

**A REPORT OF HARTMANIELLIDAE (ANNELIDA: POLYCHAETA)
FROM THE ANDAMAN SEA, INDIAN OCEAN**

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ABSTRACT

A specimen of the polychaete family Hartmaniellidae is described, but not formally named, from the Thai portion of the Andaman Sea. This is only the fifth published primary report of this family. Although very similar to the type species, *Hartmaniella erecta* Imajima, 1977, the animal described here also shows significant differences, most importantly the apparent fusion of maxillae III and IV on the right side of the body and the very poor development of the parapodia on setiger 1. The significance of the Hartmaniellidae for our understanding of the phylogenetic development of such characters as dorsal cirri, ventral cirri, aciculae, and compound setae, as well as its relationship to the Lumbrineridae, Oeononidae, and Orbiniidae, are discussed.

INTRODUCTION

The polychaete family Hartmaniellidae was originally described by Imajima (1977) on the basis of 7 specimens from Suruga Bay, central Japan. He referred these animals to a new genus and species, *Hartmaniella erecta*.

Imajima pointed out the truly remarkable nature of this new taxon. Members of *Hartmaniella* have a complicated jaw apparatus composed of a ventral pair of mandibles and four dorsal pairs of maxillae, which Orensanz (1990) referred to the labidognath type known from the eunicidan families Eunicidae, Onuphidae, and Lumbrineridae. However, Fauchald and Rouse (1997) considered the jaw apparatus of hartmaniellids to represent a reduced version of the prionognath type found in Oeononidae. Thus, although a third, unpaired maxillary carrier is absent, the two that are present are not firmly connected to the maxillae as in typical labidognaths. Furthermore, the mandibles resemble those of oeononids in being separate, uncalcified, and lacking growth rings.

Despite having a typical eunicidan jaw apparatus, *Hartmaniella* lacks the specific types of setae found in Lumbrineridae and Oeononidae, *viz.* hooded hooks and limbate setae (see details on setal complement in Hartmaniellidae below). This also applies to the even more complicated types of setae found in Eunicidae and Onuphidae.

The surprising feature of Hartmaniellidae, however, is the arrangement of the parapodia. Anterior parapodia are lateral in position and have notopodia represented only by dorsal cirri. Notoaciculae appear from setiger 5, and from setiger 6 (or 7, see Gathof 1984) the entire parapodium is in a dorsal position, with the neurosetae pointing in a dorsolateral direction. This “migration” of the parapodia gives the worms a striking resemblance to members of Orbiniidae.

Imajima regarded the similarity of Hartmaniellidae to Orbiniidae as superficial, *i.e.*, the result of convergent evolution. Hartmaniellids indeed lack the specific types of setae commonly found in orbiniids: crenulate capillaries; thick, heavily toothed, often blunt-tipped simple setae (usually referred to as hooks or subuluncini); and

lyrate setae. Orbiniids furthermore have emergent notosetae and branchiae that are dorsal (medial) in relation to the notopodia, both of which are absent in hartmaniellids.

Since the original description of the family there have been few reports of new finds in the literature. Amoureux (1978) described a new genus and species, *Pseudoninoe tulearensis*, based on a single specimen from Madagascar. He referred the genus to Lumbrineridae based on the appearance of the maxillae, but the animal involved was clearly a hartmaniellid (Pettibone 1982; Orensanz 1990; Fauchald and Rouse 1997). Although the description is imperfect and the illustration of the anterior end confused, Amoureux's species appears to be distinct from *H. erecta* and should be referred to as *Hartmaniella tulearensis* (Amoureux, 1978). Gathof (1984) reported on 3 animals taken off the gulf coast of Florida and referred to them as *Hartmaniella* sp. A, since they were clearly different from *H. erecta* Imajima, 1977. A third named species, *H. fujianensis*, was described by He and Wu (1986) from the Taiwan Strait (description not seen by us).

During the Thai-Danish BIOSHELF sampling Project a single specimen of *Hartmaniella* was found in the Andaman Sea. This animal is described in detail below and some ideas on the phylogenetic importance of Hartmaniellidae are presented. It should be noted that the maxillary apparatus cannot be described in detail at this time, since the maxillae are only partially everted through the mouth opening and we have decided not to dissect this unique specimen. The animal has been deposited at the Zoological Museum, Copenhagen (ZMUC). Details on the BIOSHELF sampling project are provided elsewhere in this volume (Aungtonya and Eibye-Jacobsen 2002).

SYSTEMATIC SECTION

Hartmaniellidae Imajima, 1977

Hartmaniella Imajima, 1977

Hartmaniella Imajima, 1977: 211.

Pseudoninoe Amoureux, 1977: 1098.

Hartmaniella sp.

Fig. 1A–F

Material examined: BIOSHELF st. L-3/BC, 6°45' N, 98°45' E, 83 m, sandy mud and shell fragments, 5 May 1996 (1 specimen, ZMUC-POL-1101; slide with 5 parapodia, ZMUC-POL-1102).

Description: The specimen is a female in two pieces: an anterior end with 57 setigers and a middle fragment (appears to be the direct continuation of the anterior fragment) with 26 setigers. Anterior fragment 22 mm long, 0.9 mm broad without and 1.2 mm broad with neuropodia at setiger 10; middle fragment 10 mm long. Segments clearly biannulate from setiger 7, most clearly seen in ventral view.

Prostomium large, broadly ovate, and apically very blunt, without eyes, antennae, or palps (Fig. 1A). Peristomium without appendages, divided into two distinct rings, anterior ring slightly longer than posterior one and expanded anteroventrally to form ventral and lateral rims of mouth opening. About 20 large, irregular, transparent tubercles along ventral and lateral margins of mouth opening (partially visible on Fig. 1A). Shallow groove on each side of first peristomial ring, running downwards and backwards from its anterolateral edge to anteroventral border of second peristomial ring.

Mandibles partially everted through mouth opening, tip of left mandible broken. Mandibles elongate, strongly sclerotized, separated along their entire length (visible through body wall). A pair of flattened, ventrolateral aliform projections present at lateral margins of mouth opening, on same plane as mandibles. Projections with anteriorly directed tips, generally transparent but with sclerotized tips and medial margins.

Maxillae partially everted through mouth opening; maxillae III and IV, as well as anterior tips of I and II, visible. Maxillae III and IV small and medially sclerotized, on left side (right in ventral view) as separate plates, with 2 and 1 teeth, respectively; on right side apparently fused as a larger, squarish, strongly sclerotized plate with all four corners drawn out; plate in size equivalent to combined size of left maxillae III and IV. Apical tip of maxilla I on right side immediately posterior

to fused maxillae III + IV. One pair of maxillary carriers present (visible through body wall), about 5 times as long as broad.

Parapodia of setiger 1 tiny, each with small conical dorsal cirrus, simple lobe supporting two short capillary setae, and small conical ventral

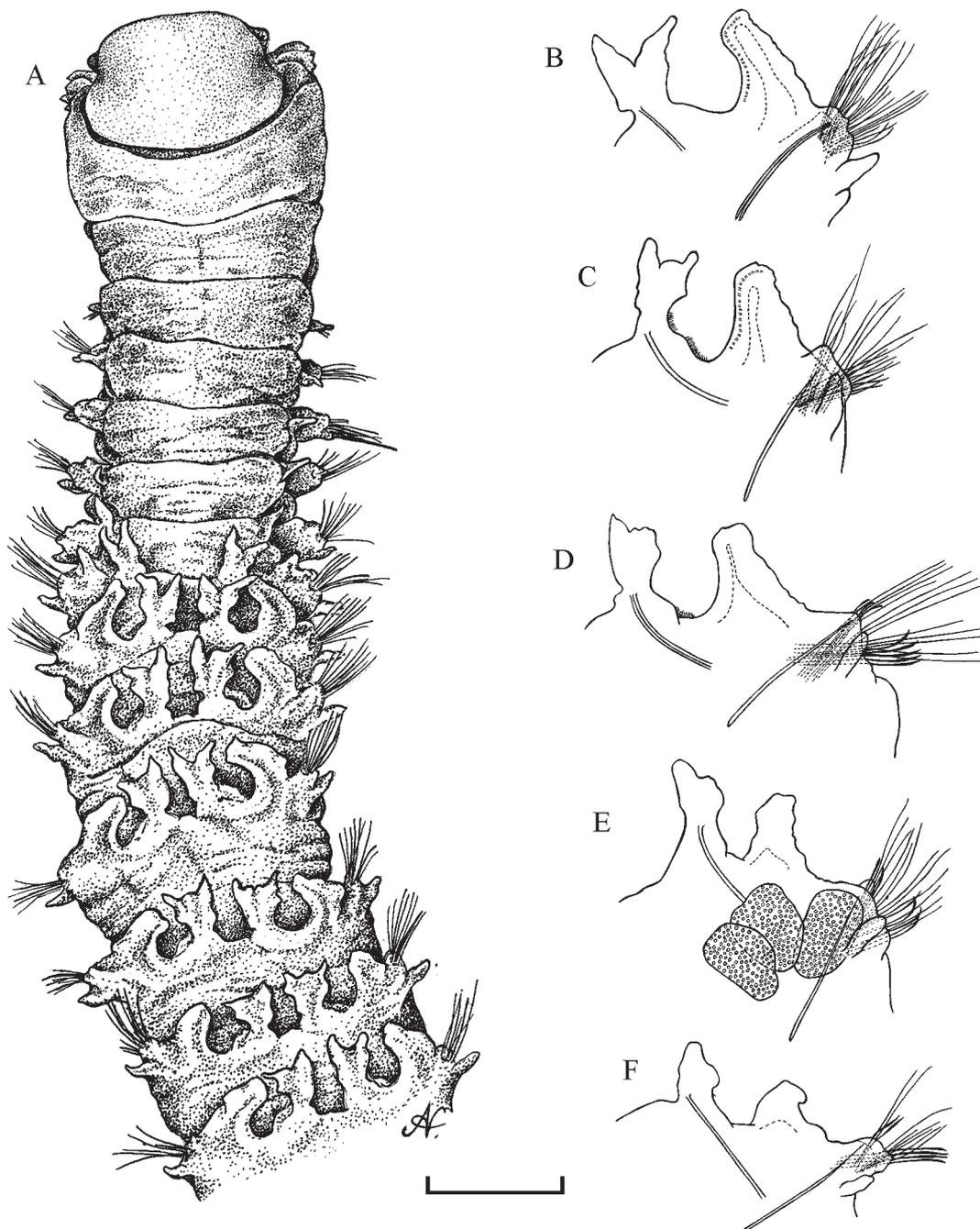


Figure 1 *Hartmaniella* sp.: A. Anterior end, dorsal view. B–F. Parapodia of setigers 7, 14, 25, 50, and 82, posterior view. – ZMUC-POL-1101 (A) and ZMUC-POL-1102 (B–F). Scale = 0.5 mm (A) and 0.25 mm (B–F).

cirrus. Parapodia gradually grow in size until about setiger 9. From setiger 6 dorsal cirri are bifurcate, neuropodium with large, quadrangulate dorsal lobe (termed interramal cirrus in Imajima 1977), both fully developed from setiger 7 (Fig. 1B) and reaching maximum size on setiger 9. From setiger 7 the two parapodia of each segment closely apposed in dorsal position, together forming broad, high “flap” which in preserved animal is bent forward onto the dorsum. Dorsal lobe of neuropodium at least on anterior part of body with internal coelomic cavity, probably serving branchial function. Ventral cirri conical, at first ventral to neuropodium, from about setiger 11 moving to a postsetal, subacicular position (Fig. 1C). Dorsal cirri, ventral cirri, and dorsal lobe of neuropodia very gradually decrease in size to last setiger present on fragment (Fig. 1F).

Neuropodia with small pre- and postacicular lobes, the former most strongly developed. Neurosetae supported by one, and in some anterior setigers two (Fig. 1B), well developed aciculae (tips of neuroaciculae not observed). Preacicular setae clearly divided into supra- and subacicular groups, postacicular setae less clearly so until about setiger 20 (Fig. 1D). Preacicular setae elongate, compound spinigers with minute serrations apically on basal shaft. From about setiger 20 preacicular fascicle with 4-5 shorter, broader simple setae in subacicular position and 2-3 similar setae in supraacicular position (Fig. 1D-F), each with elongate terminal arista. Most postacicular setae elongate, simple capillaries of two types, smooth and minutely serrate. From about setiger 12 a number of compound spinigers also present in supraacicular position.

Notopodia without emergent setae, each with 2-3 elongate, very thin internal aciculae (Fig. 1B-F). Dorsal cirri strongly bifurcate on anterior part of body, from about setiger 20 lateral branch becomes reduced (Fig. 1D). Dorsal cirri up to about setiger 40 with basal notch on medial margin (Fig. 1B-D).

Posterior part of body and pygidium unknown.

Immature eggs present in median parapodia (Fig. 1E); eggs deep yellow, containing large amounts of yolk, each with a diameter of 150-

200 μm , indicating the production of lecithotrophic larvae.

Remarks: This single specimen from the BIOSHELF Project is very well preserved and shows a strong resemblance to *Hartmaniella erecta* Imajima, 1977. There do, however, appear to be a number of more or less important differences, the significance of which cannot be determined until a larger number of specimens similar to the one described here are available for detailed comparative study. For future reference, these deviations are listed here:

1) The most significant difference appears to lie in the development of maxillae III and IV, which are apparently fused on the right side in the present specimen but separate in *H. erecta*. Interestingly, although not mentioned in the text, fig. 2d in Imajima (1977) does indicate a certain degree of asymmetry in the development of these maxillae, with those of the left side being largest.

2) Another important difference is found in the development of the parapodia of setiger 1, which in *H. erecta* are provided with about 12 setae (Imajima 1977, fig. 2f). In our specimen these parapodia have only 2 short setae each.

3) The partially sclerotized, aliform projections in the mouth opening, lateral to the mandibles, were not mentioned or figured for *H. erecta*.

4) According to Imajima, in *H. erecta* the dorsal cirri lose their lateral lobe and the dorsal neuropodial lobe is reduced in size “in median parapodia”, posterior to setiger 41. In our animal this takes place at a more anterior position, distinct from around setiger 20-22 (Fig. 1D). This difference can hardly be related to size, as our specimen is broader and was presumably longer than those described by Imajima.

5) In our specimen the arista of the broad aristate setae is clearly longer than shown by Imajima for *H. erecta* (his fig. 2m) and by setiger 50 (Fig. 1E) the arista is actually almost as long as depicted by Imajima on his fig. 2q (which shows the tip of a neuroacicula).

Some of these differences may easily be due to artefacts or incomplete observations and the

status of our specimen cannot be resolved until further material is available.

Two other apparent differences are not valid. According to Imajima (1977) the dorsal cirri of *H. erecta* are bifurcate from setiger 5, not setiger 6 as seen here, but his fig. 2a clearly shows that they are bifurcate from setiger 6. Secondly, the oblique line present on the first ring of the peristomium in our animal was not mentioned by Imajima, but can be seen on his fig. 2b.

Distribution: Known only from one station in the Andaman Sea, in the southern part of the Thai exclusive economic zone.

DISCUSSION

Whatever the specific status of the hartmaniellid from Thailand may be, our study of it has provoked some questions as to the phylogenetic position of the family.

As mentioned above, the specific morphology of the complicated jaw apparatus and the subdivision of the peristomium into two distinct rings (see Åkesson 1967, Eibye-Jacobsen 1994) in hartmaniellids unquestionably places them in the Eunicida, probably near the Oeonidae or Lumbrineridae. According to Orensanz (1990), among extant eunicidans Hartmaniellidae is the sister group of Eunicidae + Onuphidae, but we are more inclined to agree with the interpretation of the jaw apparatus suggested by Fauchald and Rouse (1997). The implications of the asymmetrical development of the maxillae, which has not previously been considered for Hartmaniellidae, are unclear and warrant further study, as asymmetry may have evolved more than once in eunicidans (see discussion in Orensanz 1990). Hartmaniellidae has clear autapomorphic characters and its recognition does not affect the monophyly of any other eunicidan family.

The presence of compound setae in Hartmaniellidae is interesting. Among the Eunicida compound setae are also found in Lumbrineridae, Eunicidae, Onuphidae, and Dorvilleidae. In particular, compound spinigers are known in Lumbrineridae and Dorvilleidae (see, e.g., Knox

and Green (1972: 77) and Uebelacker (1984: 33) for Lumbrineridae and Orensanz (1990: 121) and Oug (1990: 193) for Dorvilleidae). In their phylogenetic analysis of polychaete relationships, Rouse and Fauchald (1997: appendix II, 179, 181) coded the compound setae of these two families as dentate, as in Eunicidae and Onuphidae, rather than polymorphic. Thus, among eunicidans compound setae were only coded as tapering (*i.e.*, spinigerous) in Hartmaniellidae.

In Lumbrineridae, Eunicidae, Onuphidae, and Dorvilleidae the distal appendage of the compound setae is attached to the basal shaft by two ligaments, in contrast to the single ligament found in all other aciculate polychaetes. According to Fauchald and Rouse (1997), two ligaments are also present in hartmaniellids.

The compound setae of Hartmaniellidae are remarkable in that they appear to be very simple in structure; thus, the distal end of the basal shaft is very weakly swollen (as may be seen for *H. erecta* on fig. 2p in Imajima 1977) and the compound nature of the seta itself is only apparent at very high magnification. Scanning and transmission electron microscopic studies of hartmaniellid compound setae could confirm the arrangement of ligaments attaching the distal article to the basal shaft and would be highly valuable in order to determine whether they are strictly homologous to the compound setae of other eunicidan polychaetes.

The resemblance of hartmaniellids to orbiniids is fascinating and would appear to be enigmatic due to the great degree of separation between Eunicida and Orbiniidae seen on the cladograms depicting polychaete phylogeny published by Rouse and Fauchald (1997). This separation might, however, not be so great. The analyses performed by Rouse and Fauchald placed Orbiniidae in a basal taxon, named Scolecida, which contained polychaete families that did not clade with either Aciculata or Canalipalpata. The Scolecida as a monophyletic taxon is poorly supported, which was unavoidable given the apparent paucity of strong apomorphic characters in the families it encompasses. However, the inclusion of Orbiniidae in the Scolecida may have been due to a simple

error in the phylogenetic analysis carried out by Rouse and Fauchald. Thus, although these authors clearly state that aciculae are present in the posterior parapodia of orbiniids (Fauchald and Rouse 1997: 87, 107; Rouse and Fauchald 1997: 195), aciculae are scored as absent in both of their data matrices (Rouse and Fauchald 1997: appendix II, 179, 181).

The presence of aciculae in Orbiniidae, albeit in a form that could be regarded as primitive (*i.e.*, the aciculae are not as clearly delineated from the embedded bases of emergent setae as in typical aciculate families), opens the possibility that Orbiniidae might be a member of Aciculata, possibly the sister group of all other aciculates (= Aciculata *sensu* Rouse and Fauchald, 1997), the important autapomorphies of which would be the presence of dorsal cirri, ventral cirri, and true compound setae (*i.e.*, with ligaments).

Should this speculation be strengthened by future analyses, the Orbiniidae and Hartmaniellidae (along with other eunicidans) might prove to be relatively closely related. Further study of the elusive hartmaniellids might provide valuable insights into the phylogenesis of such important morphological characters as dorsal cirri, ventral cirri, aciculae, and compound setae.

ACKNOWLEDGMENTS

We express our gratitude to the staff of the Phuket Marine Biological Center (Phuket, Thailand), the crew of the R/V *Chakratong Tongyai*, and all other agencies involved with the BIOSHELF Project. Annie Vedelsby (ZMUC) is thanked for drawing the dorsal view of the animal and for producing the final versions of the parapodial drawings.

REFERENCES

- Åkesson, B. 1967. The embryology of the polychaete *Eunice kobeensis*. *Acta Zoologica* **48**: 141–192.
- Amoureux, L. 1978. Annélides polychètes profondes de Madagascar. Description de deux nouvelles espèces (collections Crosnier et Jouannie). *Bulletin du Muséum National d'Histoire Naturelle* **344**: 1093–1109.
- Aungtonya, C. and D. Eibye-Jacobsen. 2002. Introduction to the Thai–Danish BIOSHELF sampling project and the Polychaete Workshop held in Phuket, Thailand, June–August 1997. *Phuket Marine Biological Center Special Publication* **24**: 1–12.
- Eibye-Jacobsen, D. 1994. On the nature of the two anterior asetigerous rings in Dorvilleidae and Dinophilidae (Annelida, Polychaeta). *Mémoires du Muséum National d'Histoire Naturelle* **162**: 93–100.
- Fauchald, K. and G.W. Rouse. 1997. Polychaete systematics: Past and present. *Zoologica Scripta* **26**: 71–138.
- Gathof, J.M. 1984. Chapter 57: Family Hartmaniellidae Imajima, 1977. **In**: J.M. Uebelacker and P.G. Johnson (eds.), *Taxonomic Guide to the Polychaetes of the Northern Gulf of Mexico* **7**. Barry A. Vittor and Associates, Inc., Metairie, Louisiana, pp. 1–3.
- He, M. and Q. Wu. 1986. A new species of Hartmaniellidae (Polychaeta) from Taiwan Strait. *Journal of the Oceanography of Taiwan Strait* **5**: 65–69. [In Chinese]
- Imajima, M. 1977. A new polychaete family, Hartmaniellidae, from Japan. **In**: D.J. Reish and K. Fauchald (eds.), *Essays on Polychaetous Annelids in Memory of Dr. Olga Hartman*. The Allan Hancock Foundation, University of Southern California, Los Angeles, pp. 211–216.
- Knox, G.A. and K.M. Green. 1972. The polychaetous annelids of New Zealand. Part 2: Lumbrineridae. *Journal of the Royal Society of New Zealand* **2**: 69–81.
- Orensanz, J.M. 1990. The eunicemorph polychaetes from Antarctic and Subantarctic seas. With addenda to the Eunicemorpha of Argentina, Chile, New Zealand, Australia, and the southern Indian Ocean. *Antarctic Research Series* **52**: 1–183.

- Oug, E. 1990. Morphology, reproduction, and development of a new species of *Ophryotrocha* (Polychaeta: Dorvilleidae) with strong sexual dimorphism. *Sarsia* **75**: 191–201.
- Pettibone, M.H. 1982. Annelida. **In:** S.P. Parker (ed.), *Synopsis and Classification of Living Organisms* **2**. McGraw-Hill, New York, pp. 1–43.
- Rouse, G.W. and K. Fauchald. 1997. Cladistics and polychaetes. *Zoologica Scripta* **26**: 139–204.
- Uebelacker, J.M. 1984. Chapter 41: Family Lumbrineridae Malmgren, 1867. **In:** J.M. Uebelacker and P.G. Johnson (eds.), *Taxonomic Guide to the Polychaetes of the Northern Gulf of Mexico* **6**. Barry A. Vittor and Associates, Inc., Metairie, Louisiana, pp. 1–45.



NOTES:

