Tropical Zoology 12: 137-143, 1999

Marine Tubificidae (Oligochaeta) from a mangrove habitat in Kenya

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Received 23 March 1998, accepted 17 September 1998

Two species of Tubificidae (both subfamily Rhyacodrilinae) are described from a hypersaline, high intertidal mangrove site at Gazi Bay in southern Kenya indicating that mangrove sediments of tropical East Africa contain marine Tubificidae, as do similar habitats studied on other continents. One species is identified as *Ainudrilus mediocris* Erséus 1997, originally described from similar habitats in northern Australia. The genitalia of the Kenyan specimens differ in some dimensional features from those of the Australian material. The second taxon, *Monopylephorus parvus* Ditlevsen 1904, is reported from many parts of the world, from tropical as well as temperate regions; it possibly should be regarded as a group of (very similar) species rather than a single species.

KEY WORDS: Oligochaeta, marine Tubificidae, taxonomy, Kenya, mangrove.

INTRODUCTION

The tropical marine representatives of the oligochaete family Tubificidae have been extensively studied in some parts of the world, particularly in Australia (ERSÉUS 1981a, 1981b, 1993, 1997a, 1997b; ERSÉUS & JAMIESON 1981), Hong Kong (ERSÉUS 1984, 1990a, 1992a, 1992b, 1997c; ERSÉUS & DIAZ 1997), Saudi Arabia (ERSÉUS 1985, 1986a, 1986b, 1988, 1989), and the Caribbean area of the North-West Atlantic Ocean (ERSÉUS 1990b, MILLIGAN 1996). However, the marine Tubificidae of tropical Africa are virtually unknown. Only a single species, *Somalidrilus elongatus* (Erséus 1986), from Somalia, has been described from the eastern coast of this large continent to date (ERSÉUS 1986c, 1992c). In the present paper, two species of Tubificidae are described from a mangrove site in coastal Kenya. Both are members of the subfamily Rhyacodrilinae and attributable to taxa already described from outside Africa.

A third marine species of Oligochaeta from the same locality, *Marionina schrijversi* (family Enchytraeidae), was recently described by HEALY (1997).

MATERIAL AND METHODS

The material was collected in Gazi Bay, about 50 km south of Mombasa in southern Kenya (04.4°S, 39.5°E), by Dr Jan Schrijvers (University of Gent, Belgium), during the research programmes FKFO 32.0043.88 and 32.0009.92 of the Belgian National Fund for Scientific Research and the programme of the Kenya-Belgium Project in Marine Science. The ecology of the benthos of this site was recently studied by SCHRIJVERS et al. (1997). Samples were taken in the surface layer (0-2 cm) of an *Avicennia marina* mangrove forest, at a high intertidal site, flooded only during spring tides. The salinity was 54 ppt, pH 6.34 and the temperature 32 °C. The sediment consisted of 91.5% sand, with a high organic matter content.

Samples were fixed in a cold 8% formalin solution and stained with Rose Bengal before the sorting and counting of animals. The tubificid specimens were later transferred to 70% ethanol, dehydrated through a graded ethanol/xylene series, and finally mounted whole in Canada balsam. Measurements in the descriptions refer to the mounted, compressed, worms.

The material is deposited in the Swedish Museum of Natural History (SMNH), Stockholm.

TAXONOMIC STUDY

Subfamily Rhyacodrilinae

Genus ***Ainudrilus*** Finogenova 1982

Ainudrilus mediocris Erséus 1997 (Fig. 1A-D)

Ainudrilus mediocris ERSÉUS 1997a: 105-107, fig. 1A-D.

Material examined. SMNH Main coll. 14011-14015, five specimens from Gazi Bay, Kenya (locality described above); collected on 25 September 1992 (three specimens) and 30 October 1992 (two) by J. Schrijvers.

Description. Length (only 2 specimens complete) 4.9-5.0 mm, 39-47 segments. Width at segment XI (compressed) 0.29-0.41 mm. Clitellum (when developed) extending over 1/2X-XII. Prostomium about as long as wide, rounded triangular or somewhat squarish. Somatic chaetae (Fig. 1A) bifid, with upper tooth much longer, but thinner, than lower, (1)2-3 per bundle throughout worm. These chaetae 30-70 µm long, 2-3.5 µm thick. At sexual maturity, ventral chaetae of segment XI replaced by stout, single-pointed, penial chaetae (Fig. 1B-C, D: *pc*), 1 (occasionally 2) per bundle; in two paratypes, one bifid (somatic) chaeta still present beside one of the penial chaetae. Penial chaetae 60-75 µm long, 4.5-7 µm thick, with broad inner end and distinct nodulus. Ectal ends of penial chaetae with a short, indistinct, groove (Fig. 1B-C). Male pores paired, in line with ventral chaetae, posteriorly in segment XI. Spermathecal pores paired, in line with ventral chaetae, in most anterior part of segment X.

Pharyngeal glands poorly visible in available material, but extending at least into segment V. In segments X-XI, gut distended and more thick-walled than elsewhere. Coelomocytes granulated, round, 5-9 µm wide, numerous. Male genitalia (Fig. 1D) paired, but vasa deferentia not observed in available material. Atrium

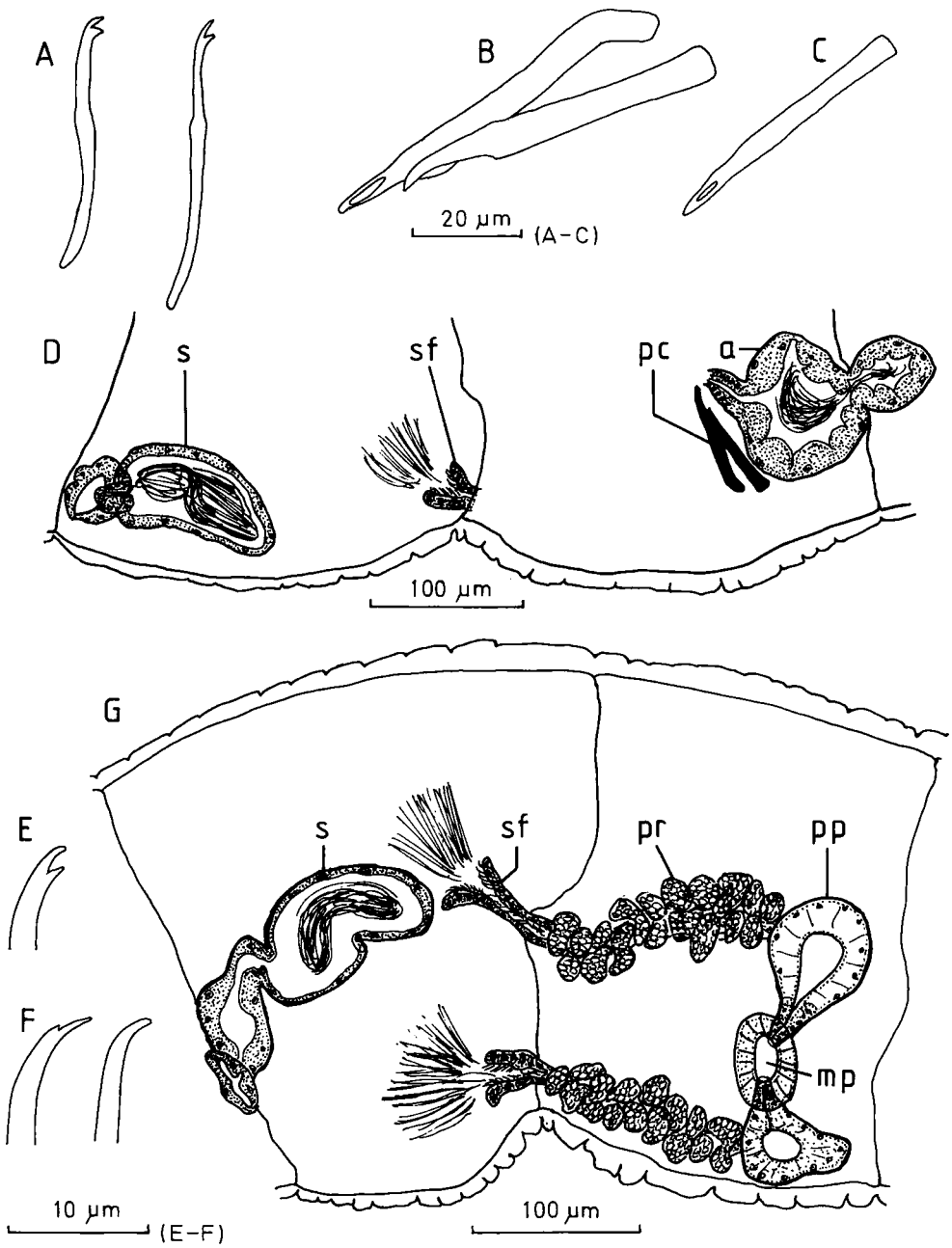

Fig. 1. — A-D, *Ainudrilus mediocris*: A, somatic bifid chaetae; B, bundle of two penial chaetae of one specimen; C, single penial chaeta of another specimen; D, lateral view of genitalia in segments X-XI. E-G, *Monopylephorus parvus*: E, bifid chaeta; F, chaetae with reduced upper tooth (right chaeta single-pointed); G, ventral view of genitalia in segments X-XI (*a* atrium, *mp* male pore, *pc* penial chaeta, *pp* pseudopenis, *pr* prostate gland, *s* spermatheca, *sf* sperm funnel).

erect or obliquely pointing towards posterior, consisting of ental ampulla and ectal duct. When fully developed, atrial ampulla 130-140 µm long, 45-50 µm wide, somewhat pear-shaped or with a constriction (as in Fig. 1D), and with somewhat granulated, irregular, inner epithelium and wide inner lumen; latter containing spermatozoa in random mass. Atrial duct indistinct, short, tapering and leading to inconspicuous (male) pore. Spermathecae (Fig. 1D: *s*) with conspicuous roundish vestibules, short, distinct ducts, and elongate, thin-walled ampullae; latter about 120 µm long, 50-55 µm wide, containing random sperm.

Remarks. This species was originally described from intertidal mangrove mud at Darwin, in northern Australia (Erséus 1997a). It is distinguished from the closely related, Caribbean species, *A. geminus* Erséus 1990b by its possession of spermathecae, and its smaller number of somatic chaetae (in *A. geminus*, spermathecae are absent, and the chaetae are up to 6 per bundle anteriorly, up to 5 per bundle posteriorly). Some dimensional features of the Gazi Bay specimens of *A. mediocris* deviate from those of the Darwin material. For instance, the atria and spermathecae are clearly smaller in the latter (with atrial ampullae only about 45-70 µm, and spermathecal ampullae 40-100 µm, long). Although this may reflect a genetic difference, it is not, per se, qualitatively great enough to justify the establishment of a new taxon for the Kenyan population.

Distribution and habitat. Known from Kenya (new record) and Northern Territory, Australia. Intertidal mangrove mud and sand.

Genus ***Monopylephorus*** Levinsen 1884

Monopylephorus parvus Ditlevsen 1904 (Fig. 1E-G)

Monopylephorus parvus Ditlevsen 1904: 427-428, figs 25-26; Baker & Brinkhurst 1981: 945-946, fig. 2; Finogenova 1982: 12; Erséus 1984: 138-140, fig. 1; additional references in Erséus (1984).

Material examined. SMNH Main coll. 14016, one specimen from Gazi Bay, Kenya (locality described above); collected on 30 October 1992 by J. Schrijvers.

Description. Length 8.0 mm, 53 segments. Width at segment XI (compressed) 0.30 mm. Clitellum extending over 2/3X-XII. Prostomium about as long as wide, rounded triangular. Somatic chaetae 3-5 per bundle in segments II-IX, 2-3 per bundle thereafter, but absent ventrally in segment XI. Intact chaetae either bifid, with upper tooth longer than lower (Fig. 1E), or 'intermediate' (with small upper tooth), or single-pointed (Fig. 1F). Bifid chaetae appear to be most common in anteriormost segments (many chaetae with broken tips), few in postclitellar segments. Most chaetae 35-40 µm long, about 2 µm thick; in segments X and XII (single-pointed chaetae) about 50 µm long, about 4 µm thick. Male pore (Fig. 1G: *mp*) unpaired, mid-ventral, posterior to middle of segment XI. Spermathecal pore unpaired, immediately lateral to mid-ventral line (at one side of body), in most anterior part of segment X.

Pharyngeal glands not visible. Coelomocytes granulated, round, 5-8 µm wide, numerous. Male genitalia (Fig. 1G), except male pore, paired. A large part of male

duct covered by diffuse prostate glands (Fig. 1G: *pr*), but exact junction with pseudopenis not observed. Pseudopenis pear-shaped, more or less erect, totally about 80 µm long, 50 µm wide, with thick walls. The two pseudopenes leading to mid-ventral, round, male bursa; latter supported by strong radial muscles (not shown in Fig. 1G) and opening to the posterior through male pore. Spermatheca (Fig. 1G: *s*) elongate, total length about 165 µm, up to about 50 µm wide. Spermathecal ampulla with large bundle of sperm.

Remarks. *Monopylephorus parvus* has been reported from widely separated areas of the world, from Denmark in the north (DITLEVSEN 1904) to Port Elizabeth, South Africa in the south (BRINKHURST 1966), and from both sides of the North Pacific Ocean (BAKER & BRINKHURST 1981, ERSÉUS 1984). In addition, the records are from sites with much different salinities. The taxon is generally regarded as a brackish-water form, but it evidently tolerates hypersaline conditions too. At the collection site in Gazi Bay, the salinity was 54 ppt.

In a previous account (ERSÉUS 1984), various geographic forms of this species were compared, and it was suggested that a northern form (with a short spermathecal ampulla) could be distinguished from a tropical/subtropical form (with a slender, twisted and folded ampulla). The present specimen from Kenya does not follow this pattern; it has a very small spermatheca (ampulla only about 110 µm long, as opposed to, e.g., about 345-590 µm in specimens from Hong Kong; see Fig. 1G, and ERSÉUS 1984). Other dimensional differences and variation in chaetal patterns between various populations have been discussed before (MARCUS 1965, BAKER & BRINKHURST 1981, ERSÉUS 1984, MILLIGAN 1996).

Considering the wide latitudinal and ecological range, and the morphological variation noted, *M. parvus* is either indeed a highly variable species, or comprises a group of several similar species.

Distribution and habitat. Denmark, North America (Atlantic and Gulf of Mexico coasts of U.S.A., Pacific coast of Canada), Brazil, India, southern China and Kenya (new record). Littoral and estuarine; muddy, fine sands, including those of intertidal mangroves and *Spartina* salt marshes, and those subjected to hypersaline conditions.

CONCLUSION

This brief contribution is merely the first indication that mangrove sediments of tropical East Africa harbour marine Tubificidae, as do all similar habitats studied on other continents (cf. ERSÉUS 1990a, 1990b, 1997a). At the studied site, oligochaetes (including the enchytraeid, *Marionina schrijversi*; see HEALY 1997) made up 2% of the total meiofauna (SCHRIJVERS et al. 1997). However, much work remains to survey the whole oligochaete fauna of the long coastline of East Africa.

ACKNOWLEDGEMENTS

I am indebted to Dr Jan Schrijvers for placing the material and associated information at my disposal; to Ms Barbro Löfnertz and Ms Christine Hammar for technical assistance; and the Swedish Natural Science Research Council for financial support.

REFERENCES

BAKER H.R. & BRINKHURST R.O. 1981. A revision of the genus *Monopylephorus* and redefinition of the subfamilies Rhyacodrilinae and Branchiurinae (Tubificidae: Oligochaeta). *Canadian Journal of Zoology* 59: 939-965.

BRINKHURST R.O. 1966. A contribution towards a revision of the aquatic Oligochaeta of Africa. *Zoologica Africana* 2: 131-166.

DITLEVSEN A. 1904. Studien an Oligochaeten. *Zeitschrift für Wissenschaftliche Zoologie* 77: 398-480.

ERSÉUS C. 1981a. Taxonomic studies of Phallodrilinae (Oligochaeta, Tubificidae) from the Great Barrier Reef and the Comoro Islands, with descriptions of ten new species and one new genus. *Zoologica Scripta* 10: 15-31.

ERSÉUS C. 1981b. Taxonomic revision of the marine genus *Heterodrilus* Pierantoni (Oligochaeta, Tubificidae). *Zoologica Scripta* 10: 111-132.

ERSÉUS C. 1984. The marine Tubificidae (Oligochaeta) of Hong Kong and southern China. *Asian Marine Biology* 1: 135-175.

ERSÉUS C. 1985. Annelida of Saudi Arabia. Marine Tubificidae (Oligochaeta) of the Arabian Gulf coast of Saudi Arabia. *Fauna of Saudi Arabia* 6: 130-154.

ERSÉUS C. 1986a. Annelida of Saudi Arabia. Marine Tubificidae (Oligochaeta) of the Arabian Gulf coast of Saudi Arabia (Part 2). *Fauna of Saudi Arabia* 7 (1985): 59-65.

ERSÉUS C. 1986b. Marine Tubificidae (Oligochaeta) of the Arabian Gulf coast of Saudi Arabia (Part 3). *Fauna of Saudi Arabia* 8: 3-5.

ERSÉUS C. 1986c. Researches on the coast of Somalia. The shore and the dune of Sar Uanle. 38. A new marine species of *Phallodrilus* (Oligochaeta Tubificidae) from the interstitial environment. *Monitore Zoologico Italiano (Nuova Serie) Supplemento* 21 (5): 105-108.

ERSÉUS C. 1988. Marine Tubificidae (Oligochaeta) of the Arabian Gulf Coast of Saudi Arabia (Part 4). *Fauna of Saudi Arabia* 9: 19-22.

ERSÉUS C. 1989. Marine Tubificidae (Oligochaeta) of the Arabian Gulf Coast of Saudi Arabia (Part 5). *Fauna of Saudi Arabia* 10: 11-19.

ERSÉUS C. 1990a. Marine Oligochaeta of Hong Kong, pp. 259-335. In: Morton B., Edit. Proceedings of the Second International Marine Biological Workshop: The Marine Flora and Fauna of Hong Kong and southern China, Hong Kong, 1986. Volume 1. *Hong Kong: Hong Kong University Press*, 448 pp.

ERSÉUS C. 1990b. The marine Tubificidae (Oligochaeta) of the barrier reef ecosystems at Carrie Bow Cay, Belize, and other parts of the Caribbean Sea, with descriptions of twenty-seven new species and revision of *Heterodrilus*, *Thalassodrilides* and *Smithsonidrilus*. *Zoologica Scripta* 19: 243-303.

ERSÉUS C. 1992a. Hong Kong's marine Oligochaeta: a supplement, pp. 157-180. In: Morton B., Edit. The marine flora and fauna of Hong Kong and southern China III. Proceedings of the Fourth International Marine Biological Workshop: The Marine Flora and Fauna of Hong Kong and Southern China, Hong Kong, 11-29 April 1989. *Hong Kong: Hong Kong University Press*, XXX + 921 pp.

ERSÉUS C. 1992b. Oligochaeta from Hoi Ha Wan, pp. 909-917. In: Morton B., Edit. The marine flora and fauna of Hong Kong and southern China III. Proceedings of the Fourth International Marine Biological Workshop: The Marine Flora and Fauna of Hong Kong and Southern China, Hong Kong, 11-29 April 1989. *Hong Kong: Hong Kong University Press*, XXX + 921 pp.

ERSÉUS C. 1992c. A generic revision of the Phallodrilinae (Oligochaeta, Tubificidae). *Zoologica Scripta* 21: 5-48.

ERSÉUS C. 1993. Class Oligochaeta, pp. 93-94. In: Mather P. & Bennett I., Edits. A coral reef handbook, 3rd edition. *Chipping Norton, NSW: Surrey Beatty & Sons Pty Limited*, 264 pp.

ERSÉUS C. 1997a. The marine Tubificidae (Oligochaeta) of Darwin Harbour, Northern Territory, Australia, with descriptions of fifteen new species, pp. 99-132. In: Hanley J.R. et al., Edits. Proceedings of the Sixth International Marine Biological Workshop. The marine

flora and fauna of Darwin Harbour, Northern Territory, Australia. *Australia: Museums and Art Galleries of the Northern Territory and the Australian Marine Sciences Association*, IX + 466 pp.

ERSÉUS C. 1997b. Marine Tubificidae (Oligochaeta) from the Montebello and Houtman Abrolhos Islands, Western Australia, with descriptions of twenty-three new species, pp. 389-458. In: Wells F.E., Edit. The Marine Flora and Fauna of the Houtman Abrolhos, Western Australia. *Perth: Western Australian Museum*, XI + 566 pp.

ERSÉUS C. 1997c. Additional notes on the taxonomy of the marine Oligochaeta of Hong Kong, with a description of a new species of Tubificidae, pp. 37-52. In: Morton B., Edit. The marine flora and fauna of Hong Kong and southern China IV: Proceedings of the Eighth International Marine Biological Workshop: The Marine Flora and Fauna of Hong Kong and Southern China, Hong Kong 1995. *Hong Kong: Hong Kong University Press*, XVIII + 513 pp.

ERSÉUS C. & DIAZ R.J. 1997. The Oligochaeta of the Cape d'Aguilar Marine Reserve, Hong Kong, pp. 189-204. In: Morton B., Edit. The marine flora and fauna of Hong Kong and southern China IV: Proceedings of the Eighth International Marine Biological Workshop: The Marine Flora and Fauna of Hong Kong and Southern China, Hong Kong 1995. *Hong Kong: Hong Kong University Press*, XVIII + 513 pp.

ERSÉUS C. & JAMIESON B.G.M. 1981. Two new genera of marine Tubificidae (Oligochaeta) from Australia's Great Barrier Reef. *Zoologica Scripta* 10: 105-110.

FINOGENOVA N.P. 1982. Revision of the genus *Monopylephorus* Levinsen, 1883 (Oligochaeta, Tubificidae). *Zoologicheskii Zhurnal* 61: 5-17.

HEALY B. 1997. *Marionina schrijversi* (Oligochaeta Enchytraeidae), a new species from a mangrove in Kenya. *Tropical Zoology* 10: 129-132.

MARCUS E. 1965. Naidomorpha aus brasilianischem Brackwasser. *Beiträge zur Neotropischen Fauna* 4: 61-83.

MILLIGAN M. 1996. Identification manual for the aquatic Oligochaeta of Florida. Volume II. Estaurine and nearshore marine oligochaetes. Final Report for Florida Department of Environmental Protection Contract No. WM550. *Tallahassee, Florida: Florida Department of Environmental Protection*, 239 pp. + Appendix.

SCHRIJVERS J., SCHALLIER R., SILENCE J., OKONDO J.P. & VINCX M. 1997. Interactions between epibenthos and meiobenthos in a high intertidal *Avicennia marina* mangrove forest. *Mangroves and Salt Marshes* 1: 137-154.