

Armandia sampadae, a new species of polychaete (Opheliidae) from Andaman Sea, Northern Indian Ocean

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A new species of polychaete, Armandia sampadae was collected from shallow sandy sediments off Rutland Island (57 m depth) and off North Andaman (52 m depth) during a benthic survey along the continental shelf of Andaman and Nicobar Islands. The major character which distinguishes this species from other members of the genus Armandia is the presence of a pair of large, flattened, rounded, stalked, pigmented, leaf-shaped ventral papillae at the ventral base of the ringed anal funnel and the occurrence of a pair of sub-triangular black pigmented spots in the basal portion of the ventral papillae.

Keywords: *Armandia*, new species, Opheliidae, polychaete, Andaman Sea, Indian Ocean

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INTRODUCTION

The genus *Armandia* (Family: Opheliidae) has a cosmopolitan distribution and includes 31 known species (WoRMS, 2015), and in general opheliids are active burrowers and appear to be deposit feeders (Fauchald & Jumars, 1979). The characters that distinguish members of *Armandia* from other opheliid genera are the presence of a ventral groove, branchiae and segmental eye spots between the parapodia. Within the genus, species are differentiated chiefly based on the morphology of the anal funnel, anal papillae and anal cirrus. To date only three species have been reported from Andaman and Nicobar waters of Indian EEZ, viz. *Armandia lanceolata*, *Armandia leptocirris* and *Armandia intermedia* (Tampi & Rangarajan, 1964; Rao, 2010).

MATERIALS AND METHODS

During benthic surveys of the Andaman Sea onboard the Fishery Oceanographic Research Vessel 'Sagar Sampada' (FORVSS Cruise No. 292), two specimens of *Armandia* were obtained in a Smith McIntyre grab, one from 57 m depth, off Rutland Island and another from 52 m depth off North Andaman (Figure 1). Sediment samples were sieved using a 300 µm mesh sieve and preserved in 5% buffered formalin, and stained using Rose Bengal solution. Taxonomic identification up to the generic level followed the keys of Fauchald (1977). A stereo zoom microscope (Leica S8APO) and a camera lucida attached to a compound microscope (Leica DM1000) were used to study the specimens. Length and width measurements were made using a Leica

Application Suite (Leica DFC 425) and photographs were taken using a CatCam 130 Microscope Camera. Although the benthic survey covered 60 stations around Andaman and Nicobar Islands (50–200 m), this species was collected only from two locations. The specimens have been deposited with the FORV Referral Centre, Centre for Marine Living Resources and Ecology, Cochin, Kerala, India.

SYSTEMATICS

Phylum Annelida
Class Polychaeta Grube, 1850
Family Opheliidae Malmgren, 1867
Genus *Armandia* Filippi, 1861
Armandia sampadae sp. nov.
(Figures 2 & 3)

TYPE MATERIAL

Holotype: IO/SS/POL/0467, Off Rutland Island, 11°28.038'N 92°43.268'E, 57 m; Paratype: IO/SS/POL/0468, Off North Andaman, 13°31.121'N 92°46.751'E, 52 m. Specimens complete, 10.5 mm long, 1.9 mm wide with 32 chaetigers (Cruise 292, 3 December 2011, pre-monsoon season). *Armandia sampadae* sp. nov. was collected from coralline sandy sediments with a dissolved oxygen content of 2.7 to 3.9 ml L⁻¹, temperature of 27.1–28.2°C and salinity of 32.7–33.4.

DIAGNOSIS

Prostomium with an elongated pigmented palpode; branchiae with brownish orange pigmentation; 14 pairs of lateral eyes; a pair of large, flattened, rounded, stalked, pigmented, leaf-shaped ventral papillae at ventral base of anal funnel and with pair of sub-triangular black pigmented spots on basal portion of ventral papillae. Anal funnel bears 14 rings and fringed with 14 marginal papillae.

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Fig. 1. Map of Andaman Islands, indicating collection locations ($9^{\circ}18.175'N$ $92^{\circ}49.337'E$; $13^{\circ}31.121'N$ $92^{\circ}46.751'E$).

DESCRIPTION

Body slender with 32 chaetigers, faintly annulated throughout body (Figures 2A & 3A). Deep ventral groove extending from chaetiger 2 to last chaetiger. Prostomium conical, with a pair of dorsal eyes, palpode elongated with pigmentation near proximal end, apparently with tactile function (Figure 2B); pair of nuchal organs present posterior to prostomium. Peristomium indistinct, probably fused with prostomium; mouth ventral. Branchiae with patchy brownish orange pigmentation, appearing from chaetiger 2–31. Fourteen pairs of lateral eyes present from anterior of chaetiger 5 continuing to chaetiger 18; each eye pigmented brownish orange. Each parapodium (Figure 3B) with a presetal conical chaetigerous lobe bearing two bundles of simple capillaries and a small ventral cirrus, postsetal lobe absent. Ventral cirrus absent in last chaetiger. Anal funnel obliquely truncate, as long as last three chaetigers, bearing 14 rings with a ventro-posterior opening. Two large flattened, rounded, stalked, leaf-shaped papillae present in ventral base of anal funnel, originating at the end of ventral groove. Brownish orange pigmented spots scattered on ventral papillae in distal end (flattened portion) whereas absent in stalk. Stalk of ventral papillae folded in the inner margin. A pair of sub-triangular black pigmented areas composed of numerous minute spots present on basal portion of ventral papillae (Figures 2C & 3C) resembling eyes. Anal funnel fringed with 14 cirriform marginal papillae; long internal anal cirrus absent. Anal papillae long, slender and unequal in length.

ETYMOLOGY

The species is named for the research vessel FORV 'Sagar Sampada', which has been the backbone of marine biological research in India since 1984.

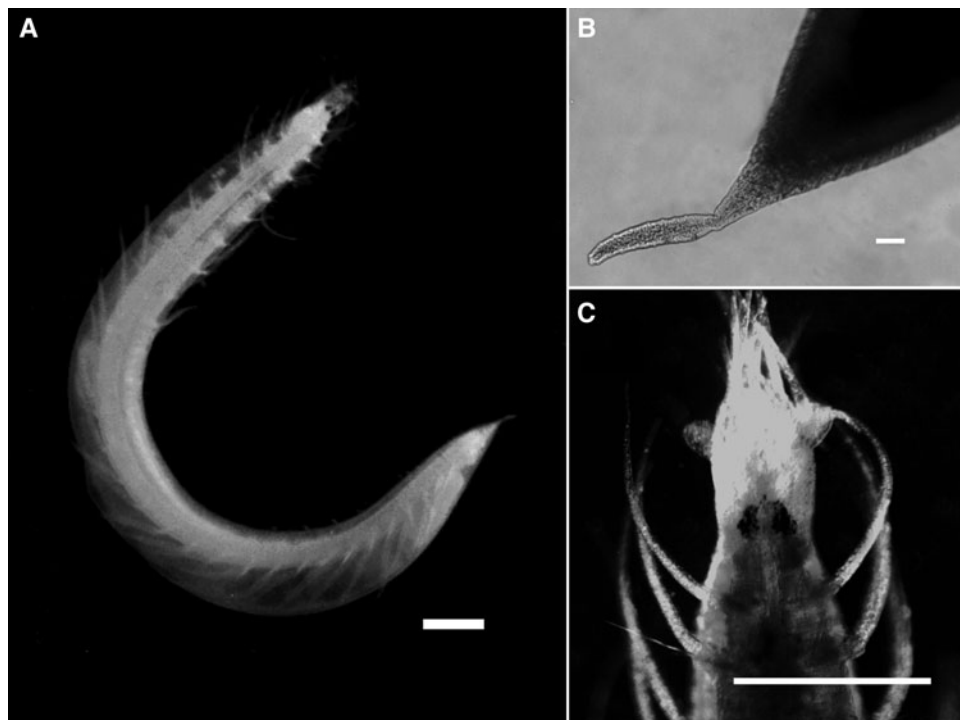


Fig. 2. *Armandia sampadae* sp. nov., holotype. (A) Entire organism, (B) Prostomium with palpode, (C) Anal funnel. Scale bar 0.5 mm.

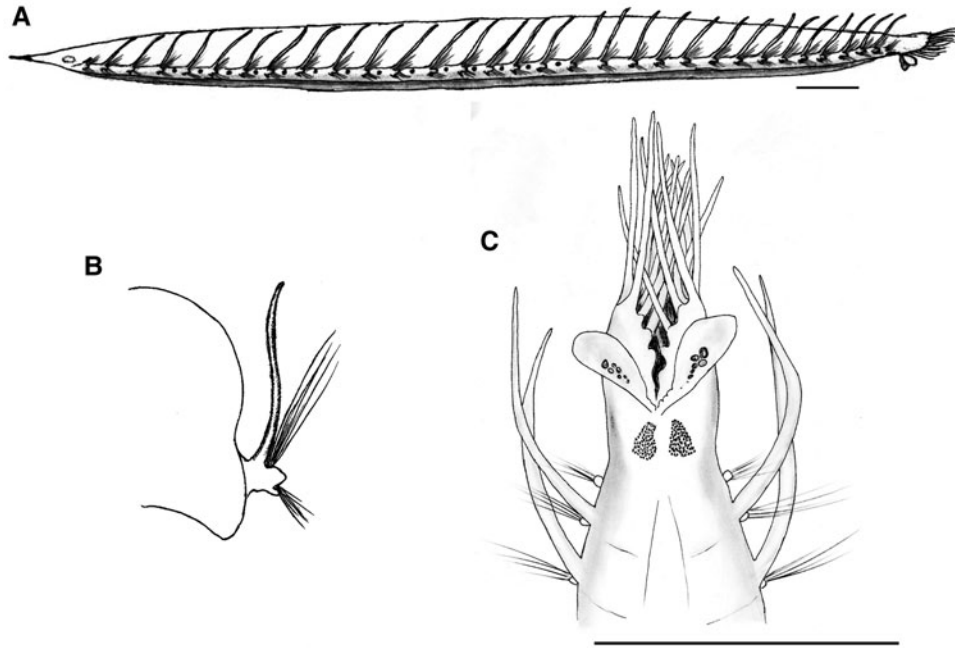


Fig. 3. *Armandia sampadae* sp. nov., holotype. (A) Entire organism, (B) Parapodium, (C) Anal funnel. Scale bar 0.5 mm.

DISCUSSION

The genus *Armandia* was first recorded from the Mediterranean Sea by Filippi, 1861 and named in honour of the French naturalist Jean Louis Armand de Quatrefages de Bréau. The genus currently includes 31 species (WoRMS, 2015) and morphological comparisons of the new species with other species are presented in Tables 1 and 2.

Along the northern Indian Ocean, six species of *Armandia* have been reported, viz. (1) *Armandia leptocirris* Grube, 1878 from Lakshadweep Islands by Misra & Chakraborty (1991), Andaman and Nicobar Islands by Rao (2010), south-west coast of India by Smitha (2011), (2) *Armandia intermedia* Fauvel, 1902 from south-west coast of India by Joydas (2002) and Smitha (2011), (3) *Armandia lanceolata* Willey, 1905 from Andaman and Nicobar Islands by Tampi & Rangarajan (1964), Thailand sector of Andaman Sea by Eibye-Jacobsen (2002), Lakshadweep Islands by Misra & Chakraborty (1991), (4) *Armandia melanura* Gravier, 1905 from Thailand sector of Andaman Sea by Eibye-Jacobsen (2002), (5) *Armandia longicaudata* Caullery, 1914 from Thailand sector of Andaman Sea by Aungtonya *et al.* (2002), (6) *Armandia andamana* Eibye-Jacobsen, 2002 from Thailand sector of Andaman Sea.

Armandia sampadae differs from all other species of *Armandia* in having a pair of large, flattened, rounded, pigmented, stalked and leaf-shaped ventral papillae at the ventral base of the anal funnel and with a pair of sub-triangular black pigmented spots in the basal portion of the ventral papillae. *Armandia sampadae* is most similar to *A. intermedia* Fauvel, 1902 in the presence of an anal funnel with annulations and with two large ventral papillae with ventral openings. *Armandia intermedia* differ from *A. sampadae* in the shape of ventral papillae; the ventral papillae of the latter is stalked, flattened, and rounded in shape whereas in the former, the ventral papillae are sessile. The anal funnel

of *A. sampadae* is devoid of ventral anal cirri which are characteristic of *A. intermedia*. The sub-triangular black pigmented spots in the basal portion of ventral papillae of *A. sampadae* is completely absent in *A. intermedia*. *Armandia intermedia* bears 18 anal papillae while only 14 were observed in *A. sampadae*.

Armandia andamana Eibye-Jacobsen, 2002 recorded from Andaman Sea possesses a ventrally fused anal funnel with a sulcus, bearing 8–9 anal papillae, compared with the 14 papillae of *A. sampadae*. There are three prostomial eyes, 25 pairs of branchiae and 11 pairs of lateral eyes in *A. andamana* while these characters numbered 2, 30 and 14 respectively, in *A. sampadae*. *Armandia melanura* Gravier, 1905 possess an anal funnel which is strongly pigmented (very dark brown) and notched on the ventral midline on each side while in *A. sampadae* the black pigmentation is visible at the basal portion of the two large ventral papillae of the anal funnel. The anal funnel is ringed in *A. sampadae* without a ring in *A. melanura*. The only similar character in both species is the paired prostomial eyes.

In *Armandia lanceolata* Willey, 1905 prostomial eyes are absent and 22 pairs of branchiae are recorded, and additionally, the anal funnel is in the form of a narrow membranous tube with 12 anal papillae, whereas in *A. sampadae*, two prostomial eyes and 30 pairs of branchiae are present, and the ringed anal funnel bears 14 papillae. The similarity between these species is the ventro-posterior opening of the anal funnel and absence of anal cirrus. In *Armandia longicaudata* Caullery, 1944 the anal funnel is obliquely truncate bearing 12 anal papillae and a ventral cirrus but in *A. sampadae* the ringed anal funnel has two large ventral papillae and 14 anal papillae, without anal cirrus. *Armandia leptocirris* Grube, 1878 possesses a long anal funnel opening upwards bearing a ventral anal cirrus, while in *A. sampadae* the anal funnel opens posterior-ventrally and lacks an anal cirrus; both possess rings in the anal funnel.

Table 1. Comparison of the morphological characters of species of *Armandia*, adapted from the literature.

Species	Length and width (mm)	No. of chaetigers	Prostomial eye spots	No. of branchiae (pairs)	Branchiae on chaetigers	No. of lateral eyes (pairs)	Lateral eye spots on chaetigers	References
<i>A. agilis</i>	36.6, 2	35–51	3	48–50	2–49 or 51	21	7–10 and 14–30	Uebelacker (1984)
<i>A. amakusaensis</i>	13.14, 0.56	32	3	30	2–31	11	7–17	Saito <i>et al.</i> (2000)
<i>A. andamana</i>	15.8, 0.8	29	3	25	2–26	11	7–17	Eibye-Jacobsen (2002)
<i>A. bifida</i>	29, 2.5	39	2	38	2–39	11	7–17	Parapar & Moreira (2015)
<i>A. bilobata</i>	11.5, NS	26	3	25	2–26	11	7–17	Hartmann-Schröder (1986)
<i>A. bipapillata</i>	21, NS	32	3	30	2–31	12	7–18	Hartmann-Schröder (1974)
<i>A. brevis</i>	20, 1.5	29	2	27	2–26	11	7–17	Blake (2000)
<i>A. broomensis</i>	5, NS	33	3	29	2–30	13	7–19	Hartmann-Schröder (1979)
<i>A. cirrhosa</i>	7 to 8, NS	26–27	3	20–22	2–21 or 23	10–14	7–8 to 16 or 17 or 20	Filippi (1861); Le Garrec (2013)
<i>A. dolio</i>	8, 1	29	2	25	2–26	11	7–17	Parapar & Moreira (2015)
<i>A. exigua</i>	13, NS	38	NS	25	2–26	NS	9–NS	Kükenthal (1887)
<i>A. filibranchia</i>	8, 0.8	29	2	28	2–29	11	7–17	Parapar & Moreira (2015)
<i>A. hossfeldi</i>	7.5, 0.6	32–34	3	31–33	2–32–34	13	6 or 7–18 or 19	Hartmann-Schröder (1956)
<i>A. inhabelae</i>	6, 0.3	32–33	3	30	2–30 or 31	19	7 or 8–25 or 26	Hartmann-Schröder (1956)
<i>A. intermedia</i>	12, NS	29	3	28	2–29	13	7–19	Fauvel (1902)
<i>A. laminosa</i>	9, 0.8	27	NS	26	2–27	11	7–17	Parapar & Moreira (2015)
<i>A. lanceolata</i>	17, 1	29	3	22 or 25	2–23 or 26	11	7–17	Wiley (1905); Eibye-Jacobsen (2002)
<i>A. leptocirris</i>	15–30, 1–2	33–38	3	31–35	2–last chaetiger	10–12	7 or 8–16 or 19	Fauvel (1953); Day (1967)
<i>A. loboii</i>	16, 1.7	30	0	28	3–30	11–13	5–15 or 17	Elias & Bremec (2003); Elias <i>et al.</i> (2003)
<i>A. longicaudata</i>	30, NS	30–32	NS	31	2–32	18	6–23	Day (1967)
<i>A. maculata</i>	22.1, 2.6	29–31	3	23–25	2–25 or 26	7–11	7–13 or 17	Uebelacker (1984); Elias <i>et al.</i> (2003)
<i>A. melanura</i>	28, NS	29	2	26	2–27	10	6–15	Gravier (1905)
<i>A. nonpaillata</i>	19, 1 to 1.5	29	0	22	2–23	11	6 or 7–16 or 17	Jones (1962)
<i>A. paraintermedia</i>	7, 0.5	29	3	25	2–26	11	7–17	Parapar & Moreira (2015)
<i>A. polyophtalma</i>	7, 1	26	3	22	2–23	14	8–21	Kükenthal (1887)
<i>A. salvadoriana</i>	15, 0.8	36	3	35	2–36	15	6–20	Hartmann-Schröder (1956)
<i>A. sampadae</i>	10.5, 1.9	32	2	30	2–31	14	5–18	present paper
<i>A. secundariopapillata</i>	4.2, NS	30	3	25	2–26	12–18	7–18 or 24	Hartmann-Schröder (1984)
<i>A. simodaensis</i>	22, 1.5	28	0	26	2–27	10	7–16	Takahashi (1938)
<i>A. sinaitica</i>	8, NS	36–42	3	34–40	2–35 or 41	12–15	6 or 7–16 or 17 or 20	Amoureux (1983)
<i>A. tubulata</i>	11, 1	29	3	25	2–26	11	7–17	Parapar & Moreira (2015)
<i>A. weissbornii</i>	40, NS	32	3	31	2–32	13	9–21	Kükenthal (1887); Amoureux (1983)

Table 2. Comparisons of the anal funnel morphology of the species of genus *Armandia*, adapted from the literature.

Species	Anal funnel (AF)	Length of AF	No. of anal papillae	Anal cirri	Opening of AF	References
<i>A. agilis</i>	AF long, compressed cylindrical with a pair of longitudinal ridges	NS	4–15	single articulated mid ventral cirrus	closed ventrally but opens posteriorly	Uebelacker (1984)
<i>A. amakusaensis</i>	AF with V shaped incision mid-dorsally and mid-ventrally	Slightly shorter than last 3 segments	11	single mid ventral cirrus with constrictions at intervals	postero-dorsal	Saito <i>et al.</i> (2000)
<i>A. andamana</i>	AF ventrally fused but with sulcus	as long as last 3 to 4 segments	8–9	absent	posteriorly	Eibye-Jacobsen (2002)
<i>A. bifida</i>	AF tube like	as long as 5–6 chaetigers	20–24	short, internal unpaired anal cirrus	posterior-ventrally	Parapar & Moreira (2015)
<i>A. bilobata</i>	AF open ventrally and dorsally open over the rear half so that the back half bi-lobed resembling 2 wings	NS	0	single ventral cirrus	dorso-posteriorly and ventro-posteriorly	Hartmann-Schröder (1986)
<i>A. bipapillata</i>	AF short with fine stripes and ventrally at the base of AF there is a brown pigmentation	NS	7 or 8 thread like cirrus terminally and subterminal to proximally 10 elongated oval, broadly rounded papillae	NS	downward and terminally opened	Hartmann-Schröder (1974)
<i>A. brevis</i>	AF entire	NS	8	single ventral cirrus	NS	Blake (2000)
<i>A. broomensis</i>	Thin AF	as long as 6 segments	6 marginal papillae, of which the dorsal 2 pairs are finger shaped and lower pair slightly shorter and thicker; medio-dorsal a small unpaired papilla	ventral unpaired ringed cirrus	NS	Hartmann-Schröder (1979)
<i>A. cirrhosa</i>	AF cylindrical	NS	7–8	single mid ventral cirrus	NS	Filippi (1861); Uebelacker (1984); Le Garrec (2013)
<i>A. dolio</i>	AF barrel shaped	as long as 4 chaetigers	20 anal cirri of differing length + 1 pair of basal cirri	an unpaired anal cirrus	posteriorly	Parapar & Moreira (2015)
<i>A. exigua</i>	AF cylindrical with 4 rings	as long as 4 segments	0	NS	ventrally	Kükenthal (1887)
<i>A. filibranchia</i>	AF funnel like V shaped ventral incision	ventral side as long as 7 chaetigers and twice as long as dorsal side	~50	NS	postero-dorsally	Parapar & Moreira (2015)
<i>A. hossfeldii</i>	AF with 16 stripes	as long as last 5 segments	6–7	single long anal cirrus	terminal	Hartmann-Schröder (1956)
<i>A. inhabelae</i>	AF curled, with 14–16 stripes, with a mid-dorsal and medio-ventral cut by a longitudinal furrow	as long as 3 to 4 segments	4–6	single ventral curled cirri	dorso-posteriorly	Hartmann-Schröder (1956)
<i>A. intermedia</i>	AF membranous, compressed laterally with terminal annulations, 2 large ventral papillae	NS	18	single ventral cirrus	ventral	Fauvel (1902)
<i>A. laminosa</i>	AF square shaped	as long as last 2 chaetigers	10–12 anal papillae + 1 pair of clavate basal cirri	long unpaired anal cirrus	posterior-ventrally	Parapar & Moreira (2015)

Continued

Table 2. Continued

Species	Anal funnel (AF)	Length of AF	No. of anal papillae	Anal cirri	Opening of AF	References
<i>A. lanceolata</i>	AF is a narrow membranous tube	as long as last 2 chaetigers	12	single anal cirrus	ventro-posterior	Willey (1905); Fauvel (1953); Eibye-Jacobsen (2002)
<i>A. leptocirris</i>	AF compressed vertically flattened more or less clearly ringed and obliquely split so that its opening bordered by two lips	NS	12–18	single ventral cirri	anus opens upwards	Fauvel (1953); Day (1967)
<i>A. loboii</i>	AF obliquely truncate with 12 rings	NS	6–8	very short external midventral non-articulated cirrus	dorso-posterior	Elias & Bremerc (2003); Elias <i>et al.</i> (2003)
<i>A. longicaudata</i>	AF obliquely truncate	NS	12	single ventral cirrus	downwards	Day (1967)
<i>A. maculata</i>	AF short and cylindrical	NS	28	single, articulated mid-ventral cirrus	ventrally	Uebelacker (1984); Elias <i>et al.</i> (2003)
<i>A. melanura</i>	AF strongly pigmented (very dark brown) and notched on the ventral midline on each side	NS	6	NS	ventro-posterior	Gravier (1905)
<i>A. nonpaillata</i>	AF with 12–13 narrow vertical bands and ventrally a cleft	as long as last 3 to 4 segments	0	absent	ventrally	Jones (1962)
<i>A. paraintermedia</i>	AF square shaped	as long as last 2 chaetigers	6 anal papillae + 1 pair of basal cirri	single long anal cirrus	posterior-ventrally	Parapar & Moreira (2015)
<i>A. polyopthalma</i>	AF present	NS	16	NS	NS	Kükenthal (1887)
<i>A. salvadoriana</i>	AF curled with 19 stripes	as long as 4 to 5 segments	7–8	single curled annulated anal cirri	terminal	Hartmann-Schröder (1956)
<i>A. sampadae</i>	AF with 14 rings and with a pair of flattened, rounded, pigmented, leaf shaped stalked ventral lobes and at the base of ventral lobes a pair of sub-triangular black pigmented spots	as long as last 3 segments	14	absent	ventro-posterior	present paper
<i>A. secundariopapillata</i>	AF short	as long as last segment	8–12 marginal papillae + 1 pair of large ventral thick papillae bearing multiple blunt papillae	single long wrinkled cirrus	ventro-terminal	Hartmann-Schröder (1984)
<i>A. simodaensis</i>	AF is horn shaped delicate membrane	ventral side of AF is 5 mm in length and twice as long as the dorsal side	0	absent	dorso-posteriorly	Takahashi (1938)
<i>A. sinaitica</i>	AF long with streaks	NS	8	single articulated ventral cirrus	NS	Amoureux (1983)
<i>A. tubulata</i>	AF tube like, long and narrow	ventrally as long as 2 chaetigers and dorsally as long as 3 chaetigers	12 anal papillae + 1 pair of basal cirri	an unpaired anal cirrus	posterior-ventrally	Parapar & Moreira (2015)
<i>A. weissbornii</i>	AF long with 30 rings	as long as 4 segments	5–6	single articulated cirrus	NS	Kükenthal (1887); Amoureux (1983)

*NS, not specified.

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