017), mainly occurring in tropical Indo-Pacific waters (Yamanishi, 1998; Salcedo *et al.*, 2015). It includes 46 recognized species and sub-species, with a few millimetres in length and with over 50 segments. Previously, members of *Pisione* were considered rare (Hartman, 1959), but numerous species have been recently described, likely indicating a diversity much higher than currently known (Rouse and Pleijel, 2001; Aguado and San Martín, 2004; Martínez *et al.*, 2008).

Male copulatory organs are a key character allowing us to distinguish the species of *Pisione*. However, they only develop when the worms become sexually mature (Schroeder and Hermans, 1975), and are absent in most specimens. Species identification therefore depends on the careful analysis of non-sexual characters which are not affected by sexual maturity (Gradek, 1991). Besides buccal aciculae ornamentation, these include the type and number of chaetae and the shape of second dorsal cirri, prechaetal lobes and neuroacacula (Yamanishi, 1998; Salcedo *et al.*, 2015).

Pisionids have rarely been recorded in benthic surveys along the Indian coastal waters, even though *Pisione alikunhi* Tenerelli, 1965, *Pisione complexa* Alikunhi, 1947, *Pisione gopalai* (Alikunhi, 1941) and *Pisione remota* (Southern, 1914) were described as occurring in the region. The former three are endemic species on the eastern Indian coast (Alikunhi, 1941, 1947, 1951; Tenerelli, 1965). This paper reports a new species of *Pisione* in Palk Bay (southern coastal waters of Tamil Nadu, India), which is fully described and illustrated here. We also provide an updated comparison of all species of *Pisione* based on key taxonomic characters and a discussion on the genus organization based on morphological characters.

Materials and methods

As part of the research project ‘Polychaete diversity of Tamil Nadu coastal waters, southeast India’, sponsored by the Ministry of Environment, Forest and Climate Change (Government of India), the specimens were collected monthly from June 2020 to March 2021 along the Tamil Nadu coast, in nearshore and offshore fishing grounds of Kottaipattinam (10–30 m depth, 1–5 km off the shoreline, Table 1) at Palk Bay, India (Figure 1).

Sediments were collected with a Van Veen grab (0.1 m²) following Mackie (1994). After sampling, the organisms were anaesthetized using hypertonic MgCl₂ diluted in seawater, extracted by decantation on a 63 µm mesh (Higgins and Thiel, 1988), sorted and identified to the genus level with a field microscope. Specimens were fixed either in 3% glutaraldehyde or trialdehyde (in 0.1 mol l⁻¹ cacodylate buffer with 5% sucrose) or in 2–4% paraformaldehyde in phosphate-buffered saline buffer, as described in Kerbl *et al.* (2015). Then whole specimens were mounted on slides with glycerol to observe under a KL-300LED Carl Zeiss-inverted microscope with a digital camera.



Table 1. List of sampling stations in Palk Bay

Station	Depth (m)	Number of specimens	Latitude (N)	Longitude (E)	Relative position
1	13.0	4	9°57'40.33	79°11'14.63	Near fish landing centre
2	14.5	6	9°57'33.54	79°17'20.83	East of fish landing centre
3	12.0	4	9°57'42.83	79°18'07.21	South of fish landing centre
4	13.5	1	9°59'57.24	79°17'58.18	North of fish landing centre

Additional specimens were prepared for scanning electron microscopy (SEM) by first transferring them to cacodylate buffer, then post-fixing in 1% osmium tetroxide (in 0.1 mol l⁻¹ cacodylate solution) for 1 h, rinsing with distilled water, dehydrating in a graded ethanol series (20–100%) and transferring over three graded steps to 100% acetone. Once dried, the specimens were mounted on aluminium stubs, sputter-coated with platinum/palladium using a high-resolution fine coater (JFC-2300HR), and examined using a JEOL JSM-6335F field emission SEM at the Central Laboratorial Unit of the Annamalai University.

Specimens of *Pisione* were identified and described according to Alikunhi (1941, 1947, 1951); Schroeder and Hermans (1975); De Wilde and Govaere (1995); Gradek (1991); Yamanishi (1998); San Martín *et al.* (1998); Moreira *et al.* (2000); Martínez *et al.* (2008) and Martins *et al.* (2012). We followed the group classification proposed by Yamanishi (1998). The description was based on the morphology of all specimens of the type series. The holotype, one paratype and additional specimens were deposited at the Museum of Indian Council of Agricultural Research–National Bureau of Fish Genetic Resources (ICAR–NBFGR) of Lucknow (India). The other two paratypes were deposited at the Centre of Advanced Study in Marine Biology of the Annamalai University Reference Museum (CASMB-AU-RM) of Chidambaram (India).

The electronic version of this article in portable document format (PDF) will represent a published study according to the ICZN (International Commission of Zoological Nomenclature, 1999). Hence, the new name in the electronic version is effectively published under that Code from the electronic edition alone. Furthermore, this published study and its nomenclatural acts have been registered in ZooBank (<http://zoobank.org/>) under urn:lsid:zoobank.org:pub:AD0A63C7-5AAB-4513-83CA-712AEBE58117.

Results

Systematics

Family SIGALIONIDAE Kinberg, 1856

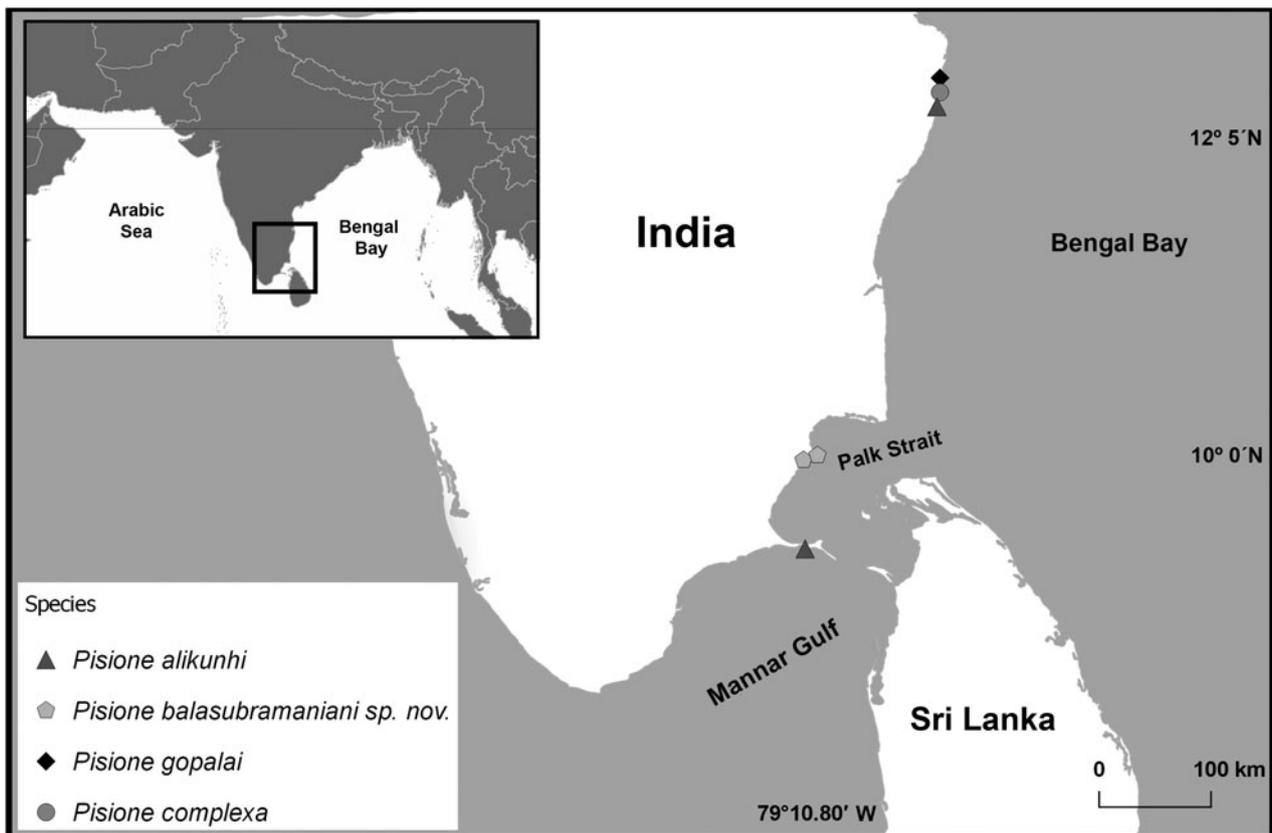
Subfamily PISIONINAE Ehlers, 1901

Genus *Pisione* Grube, 1857

Pisione balasubramaniani sp. nov. Murugesan, Miranda, Punniyamoorthy and Mahadevan
(Figures 2 and 3)

urn:lsid:zoobank.org:act:AD0A63C7-5AAB-4513-83CA-712AEBE58117

Holotype: SIGPBAL/NBFGR; mature male, Palk Bay (India), 9°57'42.83N, 79°18'07.21E; collectors Murugesan and Punniyamoorthy, 25 March 2021, 12 m depth, coarse sand.

**Figure 1.** Occurrence of the species *Pisione* along the Indian coast.

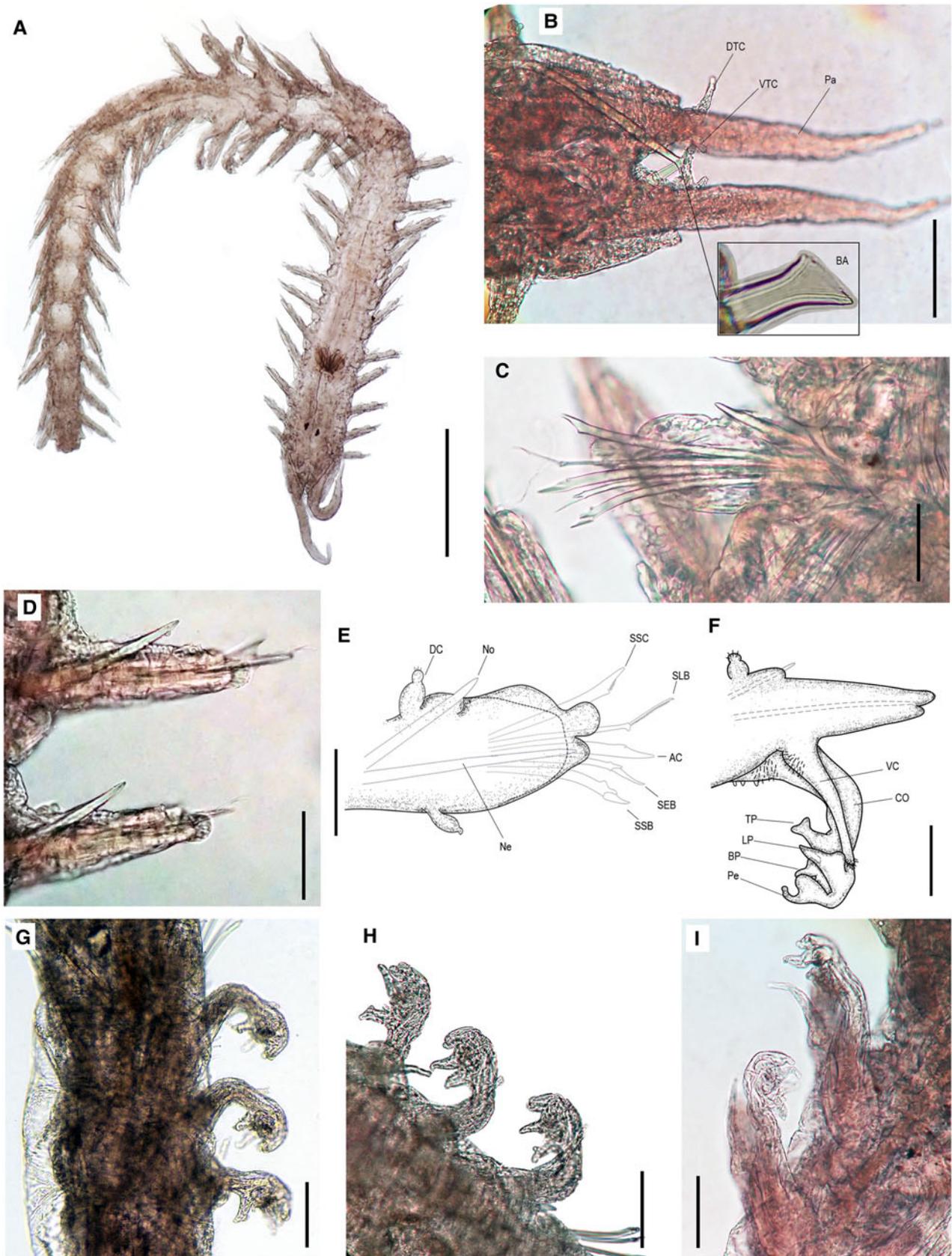


Figure 2. *P. balasubramaniani* sp. nov.: (A) complete specimen, dorsal view (holotype); (B) anterior end, dorsal view (paratype SIGPBAL.1/NBFGR); (C) midbody parapodium, lateral view (holotype); (D) posterior parapodia with protruding notoacacula, dorsal view (holotype); (E) midbody parapodium (dashed lines correspond to the posterior parapodial lobe); (F) parapodium and copulatory organ; (G) copulatory organs, dorso-lateral view (paratype SIGPBAL.1/NBFGR); (H) same in ventral view; (I) copulatory organs, ventral view (paratype SIGPBAL.1/NBFGR). Scale: (A) 0.2 mm; (B) 70 μ m; (C, E) 25 μ m; (D, G, I) 50 μ m; (F) 40 μ m; (H) 80 μ m. Ac, acicular chaeta; BA, buccal acicula; BP, blunt process; CO, copulatory organ; DC, dorsal cirrus; DTC, dorsal tentacular cirrus; LP, long process; Ne, neuroacacula; No, notoacacula; Pa, palp; Pe, penis; SEB, sub-acicular compound chaeta with spinose blade; SLB, supra-acicular compound chaeta with long blade; SSB, sub-acicular compound chaeta with smooth blade; SSC, supra-acicular simple chaeta; TP, T-shaped process; VC, ventral cirrus; VTC, ventral tentacular cirrus.

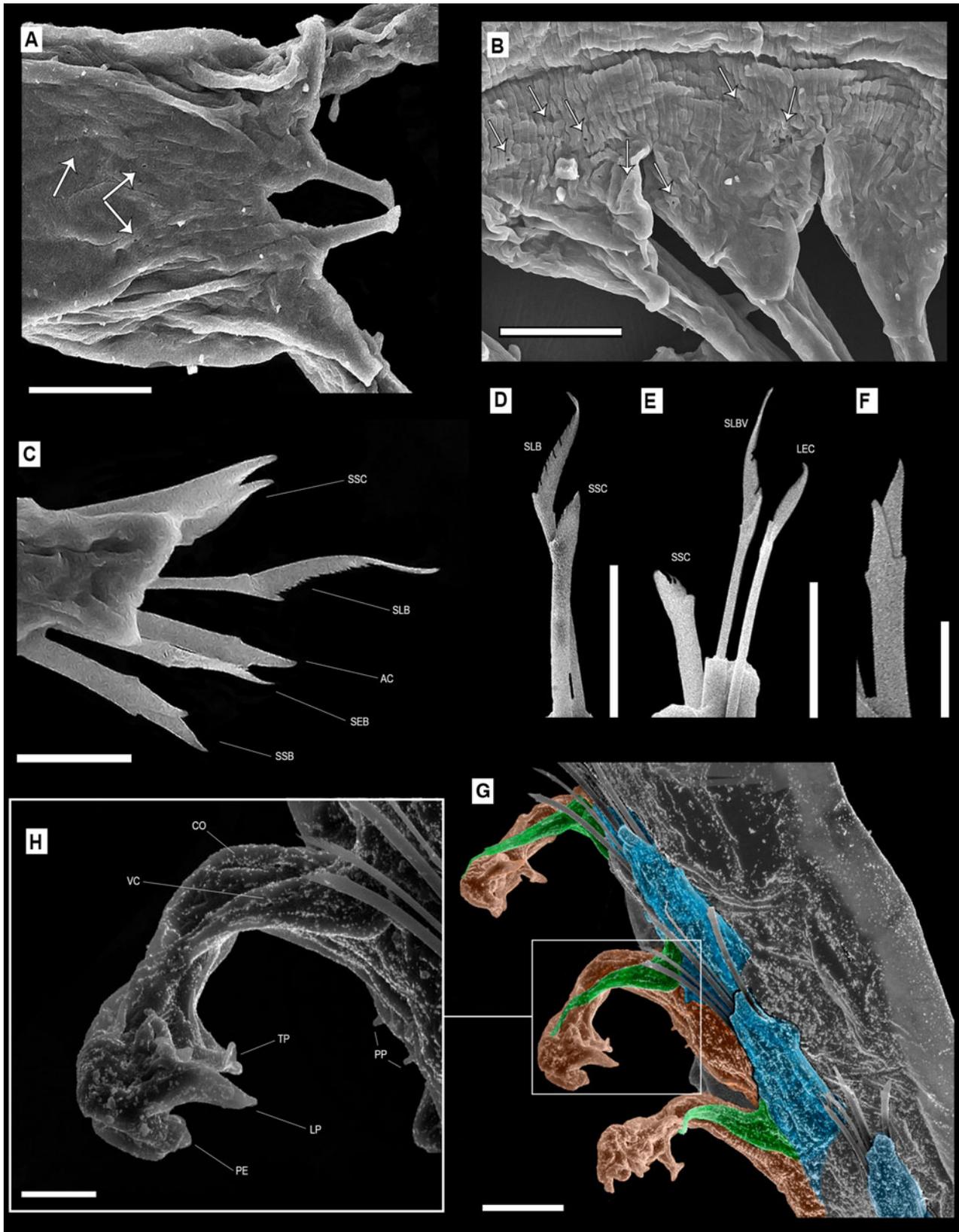


Figure 3. *P. balasubramaniani* sp. nov.: (A) prostomial region (arrows pointing on epithelial pore openings); (B) midbody dorsal epithelial pores (arrows pointing on pore openings); (C) first parapodia, anterior view; (D) supra-acicular chaetae; (E) supra-acicular chaetae and subacicular compound chaeta with spinose blade; (F) sub-acicular compound chaeta with smooth blade; (G) copulatory segments (blue: parapodial lobes; green: ventral cirri; red: male copulatory organs); (H) close view of male copulatory organ. Scales: (A, B, G) 50 μ m; (C, H) 20 μ m; (D, E): 25 μ m; (F) 10 μ m. Ac, acicular chaeta; CO, copulatory organ; LP, long process; PE, penis; PP, papillae; SEB, sub-acicular compound chaeta with spinose blade; SLB, supra-acicular compound chaeta with long blade; SSB, sub-acicular compound chaeta with smooth blade; SSC, supra-acicular simple chaeta; TP, T-shaped process; VC, ventral cirrus.

Paratypes: SIGPBAL.1/NBFG; 1 male specimen, 41 chaetigers; Palk Bay (India), 9°57'33.54N, 79°17'20.83 E; collectors Murugesan and Punniyamoorthy, 25 March 2021, 14.5 m depth, coarse sand. CASMB-AU-RM; 2 male specimens, 32 and 26 chaetigers; Palk Bay (India), 9°57'33.54N, 79°17'20.83 E; collectors Murugesan and Punniyamoorthy, 25 March 2021, 14.5 m depth, coarse sand.

Non-Type Material

CASMB-AU-RM.1; 4 male specimens; Palk Bay (India), station 1, collectors Murugesan and Punniyamoorthy, 25 March 2021, coarse sand. CASMB-AU-RM.2; 1 male and 2 specimens sex, undetermined; Palk Bay (India), station 2, collectors Murugesan and Punniyamoorthy, 25 March 2021, coarse sand. CASMB-AU-RM.3; 3 male specimens; Palk Bay (India), station 3, collectors Murugesan and Punniyamoorthy, 25 March 2021, coarse sand. CASMB-AU-RM.4; 1 specimen sex, undetermined; Palk Bay (India), station 4, collectors Murugesan and Punniyamoorthy, 25 March 2021, coarse sand.

Additionally Examined Species

Pisone oerstedii Grube, 1857 Syntype, ZMB 3834, Valparaiso (Chile), 2 specimens, incomplete. *Pisone cf. remota*: LACM-AHF 02586, Tjarno Fjord (Sweden), 20 specimens. *Pisone hermansi* Gradek, 1991: holotype: USNM 139293, California (USA). 1 specimen; paratype: USNM 139295, California (USA). 1 specimen; paratype, LACM-AHF 1732, California (USA), 1 specimen; *Pisone* spA, São Paulo (Brazil), 10 specimens, VRM personal collection.

Diagnosis

Short dorsal cirri on chaetiger two, ventral cirri elongated but shorter than parapodial lobe. Pharynx extending from the fifth to the ninth chaetigers. Copulatory organs occurring on chaetigers 15, 16 and 17, are not fused to the parapodial lobe and have four terminal digital processes (*remota*-like organs). Notoacacula protruding the parapodial lobe dorsally, from the fifth to the last chaetiger. Parapodia with up to six chaetae, of which two are simple chaetae and three to four compounds.

Description

Body short, thin, translucent to whitish (preserved), dorsal and ventral surfaces smooth, segmentation slightly visible (better distinguishable laterally) (Figure 2A), shallow ventral longitudinal groove; pores on dorsal surface all along body, mainly near parapodial basis, not observed on lateral surfaces (Figure 3A, B).

Prostomium completely fused to peristomium and first (tentacular) segment, narrow anteriorly, widening posteriorly towards the second segment (Figures 2A, B, 3A). Cerebral ganglia dorsally visible as two round lobes, greyish, from middle of buccal segment to middle of chaetiger 4 (Figure 2A). Two pairs of eyes at the level of chaetiger 3, each pair so tightly arranged that appears as single eyespots.

Tentacular segment as two small lobes anterior to the prostomium, supported by the buccal acicula; tentacular cirri emerging frontally (Figures 2B, 3A). Palps inserted ventrally to tentacular lobes, slender, smooth, non-annulated, reaching to chaetiger 5 (Figure 2A, B). Tentacular cirri inserted above palps, half as wide as palps width, elongated; dorsal cirri longer than ventral, 1/3 as long as palps length, smooth except for scattered distal ciliation; ventral cirri 2/3 as long as dorsal cirri, smooth, lacking distal ciliation (Figure 2B). Buccal acicula light yellow, prolonging from basis of first parapodia to internal tentacular lobe border, emerging off body wall; tips of aciculae expanding to distal plates with small worn denticles (Figures 2B, 3A).

Pharynx short, extending from segments 5–9. Two pairs of jaws visible by segment 5, with stout bases and sharp tips; two

wing-like semi-rectangular sheaths at both sides of each jaw; sheath 1/3 wider on external border than on internal border.

Dorsal cirri (DC) at the basis of the parapodia, shorter on chaetiger 2, lengthening to chaetiger 4, then with similar lengths; cirri small, articulated, with globular basis twice as long as upper globular papillose article, giving a bottle shape.

Ventral cirri on first chaetiger elongated, cirriform, with scattered papillae on the distal end, length equal to parapodial lobe. Remaining cirri emerging in the middle of the parapodial lobe; small, flask-shaped, smooth. Smaller on chaetiger 2, lengthening to chaetiger 5, then with similar length through the body (except for those in copulatory parapodia).

Parapodial sesquiramous. Parapodial lengthening until chaetiger 4, then of the same size. The parapodia in chaetiger 2 is half the length of those on chaetiger 4; those on chaetiger 3 barely as long as those on chaetiger 4. Notopodia restricted to notoacacula region. Neuropodia long, oval, prechaetal lobe longer than postchaetal and distally bilobed, lower lobe smaller than dorsal and with a glandular tissue at the tips (Figures 2C, D, 3C); postchaetal lobe distally rounded.

Notoacacula slightly curved dorsally, protruding off epidermis on the middle of parapodia from chaetiger 5, first only tips, then lengthening until most posterior chaetigers (Figure 2C, D). Neuroacacula twice as long as notoacacula, straight, with pointed tips, non-protruding off epidermis.

Two supra-acicular and 3–4 subacicular neurochaetae per parapodium (Figure 2C, E). Uppermost supraacicular simple chaeta (SSC), stout, obliquely truncated, with dense, fine spines on outer margin (Figures 2C, E, 3C–E); lower supraacicular long-bladed compound chaeta (SLB), heterogomph, shaft half as wide and blade twice as long as in other compound chaetae, with short spines on internal margin (Figures 2C, E, 3C, D). One infraacicular simple chaeta (AC), stout, wider than the remaining chaetae, external margin distally curved, internal margin indented subdistally, pointed tip (Figures 2C, E, 3C); 2–3 lowermost subacicular chaetae (usually two), compound heterogomphs, with short blades (half the length of supraacicular compound chaeta), distally unidentate; superior one with internal margin spinose (SEB) (Figure 3C, E), and inferior with slightly shorter and smooth blades (SSB) (Figure 3F).

Pygidium subtriangular, pigdial cirri not observed; anus terminal (Figure 2A).

Three pairs of copulatory organs on chaetigers 15–17 (Figures 2A, G–I, 3G), with parapodial lobes similar to those in remaining segments and ventral cirri longer than those in the rest of the body, similar in length or slightly longer than parapodial lobes (Figures 2F, 3G, H). A tuft of cilia covers the basis of the ventral cirri and the copulatory organ. Chaetae as in non-modified chaetigers. Male copulatory organ arising as a thick process from axis of parapodial lobe and ventral body wall, 1/3 longer than parapodial lobe, tapering terminally, ending in a recurved, hand-like structure with four digitated processes (Figures 2I–K, 3F, G); most proximal as a soft T-shaped process (TP) (Figures 2I, J, 3G); median anterior process 1.5 times longer than the remaining, somewhat conical (LP); median posterior process digitiform, with blunt tip (BP); distal process with a large base, tapering distally into a recurved S-shaped penis with chitinized tip (Pe) (Figures 2J, K, 3G). Female copulatory organ not seen.

Measurements

Holotype a complete mature male, 2.5 mm long (excluding palps), 0.2 mm wide (excluding parapodia), smaller specimen with 28 chaetigers. The longest specimen is a complete paratype, mature male, 3.5 mm long (excluding palps), 0.2 mm wide (excluding parapodia), with 41 chaetigers. In number of segments the smaller specimen has 26 chaetigers and the largest has 42 chaetigers.

Distribution

Known only from the type locality at Palk Bay (Figure 1), South India Ecoregion.

Etymology

This species is named in honour of Professor Thangavel Balasubramanian (Annamalai University), a mentor of Perumal Murugesan and a source of inspiration and constant support right from the beginning of his career.

Discussion

Despite the number of known species and articles dealing with the morphological aspects of *Pisione* species, the diagnostic characters are still poorly understood (Salcedo *et al.*, 2015). The morphology and position of the male copulatory organ are thus key characters allowing the distinction of the species of *Pisione* and *Pisionidens* Aiyar and Alikunhi, 1943. Based on this structure, Yamanishi (1998) first proposed an idea of evolution for the group separating the genus into five different groups based on its increasing complexity: *africana*, *crassa*, *gopalai*, *papuensis* and *remota*. However, this proposal was later disregarded based on morphological and molecular evidence proving that sexual characters had a high degree of homoplasy (Gonzalez *et al.*, 2017). Nevertheless, sexual characters still appear useful for distinguishing and describing species, as they show different grades of fusion to the parapodial lobes and different structures and types of papillae. Considering the above, we updated the synoptic comparisons made by De Wilde and Govaere (1995), Yamanishi (1998) and Salcedo *et al.* (2015) to include our new species (Table 2).

Pisone balasubramaniani sp. nov. belongs to the *remota* group, which is characterized by an elongated copulatory organ with a terminal penis (which may or not be spiralized) and a sub-terminal bidigitate process (Yamanishi, 1998) and currently includes eight species (Table 2). These species also share the presence of elongated ventral cirri on the first chaetiger (except in *Pisone brevicirra* De Wilde and Govaere, 1995) and a short dorsal cirrus on chaetiger 2 (except in *Pisone hartmannschroederiae* Westheide, 1995). *P. balasubramaniani* sp. nov. differs from all other species in the group in having a protruding notoacicular from the most anterior to the last chaetiger, a character mainly present in the *africana* group (except in *Pisone africana* Day, 1963 and *Pisone koepkei* Siewing, 1955). Besides the differences in male copulatory organ, *P. balasubramaniani* sp. nov. differs from the *africana* group in lacking the elongated dorsal cirri on chaetiger 2 and in having a divided pre-chaetal lobe, a sub-acicular simple chaetae and a long-bladed compound chaeta (Table 2).

P. balasubramaniani sp. nov. differs from the *gopalai* and *papuensis* groups, in having a protruding notoacicular and an infra-acicular simple chaeta (Table 2). Also, the species in these groups show a remarkable fusion of the male copulatory organ with the parapodial lobe, being completely fused even with the ventral cirri in the *gopalai* group, which also lacks chaetae in the copulatory segments. In the *papuensis* group, the male copulatory organ is only fused with the parapodial lobe while the cirri remain unmodified (yet it seems swollen in some species), and the chaetae are still present (yet less numerous).

P. balasubramaniani sp. nov. differs from the *crassa* group in having protruding notoacicularae (absent in all species of this group) and sub-acicular simple chaetae (absent in all species of the group except in *Pisone vestigialis* Yamanishi, 1998). In addition to the protruding of notoacicularae, our new species differs from *P. vestigialis* in the presence of a long-bladed neurochaeta

and in having three times fewer chaetigers than the latter (Table 2).

Among the four species of *Pisone* previously recorded in India, *P. alikunhi* was described by Tenerelli (1965), together with a partial revision of Italian and German species and the worldwide occurrence of *P. remota*. Consequently, the presence of the latter in India must be disregarded, as Tenerelli based the description of the new species on the same specimens Alikunhi (1951) used to describe the copulatory organs of '*P. remota*'. However, it is unclear whether he observed the Indian specimens or just relied on Alikunhi's (1951) description, which was based on specimens from Madras beach (Chennai) and at least 440 km far from Krusadai Island (Gulf of Nammar). The latter were all mature females, while the mature males were all sampled at Madras beach, the type locality of the other Indian species of *Pisone*. Therefore, *P. alikunhi* sensu Tenerelli (1965) must be considered valid until further examination of type specimens. However, it is unclear whether the females described by Tenerelli (1965) truly belong to that species or could belong to another one, including *P. balasubramaniani* sp. nov., as both species differ in the bilobed pre-chaetae lobe, the protruding notoacicular and the sub-acicular simple chaetae present in our new species.

P. alikunhi was described by both Alikunhi (1951) and Tenerelli (1965) as having mature males with a reduced number of chaetae in the copulatory segments, which only occurs in the *papuensis* and *gopalai* groups. However, Alikunhi (1951, p. 18) describes the male copulatory organ as having a 'knife blade-like appendage in the form of a recurved hook with the inner edge cutinized and raised into minute projections', which only occurs in the *remota* and *crassa* groups, whereas it was illustrated as having the typical form of the *remota* group in Alikunhi (1951, fig. 3) as well as by Tenerelli (1965). The placement of *P. alikunhi* in any of the groups of *Pisone* remains thus unclear, and the species certainly needs a careful redescription based on the type or topotype materials.

P. balasubramaniani sp. nov. differs from *P. complexa* (Alikunhi, 1942) in keeping the parapodial morphology and elongated ventral cirri in the copulatory segments instead of having parapodia reduced to a globose/papillary structure and ventral cirri transformed into a wide foliaceous structure as in *P. complexa*. Moreover, *P. balasubramaniani* sp. nov. has three sexual segments vs up to six in *P. complexa*, the latter also has shorter ventral cirri on the first chaetiger and lacks protruding notoacicular and simple subacicular neurochaetae.

P. balasubramaniani sp. nov. and *P. gopalai* (Alikunhi, 1941) vary in the morphology of the male copulatory organs, being quite simple, almost completely fused to parapodial lobes and with single tips in the latter, and hand-like with four soft tips in the former. Also, there is only one pair of copulatory organs in *P. gopalai* instead of three in our new species. Additionally, *P. gopalai* lacks simple subacicular neurochaetae and protruding notoacicularae, has shorter ventral cirri in the first segment (elongated in *P. balasubramaniani* sp. nov.), and undivided pre-chaetal lobes (bilobed in *P. balasubramaniani* sp. nov.).

Relatively close to India, seven species of *Pisone* were described from Papua New Guinea by De Wilde and Govaere (1995): *Pisone helenae*, *Pisone parhelenae*, *Pisone parva*, *P. brevicirra*, *Pisone ungulata*, *Pisone primitiva* and *P. papuensis*. They all differ from *P. balasubramaniani* sp. nov. in the morphology of male copulatory organs. Moreover, all species, except that *P. primitiva* and *P. ungulata*, lack protruding notoacicularae, while these two lack the subacicular simple neurochaeta. *P. brevicirra* is unique showing subacicular simple neurochaeta, but in addition to the protruding notoacicular, it also lacks the long-bladed compound neurochaeta.

Table 2. Key morphological characters for the currently accepted species of *Pisone*

Taxon	1	2	3	4	5	6	7	8	9	10
<i>P. africana</i> Day, 1963	+	+	+	-	+	+	8	23-30	<i>africana</i>	75
<i>P. alikunhi</i> Tenerelli, 1965	+	-	-	-	-	+	1-2	16-20	?	52
<i>P. brevicirra</i> De Wilde and Govaere, 1995	-	-	+	-	+	-	1	17-18	<i>remota</i>	28
<i>Pisone bulbifera</i> Yamanishi, 1998	+	-	+	-	-	+	1	19-26	<i>remota</i>	60
<i>P. complexa</i> (Alikunhi, 1942)	-	-	+	-	-	+	1-6	32-82	<i>gopalai</i>	100
<i>Pisone corallicola</i> Hartmann-Schröder, 1974	+	-	+	-	-	+	?	?	?	>12
<i>P. crassa</i> Yamanishi, 1976	+	+	-	-	-	-	4-23	26-63	<i>crassa</i>	105
<i>Pisone galapagoensis</i> Westheide, 1974	+	-	-	-	-	+	3-6	34-40	<i>papuensis</i>	68
<i>Pisone garciavaldecasasi</i> San Martín, López and Camacho, 1998	+	+	-	-	-	+	3-5	45-79	<i>gopalai</i>	117
<i>P. gopalai</i> (Alikunhi, 1941)	-	-	-	-	-	+	1-2	14-21	<i>gopalai</i>	50
<i>Pisone guanche</i> San Martín, López and Núñez, 1999	+	+	+	+	-	-	5-8	33-46	<i>africana</i>	62
<i>Pisone hainanensis</i> Wu, Ding and Huang, 1998	?	+	+	+	-	+	?	?	?	?
<i>P. hartmannschroederiae</i> Westheide, 1995	+	+	-	-	-	+	1-3	23-30	<i>remota</i>	75
<i>P. helenae</i> De Wilde and Govaere, 1995	+	-	+	-	-	+	1-4	18-33	<i>crassa</i>	53
<i>P. hermansi</i> Gradek, 1991	+	+	+	-	-	-	4-11	53-89	<i>crassa</i>	117
<i>Pisone hippocampus</i> Salcedo, Hernández-Alcántara and Solis-Weiss, 2015	+	+	+	+	-	+	1-9	34-42	<i>africana</i>	80
<i>Pisone inkoi</i> Martínez, Aguirrezabalaga and Adarraga, 2008	+	-	+	+	-	+	3	20-37	<i>africana</i>	50
<i>P. koepkei</i> Siewing, 1955	?	-	-	-	-	+	2	14-15	<i>africana</i>	?
<i>Pisone laubieri</i> Hartmann-Schröder, 1970	-	-	-	-	-	+	1-3	27-46	<i>gopalai</i>	57
<i>Pisone levisetosa</i> Zhao, Westheide and Wu, 1991	+	-	-	+	+	+	?	?	?	48
<i>Pisone longipalpa</i> Uschakov, 1956	+	-	-	-	+	-	?	?	?	70
<i>Pisone longispinulata</i> Aguado and San Martín, 2004	+	-	+	-	-	-	1	18-20	<i>gopalai</i>	37
<i>Pisone martinsi</i> Hartmann-Schröder, 1974	+	-	+	-	?	+	1-2	11-12	<i>papuensis</i>	>23
<i>Pisone mista</i> Yamanishi, 1998	+	+	+	+	+	+	?	?	<i>africana</i>	121
<i>P. oerstedii</i> Grube, 1857	+	+	-	-	-	+	Many	From midbody on	<i>africana</i>	210
<i>Pisone papillata</i> Yamanishi, 1976	+	+	+	-	-	+	1	20	<i>gopalai</i>	95
<i>P. papuensis</i> Govaere and De Wilde, 1993	+	+	-	-	-	+	1	37	<i>papuensis</i>	78
<i>Pisone parapari</i> Moreira, Quintas and Troncoso, 2000	+	+	-	-	-	+	1-4	11-34	<i>crassa</i>	57
<i>P. parhelenae</i> De Wilde and Govaere, 1995	+	-	+	-	-	+	1	17	<i>gopalai</i>	39
<i>P. parva</i> De Wilde and Govaere, 1995	-	-	+	-	-	-	2-5	11-21	<i>gopalai</i>	29
<i>Pisone paucisetosa</i> Yamanishi, 1998	-	-	+	-	-	+	1	50-54	<i>gopalai</i>	76
<i>P. primitiva</i> De Wilde and Govaere, 1995	+	-	+	+	-	+	1	23	<i>africana</i>	>45
<i>Pisone pulla</i> Westheid, 1974	+	+	+	-	-	+	?	?	?	59
<i>Pisone puzae</i> Siewing, 1953	+	-	-	-	+	-	2-4	20-25	<i>remota</i>	73
<i>Pisone reducta</i> Storch, 1967	?	-	?	-	-	-	?	?	?	?
<i>P. remota</i> (Southern, 1914)	+	-	+	-	+	-	4-18	19-42	<i>remota</i>	85
<i>Pisone sanmartini</i> Salcedo, Hernández-Alcántara and Solis-Weiss, 2015	+	-	+	+	-	+	2-5	21-25	<i>africana</i>	59
<i>P. subulata</i> Yamanishi, 1992	+	-	-	+	+	+	3-5	14-18	<i>africana</i>	64
<i>Pisone tortuosa</i> Hartmann-Schröder and Parker, 1990	+	+	+	-	-	+	?	?	?	94
<i>Pisone umbraculifera</i> Yamanishi, 1998	+	-	+	-	-	+	3-4	30-35	<i>remota</i>	80

(Continued)

Table 2. (Continued.)

Taxon	1	2	3	4	5	6	7	8	9	10
<i>P. ungulata</i> De Wilde and Govaere, 1995	+	+	+	+	-	+	11	29–39	<i>africana</i>	>39
<i>P. vestigialis</i> Yamanishi, 1998	+	-	+	-	+	-	7–26	49–93	<i>crassa</i>	133
<i>Pisione wolfi</i> San Martín, López and Núñez, 1999	+	-	-	-	-	+	2	21–23	<i>remota</i>	62
<i>P. balasubramaniani</i> sp. nov.	+	-	+	+	+	+	3	15–17	<i>remota</i>	41

Modified from De Wilde and Govaere (1995), Yamanishi (1998) and Salcedo et al. (2015).

Characters: (1) ventral cirri of the first chaetiger elongated, (2) dorsal cirri of the second chaetiger elongated, (3) prechaetal lobe divided, (4) protruding notoacacula, (5) infra-acicular simple chaeta, (6) long-bladed compound chaeta, (7) number of male copulatory organ, (8) occurrence of male copulatory organ (segments range), (9) reproductive group, (10) number of segments; (+) character present; (-) character absent; (?) character unknown or not observed.

Pisione subulata Yamanishi (1992), originally described from Japan, was also reported in Papua New Guinea (De Wilde and Govaere, 1995). Yet, this species resembles *P. balasubramaniani* sp. nov. in the morphology of the copulatory organs, the protruding notoacacula after chaetiger 6, the absence of the elongated dorsal cirrus on segment 2 and the number and types of chaetae. However, the specimens from Papua New Guinea diverge from the Japanese because “The copulatory organs are also “fistlike” but we did not observe the “ribbon”. The ventral cirrus seems much larger than mentioned in the original description, the tip bending into the “fist” (De Wilde and Govaere, 1995, p. 60). We assume that the ‘ribbon’ would be the chitinous structure on the proximal larger papilla of the copulatory organ, but this requires verification. Yet, such chitinous structure is absent in *P. balasubramaniani* sp. nov., which shows three pairs of copulatory organs (instead of up to five like in *P. subulata*), protruding notoacacula up to the last parapodial lobe before the pygidium (absent in few posterior segments in *P. subulata*), long-bladed compound neurochaeta (absent in *P. subulata*) and pre-chaetal lobes distally bifurcate (entire in *P. subulata*).

Despite the difficulties associated with morphologically distinguishing and characterizing new species within Pisioninae, we believe many more species await being described, particularly in *Pisione*. This genus is known to include many species described even in small-scale geographic regions (e.g. Yamanishi, 1992, 1998; Govaere and De Wilde, 1993; De Wilde and Govaere, 1995; San Martín et al., 1998; Moreira et al., 2000; Aguado and San Martín, 2004; Martínez et al., 2008; Moreira et al., 2010; Salcedo et al., 2015; Gonzalez et al., 2017). The description of *P. balasubramaniani* sp. nov. is thus our contribution to the growing knowledge on the poorly investigated polychaete diversity in India and nearby regions.

Data

All data are provided within the manuscript. Specimens are deposited at the Museum of ICAR-National Bureau of Fish Genetic Resources, and at the Centre of Advanced Study in Marine Biology (Annamalai University).

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Conflict of interest. The authors declare that they have no conflict of interest.

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