PROCEEDINGS OF THE BIOLOGICAL SOCIETY OF WASHINGTON
120(1):49–55. 2007.

Axiothella isocirra, a new species of Maldanidae (Annelida: Polychaeta) from Belize

Christoph Bleidorn and Harald Hausen*

(CB) Evolutionsbiologie/Spezielle Zoologie, Institut f. Biochemie & Biologie, Universität Potsdam, Karl-Liebknecht-Str. 24-25, Haus 26, 14476 Golm, Germany, e-mail: Bleidorn@uni-potsdam.de;
(HH) Systematik und Evolution der Tiere, Institut f. Biologie, Freie Universität Berlin, Königin-Luise-Str. 1-3, 14195 Berlin, Germany, e-mail: hhausen@zoosyst-berlin.de

Abstract.—A new species of Maldanidae (Annelida: Polychaeta), *Axiothella isocirra*, is described from soft bottom samples taken at shallow depth at Blue Ground Range, Belize. The new species is characterized by a combination of few chaetae in the anterior setigers, the presence of four achaetous preanal segments and the equal length of the pygidial cirri. Variability of certain characters is shown, and its utility for taxonomy is discussed.

During a two week visit to Carrie Bow Caye, Belize in July 2002, a few maldanids (Annelida: Polychaeta) were collected. Light microscopical and scanning electron microscopical (SEM) investigations revealed that some of the individuals belong to a hitherto undescribed maldanid species.

The taxonomy of maldanids is based mainly on morphology of the head, total number of segments, chaetal structure, shape of the pygidium, and position of the anus (Rouse & Pleijel 2001). The recognition of the new species described herein additionally depends on quantitative characters such as numbers of chaetae in certain setigers. Those characters can show intraspecific variability in maldanids (Pilgrim 1977, Mackie & Gobin 1993) and have to be applied with care in taxonomy.

Materials and Methods

Type specimens (holotype and three paratypes) were collected in littoral soft bottom areas of Blue Ground Range (Belize) at 8 to 10 m depths. Samples were taken using a Van Veen grab in July 2002. The sediment was sieved and the animals were fixed in 7% formalin and preserved in 80% ethanol. The holotype and one paratype were prepared for SEM. They were dehydrated in an ethanol series, critical point dried in a Balzers CPD 030, and coated with gold in a Balzers SCD 050. Micrographs were taken using a Hitachi S 450 and a FEI Quanta 200 SEM. The remaining two paratypes were investigated with a Leica MZ 16 A stereo microscope. The holotype has been deposited at the Museum für Naturkunde der Humboldt Universität zu Berlin (Germany).

Axiothella isocirra, new species
Figs. 1–3

Material examined.—Caribbean Sea, Belize, Blue Ground Range, Holotype (ZMB Vermes Generalkatalog Freilebende Würmer 11222a–c) and three paratypes (ZMB Vermes Generalkatalog Freilebende Würmer 11223a–b and collection Free University Berlin), coll. C. Bleidorn and H. Hausen, 1 Jul 2002.

* Corresponding author.

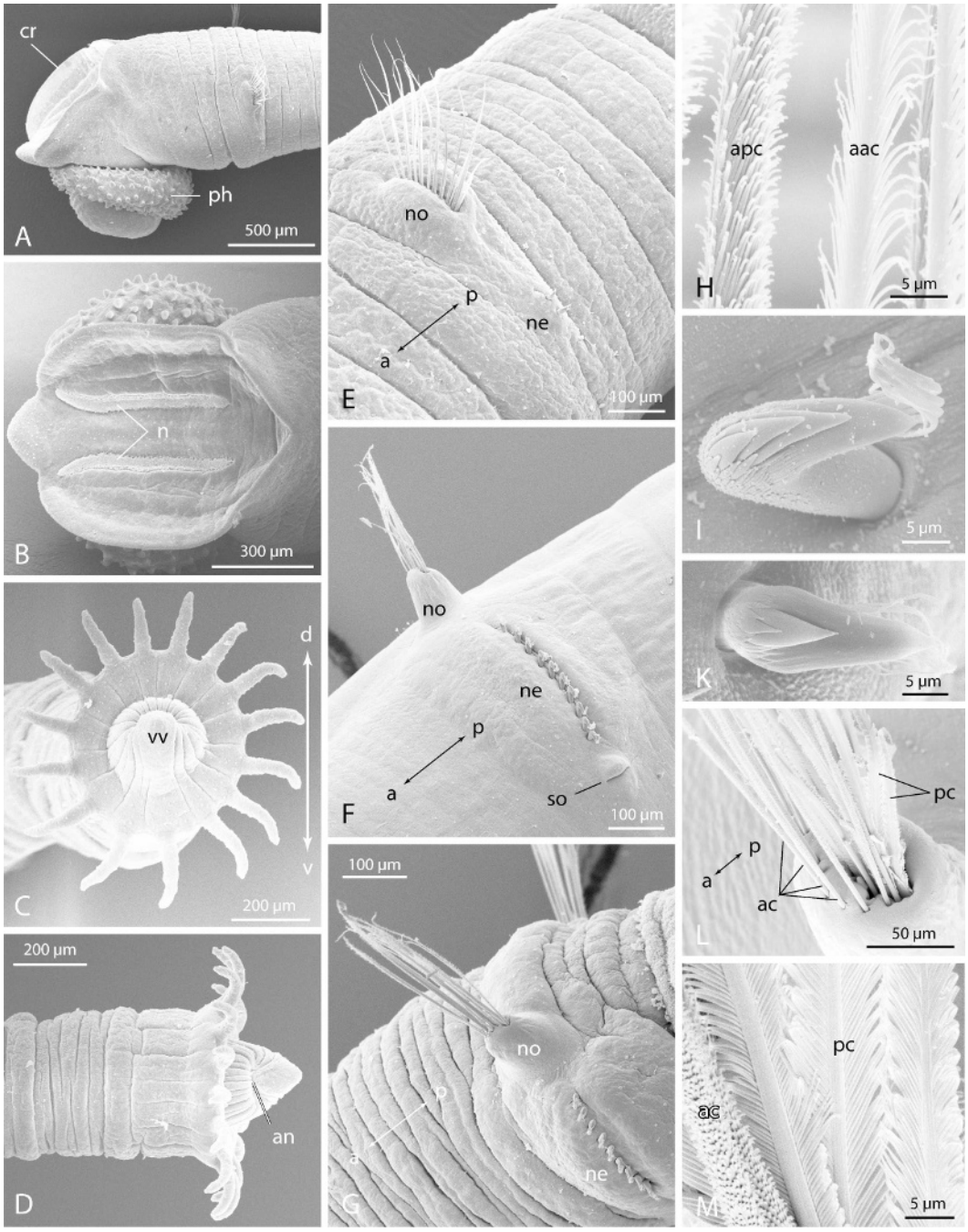

Fig. 1. *Axiothella isocirra* (SEM). A, head from lateral with everted pharynx (ph). B, head from dorsal showing nuchal organs (n). C, pygidium with ventral valve (vv). D, hind end from dorsal. E, setiger 1 with notochaetae in transverse double row and two neuropodial hooks. F, setiger 9 with notochaetae in transverse double row, 10 ventrally pointing neuropodial hooks and ventral slit-like opening (so). G, setiger 16 with notochaetae in longitudinal double row and 10 ventrally and slightly anteriorly pointing neuropodial hooks. H, apical part of posterior (apc) and anterior (aac) notochaetae from setiger 14. I, neuropodial hook from setiger 9. K, neuropodial hook from setiger 3. L, notopodium of setiger 10 with

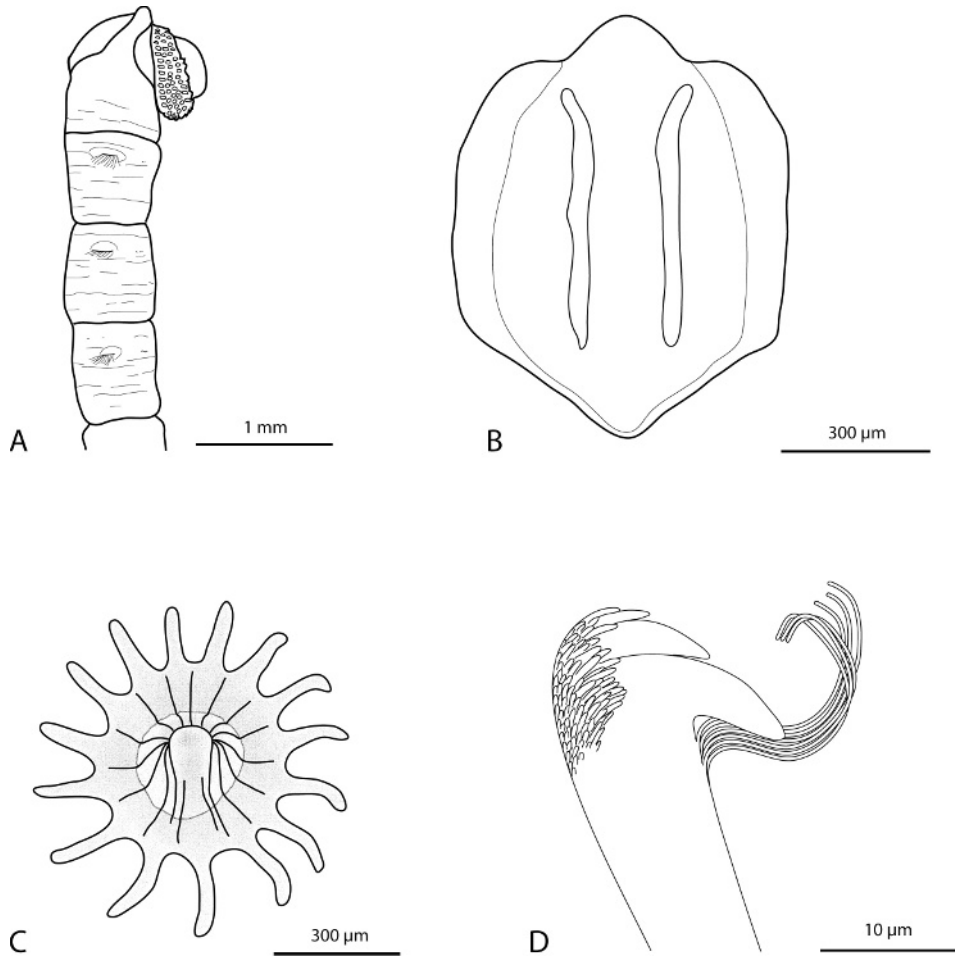

Fig. 2. *Axiothella isocirra*. Redrawings from holotype. A, anterior end, lateral view. B, cephalic plate from dorsal. C, Pygidium from posterior. D, neuropodial hook from midbody region.

Description.—Holotype. Body 23 mm long, 0.5 to 1 mm wide, cylindrical in cross-section without color pattern in alcohol. With achaetous head, 18 setigers, 4 achaetous preanal segments, and pygidial funnel. Prostomium slightly longer than wide (0.9 mm long; 0.7 mm wide). Cephalic plate well developed, elliptical with entire, not incised, rim (Figs. 1A, B, 2B). Palpode tongue shaped (Figs. 1B, 2B). Nuchal grooves long, parallel, slightly outward curved anteriorly (Figs. 1B, 2B). Ventral side of prostomium with several pigment spots. Everted pharynx sac-like with numerous papillae (Figs. 1A, 2A).

All setigers biramous with interramal ciliary brushes between noto- and neuropodia. Parapodia situated anteriorly in setiger 1 to 7, in middle of setiger 8, and posteriorly from setiger 9 onward. Both rami without appendages. Notopodium

←

transverse row of anterior chatae (ac) and bundlelike arrangement of posterior chaetae (pc). M, detail of anterior (ac) and posterior feather-like (pc) notochaetae in setiger 10. a, anterior; an, anus; cr, cephalic rim; d, dorsal; ne, neuropodium; no, notopodium; p, posterior; v, ventral.

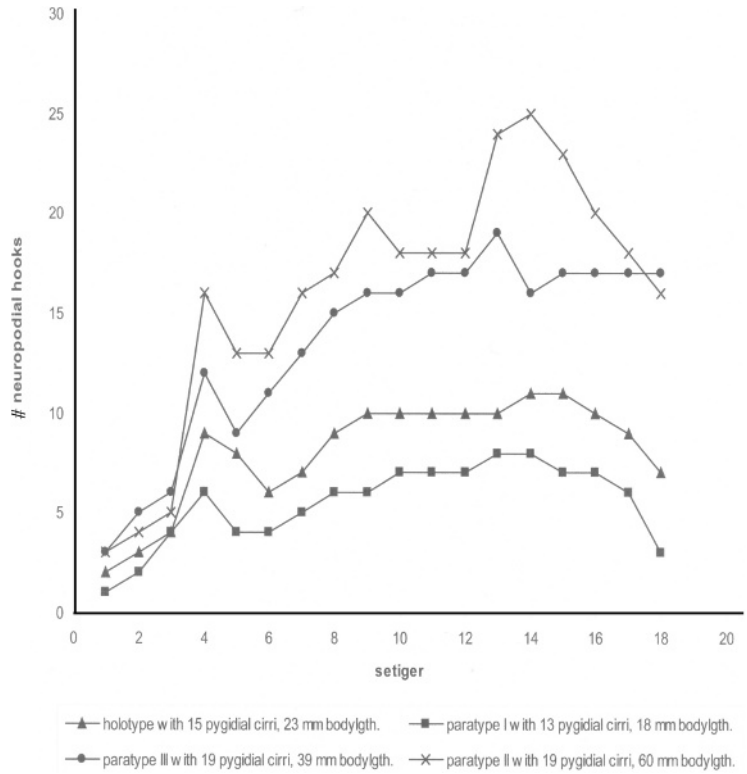

Fig. 3. *Axiothella isocirra*. Number of hooks per neuropodial row in different specimens.

with low lobe in setiger 1 to 3 (Fig. 1E) but with higher and conical lobe in setiger 4 to 18 (Fig. 1F, G). Neuropodium without lobe in setiger 1 to 3 but with low torus in setiger 4 to 18. All achaetous preanal segments without notopodial lobe but with weak neuropodial torus. Interramal ciliary brushes present dorsal to neuropodium in all four preanal segments.

Notochaetae form alternating double row in all setigers, except setiger 1. Double row in dorso-ventral direction in setigers 1 to 9 (Fig. 1E, F). From setiger 11, stepwise transformation in notopodia to bent, longitudinally directed double row in setiger 14 and onward (Fig. 1G); thereby, posterior chaetae becoming dorsal ones and anterior chaetae becoming ventral ones. In setiger 1 to 9 and from setiger 11 onward, anterior (respectively ventral) chaetae thinner and extending less from body surface than posterior (respectively dorsal) chaetae. Base of both chaetal types smooth. Middle and upper part ornamented with spines distally, increasing in number and length. Spines project from all around chaetae on middle and upper part of posterior (respectively dorsal) chaetae (Fig. 1H) and on middle part of anterior (respectively ventral) chaetae. Upper part of anterior (respectively ventral) chaetae clearly bipinnate (Fig. 1H). In setiger 10, anterior notochaetae form bent transverse row, whereas posterior notochaetae in bundle-like arrangement. Anterior notochaetae in setiger 10 of the same type as posterior (respectively dorsal) chaetae in other notopodia (Fig. 1M). Posterior notochaetae in setiger 10 strictly bipinnate with broad spines and feather-like appearance. In anterior setigers, new chaetae enter notopodial double row from ventral,

respectively from posterior in posterior setigers. Position of chaetal formation zone unknown in setiger 10.

Neuropodia with hooks in all setigers situated in transverse groove. In setiger 1, two posteriorly pointing, in setiger 2, three dorsally pointing, and in setiger 3, four posteriorly and slightly dorsally pointing hooks. Six to 11, ventrally and slightly anteriorly pointing hooks in setiger 4 to 16. Hooks pointing anteriorly in setiger 17 and 18. Hooks in all setigers with beard structure, strongly bent rostrum, followed by few major apical teeth and numerous small apical teeth (Fig. 2D); in setiger 1 to 3, two major teeth (Fig. 1K), in setiger 4 to 17, three major teeth (Fig. 1I), and in setiger 18, two to three major teeth.

In setiger 7 to 9, slit like opening on ventral base of knob-like elevation ventral to neuropodium. Pygidial funnel with 15 equally long cirri. Anus on cone central within funnel depression with distinct midventral valve (Figs. 1C, D, 2C).

Variability.—The body length ranges from 18 to 60 mm in the paratypes. All specimens have the same number of segments with 18 setigers and 4 achaetous preanal segments. The number of pygidial cirri increases with body length and varies from 13 for the shortest specimen to 19 for the longest. Also, the number of hooks per neuropodium is higher in longer specimens. In each specimen, the number of hooks increases more or less continuously from setiger 1 to the midbody region, except for a peak in setiger 4 (Fig. 3). In three of four specimens, hooks decrease in number in the posterior body region. The maximal difference between specimens is two hooks in setiger 1 to 3 but is much higher from setiger 4 onward, with the highest difference of 17 hooks between the shortest and longest specimens in setiger 14. In the shortest specimen, which has been investigated with SEM, hooks point in the same direction as they do in the holotype, with the exception of setiger 2, where they point posteriorly instead of dorsally and setiger 17 and 18, where they point ventrally and only slightly anteriorly, instead of clearly anteriorly. The number of apical teeth is two in setiger 1 to 3 and three in all following setigers, nearly identical to the condition in the holotype. Posterior notochaetae alike form a bundle in the notopodium of setiger 10. From setiger 11 the notopodia are also transformed to bear bent longitudinally directed double rows.

Geographic distribution.—Blue Ground Range, Belize, 8–10 m depth, Caribbean Sea.

Etymology.—The species name *isocirra* is a combination of the Greek *iso* = equal, and the Latin *cirrus* = tendril, and refers to the equal length of the pygidial cirri, a condition not reported for other taxa in the genus *Axiothella*.

Remarks.—The combination of a cephalic plate with a well-developed rim, the ventral valve of the anus and its position on a cone, which is sunken in a funnel and ringed by cirri, hooks being aligned in a single row, and the absence of a ventral glandular shield on setiger 8 indicate the membership in Euclymeninae Arwidsson, 1907.

The hooks, starting on setiger 1, and the similarity of the hooks throughout the body, in showing a strongly bent rostrum followed by a series of apical teeth and a beard structure, fit the diagnosis of *Axiothella* sensu Verrill (1900). However, minor differences exist in subsequent diagnoses of *Axiothella*. The pygidial cirri are of the same length and not of alternating length as in *Axiothella* sensu Arwidsson (1907). Further, the hooks are not numerous in setiger 1 to 3. In disagreement with the diagnosis of *Axiothella* sensu Day (1967), *A. isocirra* possesses a ventral valve on the anus.

Because more differences exist between the new species and diagnoses of other genera of Euclymeninae, we decided

Axiothella is the appropriate genus. The conflicts may be due to the fact that Euclymeninae, like other maldanid subtaxa, never has been revised since its erection by Arwidsson (1907), whereafter many species and genera have been added.

Within *Axiothella*, quantitative characters are used to distinguish species. This factor mainly concerns the number of hooks, especially within the first three setigers, the number of achaetous preanal segments, and the number of pygidial cirri. All of these characters can show intraspecific variability and thus have to be applied with caution. Chaetae can be added to and removed from chaetal rows throughout life as shown for many sedentary polychaetes (Bobin 1935, Pilgrim 1977, Gruet 1986, Duchene & Bhaud 1988, Bartolomaeus 1998) and also for the maldanids *Clymenella torquata* and *Euclymene oerstedii* (Pilgrim 1977). Further, an increase in the number of chaetae per row with age is well known for many polychaetes. Young stages of *Axiothella mucosa*, displaying the same number of setigers as adults, possess only two hooks per neuropodium (Bookhout & Horn 1949). Instead, older specimens show 30 hooks per neuropodium in the posterior region (Andrews 1891). Also, in *A. isocirra, Johnstonia* species (Mackie & Gobin 1993), and *C. torquata* (Pilgrim 1977) differences in chaetal numbers are well documented.

However, as in *C. torquata* and species of *Johnstonia*, the variability in chaetal numbers in *Axiothella isocirra* is conspicuously larger in the chaetal-rich midbody and posterior setigers than in the first three setigers with only few chaetae. Here, obviously, only a few hooks are added since early ontogenesis. The low number of chaetae in the first three setigers, therefore, can be used to distinguish *A. isocirra* from other species with high numbers of chaetae in the same body region.

Age dependent increase in number of preanal achaetous segments and of pygidial cirri is evident for *Axiothella mucosa* by the description of a young stage having one preanal segment and nine cirri in contrast to adults with three preanal segments and 21 to 24 cirri (Andrews 1891, Bookhout & Horn 1949). The number of pygidial cirri seemingly also increases with age in *A. isocirra*. However, there is no evidence for an increase in the number of achaetous preanal segements, at least in individuals already longer than 18 mm.

The observed combination of few chaetae in the anterior setigers, the presence of four achaetous preanal segments, and the equal length of the pygidial cirri is unique within *Axiothella* (for a comparison of taxonomic characters of known species of *Axiothella*, see Gillet 1989). Those species with few hooks in the anterior setigers, namely *A. brasiliensis* Mangum, 1966, *A. jarli* Kirkegaard, 1959, and *A. somersi* Verrill, 1900, have fewer than four achaetous preanal segments and cirri that alternate in length, whereas *A. serrata* Kudenov, 1977 shows a very long medial pygidial cirrus and a serrated prostomial rim. *Axiothella zetlandica* McIntosh, 1915 has cirri alternating in length, *Axiothella crozetensis* Gillet, 1989 shows no pygidial funnel but a cone with only three long pygidial cirri, *Axiothella* sp. (Wolf 1984), and *Axiothella* sp. (Hartmann-Schröder 1984) have one long and several short pygidial cirri and one and two preanal segments, respectively.

In some chaetal characters, noteworthy similarities between *Axiothella isocirra* and detailed descriptions of other maldanids are apparent. The notopodial rows also shift from a transverse direction in anterior setigers to a more longitudinal direction in posterior setigers in *Clymenella torquata, Euclymene oerstedii* (Pilgrim 1977) and *Johnstonia duplicata*. This shift is not typical for sedentary poly-

chaetes and is also missing in the Maldaninae (*Metasychis disparidentata*, pers. obs.) and thus might be useful for systematics within maldanids. Chaetal bundles are described in the notopodia of setiger 9 in *C. torquata* and of setiger 8 and 9 and in *E. oerstedii* (Pilgrim 1977). That is one setiger earlier than in *A. isocirra* and the bundles do not replace the posterior ones but the anterior chaetae of the double row. In *J. duplicata*, chaetal bundles appear in the notopodia of setiger 9 and 10 but only in setiger 9 in *J. clymenoides*, *J. knysna*, and *Johnstonia* sp. (Mackie & Gobin 1993). Whether these bundles of chaetae are of value for maldanid systematics has yet to be determined.

Acknowledgments

We are very thankful to the Smithsonian Institution for the opportunity to work at the marine laboratory on Carrie Bow Cay, Belize. In particular we are indebted to K. Fauchald (USNM) for supporting the project and M. Carpenter for organizational and field assistance.

Literature Cited

Andrews, E. A. 1891. Report upon the Annelida Polychaeta of Beaufort, North Carolina.—Proceedings of the United States National Museum 14(852):277–302.

Arwidsson, I. 1907. Studien über die skandinavischen und arktischen Maldaniden.—Zoologische Jahrbücher, Abteilung für Systematik, Ökologie und Geographie der Tiere 25:1–308.

Bartolomaeus, T. 1998. Chaetogenesis in polychaetous Annelida — significance for annelid systematics and the position of the Pogonophora.—Zoology (ZACS) 100:348–364.

Bobin, G. 1935. Étude des soies simples et de leurs bulbes sétigères chez deux sabelliens.—Travaux de la Station Biologique de Roscoff 13:157–175.

Bookhout, C. G., & E. C. Horn. 1949. The development of *Axiothella mucosa* (Andrews).—Journal of Morphology 84:145–183.

Day, J. H. 1967. A Monograph on the polychaeta of southern Africa Part 2. Sedentaria. Porstmouth: Grosvenor Press.

Duchene, J., & M. Bhaud. 1988. Uncinal patterns and age determination in terebellid polychaetes.—Marine Ecology Progress Series 49:267–275.

Gillet, P. 1989. *Axiothella crozetensis*, a new species of maldanid polychaete from Crozet Islands.—Proceedings of the Biological Society of Washington 102:866–871.

Gruet, Y. 1986. Premières observations sur la chute des soies operculaires ou palées chez l'Annélide Polychète Sabellariidé *Sabellaria alveolata* (Linné).—Comptes Rendus de l'Académie des Sciences - Série III 302(10):375–378.

Hartmann-Schröder, G. 1984. Zur Kenntnis des Eulitorals der australischen Küsten unter besonderer Berücksichtigung der Polychaeten und Ostracoden. Teil 10. Die Polychaeten der antiborealen Südküste Australiens (zwischen Albany im Westen und Ceduna im Osten).—Mitteilungen des hamburgischen zoologischen Museums und Instituts 81:7–62.

Kirkegaard, J. B. 1959. The Polychaeta of West Africa.—Atlantide Report 5:7–117.

Kudenov, J. D. 1977. *Axiothella serrata* n.sp., a maldanid polychaete from Porirua Harbour, New Zealand.—New Zealand Journal of Marine and Freshwater Research 11:697–702.

Mackie, A. S. Y., & J. Gobin. 1993. A review of the genus *Johstonia* Quatrefages, 1986 (Polychaeta, Maldanidae), with a description of a new species from Trinidad, West Indies.—Zoologica Scripta 22:229–241.

Mangum, C. P. 1966. Two new species of *Clymenella* (Polychaeta: Maldanidae) from Brazil.—Postilla 104:1–10.

McIntosh, W. C. 1915. A monograph of the British marine annelids.—Ray Society, Dulau and Co. Ed. 3:217–229.

Pilgrim, M. 1977. The functional morphology and possible taxonomic significance of the parapodia of the maldanid polychaetes *Clymenella torquata* and *Euclymene oerstedi*.—Journal of Morphology 152:281–302.

Rouse, G. W., & F. Pleijel. 2001. Polychaetes. Oxford: University Press, 354 pp.

Verrill, E. A. 1900. Additions to the Turbellaria, Nemertina, and Annelida of the Bermudas, with revisions of some New England genera and species.—Transactions of the Connecticut Academy of Arts and Sciences 10(2):595–671.

Wolf, P. S. 1984. Family Maldanidae. Pp. 15-1–15-21 *in* J. M. Uebelacker and P. G. Johnson, eds., Taxonomic guide to the polychaetes of the northern Gulf of Mexico, vol. 2. Mobile, Alabama: Barry A. Vittor & Associates, Inc.

Associate Editor: Stephen L. Gardiner