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A new species of *Armandia* and a new record of *Ophelina* (Polychaeta: Opheliidae) from Indian waters

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Abstract

A new species of polychaete annelid, *Armandia ramanamurthyi* n. sp., is described from the sandy sediments off Tamil Nadu coast, Bay of Bengal, northern Indian Ocean. The major feature distinguishing *A. ramanamurthyi* n. sp. from other species of the genus is bearing a non-papillated anal tube and the presence of a bulbous, orbicular papilla ventrally placed at the proximal end of the anal tube. The orbicular papilla bears black pigmentation and posteriorly ends in an oblique cirrus. Additionally, *Ophelina arabica* Parapar, Al-Kandari, Barroso & Moreira, 2023 described from Kuwait waters is recorded for the first time in Indian waters since its original description.

Marine Record

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Introduction

The subfamily Opheliininae Hartmann-Schröder, 1971 under the family Opheliidae Malmgren, 1867 is comprised of six genera *Ammotrypanella* McIntosh, 1878 (six species), *Antiobactrum* Chamberlin, 1919 (single species), *Armandia* Filippi, 1861 (38 species), *Ophelina* Örsted, 1843 (61 species), *Polyophthalmus* Quatrefages, 1850 (10 species), and *Tachytrypane* McIntosh in Jeffreys, 1876 (single species) (Read and Fauchald, 2024). The genus *Armandia* is characterized by an elongate body, a ventral groove extending all along ventral side, conical prostomium with palpode, cirriform branchiae from the second chaetiger to posterior end, lateral segmental eyespots, simple parapodia with two bundles of capillary chaetae and anal tube. The anal tube is one of the major distinguishing features among the species of this genus, as its length, shape, opening, presence, and types of anal papillae varies among species (Moreira and Parapar, 2017). In the Indian waters, five species of *Armandia* have been reported (Gopal *et al.*, 2016; Sivadas and Carvalho, 2020) viz. *Armandia intermedia* Fauvel, 1902, *A. lanceolata* Willey, 1905, *A. leptocirris* (Grube, 1878), *A. longicaudata* (Caullery, 1944), and *A. sampadae* Gopal, Jaleel, Parameswaran & Vijayan, 2016.

The genus *Ophelina* differs from the genus *Armandia* in the absence of lateral segmental eyespots along the body. The body is elongated with deep ventral groove, cirriform branchiae may be present or absent, parapodia are provided with capillary chaetae and pygidium bears a defined anal tube (Parapar *et al.*, 2023). Under the genus *Ophelina*, only a single species i.e. *Ophelina acuminata* Örsted, 1843 has been recorded from Indian waters (Sivadas and Carvalho, 2020).

The present paper describes a new species belonging to the genus *Armandia* and provides the first record of *Ophelina arabica* Parapar, Al-Kandari, Barroso & Moreira, 2023 from Indian waters (Figure 1).

Materials and methods

As part of the Sea Water Quality Monitoring Programme, benthic sampling was conducted along the entire coastline of India covering western Bay of Bengal (August–October 2023) and eastern Arabian Sea (December 2023–January 2024) onboard CRV *Sagar Tara* and CRV *Sagar Anveshika*. A Van Veen grab (0.1 m^2 bite area) was used to collect sediment samples at 2 and 5 km distance perpendicular from the coast in each transect. Sediment samples were sieved using 500 µm mesh sieve and residual samples were preserved in a 5% Rose Bengal formalin solution. Light microscopy observations and measurements were carried out using a Leica M205C stereo zoom microscope and Leica DM1000 LED compound microscope. Photographs were taken using a Leica Flexacam C3 camera attached to the stereomicroscope as well as compound microscope. Drawings of the holotype specimen of *Armandia ramanamurthyi* n. sp. were created using a Leica M Series drawing tube, attached to the Leica M205C stereo zoom microscope. Opheliid polychaetes were identified using taxonomic references (e.g. Fauchald, 1977; Parapar and Moreira, 2015; Moreira and Parapar, 2017). All type materials are deposited in the reference collections of the National Centre for Coastal Research (NCCR), Chennai, Tamil Nadu, India. The accession number IO/NCCR/POLY/xxxx denotes IO-Indian Ocean, NCCR-National Centre for Coastal Research, POLY-Polychaeta, xxxx-accession number.

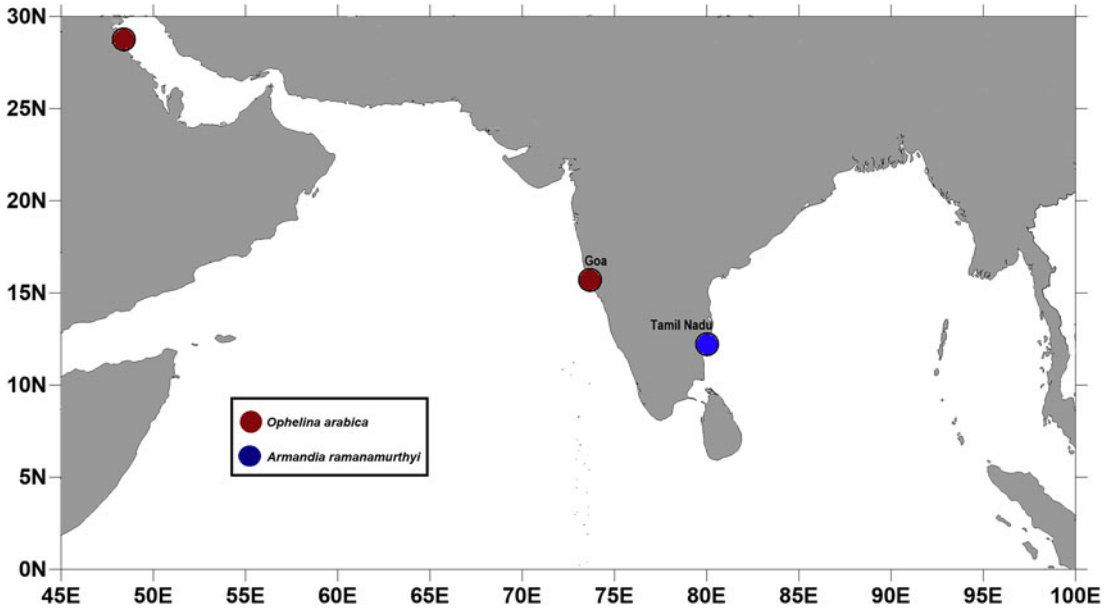

Figure 1. Map of northern Indian Ocean, indicating collection locations of *Armandia ramanamurthyi* n. sp. and *Ophelina arabica*.

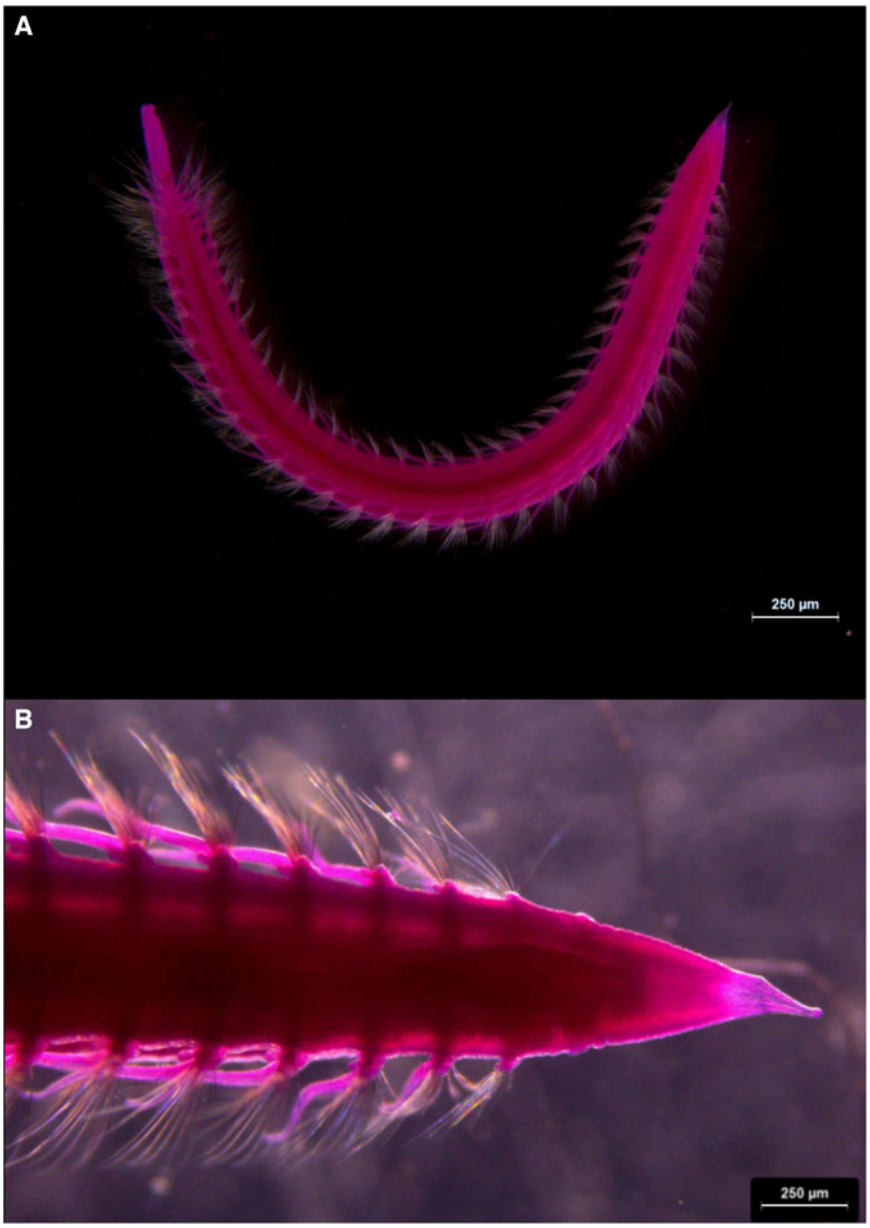

Figure 2. *Armandia ramanamurthyi* n. sp., holotype: (A) entire specimen, ventral view and (B) prostomium, anterior end, and palpode.

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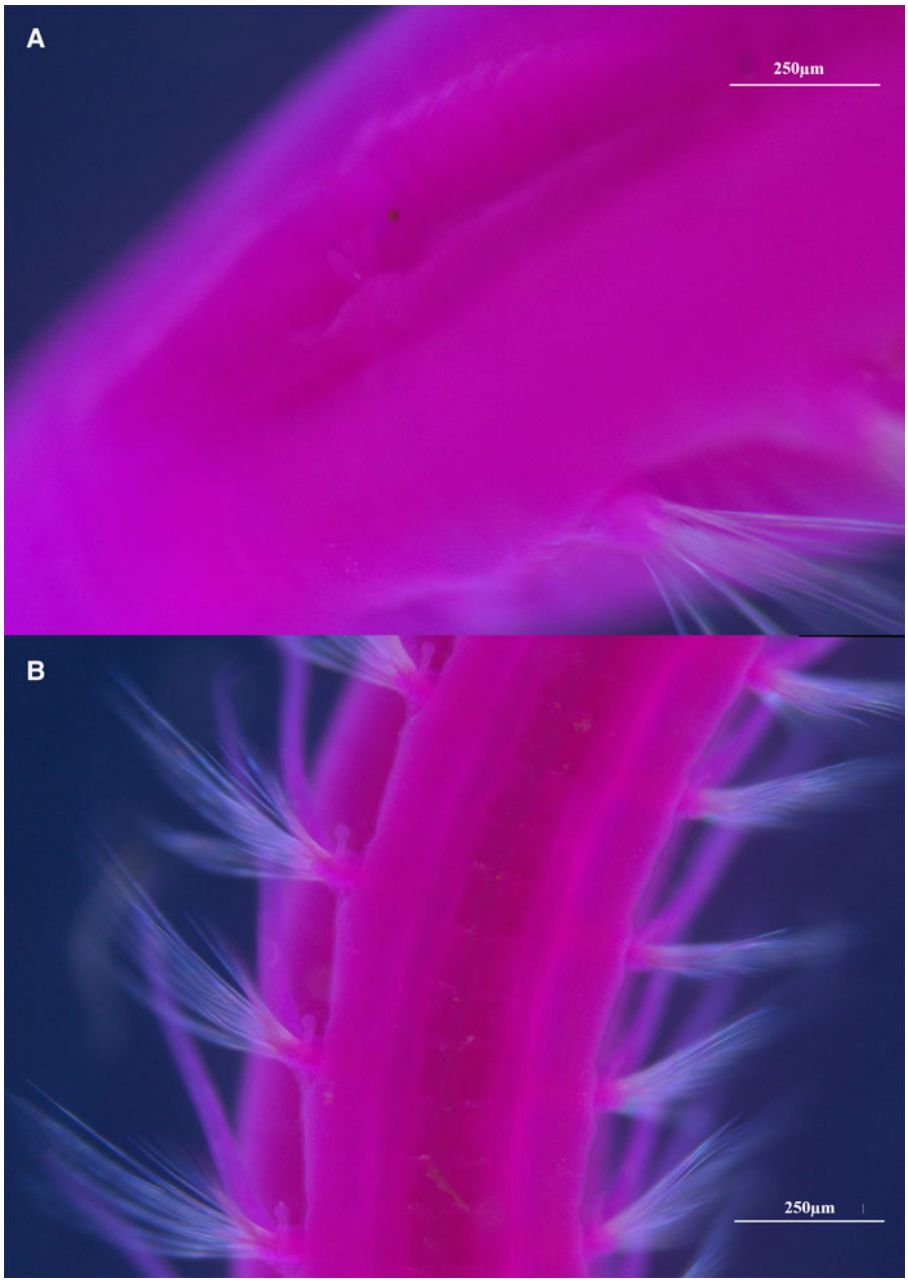

Figure 3. *Armandia ramanamurthyi* n. sp., holotype: (A) ventral mouth with oral papillae and (B) ventral view of body showing ventral cirrus.

Results

Class POLYCHAETA Grube, 1850
Family OPHELIIDAE Malmgren, 1867
Genus *Armandia* Filippi, 1861
Armandia ramanamurthyi n. sp.
(Figures 1–7)

Diagnosis

Prostomium with clavate tipped palpode. Prostomial eyes absent. Branchiae present from chaetiger 2 to 39. Lateral eyespots from chaetiger 7 to 28. Anal tube long, laterally compressed forming a ridge in ventral margin. Proximal end of anal tube provided ventrally with an orbicular papilla with black pigmentation on dorsal surface of bulbous portion; orbicular papilla ending in an oblique cirrus towards posterior end. Anal tube opening dorso-posteriorly without marginal papillae in the posterior margin.

Etymology

The species is named in honour of Dr. M. V. Ramana Murthy, Director, National Centre for Coastal Research (NCCR), Ministry of Earth Sciences, India. He is also serving as Mission Director for Deep Ocean Mission, India which is flagship initiative of the Government of India to explore and harness the resources of the deep ocean.

Material Examined

Holotype. India. Tamil Nadu: Marakkanam, TN4/2, 12°13.143′N, 80°0.871′E, 7.8 m, specimen complete, IO/NCCR/POLY/0001, 3.19 mm long and 0.18 mm wide, 40 chaetigers.

Paratypes. India. Tamil Nadu: Marakkanam, two complete specimens, IO/NCCR/POLY/0002, 3.51 mm long and 0.13 mm wide, 40 chaetigers; IO/NCCR/POLY/0003, 1.46 mm long and 0.08 mm wide, 40 chaetigers.

Description

Body slender, tapering towards anterior end, with a deep ventral groove all along body (Figures 2A & 7A). Prostomium conical with a clavate palpode (Figure 2B). Prostomial eyes absent. Nuchal organs present on lateral side of prostomium, as a

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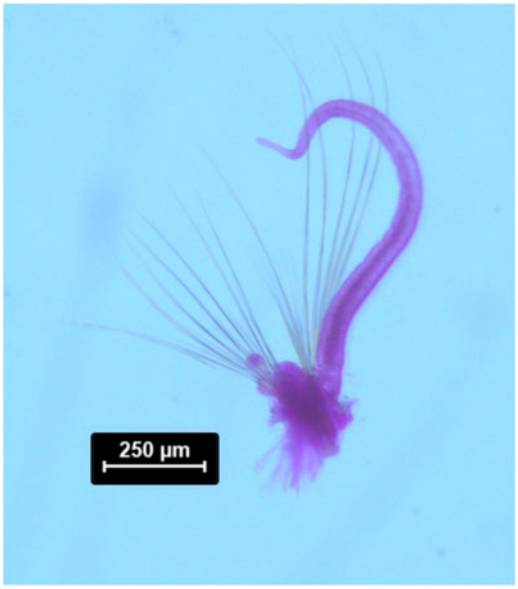

Figure 4. *Armandia ramanamurthyi* n. sp., holotype. Parapodium from 18th chaetiger.

U-shaped depression. Mouth ventral, three oral tentacles protruding from pharynx (Figure 3A). Branchiae long, even surpassing parapodium, starting from chaetiger 2 to 39. Branchiae marginally increasing in length from anterior to middle chaetigers and then marginally decreasing in length towards posterior chaetigers; branchial length variation not pronounced. Black, rounded lateral eyespots of the same size observed from chaetiger 7 to 28. Each parapodium with a conical chaetigerous lobe bearing two bundles of chaetae, a very short dorsal cirrus and a stalked spherical ventral cirrus (Figure 4). First chaetiger with a dorsal cirrus and ventral cirrus, both small and spherical, ventral cirrus stalked and spherical in consecutive parapodia (Figure 3B). Parapodia bearing two bundles of simple capillary chaetae (Figures 4 & 7C). Notochaetae longer than neurochaetae, comprising 7–8 long capillaries and 7–8 medium-sized capillaries; neurochaetae includes 7–8 medium-sized capillaries and 7–8 small-sized capillaries. Anal tube about 5.5 times as long as wide, as long as last eight chaetigers, laterally compressed forming a ridge in ventral margin, bearing 20–22 faint vertical bands in entire length (Figures 5A, B & 6A, B). A bulbous orbicular papilla-like structure ventrally and near to proximal region of anal tube (Figures 5A & 7D); orbicular papilla with black pigmentation on dorsal surface ending in an oblique cirrus

Figure 5. *Armandia ramanamurthyi* n. sp., holotype: (A) anal tube, ventral side and (B) anal tube, details of orbicular papilla bearing black pigmentation.

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Figure 6. *Armandia ramanamurthyi* n. sp., holotype: (A) anal tube and posterior end, dorsal view and (B) anal tube, ventrolateral view.

towards posterior end; cirrus broken in the posterior end in both holotype and paratypes (Figure 5B). Anal tube opening dorso-posteriorly, posterior margin lacking marginal papillae (Figures 6A & 7B).

Distribution

Tamil Nadu, 7.8 m depth, sandy sediments.

Genus *Ophelina* Örsted, 1843

Ophelina arabica Parapar, Al-Kandari, Barroso & Moreira, 2023 (Figures 1 & 8A, B)

Ophelina arabica Parapar *et al.*, 2023: 4–12, Figures 1–5.

Diagnosis

Body tubular with ventral and lateral grooves. Branchiae present from second chaetiger. Parapodia biramous with a rounded prechaetal lobe, ligulate ventral lobe and short spherical dorsal cirrus. Anal tube long, annulated, with a black pigmented, elongated, bump-like structure in ventral side of anal tube, fringed with a pair of small elongated papillae and an unpaired anal cirrus. Anal tube opening dorso-posteriorly, lacking marginal papillae.

Material Examined

India. Goa: GA3/2, 15°42′N, 73°40′E, 9 m, 3 complete specimens; IO/NCCR/POLY/0004, 2.58 mm long and 0.11 mm wide, 38 chaetigers, IO/NCCR/POLY/0005, 2.05 mm long and 0.11 mm wide, 38 chaetigers, IO/NCCR/POLY/0006, 1.93 mm long and 0.11 mm wide, 38 chaetigers.

Description

Body long, tubular, slender tapering anteriorly (Figure 8A). Ventral and lateral grooves extending from anterior to posterior end. Prostomium pointed and bearing a terminal palpode; prostomial eyes not observed. Nuchal organs oval, seen as deep lateral depressions. Branchiae long, starting from chaetiger 2 to last chaetiger. Biramous parapodia, with a rounded prechaetal lobe, ligulate ventral lobe and short spherical dorsal cirrus. Parapodia bearing two bundles of chaetae; chaetae as simple smooth capillaries, with 6–8 capillaries in each bundle. Anterior parapodia chaetae oriented laterally or postero-laterally. Notochaetae longer than neurochaetae, as long as branchiae. Notochaetae of posterior five chaetigers oriented latero-posteriorly and longer than those

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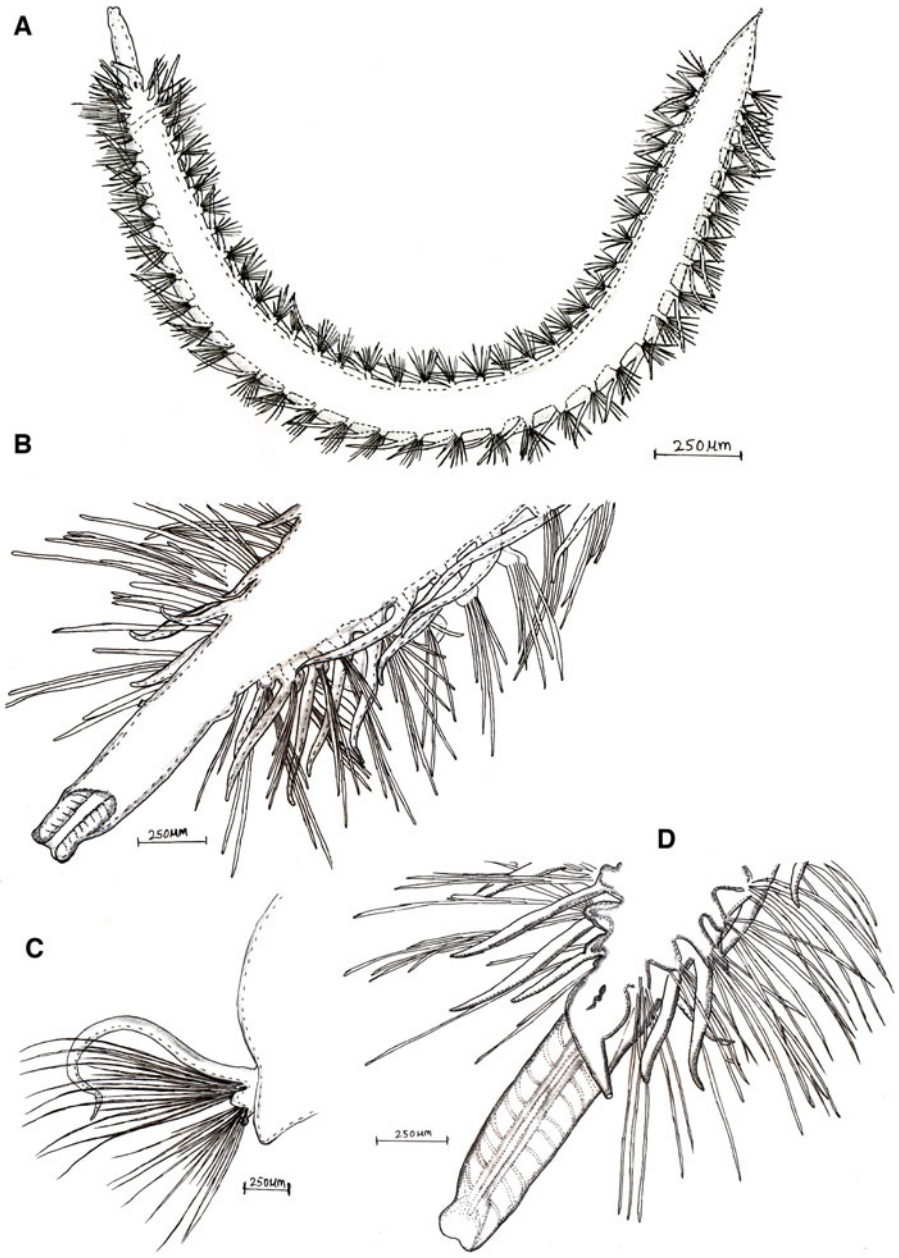

Figure 7. *Armandia ramanamurthyi* n. sp., holotype: (A) entire specimen, ventral view; (B) anal tube, dorsal side; (C) parapodium from 18th chaetiger (left side) and (D) anal tube, ventral side.

from anterior chaetigers, even surpassing anal tube. Anal tube as long as last 5–6 chaetigers, 2.5 times as long as wide, with 25–26 fine annulations. Anal tube opening dorso-posteriorly, without marginal papillae. Ventral side of anal tube bearing a black pigmented, elongated, bump-like structure in basal portion, fringed with a pair of small elongated papillae and an unpaired anal cirrus even surpassing anal tube. Ventral margin of anal tube fused, showing a pronounced ventral fusion line extending from anal cirri base to anal tube opening (Figure 8B).

Distribution

Kuwait (Parapar *et al.*, 2023), India (present study); intertidal to 9 m, sandy substrate.

Discussion

Four species of *Armandia* lack papillae in the posterior margin of the anal tube viz. *Armandia bilobata* Hartmann-Schröder, 1986, *Armandia exigua* Kükenthal, 1887, *Armandia nonpapillata* Jones, 1962, and *Armandia simodaensis* Takahashi, 1938. *Armandia ramanamurthyi* n. sp. is similar to all aforementioned species in the absence of posterior marginal papillae in the anal tube and differs from all aforementioned species in the presence of a black pigmented, bulbous orbicular papilla in the ventral proximal region of the anal tube.

In the Indo-Pacific region, three species of *Armandia* lacking papillae in the posterior margin of the anal tube have been reported. *Armandia bilobata*, described from sandy beaches of Port Hughes (Australia) bears an anal tube which opens ventrally and dorsally over the posterior half so that the bi-lobed back half resembles two wings. In *A. ramanamurthyi* n. sp. the anal tube is longitudinally closed and opens dorso-posteriorly. Lateral eyespots are double in number and branchiae are relatively more numerous in *A. ramanamurthyi* n. sp. than in *A. bilobata* (Table 1). *Armandia bilobata* is provided with three prostomial eyespots while those are absent in *A. ramanamurthyi* n. sp. *Armandia simodaensis*, reported from the beach sediments near Shimoda Marine Biological Station (Japan), possesses a horn-shaped delicate membranous anal tube while in *A. ramanamurthyi* n. sp. anal tube is tubular

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Figure 8. *Ophelina arabica* Parapar, Al-Kandari, Barroso & Moreira, 2023: (A) entire specimen and (B) anal tube, lateroventral view.

and relatively thick. Anal tube opens dorso-posteriorly and lacks prostomial eyespots in both species. The dorsal cirri are long and subulate in *A. simodaensis* but small and spherical in *A. ramanamurthyi*. *Armandia simodaensis* has fewer lateral eyespots and branchiae than *A. ramanamurthyi* n. sp. (Table 1). *Armandia exigua* from China bears a ventrally opened cylindrical anal tube, with a notch on ventral side of the anal tube as a continuation of abdominal groove whereas *A. ramanamurthyi* n. sp. bears a relatively long anal tube, closed all along its length and opens only dorso-posteriorly. Prostomial eyespots are absent in both species. The number and arrangement of lateral eyespots and branchiae and in chaetigers are detailed in Table 1.

In the North Atlantic Ocean, *A. nonpapillata*, reported from Kingston Harbour (Jamaica), bears ventrally an opened truncated anal tube whereas *A. ramanamurthyi* n. sp. bears a dorso-posteriorly opened anal tube. *Armandia nonpapillata* has elliptical segmental eyespots and ciliated branchiae while *A. ramanamurthyi* n. sp. possesses circular segmental eyespots and non-ciliated branchiae (Table 1); both species lack prostomial eyespots. The dorsal cirri are small and spherical in both species while ventral cirri are subtriangular in *A. nonpapillata* and spherical and stalked in *A. ramanamurthyi*. The report of the new species from Bay of Bengal increases the number of known *Armandia* species to six in Indian waters and 39 species globally.

The specimens of *Ophelina arabica* reported from Kuwait (Figure 1) and the present specimens from India are mostly similar apart from two features. In specimens of *O. arabica* from Kuwait (Parapar *et al.*, 2023), the notochaetae of posterior five chaetigers do not surpass the distal end of the anal tube, while in Indian specimens, the notochaetae fairly surpass the anal tube. A reddish spot is present in distal end of anterior lobe of all parapodia in specimens from Kuwait whereas such spots were completely absent in Indian specimens. This new record of *O. arabica* from Indian waters extends its known geographic distribution from the Persian Gulf to Indian waters.

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Table 1. Comparison of species of the genus *Armandia* Filippi, 1861 that lack anal papillae in the anal tube

Species	Prostomial eye spots	No. of lateral pair of eyes (range of no. of chaetigers)	No. of pairs of branchiae (range of no. of chaetigers)	Anal tube (AT)	AT length	Anal cirrus	AT opening	Distribution	Reference
Armandia bilobata Hartmann-Schröder, 1986	3 eyes arranged in a triangle	11 (7–17)	25 (2–26)	AT opening ventrally and dorsally open over rear half; bilobed back half resembling 2 wings	NS	Single ventral cirrus	Dorso-posteriorly and ventro-posteriorly	Australia, intertidal	Hartmann-Schröder (1986)
Armandia exigua Kükenthal, 1887	Absent	NA (9–NA)	25 (2–26)	AT cylindrical with a notch on ventral side as a continuation of abdominal groove	As long as 4 segments	Absent	Ventrally	China, 15 m	Kükenthal (1887)
Armandia nonpapillata Jones, 1962	Absent	11 (6–17)	22 (2–23)	AT with 12–13 narrow vertical bands	As long as last 3–4 segments	Absent	Ventrally	Jamaica	Jones (1962)
Armandia simodaensis Takahashi, 1938	Absent	10 (7–16)	26 (2–27)	AT as a horn shaped delicate membrane	AT ventral side twice as long as dorsal side	Absent	Dorso-posteriorly	Japan, intertidal	Takahashi (1938)
Armandia ramanamurthyi n. sp.	Absent	22 (7–28)	38 (2–39)	AT long, laterally compressed, bearing an orbicular papilla in the proximal region of AT. Orbicular papilla with black pigmentation on the dorsal surface of bulbous portion and posteriorly ending in an oblique cirrus	As long as 9 chaetigers	Cirrus broken	Dorso-posteriorly	India, 7.8 m	Present study

NA, not available; NS, not specified.

Data. All data generated during this study are included in this article.

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Author contributions. A. G.: conceptualization, identification, and writing; S. K. S. and K. R.: writing – review.

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Competing interests. None.

Ethical standards. No animal testing was performed during this study.

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