

**SCALIBREGMATIDAE AND OPHELIIDAE (ANNELIDA: POLYCHAETA) COLLECTED
IN THE ANDAMAN SEA, THAILAND, DURING THE BIOSHELF PROJECT****Danny Eibye-Jacobsen***Zoological Museum, Universitetsparken 15, Copenhagen 2100, Denmark (dejacobsen@zmuc.ku.dk)***ABSTRACT**

A total of 10 specimens of Scalibregmatidae and 73 specimens of Opheliidae are reported from the collections made during the Thai–Danish BIOSHELF Project in 1996–97 in the Thai sector of the Andaman Sea. Three species of Scalibregmatidae and seven species of Opheliidae were found. *Asclerocheilus elisabethae* and *A. shanonae* (Scalibregmatidae), as well as *Armandia andamana* (Opheliidae), are newly described.

INTRODUCTION

Scalibregmatids are commonly found in most marine sediments, but rarely occur in large numbers. They are generally considered to be non-selective deposit feeders. Major treatments of the morphology, biology and taxonomy of Scalibregmatidae may be found in Kudenov and Blake (1978) and Blake (1981, 2000a). The material described in the present paper is limited to two genera and does not provide the basis for a broad discussion of the family. An exception concerns the genus *Asclerocheilus* Ashworth, 1901, of which two new species are described below. This was done on the basis of a revision of the genus, to be published elsewhere (Eibye-Jacobsen, submitted).

Opheliids are often regarded as closely related to Scalibregmatidae (e.g., Rouse and Fauchald 1997; Blake 2000a), although this conclusion appears to be partly based on the rather general resemblance of some opheliids (e.g., members of *Travisia* Johnston, 1840) to scalibregmatids. Opheliids are common inhabitants of substrates in which sand is a major component and can occur in great numbers on sandy beaches (pers. obs.). Good general treatments of opheliid morphology, biology and taxonomy may be found in Uebelacker (1984: 1–3) and Blake (2000b: 145–148).

Hartmann-Schröder (1971) assigned the genera of Opheliidae to three subfamilies based on whether ventral and lateral grooves are found along the entire body (Ophelininae: *Polyophthalmus* de Quatrefages, 1850, *Armandia* Filippi, 1861 and *Ophelina* Örsted, 1843), the posterior part of the body only (Opheliinae: *Ophelia* Savigny, 1818 and *Euzonus* Grube, 1866) or are absent (Travisiinae: *Travisia*).

Apart from a single specimen of *Travisia*, all the opheliids reported in this paper belong to either *Armandia* or *Ophelina*. In addition to having ventral and lateral grooves along the entire body, the two latter genera have branchiae from setiger 2 to near the end of the body and a pygidium that is extended beyond the anus as a hollow tube or hood (the anal funnel). The two genera differ only in the presence (*Armandia*) or absence (*Ophelina*) of lateral, segmental eyes. It is highly doubtful that both represent monophyletic groups, among other reasons because segmental eyes are also present in *Polyophthalmus*, where branchiae are absent, but a thorough phylogenetic analysis of the family is needed in order to determine the polarity of major characters.

However, in a family otherwise regarded as relatively “primitive” among polychaetes, members of Ophelininae are extremely specialized, being highly adapted to life within sandy sediments.

They are characterized by the strong development of their longitudinal musculature and the weak development (or absence?) of the circular musculature (Hartmann-Schröder 1958; Storch 1968). The dorsolateral longitudinal muscle bands are fused, whereas the ventrolateral ones are separate; the ventral and lateral grooves occur between these three bands. The strongly developed longitudinal muscles cause the body to be very stiff and unlikely to be deformed following preservation; apart from the anal funnel, which detaches quite easily, most of the specimens reported here are complete. The absence of a functional circular musculature makes peristaltic movement impossible, but ophelinins are capable of entering and moving through sand by means of rapid lateral movements, in essence "swimming" through sand. A further function of the strongly developed longitudinal musculature could be that the resultant longitudinal grooves allow the worm to localize and direct the flow of water through the lateral grooves, where the branchiae are located, and back towards the head through the ventral groove.

The number of setigers in adult opheliids usually falls within a narrow range which is species-specific. This phenomenon of relative segment constancy is more common in Opheliidae than in most families of polychaetes, although the variability of number of segments in polychaetes has often been exaggerated in the literature.

The setae of opheliids provide practically no information of taxonomic value. In general, notopodia contain thick, long capillaries in a ventral position and thin, short capillaries more dorsally; these two types of setae also occur in the neuropodia, although they are usually shorter, with the thick, long capillaries in a dorsal position (see, e.g., Figs. 5C, 7C and 8C). Since no variation was observed in this pattern, the setae of members of *Armandia* and *Ophelina* are not described in further detail in this paper.

Fauvel (1932, repeated in Fauvel 1953 and Hartman 1974) reported *Scalibregma inflatum* Rathke, 1843 and *Parasclerocheilus branchiatus* Fauvel, 1928 from the Gulf of Oman. Apart from the original description of the latter species from

India, this is the only previous report of scalibregmatids from the northern Indian Ocean.

On the other hand, there have been several reports of opheliids from the same region. Fauvel (1932, repeated in 1953) reported 5 species and Caullery (1944) described 9 new species from Indonesia. Pillai (1961) described *Ophelina grandis* (as *Ammotrypane*) from Sri Lanka. Tampi and Rangarajan (1964) reported *Armandia lanceolata* Willey, 1905 from the Andaman Islands. Hartman (1974) listed 9 species as having been reported from the Indian Ocean (this did not include Caullery's species).

The only previous report of opheliids from the Thai sector of the Andaman Sea is that of Phasuk (1992), who listed 6 named species and *Travisia* spp. A small amount of Phasuk's material was made available to the present author for comparative study.

MATERIALS AND METHODS

Information on the BIOSHELF Project and how material was treated during collections in 1996 and 1997 can be found in Aungtonya, Thaipal and Tendal (2000). For SEM observations specimens were dehydrated via a graded ethanol and acetone series, critical-point dried using CO₂, mounted on aluminium stubs and subsequently sputter-coated with gold. Observations were performed with a JEOL JSM-840 scanning electron microscope.

The lists of examined material provided for each species include only specimens from BIOSHELF stations; the number of specimens from any given station and information on where they have been deposited follows in parentheses. A more detailed list of the BIOSHELF stations is provided in Aungtonya and Eibye-Jacobsen (2002).

The width of scalibregmatids was measured around setiger 8, on opheliids at midbody, in both cases excluding setae. All descriptions are based on BIOSHELF specimens.

The following abbreviations are used for institutions: PMBC (Phuket Marine Biological Center, Phuket, Thailand) and ZMUC (Zoological Museum, Copenhagen, Denmark).

SYSTEMATIC SECTION

Scalibregmatidae Malmgren, 1867

Asclerocheilus Ashworth, 1901

Asclerocheilus Ashworth, 1901: 284.

Type species: *Lipobranchius intermedius* Saint-Joseph, 1894: 113–114, pl. 5, figs. 146–147, by original designation.

Remarks: *Asclerocheilus* was recently revised and found to include 13 valid species, including the two new species described below (Eibye-Jacobsen, submitted).

Asclerocheilus elisabethae n. sp.

Fig. 1A–E

Material examined: BIOSHELF st. G-3/BC, 8°00' N, 97°54' E, 76 m, muddy sand, 23 Apr 1996 (holotype, PMBC 18844); st. H-3/BC, 7°45' N, 97°58' E, 70 m, coarse sand, 9 May 1996 (1 paratype, ZMUC-POL-1152; 1 paratype on SEM stub, ZMUC-POL-1153).

Description: Up to 10.0 mm long and 1.2 mm wide with up to 47 setigers, holotype 6.1 mm long and 1.2 mm wide with 28 setigers (posteriorly incomplete). Body arenicoliform, *i.e.*, with broad anterior region and narrower “tail” region beginning around setiger 20. Prostomium with two antero-

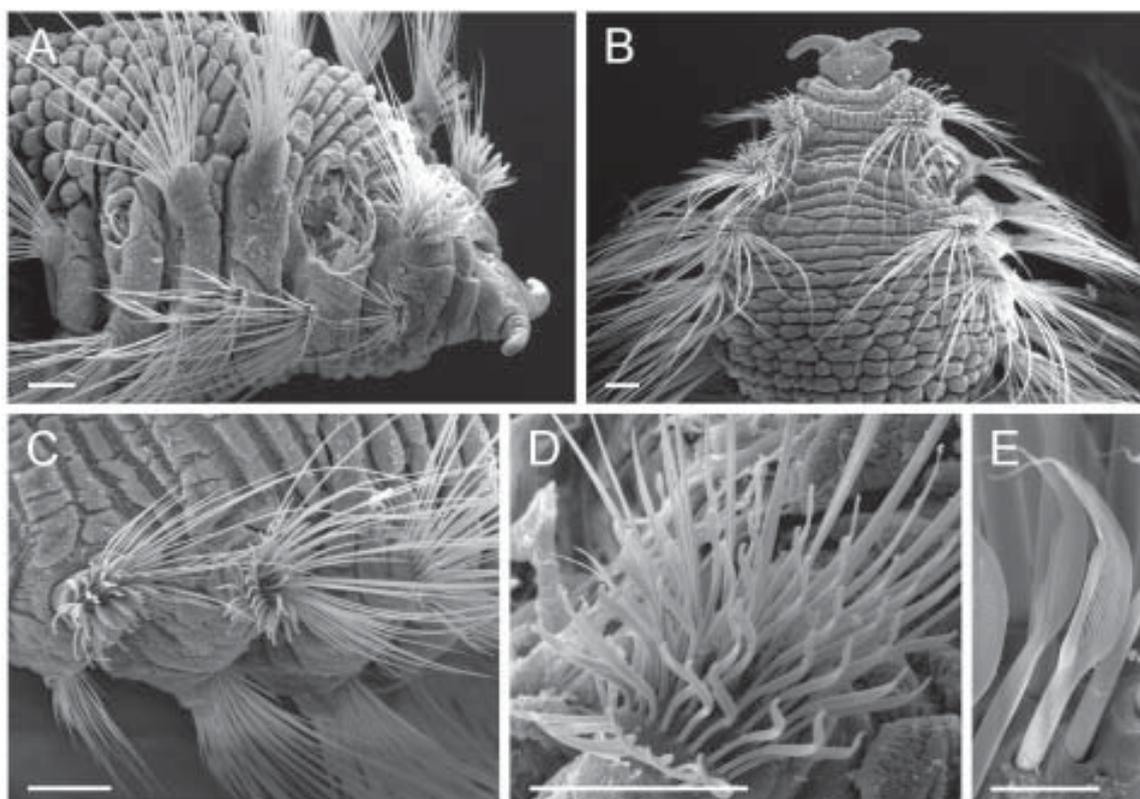


Figure 1 *Asclerocheilus elisabethae* n. sp.: A. Anterior end, dorsolateral view; notopodia of setigers 1 and 5 removed. B. Anterior end, dorsal view. C. Notopodia of setigers 1–3, dorsolateral view. D. Notopodium of setiger 1, with 5 rows of sigmoid, terminally blunt acicular setae and two rows of capillary setae, anterolateral view. E. Furcate setae from notopodium of setiger 3. – SEM micrographs. ZMUC-POL-1153. Scales = 0.1 mm (A–D) and 10 μ m (E).

lateral, antenniform projections, about 3 times as long as broad, sharply set off from prostomium (Fig. 1A, B). Eyes present as two pairs of orange brown bands, diagonal from anteromedial to posterolateral, sometimes laterally coalesced, anterior bands strongest pigmented. Peristomium weakly biannulate.

Notopodia of setigers 1 and 2 with 3–5 rows of weak, distally sigmoidally curved, somewhat corkscrewed, blunt acicular setae (Fig. 1C, D). Capillary setae of notopodia of setigers 3–7 particularly elongate (Fig. 1B). Notopodia of setigers 1–4 slightly swollen. Furcate setae from notopodia of setiger 3 and neuropodia of setiger 2, with relative tine length 1.5–2.1 (Fig. 1E). Dorsal and ventral “cirri” absent. Branchiae absent.

Setigers 3–18 quadriannulate, tessellated. Pygidium with 4 lateral and 1 midventral cirri, 5–6 times as long as broad (ZMUC-POL-1152). Preserved specimens light brown.

Remarks: The acicular setae of *Asclerocheilus elisabethae* n. sp. are unique within the genus in their shape and especially in being arranged in more than 2 rows. It is also the only species, apart from *Lipobranchius intermedius* sensu Fauvel 1914 (not *A. intermedius* (de Saint-Joseph, 1894), but an undescribed species of *Asclerocheilus* to be named in Eibye-Jacobsen, submitted) in which the acicular setae are distally blunt. *A. elisabethae* differs from this species especially in the presence of eyes and the absence of neuropodial acicular setae. Together with *A. victoriensis* Blake, 2000 these two species are the only ones in the genus in which the prostomium has antenniform projections rather than short, blunt lobes.

Distribution: Known only from the southern part of the Thai sector of the Andaman Sea, in sand at depths of 70–80 m.

Etymology: This species is named after my eldest daughter, Elisabeth Eibye-Jacobsen.

Asclerocheilus shanonae n. sp.

Fig. 2

Material examined: BIOSHELF st. RY-1/BC, 7°36' N, 98°19' E, 55 m, sand with shell

fragments, 8 May 1996 (holotype, PMBC 18845; 1 paratype, ZMUC-POL-1154); st. RY-2/BC, 7°39' N, 98°23' E, 45 m, sand with shell fragments, 8 May 1996 (1, PMBC 18846).

Description: Up to 17.8 mm long and 1.4 mm wide with up to 58 setigers, holotype 16.7 mm long and 1.2 mm wide with 58 setigers (complete). Body arenicoliform, *i.e.*, with broad anterior region and narrower “tail” region beginning around setiger 20. Prostomium with two anterolateral lobes, evenly tapering and distally blunt, about 1½ times as long as broad, weakly set off from prostomium (Fig. 2). Eyes present as two pairs of dark brown bands, diagonal from anteromedial to posterolateral, sometimes laterally coalesced, anterior bands much stronger than posterior bands (Fig. 2). Peristomium weakly biannulate.

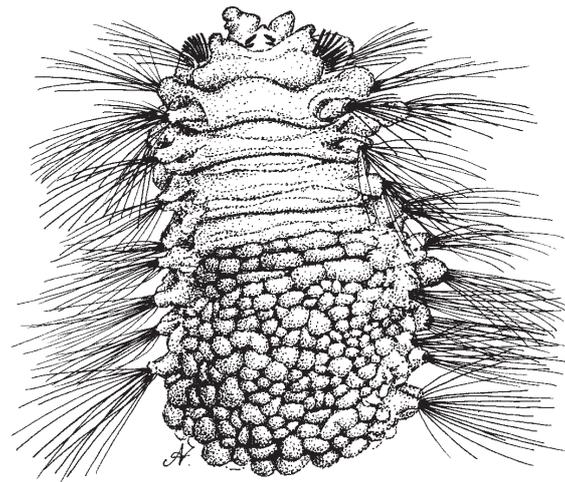


Figure 2 *Asclerocheilus shanonae* n.sp.: Anterior end, dorsal view; thickness of acicular setae slightly exaggerated. – PMBC 18845.

Notopodia of setiger 1 with two rows of weak, distally curved but not sigmoid, distally pointed acicular setae (thickness of acicular setae slightly exaggerated on Fig. 2). Neuropodia of setiger 1 with anterior row of short spines. Furcate setae from notopodia and neuropodia of setiger 2, with relative tine length about 1.2. Dorsal and ventral “cirri” absent. Branchiae absent.

Median setigers with 4–5 weakly defined annuli, body tessellated from about setiger 6 (holotype; less apparent in paratype). Pygidium

of holotype with 3 lateral (one apparently lost) and 1 midventral cirri, about 5 times as long as broad. Preserved specimens light brown.

Remarks: *Asclerocheilus shanonae* n. sp. resembles *A. acirratus* (Hartman, 1966) and *A. tropicus* Blake, 1981 in having eyes and having acicular setae limited to the notopodia of setiger 1. The acicular setae of *A. tropicus* are much more strongly developed than in the two other species; those of *A. shanonae* are somewhat stronger developed than in *A. acirratus* and they are not distally sigmoid. Furthermore, unlike *A. acirratus* it has setigers 5–10 considerably broader than setigers 2–3.

It is with doubt that PMBC 18846 is referred to this species. The specimen in question is a juvenile that has been dried and it differs from the holotype and paratype in having acicular setae that appear to be more strongly developed.

Distribution: Known only from the waters around Racha Yai Island, Andaman Sea, in sand at depths of 40–60 m.

Etymology: This species is named after my youngest daughter, Shanon Lisanne Andrea Rademacher.

Scalibregma Rathke, 1843

Scalibregma Rathke, 1843: 184.

Type species: *Scalibregma inflatum* Rathke, 1843: 184, by monotypy.

Scalibregma cf. *inflatum* Rathke, 1843

Fig. 3A–D

Scalibregma inflatum Rathke, 1843: 184. – Fauvel 1932: 187–188; 1953: 355, fig. 185a–f. – Imajima and Hartman 1964: 305. – Gallardo

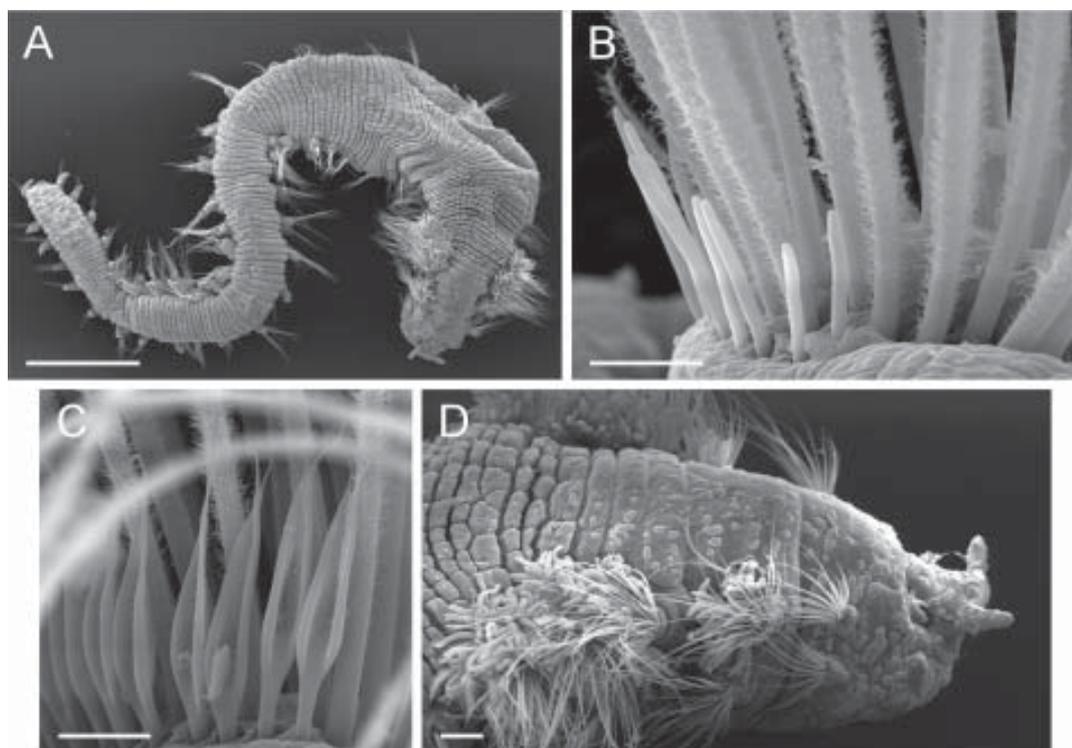


Figure 3 *Scalibregma* cf. *inflatum*: A. Entire animal (posteriorly incomplete), dorsal view. B. Notopodium of setiger 1, dorsoanterior view, showing anterior row of short, spine-like setae. C. Furcate setae from notopodium of setiger 3. D. Anterior end, dorsolateral view. – SEM micrographs. ZMUC-POL-1250. Scales = 1 mm (A), 10 μ m (B, C) and 0.1 mm (D).

1968: 110. – Gibbs 1971: 181. – Hartman 1974: 627.

Material examined: BIOSHELFL st. E-2/BC, 8°30' N, 98°00' E, 63 m, muddy sand, 22 Apr 1996 (1, PMBC 18847); st. J-2/OS, 7°15' N, 98°51' E, 61 m, soft mud, 4 May 1996 (2, ZMUC-POL-1249); st. PB-8/BC, 7°45' N, 98°52' E, 19 m, sand with shell fragments, 22 Apr 1997 (1 on SEM stub, ZMUC-POL-1250).

Description: Up to 14.5 mm long and 3.0 mm wide with at least 36 setigers (all specimens posteriorly incomplete). Broad anterior region with 17–20 setigers, setigers 6–13 especially inflated, narrower posterior region up to 1.1 mm wide (Fig. 3A). Prostomium trapezoid, broadest anteriorly, “T-shaped” with a pair of anterolateral projections about twice as long as broad (Fig. 3A). Eyes not observed. Nuchal organs at lateral base of prostomium. Peristomium developed as a swollen collar posterior and ventral to prostomium (Fig. 3D).

Most setae are strongly hirsute capillaries (Fig. 3B). Noto- and neuropodia of setiger 1 with an anterior row of short, spine-like setae (Fig. 3B), from setiger 2 replaced by furcate setae with almost equal tines (Fig. 3C). Dorsal and ventral “cirri” begin on setiger 15–16 as small warts directly dorsal to notopodia and ventral to neuropodia, gradually growing and becoming inflated lanceolate lobes, about 3 times as long as broad, on posterior setigers. Branchiae present on setigers 2–5, bush-like, arranged in a semicircle posterior to notopodium, gradually increasing in size from setiger 2 to 5 (Fig. 3D).

Most setigers with 4–5 annuli, tessellation strongly developed from setiger 4–5. Body brown with orange, rust-like encrustations on peristomium and posterior setigers.

Remarks: These specimens strongly resemble *Scalibregma inflatum* Rathke, 1843, described from Norway. However, only very general characters are involved in this comparison and since the Thai specimens are relatively small, possibly juveniles, it would not be appropriate to refer them to this European species without doubt. A possible

difference may be seen in the development of the prostomial “horns”, as they appear to be relatively more strongly developed in the animals described here.

Scalibregma inflatum is widely distributed in the North Atlantic region and has been regarded as a cosmopolitan species, but this is possibly due to the lack of detail provided in available descriptions.

Distribution: *Scalibregma inflatum* has previously been reported from the Gulf of Oman (Fauvel 1932), Vietnam (Gallardo 1968) and the Solomon Islands (Gibbs 1971). BIOSHELFL specimens are from sandy and muddy bottoms at depths of 19–63 m.

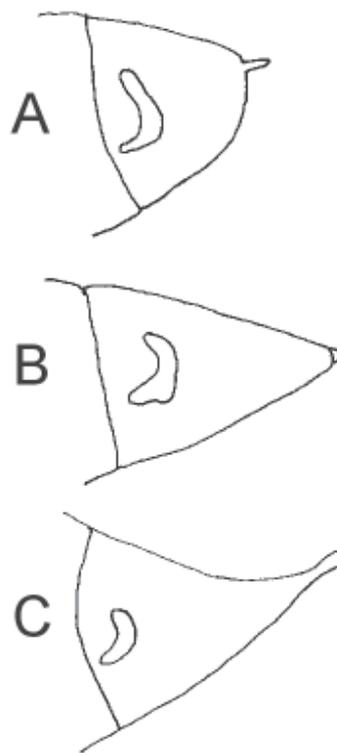


Figure 4 Schematic drawings of prostomium in three species of *Armandia*, lateral view: A. *A. andamana* n. sp. B. *A. lanceolata* Willey, 1905. C. *A. cf. melanura* Gravier, 1905.

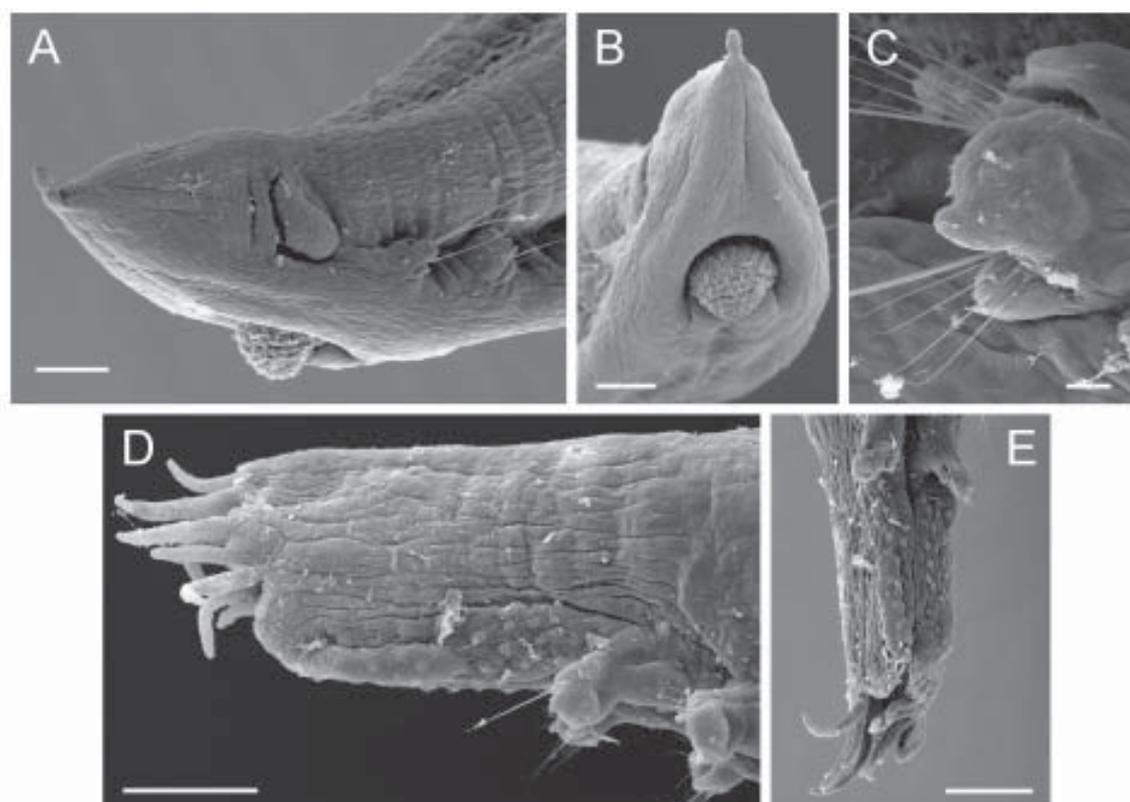


Figure 5 *Armandia andamana* n. sp.: A. Anterior end, lateral view. B. Anterior end, ventroanterior view; note shape of terminal palpode on prostomium. C. Parapodium of median setiger, anterior view; branchia lost, base visible. D. Anal funnel and last two setigers, lateral view. E. Anal funnel and last setiger, ventral view. – SEM micrographs. ZMUC-POL-1253 (A–D) and ZMUC-POL-1252 (E). Scales = 0.1 mm (A, B, D, E) and 10 μ m (C).

Opheliidae Malmgren, 1867

Armandia Filippi, 1861

Armandia Filippi, 1861: 215.

Type species: *Armandia cirrhosa* Filippi, 1861: 219, by monotypy.

Remarks: Amoureux (1983) provided a table detailing the principle numeric characters of the 20 species of *Armandia* known at that time. A good source of information on the variability of characters in *Armandia* may be found in Saito *et al.* (2000). See the Introduction for further remarks on this genus.

Armandia andamana n. sp.

Figs. 4A, 5A–E, 6A

Material examined: BIOSHELF st. E-2/BC, 8°30' N, 98°00' E, 63 m, muddy sand, 22 Apr 1996 (1 paratype, PMBC 18848); st. E-2/OS, 8°31' N, 98°00' E, 60 m, muddy sand, 22 Apr 1996 (3 paratypes, ZMUC-POL-1251; 1 paratype on SEM stub, ZMUC-POL-1252; 1 paratype on SEM stub, ZMUC-POL-1253); st. G-1/BC, 8°00' N, 98°14' E, 42 m, sandy mud, 24 Apr 1996 (1 paratype, PMBC 18849); st. G-2/OS, 8°00' N, 98°10' E, 63 m, muddy sand, 23 Apr 1996 (holotype, PMBC 18850; 2 paratypes, PMBC 18851).

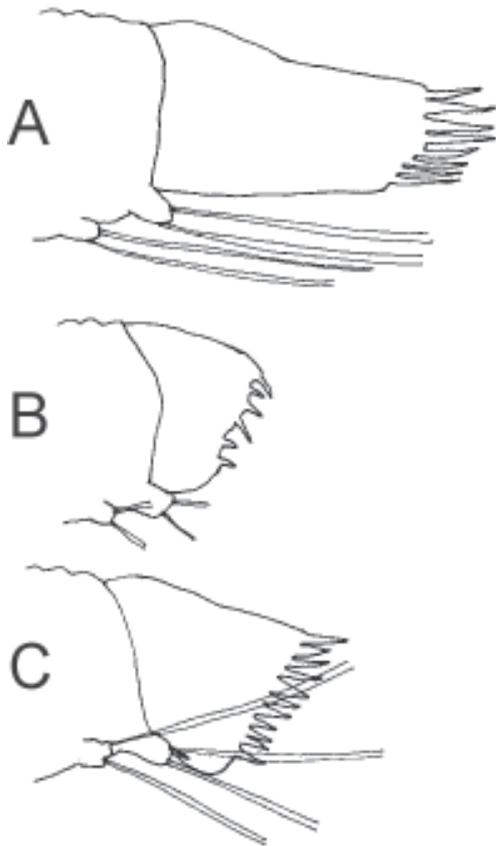


Figure 6 Schematic drawings of anal funnel in three species of *Armandia*, lateral view: A. *A. andamana* n. sp. B. *A. lanceolata* Willey, 1905. C. *A. cf. melanura* Gravier, 1905. The setae of posterior setigers are shown as being shorter in B than in A or C; this is an artifact.

Description: Up to 15.8 mm long and 0.8 mm wide with 29 setigers (holotype, complete). Prostomium broadly conical (Fig. 5A) or more blunt, excluding palpode shorter than wide (Fig. 4A and holotype); palpode well developed but short and narrow, only weakly clavate (Figs. 4A, 5A, B). Juvenile specimens with 3 dark brown eyes, two lateral and one dorsal, deeply embedded in prostomium; often only dorsal eye visible in adults, including holotype. Nuchal organs large (Fig. 5A), everted on holotype. Proboscis partly everted in holotype, with at least 5 oral cirri in a continuous series.

Branchiae present on setigers 2–26, relatively long but not meeting middorsally. Presetal lobes asymmetrical, with short, ventrally displaced tip (Fig. 5C), not enlarged on anterior setigers. Small “ventral cirrus” present, posteroventral to neuropodium (Fig. 5C). Lateral eyespots anterior to parapodia on setigers 7–17, orange, horizontally oval, those of setiger 17 smaller than the others.

Anal funnel $1\frac{1}{2}$ –2 times as long as width at base (Figs. 5D, 6A), as long as last 3–4 setigers; ventrally fused but with sulcus (Fig. 5E), open only at posterior margin. Internal, unpaired anal cirrus not observed. Paired basal cirri absent. Posterior margin with 8–9 pairs of uniform, elongate, almost acute papillae, 4–5 times as long as broad (Figs. 5D, 6A). Outer ventral surface of anal funnel apparently glandular (Figs. 5D, E).

Remarks: Several other species of *Armandia* are similar to the present one in having 29 setigers, branchiae on setigers 2–26 and lateral eyespots on setigers 7–17. *A. andamana* n. sp. differs from these by the shape of the anal funnel (elongate with an opening that is neither dorso- nor ventro-posterior). Although information in the literature is not detailed enough to allow close comparison, the shape of the prostomial palpode also appears to be characteristic for this species.

Armandia andamana resembles *A. longicaudata* (Caullery, 1944) in most characters, but the anal funnel is less elongate than in Caullery’s species. Furthermore, the presetal lobe of anterior setigers is considerably enlarged in *A. longicaudata* (see Caullery’s fig. 35a which is, however, confused as regards setigers 1 and 2) and the characteristic unpaired anal cirrus of that species (see Caullery’s fig. 35b, c) was not observed here. *A. longicaudata* was reported from Thai waters by Phasuk (1992: 85). Two of Phasuk’s samples (PMBC 12376 from st. 1019 and PMBC 12377 from st. 1096) have been studied and this identification confirmed.

Distribution: Known only from the Thai sector of the Andaman Sea, found in muddy sand and sandy mud at depths of 42–63 m.

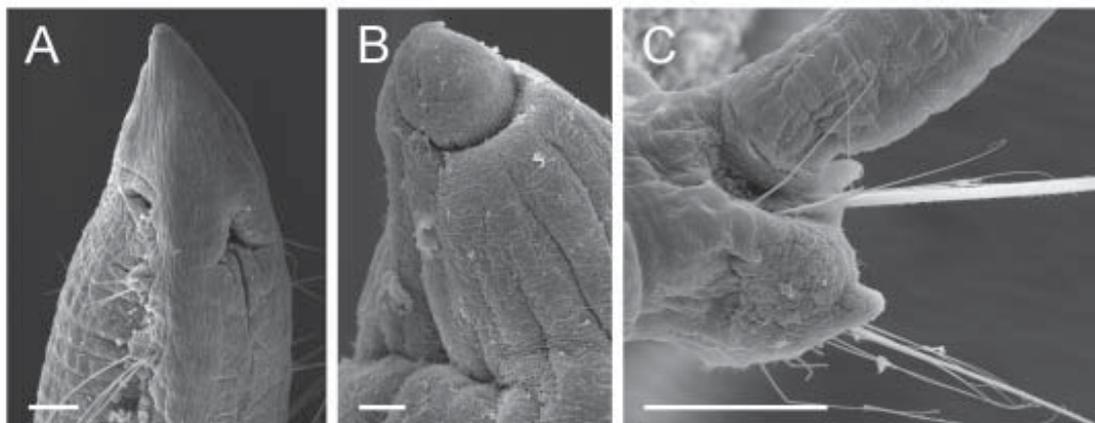


Figure 7 *Armandia lanceolata*: A. Anterior end, ventrolateral view. B. Distal end of prostomium, dorsolateral view; note broad, “sunken” palpode. C. Parapodium of median setiger, dorsoanterior view; “ventral cirrus” hidden from view. – SEM micrographs. ZMUC-POL-1255 (A, B) and ZMUC-POL-1256 (C). Scales = 0.1 mm (A), 10 μ m (B) and 50 μ m (C).

Etymology: This species is named after the Andaman Sea.

Armandia lanceolata Willey, 1905
Figs. 4B, 6B, 7A–C

Armandia lanceolata Willey, 1905: 288, pl. 5, fig. 120. – Fauvel 1932: 189; 1939: 348; 1953: 358. – Takahasi 1938: 207–209, fig. 11a, b. – Imajima and Hartman 1964: 306. – Tampi and Rangarajan 1964: 627. – Gallardo 1968: 113, pl. 52, fig. 1. – Gibbs 1971: 182. – Rullier 1972: 133. – Hartman 1974: 627. – Phasuk 1992: 85.

Material examined: BIOSHELF st. G-1/OS, 8°00' N, 98°14' E, 43 m, sandy mud, 24 Apr 1996 (1, PMBC 18852); st. H-1/BC, 7°45' N, 98°16' E, 32 m, sandy mud, 9 May 1996 (1, PMBC 18853); st. H-1/OS, 7°45' N, 98°16' E, 31 m, mud, 9 May 1996 (1, PMBC 18854); st. H-2/OS, 7°45' N, 98°15' E, 56 m, soft mud, 9 May 1996 (7, ZMUC-POL-1254; 1 on SEM stub, ZMUC-POL-1255; 1 on SEM stub, ZMUC-POL-1256); st. I-20m/OS, 7°30' N, 99°01' E, 21 m, mud, 3 May 1996 (3, PMBC 18855); st. PB-5/BC, 7°52' N, 98°48' E, 21 m, sand with shell fragments, 22 Apr 1997 (1, PMBC 18856).

Description: Up to 17.2 mm long and 1.1 mm wide with 29 setigers. Prostomium bluntly conical (Fig. 7A), excluding palpode slightly longer than wide (Fig. 4B); palpode appears “sunken” into tip of prostomium (Fig. 7B), broad, iridescent whitish. Adults and juveniles with 3 clearly visible, black eyes, two lateral and one dorsal, deeply embedded in prostomium. Nuchal organs large, may be everted (PMBC 18852). Proboscis with about 8 oral cirri in a continuous series.

Branchiae present on setigers 2–26, not meeting middorsally. Presetal lobes asymmetrical, with short, ventrally displaced tip (Fig. 7C), not enlarged on anterior setigers. Small “ventral cirrus” present, posteroventral to neuropodium. Lateral eyespots anterior to parapodia on setigers 7–17, brownish red, horizontally oval, those of setiger 17 smaller than the others.

Anal funnel slightly longer than width at base (Fig. 6B), as long as last 2 setigers, with ventro-posterior opening, open to ventral base of funnel. Internal, unpaired anal cirrus not observed. Paired basal cirri absent. Posterior margin with 5–6 pairs of irregular papillae, up to 2½ times as long as broad (Fig. 6B).

Remarks: The specimens reported here agree in all characters with most previous descriptions of

Armandia lanceolata except in the development of the prostomial palpode. For example, Takahasi (1938: fig. 11b) shows an elongate, clavate palpode similar in shape to that reported below for *A. cf. melanura* Gravier, 1905. The development of the palpode seen on Fig. 7B is not an artifact, as this shape occurs on all the specimens reported here, as does the whitish iridescent pigment described above. Future studies may indicate that these animals belong to an undescribed species.

Armandia lanceolata is similar to *A. andamana* n. sp. in having 29 setigers, branchiae on setigers 2–26 and lateral eyespots on setigers 7–17, but the two species can easily be separated based on the shape of the prostomial palpode and the anal funnel, as well as the visibility and colour of the prostomial eyes.

Day (1957) considered *A. lanceolata* to be a junior synonym of *A. intermedia* Fauvel, 1902. Although the two species are very similar (size, number of setigers, distribution of branchiae and lateral eyespots), according to Saito *et al.* (2000), who studied the holotype of *A. intermedia*, the ventral margin of the anal funnel is longer than the dorsal one in that species, the opening of the funnel being terminal or terminodorsal.

Distribution: Gulf of Oman, India, Andaman Sea, Vietnam, New Caledonia, Solomon Islands, Japan. In the present study found in various mixtures of sand and mud at depths of 21–56 m.

Armandia cf. melanura Gravier, 1905
Figs. 4C, 6C, 8A–D

Armandia melanura Gravier, 1905: 175–176, textfigs. 341–344, pl. 2, figs. 196–199a. – Gibbs 1972: 215. – Hartman 1974: 627.

Material examined: BIOSHELF st. C-2/OS, 9°00' N, 97°53' E, 64 m, muddy sand, 20 Apr 1996 (1, PMBC 18857); st. C-3/OS, 9°00' N, 97°43' E, 80 m, fine sand with shell fragments, 20 Apr 1996 (2, PMBC 18858); st. E-2/BC, 8°30' N, 98°00' E, 63 m, muddy sand, 22 Apr 1996 (1, ZMUC-POL-1257); st. G-2/OS, 8°00' N, 98°10' E, 63 m, muddy sand, 23 Apr 1996 (1, PMBC 18859); st. G-3/BC, 8°00' N, 97°54' E, 76 m, muddy sand, 23

Apr 1996 (1, ZMUC-POL-1258); st. H-1/OS, 7°45' N, 98°16' E, 31 m, mud, 9 May 1996 (1, PMBC 18860); st. H-2/OS, 7°45' N, 98°15' E, 56 m, soft mud, 9 May 1996 (1 on SEM stub, ZMUC-POL-1259); st. RY-2/OS, 7°40' N, 98°24' E, 44 m, sand with shell fragments, 8 May 1996 (1 on SEM stub, ZMUC-POL-1260).

Description: Up to 14.8 mm long and 1.0 mm wide with 29 or 31 setigers. Prostomium conical, excluding palpode slightly longer than wide; palpode well developed, large, clavate (Figs. 4C, 8A). Adults and juveniles with 3 dark brown eyes, two lateral and one dorsal, deeply embedded in prostomium. Nuchal organs large (Fig. 8A). Proboscis with at least 9 oral cirri, possibly in a continuous series (PMBC 18859).

Specimens with 29 setigers with branchiae on setigers 2–26, those with 31 setigers with branchiae on setigers 2–29 (or 30). Presetal lobes symmetrical (Fig. 8C), on anterior setigers with elongate tip (Fig. 8B), on posterior setigers truncate. Small “ventral cirrus” present, postero-ventral to neuropodium (Fig. 5C). Lateral eyespots anterior to parapodia on setigers 7–17, dark orange, horizontally oval, those of setiger 17 smaller than the others.

Anal funnel as long as width at base (Fig. 6C) or slightly longer (Fig. 8D), as long as last 3 setigers; fused from base to halfway along ventral margin, *i.e.*, with terminal (ventroposterior) and partially ventral opening. Internal, unpaired anal cirrus protruding from anal funnel (PMBC 18859, ZMUC-POL-1258). Paired basal cirri absent. Posterior margin with up to 12 pairs of uniform, cirriform or filiform papillae, 4–10 times as long as broad (Figs. 6C, 8D). Outer ventral surface of anal funnel apparently glandular (Fig. 8D). Ventral base of anal funnel with an elongate, brown spot of pigment on either side (Fig. 6C).

Remarks: The material described here may very well belong to two separate species, one with 29 setigers and branchiae on setigers 2–26 and the other with 31 setigers and branchiae on setigers 2–29 (or 30). They are united here for the time being based on the characteristic form of the anal funnel, with ventral spots of pigment, and the

shape of the prostomial palpode. In describing *Armandia amakusaensis*, Saito *et al.* noted that most specimens had either 29 or 33 setigers, with very few having intermediate numbers. They suggested that growth through stages with 30 and 31 setigers took place rapidly. A similar growth pattern could explain the occurrence of two apparently disparate groups in the present material.

According to the original description of *Armandia melanura*, lateral eyespots begin on setiger 6, there are only about 12 marginal papillae on the anal funnel (although some of the original specimens were up to 28 mm long) and the entire anal funnel is darkly pigmented. Furthermore, none of Gravier's specimens had more than 29 setigers. The present material is in better agreement with *A. melanura* as reported by Gibbs (1972: 215)

from the Cook Islands; he stated that the “ventral surfaces” of the anal funnel were dark brown, *i.e.*, presumably larger surfaces than the small spots reported here for Thai specimens.

The differences between the present material and previous descriptions of *A. melanura* are very considerable. In this case, the “*cf.*” in the present identification is to be taken as an indication that these animals do not belong to Gravier's species, only that they share several similarities. It was considered unwise to describe a new species until further studies (and material) led to a better understanding of the variation observed in the number of setigers and distribution of branchiae.

Armandia bipapillata Hartmann-Schröder, 1974, described from Moçambique, has similar pigment on the anal funnel as that described here,

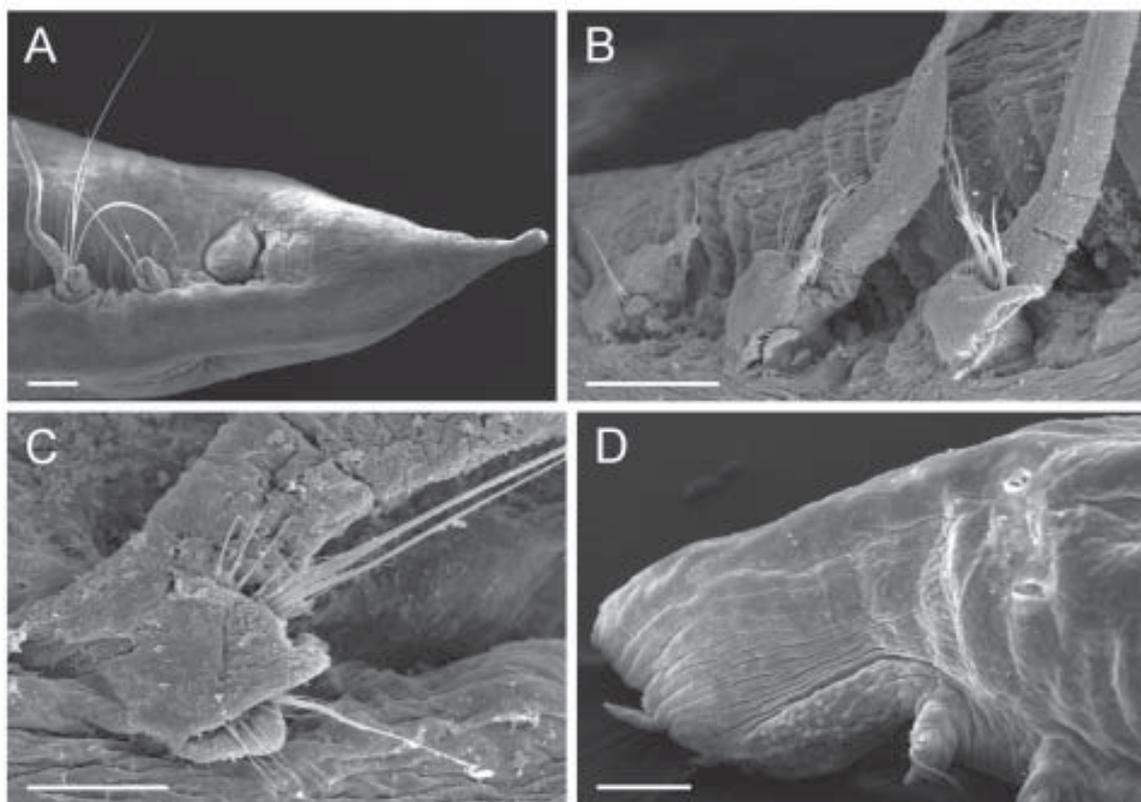


Figure 8 *Armandia cf. melanura*: A. Anterior end, lateral view; note clavate terminal palpode. B. Parapodia of setigers 1–3, lateral view, showing well developed presetal lobes. C. Parapodium of median setiger, anterior view. D. Anal funnel and last two setigers, lateral view. – SEM micrographs. ZMUC-POL-1260 (A, D) and ZMUC-POL-1259 (B, C). Scales = 0.1 mm (A, B, D) and 50 μ m (C).

but that species has 32 setigers, branchiae to the last setiger and a differently shaped anal funnel with two distinctive types of marginal papillae.

Distribution: Red Sea?, Andaman Sea, Cook Islands? In this study found in various mixtures of sand and mud at depths of 31–80 m.

Armandia sp., indeterminate

Material examined: BIOSHELF st. A-2/OS, 9°32' N, 97°50' E, 66 m, sandy mud, 18 Apr 1996 (2, PMBC 18861); st. C-1/BC, 9°00' N, 98°03' E, 40 m, muddy sand with shell fragments, 20 Apr 1996 (1, PMBC 18862); st. G-2/BC, 8°00' N, 98°10' E, 63 m, muddy sand, 23 Apr 1996 (1, PMBC 18863); st. G-3/OS, 8°00' N, 97°54' E, 77 m, muddy sand, 23 Apr 1996 (1, PMBC 18864); st. PB-8/BC, 7°45' N, 98°52' E, 19 m, sand with shell fragments, 22 Apr 1997 (1, PMBC 18865).

Remarks: These specimens consist of juveniles, some of which have previously been dried, all of which have been damaged. In all likelihood they belong to the three species described above.

Ophelina Örsted, 1843

Ophelina Örsted, 1843: 45.

Ammotrypane Rathke, 1843: 186.

Type species: *Ophelina acuminata* Örsted, 1843: 46, by monotypy.

Remarks: See the Introduction for remarks on the relationship between *Ophelina* and *Armandia*.

Ophelina cf. *cordiformis* (Caullery, 1944)
Figs. 9A–C, 10A

Ammotrypane cordiformis Caullery, 1944: 42–44, fig. 34a–b.

Material examined: BIOSHELF st. C-2/OS, 9°00' N, 97°53' E, 64 m, muddy sand, 20 Apr 1996 (1, PMBC 18866); st. H-1/OS, 7°45' N, 98°16' E, 31 m, mud, 9 May 1996 (2, ZMUC-POL-1261; 1 on SEM stub, ZMUC-POL-1262; 1 on SEM stub,

ZMUC-POL-1263); st. H-2/OS, 7°45' N, 98°15' E, 56 m, soft mud, 9 May 1996 (3, PMBC 18867); st. I-1/OS, 7°30' N, 98°57' E, 38 m, mud, 3 May 1996 (1, PMBC 18868); st. I-3/BC, 7°30' N, 98°10' E, 79 m, sand with shell fragments, 2 May 1996 (1, PMBC 18869); st. K-3/BC, 7°00' N, 98°41' E, 83 m, sandy mud, 5 May 1996 (1, PMBC 18870); st. L-2/OS, 6°44' N, 99°05' E, 56 m, soft mud, 5 May 1996 (1, ZMUC-POL-1264).

Description: Up to 23.0 mm long and 1.0 mm wide with up to 51 setigers (PMBC 18867). Prostomium conical, excluding palpode slightly longer than wide; palpode well developed, elongate, large, clavate (Fig. 9A; tip of prostomium damaged in this specimen). A single, very deeply embedded, black cephalic eye observed in one specimen only (PMBC 18867). Nuchal organs large, often everted. Proboscis and oral cirri not observed.

Branchiae present from setiger 2 to second last setiger, relatively long, almost meeting middorsally (Fig. 9A). Presetal lobes elongate, cirriform (Fig. 9B), particularly long on anterior 6–8 setigers (Fig. 9A), on setiger 1 up to half as long as branchiae of setiger 2 (ZMUC-POL-1261). Small, digitiform “ventral cirrus” present, postero-ventral to neuropodium, up to twice as long as broad (not visible on Fig. 9B). Posterior setigers short but with well developed parapodia.

Anal funnel 1½–2 times as long as width at base, with large ventral folds (Figs. 9C, 10A), as long as last 7–9 setigers; ventral margin open to base. Internal, unpaired anal cirrus distally blunt, shorter than anal funnel (Fig. 9C, 10A). Paired basal cirri absent. Posterior margin with up to 6 pairs of irregular, short papillae, up to 3 times as long as broad; ventral margin without papillae.

Remarks: The present specimens are very similar to *Ophelina cordiformis* as originally described by Caullery (1944, as *Ammotrypane*). It is, however, difficult to make a detailed comparison of the anal funnel, as Caullery only figured it in ventral view (*i.e.*, similar to Fig. 9C here). The most important reason for referring the present specimens to Caullery's species is the close similarity in the development of the presetal lobes, in particular

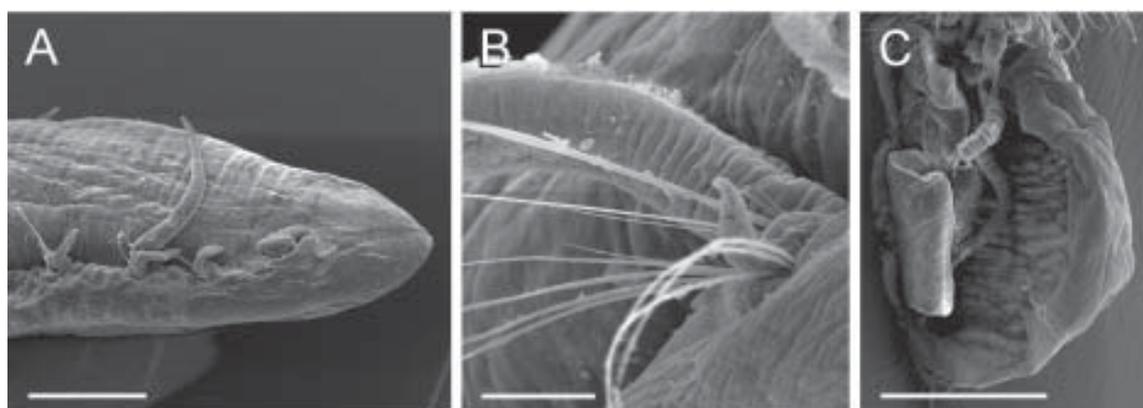


Figure 9 *Ophelina* cf. *cordiformis*: A. Anterior end, lateral view; tip of prostomium damaged, terminal palpode folded out of view; note large presetal lobes. B. Parapodium of median setiger, ventral view, showing well developed presetal lobe. C. Anal funnel, slightly damaged; ventral view. – SEM micrographs. ZMUC-POL-1262 (A, C) and ZMUC-POL-1263 (B). Scales = 0.5 mm (A, C) and 0.1 mm (B).

those of the anteriormost setigers (note that they are in most cases considerably longer than seen on Fig. 9A). *O. cordiformis* was described on the basis of one damaged specimen; therefore, Caullery was unable to describe the distribution of branchiae.

Caullery stated that 3 + 3 tubercles occur on the inner surface of the anal funnel, near its dorsal base. Such tubercles were not observed in the present material and it is possible that Caullery saw an optical illusion caused by the annulation of the anal funnel as seen in transmitted light, combined with some folding of the funnel itself.

The animals described here are also similar to *Ammotrypane* ? *dubia* Caullery, 1944 *sensu* Gallardo (1968: 111, pl. 52, fig. 2), as the presetal lobe of setiger 1 was not mentioned as being considerably longer than subsequent ones, as described by Caullery. *Ophelina dubia* (as *Ammotrypane*) was reported from the present study area by Phasuk (1992: 85); unfortunately, the material in question was not available for study.

Distribution: Indonesia?, Andaman Sea. In the present study found in various mixtures of sand and mud at depths of 31–83 m.

Ophelina grandis (Pillai, 1961)
Fig. 10B

Ammotrypane grandis Pillai, 1961: 25–27, fig. 9a–c. – Gallardo 1968: 112, pl. 52, fig. 5. – Hartman 1974: 627. – Phasuk 1992: 85.

Material examined: BIOSHELF st. C-3/BC, 9°00' N, 97°43' E, 79 m, sandy mud, 20 Apr 1996 (1, ZMUC-POL-1265); st. H-2/OS, 7°45' N, 98°15' E, 56 m, soft mud, 9 May 1996 (1, PMBC 18871).

Description: Up to 47 mm long (34.5 mm according to Pillai 1961) and 2.2 mm wide with up to 65 setigers (66 according to Pillai 1961). Prostomium conical, excluding palpode slightly longer than wide; palpode well developed, elongate, large, clavate. Cephalic eyes not observed. Nuchal organs large. Proboscis and oral cirri not observed (about 7 in a continuous, anterior series according to Pillai 1961, confirmed by Gallardo 1968).

Branchiae present from setiger 2, well developed to last setiger, relatively long, meeting middorsally. Notosetae of first 2 setigers elongate, curved forwards. Presetal lobes short, elongate triangular, on setigers 1–3 up to 2½ times as long as broad. Small digitiform “ventral cirrus” present, up to about twice as long as broad, posteroventral to neuropodium. Posterior setigers very short, but with well defined parapodia and well developed branchiae.

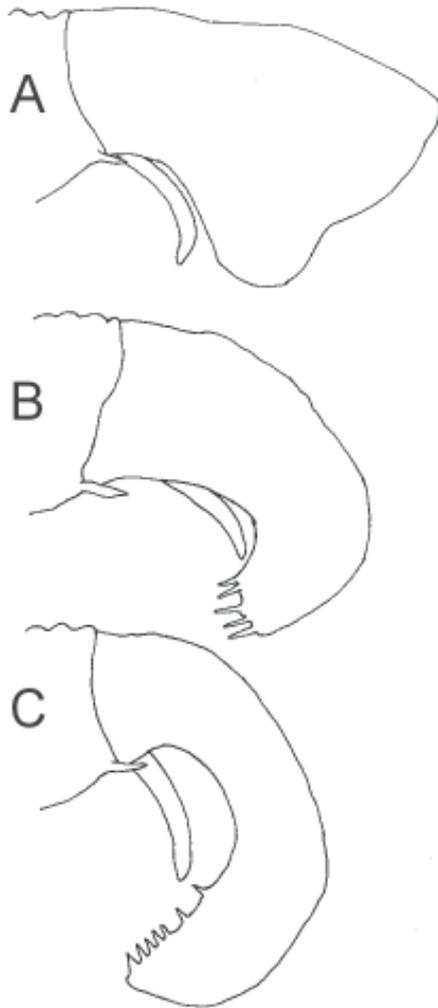


Figure 10 Schematic drawings of anal funnel in three species of *Ophelina*, lateral view: A. *O. cf. cordiformis* (Caullery, 1944). B. *O. grandis* Pillai, 1961. C. *O. cf. sibogae* (Caullery, 1944).

Anal funnel twice as long as width at base (Fig. 10B), as long as last 9 setigers; ventrally open to base. Internal, unpaired anal cirrus distally blunt, considerably shorter than anal funnel. Paired basal cirri present, confluent with longitudinal muscle ridges along body. Posterior margin of funnel with 5 pairs of cirriform papillae, up to 3 times as long as broad (Fig. 10B), ventral margin with a few papillae of similar form.

Remarks: According to the original description of *Ophelina grandis*, the setae of setigers 1 and 2

are elongate and bent forwards. This was also found on the specimens reported here, as shown on Pillai's fig. 9a, but not as strongly as shown on his fig. 9b. Pillai described lateral pigment spots (not eyespots) beginning at setiger 16; such spots were not found on the Thai animals. Furthermore, fewer papillae were observed on the margin of the anal funnel than the large number seen on Pillai's fig. 9c. The two BIOSHELF specimens are very large and it is possible that some papillae have been lost due to wear.

This species has previously been reported from the present study area by Phasuk (1992: 85). One of his samples was studied (PMBC 12978 from st. 1103) and the identity of the two specimens it contains was confirmed. The number of marginal papillae on the anal funnel was intermediate between that described by Pillai and that reported here.

Distribution: Sri Lanka, Andaman Sea, Vietnam. In the present study found in mud and sandy mud at depths of 56 and 79 m.

Ophelina cf. sibogae (Caullery, 1944)
Figs. 10C, 11A–B

Ammotrypane sibogae Caullery, 1944: 40–41, fig. 31a–f.

Ammotrypane sibogae major. – ?Phasuk 1992: 85.

Material examined: BIOSHELF st. C-3/OS, 9°00' N, 97°43' E, 80 m, fine sand with shell fragments, 20 Apr 1996 (2, PMBC 18872); st. E-3/BC, 8°31' N, 97°46' E, 81 m, sandy mud, 22 Apr 1996 (1, PMBC 18873); st. E-3/OS, 8°30' N, 97°46' E, 81 m, sandy mud with shell fragments, 22 Apr 1996 (6, PMBC 18874; 4, ZMUC-POL-1266; 1 on SEM stub, ZMUC-POL-1267; 1 on SEM stub, ZMUC-POL-1268); st. J-3/OS, 7°15' N, 98°36' E, 79 m, muddy sand, 4 May 1996 (2, PMBC 18875).

Description: Up to 14.5 mm long and 0.6 mm wide with up to 42 setigers (PMBC 18872). Prostomium conical, excluding palpode slightly longer than wide; palpode well developed, elongate, clavate (Fig. 11A). A single, deeply embedded, black cephalic eye observed in one

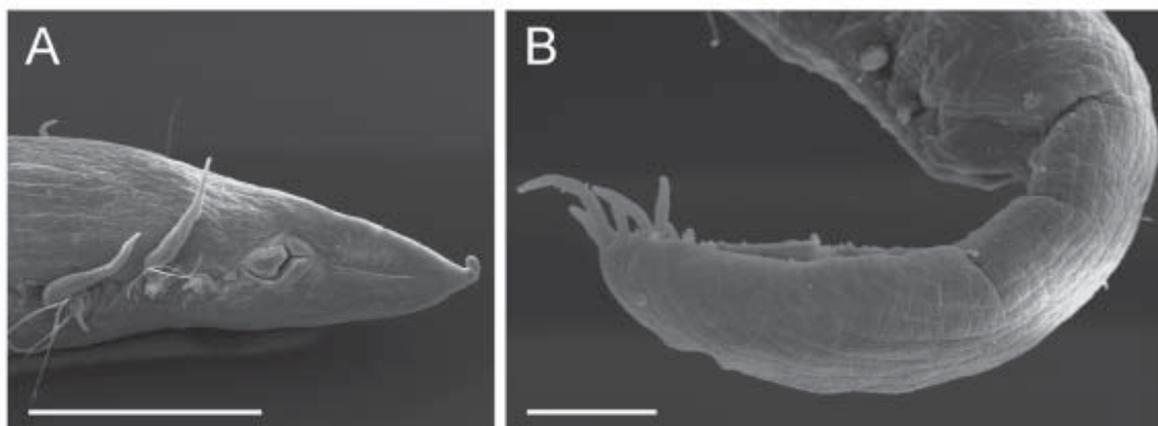


Figure 11 *Ophelina cf. sibogae*: A. Anterior end, lateral view. B. Anal funnel and last setigers, lateral view. – SEM micrographs. ZMUC-POL-1268. Scales = 0.5 mm (A) and 0.1 mm (B).

specimen only (PMBC 18872). Nuchal organs large (Fig. 11A). Proboscis elongate, curved forwards; oral cirri observed, distribution unclear.

Branchiae from setiger 2, present to at least 7 setigers from posterior end (posterior branchiae lost on all specimens), relatively long, almost meeting middorsally. Presetal lobes cirriform, about twice as long as broad on anterior setigers (Fig. 11A), gradually decreasing in size and no longer distinguishable by setiger 15. Small “ventral cirrus” present, posteroventral to neuropodium. Posterior setigers relatively long, with weakly developed parapodia.

Anal funnel $3\frac{1}{2}$ –4 times as long as width at base (Figs. 10C, 11B), as long as last 6 setigers; elongate hood-like, usually curved ventrally and forwards (Fig. 11B), ventral margin open to base. Internal, unpaired anal cirrus about $\frac{3}{4}$ as long as anal funnel. Paired basal cirri absent. Margin of anal funnel with up to 5 pairs of papillae concentrated near posterior end (Fig. 11B) and up to 6 pairs spread along rest of margin; papillae cirriform, 4–6 times as long as broad.

Remarks: *Ophelina sibogae* was originally described by Caullery (1944, as *Ammotrypane*) from Indonesia, from depths similar to those at which the present material was taken. BIOSHELF specimens agree well with Caullery’s description, particularly as regards the shape of the anal funnel (although a close comparison is complicated by

the fact that Caullery only figured it in ventral view). However, the Indonesian animals were considerably larger than those reported here (up to 30 mm long, with up to 65 setigers) and branchiae were present to the last setiger. Posterior gills were lost on the BIOSHELF specimens, so their true distribution is not known.

Ophelina sibogae has previously been reported from one station in the present study area by Phasuk (1992, as *Ammotrypane sibogae major* Caullery, 1944). This material was not available for study.

The present material also shows general similarities to *Ammotrypane kampeni* Horst, 1919 and *A. buitendijki* Horst, 1919, but the original descriptions are too vague to allow any detailed comparison to be made. The latter species was reported from the Thai sector of the Andaman Sea by Phasuk (1992: 85), but this material was unfortunately also unavailable for study.

It should be noted that although the anal funnel of the species reported here is considerably more elongate than in *O. grandis* or *O. cf. cordiformis*, its length corresponds to a lower number of posterior setigers than in those species because these setigers are noticeably more widely spaced in *O. cf. sibogae*.

Distribution: Indonesia?, Andaman Sea. In the present study found in sand more or less mixed with mud at depths of 79–81 m.

Travisia Johnston, 1840

Travisia Johnston, 1840: 373.

Type species: *Travisia forbesii* Johnston, 1840: 373, by monotypy.

***Travisia cf. horsti* Caullery, 1944**

Travisia horsti Caullery, 1944: 47–48, fig. 40a–f.

Material examined: BIOSHELF st. C-4/BC, 9°00' N, 97°30' E, 129 m, sandy mud, 21 Apr 1996 (1, ZMUC-POL-1269).

Description: The single specimen is 23 mm long and 3.7 mm wide with 24 setigers (posteriorly incomplete). Prostomium conical, almost twice as long as broad, very acute, drawn out to thin tip, not clavate. Cephalic eyes not observed. Nuchal organs C-shaped, relatively small. Proboscis and oral cirri not observed. Peristomium swollen as a collar behind prostomium.

Branchiae present on setigers 2–23, short at first, gradually growing until setiger 11, cirriform. Presetal lobes small. Dorsal and ventral lobes, directly above notopodia and below neuropodia, developed from setiger 15, by setiger 20 half as long as branchiae, broad and flattened.

Posterior end unknown. Body light brown to orange. Median setigers quadriannulate, each annulus with up to 5 poorly defined transverse rows of very fine, low papillae.

Remarks: *Travisia horsti* was originally described from a single specimen from Indonesia taken at a depth of 959 m. This specimen was 38 mm long, with 28 setigers and cirriform branchiae on setigers 2–22. The animal described above cannot be identified with certainty because it is posteriorly incomplete, but differs from Caullery's description in the distribution of papillae on the body. Furthermore, Caullery did not mention or figure lobes dorsal and ventral to the parapodia.

Phasuk (1992: 85) reported *Travisia* spp. from 13 stations in the present study area. Two of his samples (PMBC 12403 from st. 1026 and PMBC 12404 from st. 1037) were studied and found to contain specimens of *Travisia* in which the branchiae are composed of a large number of short, thin filaments. They thus do not belong to the species reported here and are more similar to *T. arborifera* Fauvel, 1932.

Distribution: The present specimen was found in sandy mud at a depth of 129 m.

ACKNOWLEDGMENTS

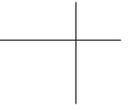
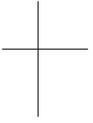
The staff of the Phuket Marine Biological Center is thanked for providing excellent facilities during the Thai–Danida Polychaete Workshop, June–August 1997. I am grateful to Annie Vedelsby for drawing Figure 2 and to Bjarne Bisballe (both ZMUC) for critical point drying specimens for SEM investigation.

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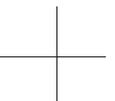
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