

A record of the genus *Trochochaeta* (Polychaeta) in the southern hemisphere with description of a new species

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The small polychaete family Trochochaetidae is monogeneric and had been recorded almost exclusively in the northern hemisphere before this study. During a benthic investigation in the coastal shelf zone off Angola at 15°S several specimens were collected from 84 m depth differing from other members of the family and we described it as a new species herein. The only known African species so far was Trochochaeta kirkegaardi from the eastern Atlantic. Trochochaeta ankeae sp. nov. is characterized by having four minute eyes, a small conical antenna, a nuchal crest projecting through chaetiger 2, by lacking notochaetae on chaetiger 2, by having acicular spines on neuropodia 2 and 3 and a pair of conical papillae ventral on abdomen. A key to all 11 known species (including an unnamed one) is given.

Keywords: polychaete, Trochochaetidae, new species, Angola, south-east Atlantic

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INTRODUCTION

Trochochaeta Levinsen, 1883 is the only genus of the small family Trochochaetidae Pettibone, 1963. Trochochaetids are spioniform polychaetes and, up to now, only nine species are described, while one species remains unnamed. Hernández-Alcántara & Solís-Weiss (2011) recently described a new species from the Eastern Pacific off Mexico after about twenty years without new species descriptions. Further, their work summarized almost all available informations about the known species, mapped the world distribution of each species, compared a dozen taxonomic features and provided an identification key to all known species.

Trochochaetids are sedentary polychaetes with numerous segments. The body is divided into a short thoracic and a long abdominal region, changing gradually with some transitional segments. Main diagnostic features within the genus are: the presence of notochaetae in chaetiger 2, the presence of stout acicular neurosetae on chaetiger 3, the occurrence of an antenna, eyes and abdominal papillae, the length of the nuchal crest and the shape of postchaetal lobes.

Up to now, trochochaetids were mostly known from the northern hemisphere. A single record of several unspecified *Trochochaeta* individuals from the southern hemisphere was given in an ecological study from Brazil at 11°S (Santos *et al.*, 1994). Trochochaetids occur rarely in the world and are widely recorded from temperate-cold waters from the western and eastern USA, from the North Atlantic and from the North and West Pacific. A few records have been made in warm waters. *Trochochaeta diverapoda* (Hoagland, 1920)

is recorded from several locations of the North Indian Ocean, *T. cirrifera* (Hartman, 1974) was found in the Arabian Sea and *T. mexicana* Hernández-Alcántara & Solís-Weiss, 2011 were recorded in the Eastern Pacific. *Trochochaeta kirkegaardi* Pettibone, 1976 inhabits the Eastern Pacific (Costa Rica) and is the only species found, up to now, in the Eastern Atlantic and off Africa (Liberia to Nigeria).

During a benthic investigation in the coastal shelf zone off Angola several specimens were identified to the genus *Trochochaeta* but differed from all known species of the genus in some morphological features and were therefore considered as a new species.

MATERIALS AND METHODS

Samples were collected at the shelf off Angola with a Van Veen grab (0.1 m²) during the cruise of the RV 'Alexander von Humboldt' in 2004. Samples were sieved through a 1 mm screen and animals were preserved in 4% buffered formaldehyde. Sorting procedures were conducted at the laboratory with a stereomicroscope. The animals were then preserved in 70% ethanol and later examined using a compound microscope with up to ×800 magnification. Digital microphotographs were made by using an AxioCam ICC3 (Carl Zeiss MicroImaging GmbH, Jena) and the Software AxioVision Release 4.8.1 (Carl Zeiss Imaging Solutions GmbH, Jena). The resulting files were imported into Adobe Illustrator CS5 Release 15.0 (Adobe Systems Incorporated) and digital line drawings were made using a WACOM Intuos digitizer board. Scanning electron microscopy (SEM) studies were performed by means of Cam Scan 44WEX.

The type material was deposited at the zoological collection of the University of Rostock (ZSRO, Germany) and further

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material at the collection of the Leibniz Institute for Baltic Sea Research (Germany).

RESULTS

SYSTEMATICS

Class POLYCHAETA Grube, 1850
 Family TROCHOCHAETIDAE Pettibone, 1963
 Genus *Trochochaeta* Levinsen, 1883
Trochochaeta ankeae sp. nov.
 (Figures 1–5)

TYPE MATERIAL

Holotype: incomplete specimen with 50 chaetigers: length 12.7 mm, and 1.0 mm wide at 8th segment (ZSRO-P2203) (AHAB 8, BE11; south-east Atlantic, shelf coast off Angola; water depth 83.6 m, grab sampling; coordinates: 15°07.733S 12°06.508E; abiotic factors at the bottom: salinity 35.6; temperature 16.0°C; and oxygen 0.92 ml/l). Collected by M.L. Zettler, 17 May 2004.

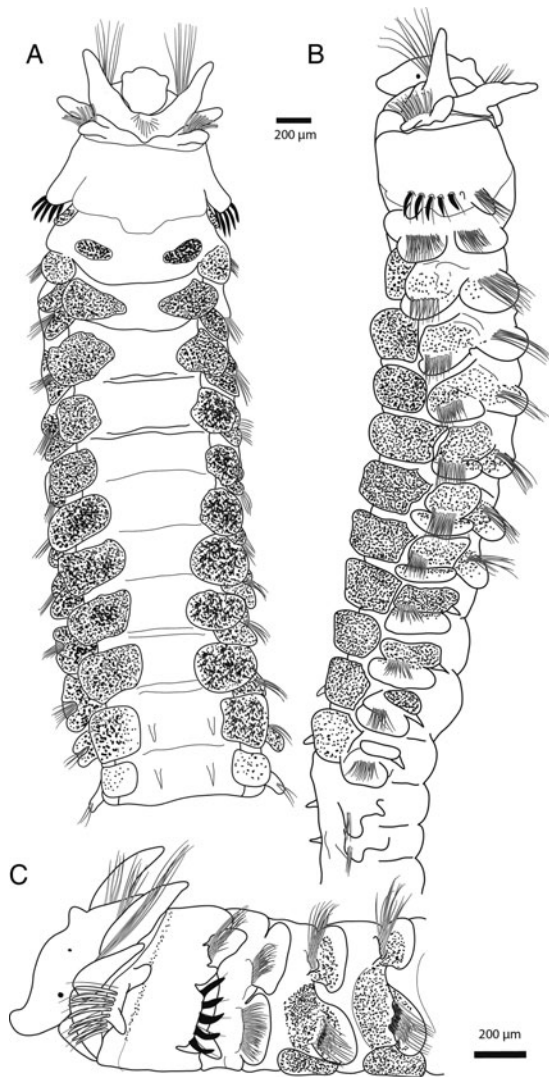


Fig. 1. *Trochochaeta ankeae* sp. nov.: (A) chaetigers 1–14 ventral view; (B) chaetigers 1–16 lateral view; (C) chaetigers 1–6 lateral view.

Paratypes: 8 incomplete anterior fragments; 30–59 chaetigers; longest fragment with 17.3 mm in length (59 chaetigers) and 0.96 mm wide at 8th segment; from the same samples as the holotype (ZSRO-P2204).

Additional material: 24 incomplete anterior fragments; 90 middle fragments of 12–72 chaetigers.

DIAGNOSIS

Body slender, thorax with 10 chaetigers. Prostomium elongate, truncate anteriorly, with four slight lobes, with a small conical antenna and a nuchal crest projecting through chaetiger 2; two pairs of minute eyes. Second parapodia biramous, without notochaetae. Acicular spines on neuropodia 2 and 3. Postchaetal lobes entire, low, subrectangular to rounded. Abdominal region from chaetiger 15 without notochaetae, ventrally with pair of conical papillae from chaetigers 13–15. Chaetigers 5 to 10 with reddish areas ventro-lateral and at the base of parapodia. Transitional region from chaetigers 11 to 14 without notochaetae, with bundles of neurochaetae and with neuropodia showing anterior and ventral reddish areas.

DESCRIPTION

Prostomium elongate, truncate anteriorly, with four slight lobes, tapering posteriorly, with narrow nuchal crest extending posteriorly on chaetiger 2 to the anterior margin of chaetiger 3; with a small conical median antenna on the anterior region of the crest (Figures 1B, C & 4C). Two pairs of minute eyes in antero-lateral and postero-medial position, posterior pair smaller than anterior pair, difficult to observe (Figure 1C).

Anterior four segments of thoracic region differing from one another (Figures 1A–C & 4A, C), with modified biramous parapodia. First chaetiger with parapodia shifted dorsally,

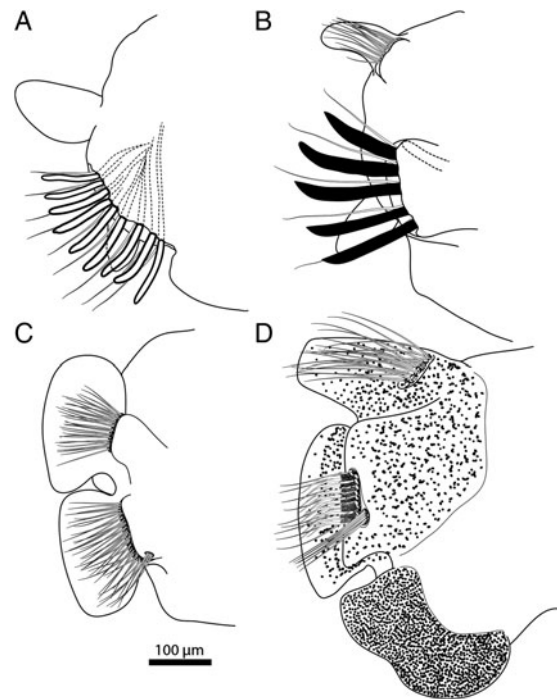


Fig. 2. *Trochochaeta ankeae* sp. nov.: (A) right parapodium 2, anterior view; (B) right parapodium 3, anterior view; (C) right parapodium 4, anterior view; (D) right parapodium 8, anterior view.

directed anteriorly, notopodial and neuropodial lobes distinct. Notopodia with bundles of about 8–15 smooth capillary chaetae. Neuropodia with numerous (about 25) short and long smooth capillary chaetae, distinctly longer than noto-chaetae. Notopodial and neuropodial postchaetal lobes elongate, subconical, wider basally.

Second segment with parapodia shifted ventrally, biramous, without notochoetae (Figure 2A). Neuropodia with two kinds of paired chaetae: anterior row of 9 stout yellowish-brown acicular chaetae each accompanied postero-dorsal by one slightly longer, faintly hairy slender capillary (Figure 4B). Noto- and neuropodial postchaetal lobes small, subconical, with notopodial postchaetal lobe slightly longer.

Third segment with lateral parapodia, notopodial lobe small, with fan-shaped bundle of about 15 smooth capillary chaetae (Figure 2B), postchaetal notopodial lobe subconical. Neuropodial lobe low, wide, with fan-shaped bundle of 5 stout black acicular spines, clearly heavier than acicular spines from second chaetiger, alternating with equal number of slender capillary neurochaetae. Postchaetal neuropodial lobe low, conical, similar to notopodial lobe, shifted ventrally.

Fourth segment with lateral parapodia, chaetal lobes low and wide, neuropodia and notopodial each with about 40 slender, capillary chaetae arranged in two rows (Figure 2C). Noto- and neuropodial postchaetal lobes similar, with outer margins smooth, low, wide, slightly rounded, meeting one another medio-lateral.

Following 6 thoracic segments (chaetigers 5 to 10) similar, with prominent biramous parapodia. Positions of neuropodia shift continuously from lateral, with wide parapodial gap to medio-lateral position on chaetiger 8 with lowest parapodial gap, positions of neuropodia shift back to lateral position until chaetiger 10. Reddish glandular areas present ventro-laterally, largest at chaetiger 8, anterior and posterior to parapodia. Notopodial chaetal lobes low, wide, with two rows of slender, smooth capillaries (Figure 4D). Notopodial postchaetal lobes entire, thick fleshy, broad and rounded, becoming subconical until end of thorax. Neuropodial chaetal lobes low, wide, with compact bundles of neurochaetae of two different types (Figures 2D, 3A, B & 4E), two anterior rows of about 8–9 strong backwards curved frayed chaetae, basally with numerous very fine, short hair-like projections

on anterior margin, tapering gradually to fine hairy capillary tips (Figure 5A), one posterior row of about 10–12 hairy capillaries and also one bundle of 1–3 capillaries emerging ventro-anteriorly to first row of neurochaetae (Figure 2D). Neuropodial postchaetal lobes wide, increasing in size to posterior thoracic region, rounded in chaetigers 5–6, becoming subrectangular in chaetigers 8–10.

Parapodia of chaetigers 11–14 (transitional region) with notopodia represented only by small subconical papillae (Figure 4F), lacking notochoetae. Neuropodial postchaetal lobes of chaetigers 11–12 similar to last thoracic chaetiger, becoming smaller at segments 13–14, with reddish glandular areas of similar size ventro-lateral and anterior to neurochaetal lobe, disappearing at chaetiger 14. Neurochaetae of chaetiger 11 similar to those of preceding thoracic chaetigers, with frayed chaetae strongly curved backwards and with numerous very fine, short hair-like projections basally on anterior margin, modifying gradually to hairy capillaries at chaetiger 14. Chaetigers 13–14 with paired ventral papillae (Figure 1A).

Abdominal region beginning at chaetiger 15, slightly narrower than thoracic region, with paired rounded white structures, with conspicuous central opening dorso-lateral (Figure 5C, D), with paired papillae ventrally, without notopodia or notochoetae, neuropodial lobes small, elongated, with a few (1–3) slender capillaries, and 2–3 stouter acicular chaetae with or without subterminally attached aristae (Figures 3C, D & 5B).

Neuropodial postchaetal lobes small, digitiform.

Posterior abdominal region and pygidium unknown.

ETYMOLOGY

The new species is named after Anke Bochert, wife of the first author.

TYPE LOCALITY

South-west Atlantic, shelf off South Angola.

HABITAT

The specimens of *T. ankeae* sp. nov. were only found at the type locality at 84 m depth in muddy sediment. They live in fine sandy tubes of up to 2.7 mm in diameter with a wall thickness of 0.3–0.35 mm.

COLOUR

Specimens in alcohol: yellowish, with black aciculae on chaetiger 3, reddish lateral and ventro-lateral from chaetigers 4–14, white spots dorso-lateral on the abdomen.

REMARKS

Up to now only nine nominal species and one unnamed species are known all over the world (Hernández-Alcántara & Solís-Weiss, 2011). Two main species groups are recognized, one presents noto- and neurochaetae in all thoracic chaetigers (*T. watsoni*, *T. cirrifera* and *T. sp. A*) and one (where chaetae are lacking in chaetiger 2) containing the remaining species.

Trochochaeta ankeae sp. nov. belongs to the second group, in which notochoetae are lacking in chaetiger 2. The new species have also acicular neurochaetae on chaetiger 2, differing from *T. carica* and *T. pettiboneae* which lack this feature. Most of the trochochaetid species, including *T. ankeae* sp. nov. have entire postchaetal lobes and are distinguishable from *T. multisetosa* and *T. sp. A* that present serrated or fimbriated postchaetal lobes. To compare the morphological

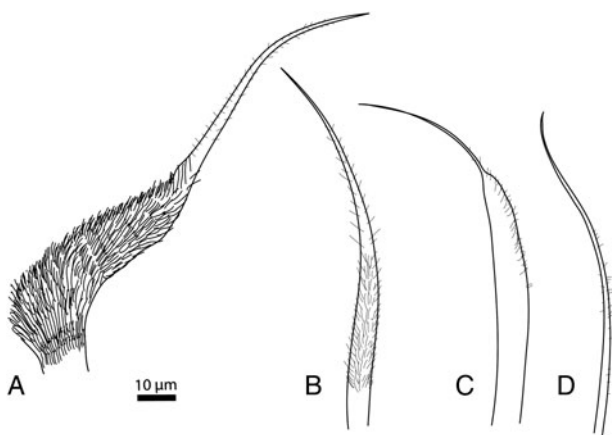


Fig. 3. *Trochochaeta ankeae* sp. nov.: (A) frayed neurochaetae strongly curved backwards, basal with numerous very fine, short, hair-like projections anteriorly, tapered gradually to fine hairy capillary tips from chaetiger 8; (B) hairy capillary neurochaetae from posterior row of chaetiger 8; (C) stout acicular chaeta abdominal region; (D) slender capillary from abdominal region.

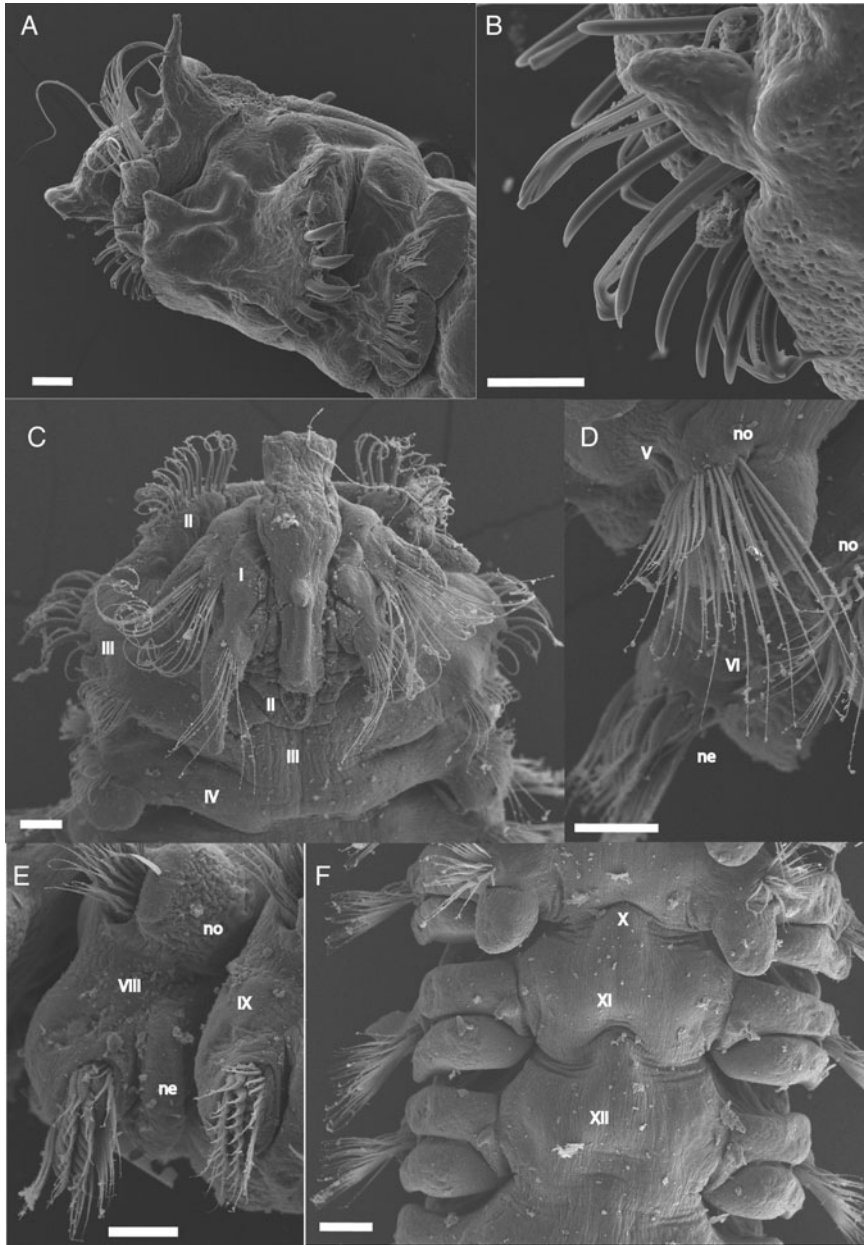


Fig. 4. Scanning electron microscopy micrographs of *Trochochaeta ankeae* sp. nov.: (A) anterior thorax (chaetigers 1–4) lateral view; (B) neuropodia (chaetiger 2) posterior view; (C) prostomium and anterior thorax (chaetigers 1–4) dorsal view; (D) notopodia (no) and neuropodium (ne) posterior thorax (chaetigers 5–6) dorso-lateral view; (E) notopodium (no) and neuropodia (ne) posterior thorax (chaetigers 8–9) dorso-lateral view; (F) transition region (chaetigers 10–12) dorsal view; roman numerals= number of chaetiger. Scale bars: B = 50 μm ; A, C–F = 100 μm .

characteristics of *T. ankeae* sp. nov. with those of other species an overview is given in Table 1 following the diagnostic features of Hernández-Alcántara & Solís-Weiss (2011).

The new species is similar to *T. japonica*, *T. mexicana*, *T. diverapoda* and *T. kirkegaardi* by having entire postchaetal lobes, chaetiger 2 with stout acicular neurochaetae and without notochaetae. The presence of 4 eyes in *T. ankeae* sp. nov. is shared by *T. japonica* and *T. mexicana*, whereas the other two species lack eyes. *Trochochaeta japonica* does not present antenna, in contrast to *T. ankeae* sp. nov., and *T. mexicana* lacks abdominal papillae on midventral line and has the nuchal crest extending only to the end of chaetiger 1, instead of to the end of chaetiger 2 as seen in *T. ankeae* sp. nov. In contrast, the nuchal crest of *T. diverapoda* extends to the end of chaetiger 3.

The only known species from the East Atlantic off Africa is *T. kirkegaardi*. There are no other records of trochochaetids off Africa except that of this species off Liberia and off Nigeria (4°N – 6°N) (Pettibone, 1976). *Trochochaeta ankeae* sp. nov. can easily be distinguished from the latter by the presence of eyes, by the abdominal region on chaetiger 15, with papillae on midventral line from chaetigers 13–15, by the presence of a small, subconical antenna and by the nuchal crest reaching to chaetiger 2. In *T. kirkegaardi* eyes are lacking, the abdominal region begins on chaetiger 16, papillae on midventral line appear from chaetiger 16, the antenna is small, subtriangular and continuous with the nuchal crest, which extends at least to middle of chaetiger 3.

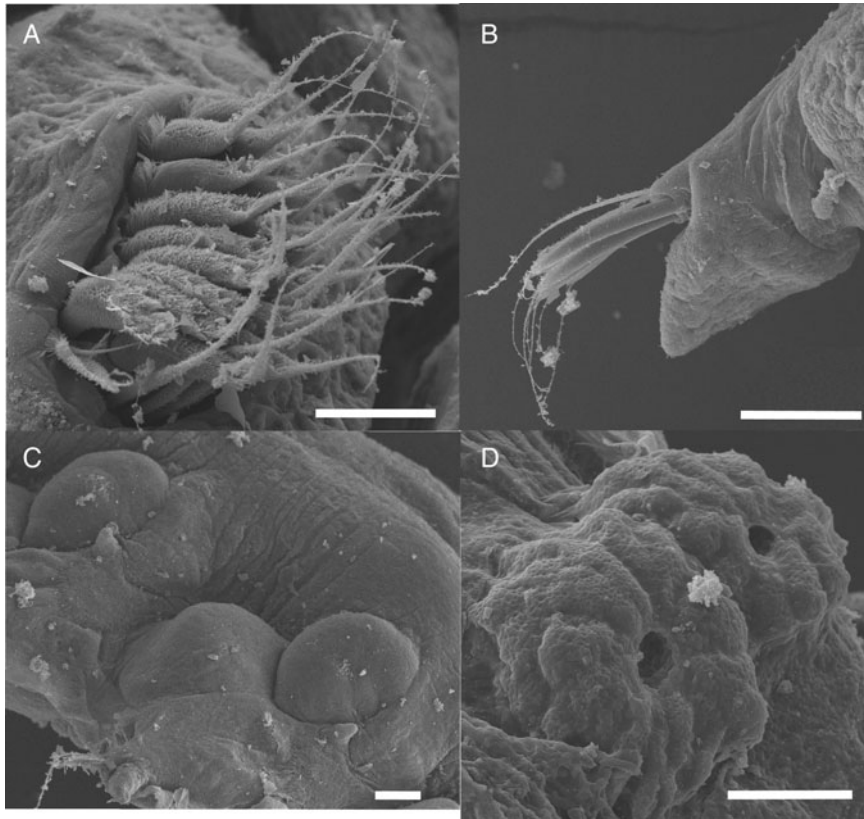


Fig. 5. Scanning electron microscopy micrographs of *Trochochaeta ankeae* sp. nov.: (A) neuropodia (chaetiger 8) anterior view; (B) anterior abdominal parapodia dorsal view; (C) two anterior abdominal parapodia dorso-lateral view; (D) abdominal region with paired round, white structures with conspicuously central opening dorsal view. Scale bar: 50 μ m.

Table 1. Diagnostic characters of *Trochochaeta ankeae* sp. nov. based on Hernández-Alcántara & Solís-Weiss (2011).

Diagnostic characters	<i>T. ankeae</i> sp. nov.
Prostomium	Elongated, truncate anteriorly, tapering posteriorly, slightly four lobed
Eyes	4
Nuchal crest	Extending to posterior margin of chaetiger 2
Antenna	Small, conical
Notochaetae on chaetiger 2	Lacking
Neuropodia with acicular spines	Chaetigers 2 and 3
Thoracic notochaetae (posterior thorax, from chaetiger 5)	Smooth, capillaries
Thoracic neurochaetae (posterior thorax, from chaetiger 5)*	One bundle of 1–3 capillaries basal; two anterior rows of strong backwards curved frayed setae, basal with numerous very fine, short, hair-like projections, tapered gradually to fine hairy capillary tips; one posterior row of hairy capillaries
Thoracic notopodial and neuropodial postchaetal lobes**	Entire thick, fleshy, notopodial lobes low, subrectangular to rounded, neuropodial lobes low, wide, subrectangular
Transitional region	Chaetigers 11–14
Abdominal region initiates	Chaetiger 15
Abdominal acicular neurochaetae	Stout, hairy, with hair-like projection
Acicular spines in posterior notopodia	Lacking
Papillae on mid-ventral line in abdominal region	From chaetiger 13
Pygidium	?
Distribution	South-west Africa, off Angola
Habitat	84 m, mud

*, the text of diagnostic features from table 1 in Hernández-Alcántara & Solís-Weiss (2011) refers to 'anterior thorax', but this must be a mistake because specialized neurochaetae occur from chaetiger 5 (posterior thorax); **, the text of diagnostic features from table 1 in Hernández-Alcántara & Solís-Weiss (2011) refers to 'thorax anterior', but this must be a mistake because their table lists features of chaetiger 3 (anterior thorax) and chaetiger 5 or chaetiger 11 (posterior thorax).

KEY TO THE SPECIES OF
TROCHOCHAETA LEVINSSEN, 1883
(ADAPTED FROM HERNÁNDEZ-
ALCÁNTARA & SOLÍS-WEISS (2011))

- 1 With noto- and neurochaetae in all thoracic parapodia
.....2
— Without notochaetae in chaetiger 24
- 2 Postchaetal lobes thick and subconical3
— Postchaetal lobes cirriform
.....*T. cirrifera* (Hartman, 1974)
- 3 Postchaetal lobes serrated or fimbriated
.....*T. sp.* A Gilbert, 1984
— Postchaetal lobes entire, not serrated or fimbriated
.....*T. watsoni* Pettibone, 1976
- 4 Stout acicular neurochaetae on chaetiger 25
— Stout acicular neurochaetae on chaetigers 2 and 36
- 5 13–15 thoracic chaetigers; 4–8 filiform anal cirri
.....*T. carica* (Birula, 1897)
— 15–19 thoracic chaetigers; 10 digitate anal cirri
.....*T. pettiboneae* Dean, 1987
- 6 Postchaetal lobes serrated or fimbriated
.....*T. multisetosa* (Örsted, 1843)
— Postchaetal lobes entire, not serrated or fimbriated7
- 7 Prostomium without antenna; median crest projects on
chaetiger 1 *T. japonica* Imajima, 1989
— Prostomium with antenna; median crest arising upwards
from the prostomium8
- 8 With eyes; prostomium with nuchal crest extending on
chaetiger 1 or 29
— Without eyes; prostomium with nuchal crest extending on
chaetiger 310
- 9 Without abdominal papillae on midventral line; prostomium
with nuchal crest extending on chaetiger 1
... *T. mexicana* Hernández-Alcántara & Solís-Weiss 2011
— With abdominal papillae on midventral line; prostomium
with nuchal crest extending on chaetiger 2
..... *T. ankeae* sp. nov.
- 10 Prostomium with filiform antenna
.....*T. diverapoda* (Hoagland, 1920)
— Prostomium with small subtriangular antenna, continuous
with nuchal crest *T. kirkegaardi* Pettibone, 1976

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REFERENCES

- Birula A.** (1897) Researches in biology and zoogeography, chiefly in Russian Seas, collected by Dr. A.L. Botkine in 1895 in the Gulfs of Yenesei and Obi. *Annuaire du Musée Zoologique de l'Académie Impériale des Sciences de St Pétersbourg* 2, 78–116.
- Dean D.** (1987) *Trochochaeta pettiboneae*, a new species (Polychaeta, Trochochaetidae) from the Gulf of Maine with additional comments on *T. carica*. *Bulletin of the Biological Society of Washington* 7, 46–49.
- Gilbert K.M.** (1984) Family Trochochaetidae Pettibone, 1963. In Uebelacker J.M. and Johnson P.G. (eds) *Taxonomic guide to the polychaetes of the Northern Gulf of Mexico, Volume 2*. Mobile, AL: Barry A. Vittor and Associates, Inc., pp. 8.1–8.4.
- Hartman O.** (1974) Polychaetous annelids of the Indian Ocean including an account of species collected by members of the International Indian Ocean Expeditions, 1963–64 and a catalogue and bibliography of the species from India. *Journal of the Marine Biological Association of India* 16, 191–252.
- Hernández-Alcántara P. and Solís-Weiss V.** (2011) *Trochochaeta mexicana*, a new species from an unusual family of Polychaeta, with comments on the world distribution of Trochochaetidae. *Journal of the Marine Biological Association of the United Kingdom* 91, 403–413.
- Hoagland R.A.** (1920) Polychaetous annelids collected by the United States Fisheries Steamer 'Albatross' during the Philippine Expedition of 1907–1909. *Bulletin of the United States National Museum* 100, 603–635.
- Imajima M.** (1989) A new species of *Trochochaeta* (Polychaeta, Trochochaetidae) from Japan. *Bulletin of the National Science Museum, Tokyo, Series A (Zoology)* 15, 139–146.
- Levinsen G.M.R.** (1883) Systematisk-geografisk Oversigt over de nordiske Annulata, Gephyrea, Chaetognathi og Balanoglossi. *Videnskabelige Meddelelser fra Dansk naturhistorisk Forening i København* 1882, 160–251.
- Örsted A.S.** (1843) *Maxicolae. Part I of Annulorum Danicorum Conspectus*. Copenhagen.
- Pettibone M.H.** (1963) Marine polychaete worms of the New England region, Part I: Aphroditidae through Trochochaetidae. *Bulletin of the United States National Museum* 227, 1–356
- Pettibone M.H.** (1976) Contribution to the polychaete family Trochochaetidae Pettibone. *Smithsonian Contributions to Zoology* 230, 1–21.
- and
- Santos M.A., Santos C.S.G. and Oliveira C.M.M.** (1994) Polychaeta in the estuary of the Piauí river, Sergipe, Brazil. *Mémoires du Muséum National d'Histoire Naturelle, Paris* 162, 541–547.

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