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Trochochaeta mexicana, a new species from an unusual family of Polychaeta, with comments on the world distribution of Trochochaetidae

PABLO HERNÁNDEZ-ALCÁNTARA AND VIVIANNE SOLÍS-WEISS

Laboratorio de Ecología y Biodiversidad de Invertebrados Marinos, Instituto de Ciencias del Mar y Limnología, Universidad Nacional Autónoma de México, Apartado Postal 70–305, México, D.F. 04510, México

The small, monogeneric family of polychaetes known as Trochochaetidae has been exclusively collected in the northern hemisphere, mainly in temperate–cold environments. Nine species have been described so far including Trochochaeta mexicana *sp. nov. described herein, while one species remains unnamed. Only two species had previously been recorded in the eastern Pacific, so* T. mexicana *sp. nov. is the first record for the family in the tropical Mexican Biogeographic Province. The new species is characterized by having a pair of eyes, acicular neurochaetae on chaetigers 2 and 3, a small knob-like antenna and a nuchal crest projecting through chaetiger 1.* Trochochaeta mexicana *sp. nov., together with* Trochochaeta kirkegaardi, Trochochaeta diverapoda *and* Trochochaeta cirrifera *are the only trochochaetids that have been found exclusively in warm environments.*

Keywords: Polychaeta, Trochochaetidae, new species, Mexican Pacific

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INTRODUCTION

The family Trochochaetidae Pettibone, 1963, is a small family of spioniform polychaetes known for a single genus *Trochochaeta* Levinsen, 1883. It included, up to now, eight nominal species and one species, from the northern Gulf of Mexico, described but not formally named, and only known as *Trochochaeta* sp. A Gilbert, 1984. The trochochaetids constitute a small and relatively unknown group of polychaetes that, in addition to carrying capillary chaetae, also possess, in the posterior part of the body, the most remarkable eversible spines originally held within sacs; once everted, the process is irreversible and the spines form a wheel-like array that inspired the name of the taxon (Rouse, 2001). According to Fauchald & Rouse (1997), the uniramous parapodia (notopodia missing) in a series of chaetigers in mid-body (Orrhage, 1964) constitute the evidence for the monophyly in the family.

The organisms now included in the family Trochochaetidae were originally included in the family named Disomidae by Mesnil (1897) and later renamed Disomididae by Chamberlin (1919). Initially, the family included the genera *Disoma* Örsted, 1843 and *Poecilochaetus* Claparède, 1875, until Hanners (1956) analysed the larvae and separated *Poecilochaetus* into a new family, Poecilochaetidae. Later, Pettibone (1963) replaced *Disoma*, since this name was preoccupied by a protozoan, with *Trochochaeta* Levinsen, 1883, and consequently changed the family name to Trochochaetidae.

The Trochochaetidae have consistently been placed in the group Spionida (Fauchald & Rouse, 1997; Rouse, 2001). Blake & Arnofsky (1999), in their phylogenetic analysis using Cossuridae and Paraonidae as outgroups, concluded that *Trochochaeta* fell within the Spionidae, along with other until then non-Spionidae, such as *Heterospio*, *Poecilochaetus* and Uncispionidae.

The trochochaetids have been recorded in the northern hemisphere only, at depths ranging from 2 m to more than 3700 m (Pettibone, 1976). They build fragile tubes lined with fibrous secretions and sediment particles (Wilson, 2000). These polychaetes continuously grow in length and add branches to their tubes, sometimes forming dense mats; they are considered selective bottom deposit-feeders (Fauchald & Jumars, 1979).

In the American littorals, six species have been found: *T. carica* (Birula, 1897), *T. pettiboneae* Dean, 1987 and *T. watsoni* Pettibone, 1976, all of them on the north-eastern coasts of the USA (Fauvel, 1916; Pettibone, 1976; Dean, 1987; Buzhinskaja & Jørgensen, 1997); the unnamed species *Trochochaeta* sp. A, from the northern Gulf of Mexico (Gilbert, 1984); *T. multisetosa* (Örsted, 1843) from the north-eastern coasts of the USA and Canada (Pettibone, 1976) and from San Francisco Bay in the Pacific Ocean (Hartman, 1947); and finally, *T. kirkegaardi* Pettibone, 1976, the only species recorded previously from the tropical eastern Pacific, collected in the subtidal zone of the Gulf of Nicoya, Costa Rica (Dean, 1996). Before the present study, the family had not been reported from the Mexican Pacific, in

Corresponding author:
V. Solís-Weiss
Email: solisw@cmarl.unam.mx

the Mexican Biogeographic Province as defined by Hastings (2000).

MATERIALS AND METHODS

The present study is based on new material collected from the southern Mexican Pacific, on board the RV 'El Puma' from the Instituto de Ciencias del Mar y Limnología (ICMyL), Universidad Nacional Autónoma de México (UNAM), during the oceanographic expedition 'Sedimento 1' from 15–28 November 1996. The positions of the stations were determined by Global Positioning System (GPS) and the samples were collected with a Smith–McIntyre grab (0.1 m^2). The biological material was fixed in 4% formaldehyde and preserved in 70% ethanol. Scanning electron microscopy (SEM) photographs were taken with the JEOL JSM6360LV equipment following standard methods.

The holotype and paratypes are deposited respectively at the National Polychaete Collection located in the Instituto de Ciencias del Mar y Limnología, Universidad Nacional Autónoma de México (CNP-ICML, UNAM; DFE.IN.061.0598), and the Los Angeles County Museum of Natural History (LACM-AHF POLY), USA.

SYSTEMATICS

Class POLYCHAETA Grube, 1850
Family TROCHOCHAETIDAE Pettibone, 1963
Genus *Trochochaeta* Levinsen, 1863
Trochochaeta mexicana sp. nov.
(Figures 1–4)

TYPE MATERIAL

Holotype: expedition 'Sedimento 1', Station 76, Guerrero coast; coordinates: 16° 16.3′N 98° 36.0′W; water depth: 40 m)

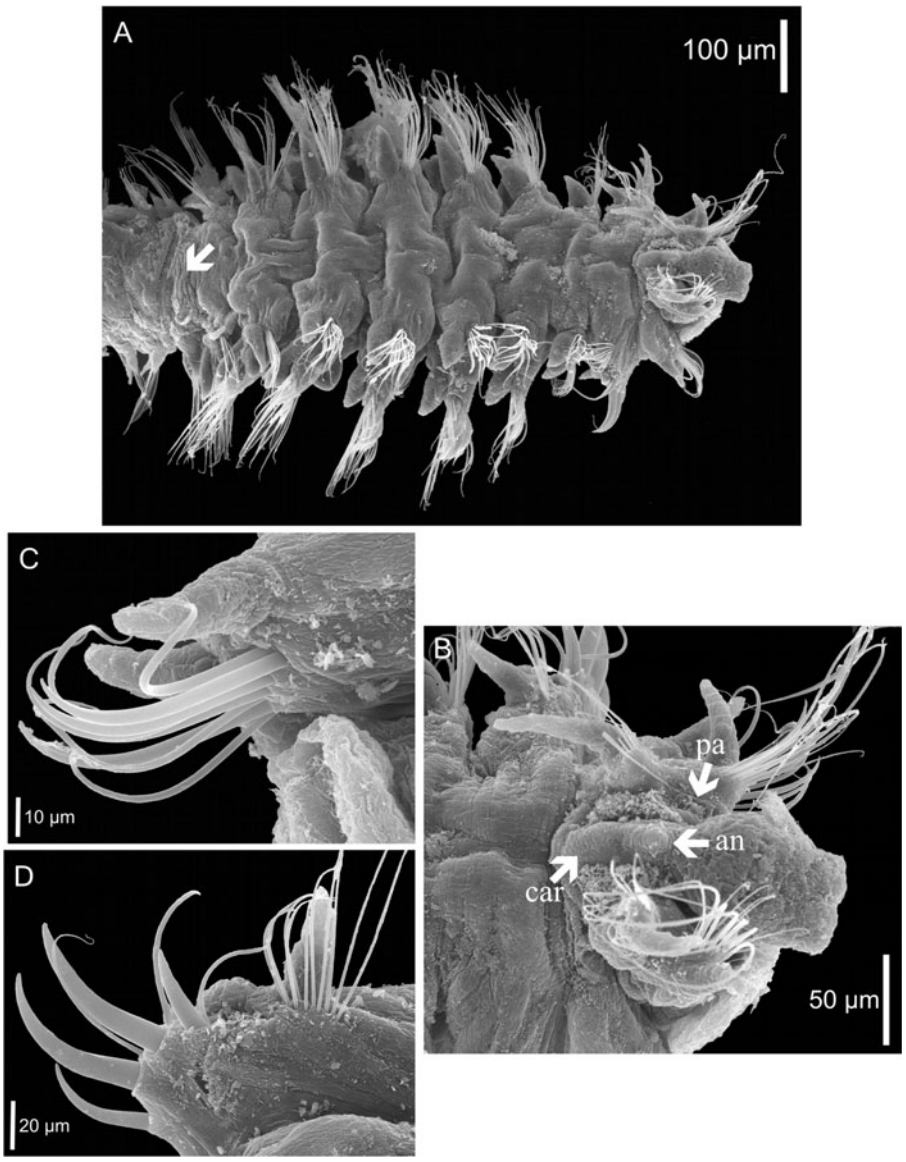

Fig. 1. Scanning electron microscopy micrographs of *Trochochaeta mexicana* sp. nov. (A) anterior and mid-body region, dorsal view, the arrow points to transition between thorax and abdomen; (B) prostomium and first parapodium, dorsal view, arrows point to position of palp (pa), antenna (an) and caruncle (car); (C) second parapodium, anterior view; (D) third parapodium, anterior view.

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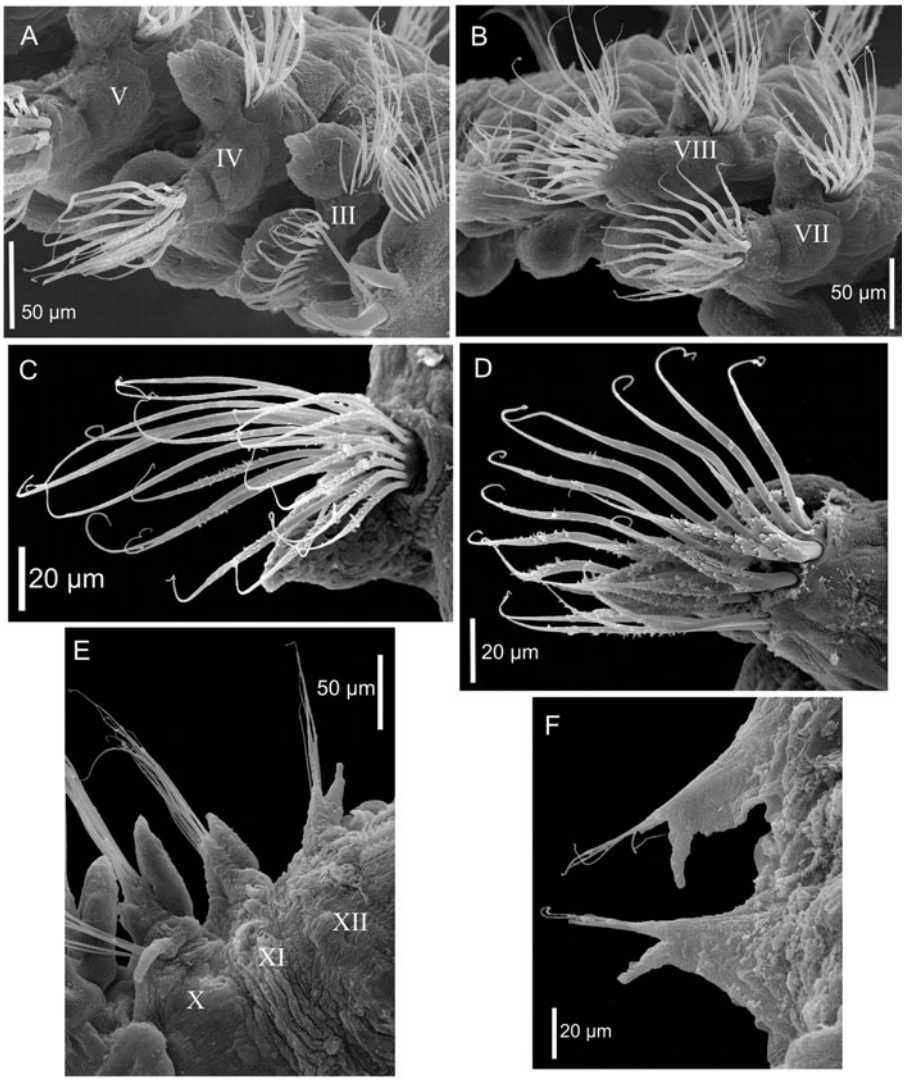

Fig. 2. Scanning electron microscopy micrographs of *Trochochaeta mexicana* sp. nov. (A) parapodia 3–5, lateral view, roman numerals = number of chaetiger; (B) parapodia 7–8, lateral view, roman numerals = number of chaetiger; (C) posterior thoracic notopodium, anterior view; (D) posterior thoracic neuropodium, anterior view; (E) parapodia 10–12, dorsal view, roman numerals = number of chaetiger; (F) anterior abdominal parapodia, dorsal view.

(CP-ICML: POH–11–001). Collected by P. Hernández-Alcántara, 19 November 1996.

Paratypes: expedition 'Sedimento 1', Station 76, Guerrero coast; coordinates: 16° 16.3′N 98° 36.0′W; water depth: 40 m) (CP-ICML: POP–11–001, 3 paratypes, one of them coated with gold for SEM studies) (LACM-AHF POLY 2468, 2 paratypes). Collected by P. Hernández-Alcántara, 19 November 1996.

DIAGNOSIS

Body slender, thorax with 11 chaetigers. Prostomium elongate with a small knob-like antenna and a nuchal crest projecting through chaetiger 1; two pairs of minute eyes. Second parapodia biramous but without notochaetae. Acicular spines on neuropodia 2 and 3, those form third chaetiger clearly heavier. Postchaetal lobes broad and subcylindrical (sometimes referred to as dorsal and ventral cirri) with margins entire. Anterior abdomen lacks notopodia, which reappear at the end of the posterior abdominal region as low mounds with a few pointed acicular spines. A few posterior chaetigers cylindrical and achaetous; pygidium with two pairs of short cirri.

DESCRIPTION

Holotype complete with 41 chaetigers: 3.13 mm long and 0.38 mm wide (at its greatest width in the thoracic region, not including chaetae). All paratypes incomplete with up to 24 chaetigers (posterior segments missing): 1.25 to 2.38 mm long and 0.35 to 0.63 mm wide. Body slender, divided into a short dorsally flattened anterior thoracic region (4 first chaetigers) and 6 chaetigers representing the posterior thoracic region; the body becomes thinner at chaetiger 11, marking the transition to the abdominal region (Figure 1A). In all the specimens analysed, the abdomen begins at chaetiger 12 (Figure 2E); the anterior abdomen lacks notopodia (Figure 2F); abdominal neuropodia with slender capillaries and stouter acicular chaetae with and without a terminal sheath projection resembling a fine thread (Figure 4D). Notopodia reappear at the end of the posterior abdominal region as low mounds with a bundle of few, pointed acicular spines; in the specimens analysed the acicular spines are withdrawn and only in a few chaetigers the tips of the spines are projected (Figure 4F). Fixed specimens are dull throughout the body. Prostomium elongate, wide and slightly bilobed

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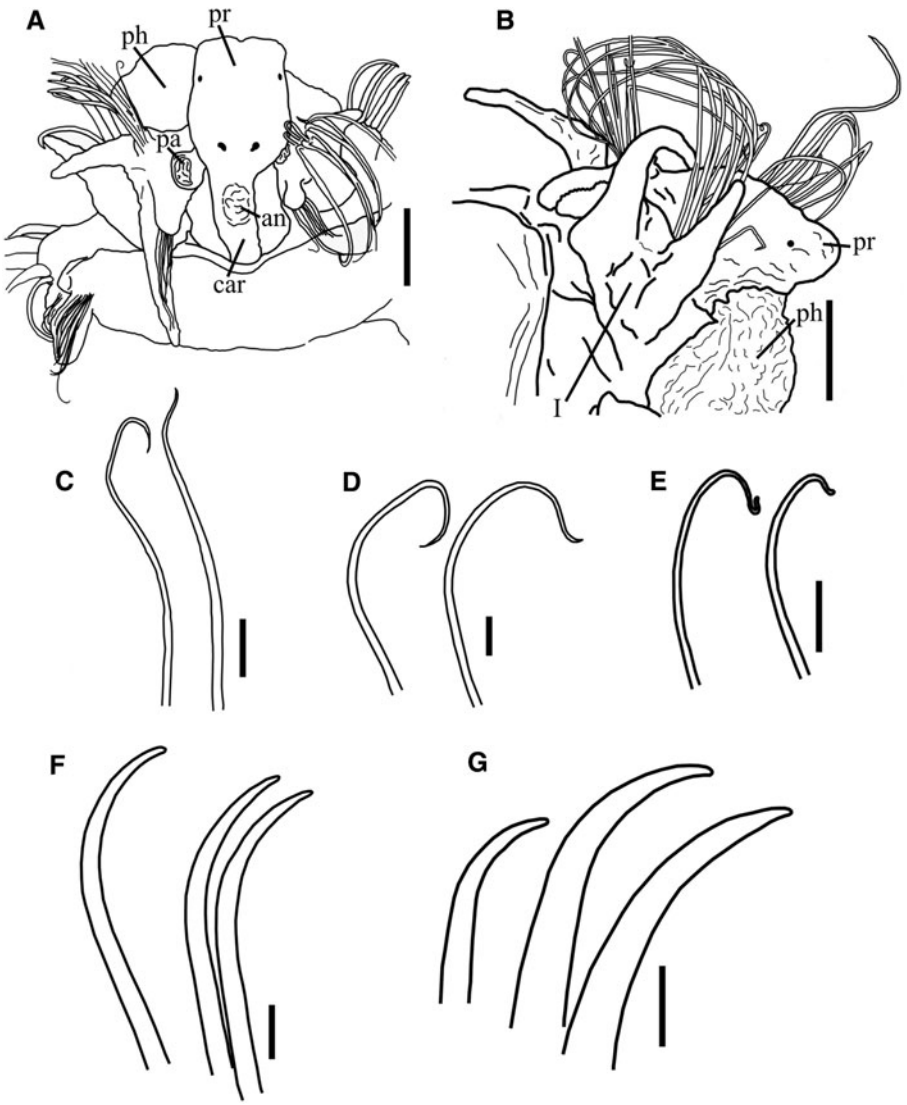

Fig. 3. (A) Anterior end, dorsal view, prostomium (pr), palp (pa), antenna (an), caruncle (car) and partially everted pharynx (ph); (B) prostomium and first parapodium, lateral view, prostomium (pr), pharynx partially everted (ph) and first chaetiger (I); (C) smooth capillaries from thoracic notopodia; (D) smooth capillaries from neuropodium 2; (E) smooth capillaries from notopodium 3; (F) acicular spines from neuropodium 2; (G) acicular spines from neuropodium 3. Scale bars: A, B, 50 μm; C, D, F, 10 μm; E, G, μm.

anteriorly, with a more or less well developed median crest extending posteriorly as a narrow caruncle, down to the posterior margin of the first chaetiger; with a small knob-like median antenna on the anterior region of the crest (Figures 1B & 3A). Two pairs of minute eyes embedded: first pair in the median-posterior region of the prostomium and second pair in antero-lateral position (Figure 3A, B). Tentacular palps cylindrical, with longitudinal ciliated groove along inner side, deciduous, but oval bases were observed between the prostomium and the parapodia of first chaetiger (Figure 1B). Mouth on ventral side of the peristomial ring; pharynx eversible, unarmed, looks like a ciliated lobulated pouch (Figure 3B).

Anterior four chaetigers of thoracic region with biramous parapodia, each one differing considerably from the other (Figure 1A). All anterior thoracic notopodia, except at chaetiger 2, with fan-shaped bundles of large and smooth capillaries (Figure 3C, E). The first, or buccal segment, enlarged ventrally, enclosing the large triangular mouth; with biramous parapodia shifted dorsally and projecting anteriorly (Figure 3B); bundles of smooth capillary notochaetae (Figure 3C), and longer smooth capillary neurochaetae (Figures 1B & 3B). Notopodial and neuropodial chaetal lobes indistinct. Notochaetae relatively few (about 8); neurochaetae numerous, forming fan-shaped spreading bundles of two types: the largest and stoutest are in the posterior edge of the bundle (Figure 1B). Notopodial and neuropodial postchaetal lobes subconical, elongate, subulate and wider basally (Figure 3A).

Second chaetiger closely apposed to the first (Figure 1A); parapodia biramous but without notochaetae (Figure 1C); neuropodial chaetal lobe low and wide. Neuro- and notopodial postchaetal lobes subconical, similar to those of the first chaetiger (Figure 2C). Two kinds of chaetae found in neuropodia: a posterior row with large smooth capillaries (Figure 3D) and an anterior row with curved, thicker acicular spines ending in sharp tips (Figure 3F).

The following two chaetigers (3 and 4) with lateral parapodia, somewhat modified relative to the more posterior thoracic

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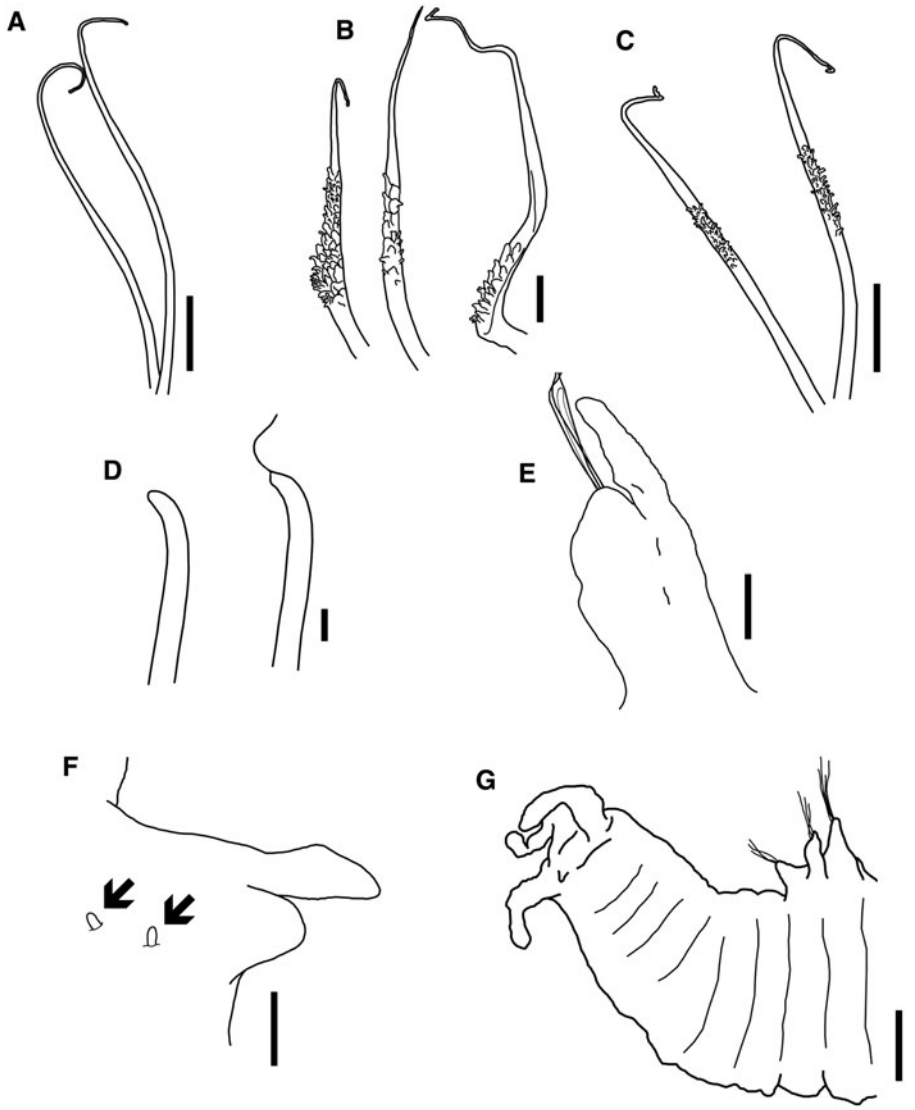

Fig. 4. (A) Smooth capillaries from posterior thoracic neuropodium; (B) capillaries with short, hair-like projections near their basal section; (C) capillaries with short, hair-like projections near their distal margin; (D) abdominal acicular chaetae with or without a terminal sheath projection; (E) anterior abdominal neuropodia; (F) posterior abdominal parapodium, showing tips of spines on dorsum (neurochaetae not drawn); (G) posterior end and pygidium. Scale bars: A, C, 20 μm; B, E, 10 μm; D, 2 μm; F, 2.5 μm; G, 5 μm.

ones; notopodial chaetal lobes low and neuropodial chaetal lobes wide and low (Figure 2A). The third chaetiger with postchaetal lobes subconical in both parapodial branches (Figure 1D). Notopodia with large capillaries (Figure 3E). Neuropodia with few smooth capillaries distributed in a posterior row, and 4–5 brown, smooth, stout, curved acicular spines placed in an anterior row (Figure 1D), clearly heavier than acicular spines from second chaetiger (Figure 3G).

Fourth chaetiger with lateral parapodia and chaetal lobes low and rounded. Postchaetal lobes similar to those of the following chaetigers; they are broad and subcylindrical with borders entire, tapering distally to digitiform tips, which are broader and more flattened on the neuropodia (Figure 2A). Notochaetae smooth, very large capillaries ending in curved fine tips (Figure 4A), arranged in two rows. Neuropodia also with fan-shaped bundles of very large capillaries, but of two kinds: those on the anterior row with numerous and very fine, short, hair-like projections on the exterior margin near their basal section (Figure 4B); those on the posterior row also with short, hair-like projections on one side, but located near their distal margin (Figure 4C).

On the remaining thoracic region, chaetigers 5 to 10 are similar, with lateral biramous parapodia (Figure 2B). Notopodial chaetal lobes low, rounded, with capillaries arranged in two rows (Figure 2C), decreasing in number towards the posterior thorax: chaetae in the anterior row with very fine, short, hair-like projections near their basal margin similar to those of chaetiger 4 (Figure 4B); chaetae in the posterior row also with short, hair-like projections, but near their distal margin (Figure 4C). Notochaetae similar to neurochaetae but clearly smaller (Figure 2C, D). Neuropodial chaetal lobes subcylindrical, with bundles of neurochaetae of two kinds: a posterior row with smooth and very long capillaries, and an anterior row with capillaries similar to the ones observed on chaetiger 4, that also exhibit somewhat frayed sheaths which appear as hair-like projections (Figure 2D). In this case, they are distributed along most of the chaetal shaft.

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Table 1. Comparison among *Trochochaeta* species.

Diagnostic characters	*T. carica* (Birula, 1897)	*T. cirrifera* (Hartman, 1974)	*T. diverapoda* (Hoagland, 1920)	*T. japonica* Imajima, 1989	*T. kirkegaardi* Pettibone, 1976
Prostomium	Small, oval to fusiform, narrowing anteriorly to more or less distinct shield shaped	Trapezoidal	Oval, truncate anteriorly	Rounded, protruding beyond anterior margin of chaetiger 1, and extending to posterior border of chaetiger 2	Small, fusiform, narrowing and truncate anteriorly
Eyes	Lacking	4	Lacking	4	Lacking
Nuchal crest	Projecting on chaetiger 1 Fauvel (1916) referred to as median antenna	Lacking	Extending on chaetiger 3 (border chaetiger 4)	Keel-like on posterior half of prostomium; anterior end digitate and arising upward from prostomium	Extending on chaetiger 3
Antenna	Lacking	Lacking	Filiform	Lacking	Small, subtriangular, continuous with nuchal crest
Notochaetae on chaetiger 2	Lacking	Present. As slender capillaries	Lacking	Lacking	Lacking
Neuropodia with acicular spines	Chaetiger 3	Chaetigers 2 and 3	Chaetigers 2 and 3	Chaetigers 2 and 3	Chaetigers 2 and 3
Thoracic notochaetae (posterior thorax)	Smooth, capillaries	Capillaries	Slender, limbate and hairy capillaries	Slender capillaries and more or less thick limbate capillaries	Limbate, frayed capillaries: shorter in anterior row; longer in posterior row
Thoracic neurochaetae (anterior thorax)	2 kinds: shorter, stout, acicular smooth or dotted, with blunt tips; and long limbate capillaries, sometimes frayed	2 kinds: thick, yellow spines with slender tips; and slender capillaries	2 kinds: stouter basally, curved with hairy distal tips; and limbate, hairy, tapering distally to fine tips	3 kinds: stout, blackish geniculate with long pubescent distal tip; slender, yellowish geniculate-like; and slender, limbate, capillaries	2 kinds: capillaries shorter, frayed or spinous, tapered rather abruptly to short slender tips; and stouter, frayed, tapered gradually to fine tips
Thoracic notopodial and neuropodial postchaetal lobes (Thorax anterior)	Entire, low, subrectangular; on fourth chaetigers without outer margins slightly undulate	Cirriform	Entire, low, wide, subrectangular; nearly contiguous	Entire: notopodial lobes entire, second and third neuropodia divided into two or three lobes	Entire, wide, subrectangular, separated by wide gap
Transitional region	Chaetigers 14 and 15 or 15 and 16	?	Chaetigers 11 and 12	Chaetiger 11	Chaetigers 11 to 15
Abdominal region initiates	About chaetiger 18	Chaetiger 10	Chaetiger 13	?	Chaetiger 16
Abdominal acicular neurochaetae	Stout with or without terminal sheath projecting as fine thread	?	Stout with whip-like hairy appendages attached subterminally	Crotches with hairy, short, mucronate or aristate tips	With aristae, attached subterminally
Acicular spines in posterior notopodia	2–5 stout pointed; beginning about chaetiger 26	?	3 or more?, dark, pointed	?	?
Papillae on midventral line in abdominal region	In posterior abdominal chaetigers	?	?	From chaetiger 13	From chaetiger 16
Pygidium	Cylindrical, with terminal anus encircled by filiform anal cirri	?	?	?	?

Distribution	Behring Sea, Kara Sea, Russia (Birula, 1897); New Brunswick to New England, USA (Pettibone, 1976); east Siberia, eastern Canada (Buzhinskaja & Jørgensen, 1997)	Arabian Sea (Hartman, 1974)	Philippine Islands (Pettibone, 1976); Hong Kong, off India (Mackie, 1990)	Honshu, off Akita, Sea of Japan; and Sagami Bay, Pacific Ocean (Imajima, 1989)	West Africa, off Liberia to off Nigeria (Pettibone, 1976); Gulf of Nicoya, Costa Rica (Dean, 1996)
Habitat	19 m, sandy mud (Birula, 1897); 12 to 1558 m; 9°C; 18 psu (Pettibone, 1976)	35 m	37 m (Pettibone, 1976)	30 to 116 m (Imajima, 1989)	44 to 175 m (Pettibone, 1976)
Diagnostic characters	***T. multisetosa* (Oersted, 1843)**	***T. pettiboneae* Dean, 1987**	***T. watsoni* Pettibone, 1976**	***Trochochaeta* sp. A Gilbert, 1984**	***T. mexicana* n. sp.**
Prostomium	Elongate, oval, rounded anteriorly	Small, fusiform, truncate to slightly bifid anteriorly and tapering posteriorly to anterior margin of chaetiger 1	Elongate, fusiform, wide and rounded or slightly bilobed anteriorly	Tapering posteriorly, broadly, rounded anteriorly	Elongated, broad and slightly bilobed anteriorly
Eyes	2 to 4 small, inconspicuous	Lacking	Lacking	2	4
Nuchal crest	Projecting on chaetiger 1	Low, thin, on posterior half ending anteriorly (some specimens as blunt point)	Projecting on chaetiger 1	Extending to posterior margin of chaetiger 2; with transverse ridges	Projecting on chaetiger 1
Antenna	Lacking	Lacking	Small, conical (keeled, according to Fauvel (1916))	Small	Low, knob-like on anterior region of the crest
Notochaetae on chaetiger 2	Lacking	Lacking	Slender, smooth capillaries	Smooth capillaries	Lacking
Neuropodia with acicular spines	Chaetigers 2 and 3	Chaetiger 3	Chaetiger 3	Chaetigers 2 and 3	Chaetigers 2 and 3
Thoracic notochaetae (posterior thorax)	Slender capillaries	Capillaries	Slender, smooth capillaries	Smooth capillaries	Smooth, very large capillaries ending in curved fine tips
Thoracic neurochaetae (anterior thorax)	2 kinds: slender, slightly limbate capillaries, with fine tips; and straight, lanceolate, acicular capillaries, with or without hairy sheaths	2 kinds: stout, straight acicula between two rows of capillary chaetae	2 kinds: stout, curved, with striate limbate margins (more or less frayed) and erect fine tips; and slender, slightly limbate, delicately frayed capillaries	2 kinds: geniculate, serrated, with long, finely tapered ends; and capillaries slightly curved, serrated	2 kinds: capillaries with very fine, short, hair-like projections near their basal section; and similar capillaries but with the hair-like projections near their distal margin
Thoracic notopodial and neuropodial postchaetal lobes (Thorax anterior)	Broad, serrated or fimbriated, beginning on chaetiger 3	Entire, broadly rounded, nearly rectangular, with outer margins smooth	Entire, thick, fleshy, subconical to oval; notopodial lobe lacking on chaetiger 11	Fimbriated, beginning on chaetiger 4; in notopodia beginning on chaetiger 5	Entire, subcylindrical, tapering distally to digitiform tips; broader and more flattened on neuropodia
Transitional region	?	? (few chaetigers)	?	?	Chaetiger 11
Abdominal region initiates	?	Chaetigers 16 to 20	Chaetiger 12	Chaetiger 14 ?	Chaetiger 12
Abdominal acicular neurochaetae	With tip blunt	Stout	?	?	Stout, curved with or without hair-like projection near the tip

Continued

Table 1. Continued

Diagnostic characters	*T. multisetosa* (Oersted, 1843)	*T. pettiboneae* Dean, 1987	*T. watsoni* Pettibone, 1976	*Trochochaeta* sp. A Gilbert, 1984	*T. mexicana* n. sp.
Acicular spines in posterior notopodia	4–7 dark yellow, short, wider basally, tapering to sharp tips	1 to 5 pointed spines, beginning on chaetigers 21 to 25	?	?	Embedded pointed spines (withdrawn, only some tips visible on few chaetigers)
Papillae on midventral line in abdominal region	From about setigers 20 to 40	In posterior abdominal chaetigers	?	?	Lacking
Pygidium	Thick, collar-like with slightly lobulate margin (4 lobes in younger specimens)	Cylindrical, terminal anus encircled by 10 anal cirri	?	?	Cylindrical, terminal anus encircled by 4 anal cirri
Distribution	West Greenland, Faroe Islands, Iceland, Swedish, Denmark; western Baltic; Gulf of St Lawrence to Massachusetts; San Francisco, California; Japan (Pettibone, 1963)	Monhegan Island, Gulf of Maine; New England; and New Brunswick, north-eastern Canada (Dean, 1987)	North Atlantic, off Nova Scotia to off Massachusetts (Pettibone, 1963)	Coast of Texas, northern Gulf of Mexico (Gilbert, 1984)	Southern Mexican Pacific
Habitat	1.8 to 666 m, fine sand, mud, black foul-smelling loose mud, mud with algae, *Zostera*, stones (Pettibone, 1963)	116 to 138 m; fine silty mud (Dean, 1987)	411 to 3753 m (Pettibone, 1963, 1976)	134 to 189 m; silty very fine sand, sandy silt, clayey silt, silty clay, clay	40 m; sandy–muddy sediments (51.1% sand, 47.3% mud and 1.6% gravel)

Parapodial postchaetal lobes are initially similar, but larger and stouter than those observed on parapodium 4 (Figure 2B); notopodial postchaetal lobes wide and subconical, becoming gradually slender, small, and digitiform on posterior thoracic chaetigers (Figure 2E); neuropodial lobes subcylindrical with borders entire. From chaetiger 5, muscular pads present below ventral edges of neuropodia (Figure 2B), gradually reducing in size to finally disappear at chaetiger 12 (first chaetiger of abdominal region).

At the transitional region (chaetiger 11), the body becomes markedly thinner, and both notopodia and notochaetae practically disappear, only represented by a small papilla (Figure 2E). Neuropodial lobes become smaller, with subconical postchaetal lobes and a few smooth, slender capillary neurochaetae.

Anterior abdominal region begins at chaetiger 12; it is long and slender, without notopodia or notochaetae (Figure 2F). Neuropodial chaetal lobes small and rounded, with a few slender, smooth capillaries, and 1–3 stouter acicular chaetae with and without a terminal sheath projection as fine thread (Figure 4D). Postchaetal neuropodial lobes elongate, broader basally, becoming smaller towards posterior parapodia (Figure 4E). Posterior abdominal chaetigers with embedded notopodial spines, without notopodial lobes; most of the notopodial spines are withdrawn, except for some tips visible on few chaetigers (4F). A few posterior segments cylindrical and achaetous. Pygidium with two pairs of short cirri (4G).

REMARKS

Some morphological characteristics of the specimens from the Mexican Pacific do not agree with any trochochaetid known to date: a number of remarkable differences were observed. First, all the species in this family can be divided into two groups: those with noto- and neurochaetae present in all thoracic parapodia (*Trochochaeta watsoni* Pettibone, 1976; *T. cirrifera* (Hartman, 1947); *T.* sp. A) and those without notochaetae in chaetiger 2 (Table 1). *Trochochaeta mexicana* sp. nov. belongs to this second group and, in addition, resembles *T. multisetosa* (Örsted, 1843), *T. diverapoda* (H oagland, 1920), *T. japonica* Imajima, 1989 and *T. kirkegaardi* Pettibone, 1976, in having stout acicular neurochaetae on chaetigers 2 and 3. In contrast, *T. carica* and *T. pettiboneae* display stout acicular neurochaetae on chaetiger 2 only.

The above-mentioned four established species with acicular neurochaetae on chaetigers 2 and 3 have previously been recorded in the Pacific Ocean (Figure 5). *Trochocheta multisetosa*, having noto- and neuropodial serrated postchaetal lobes on some anterior chaetigers, can be separated from the other trochochaetids that carry postchaetal lobes with their border entire.

Trochochaeta mexicana sp. nov., however, can be separated from *T. japonica* by the presence of a small knob-like antenna in the former, absent in the latter and in that in the former, the median crest projects on chaetiger 1 instead of arising upwards from the prostomium. Finally, *T. diverapoda* and *T. kirkegaardi* are different from *T. mexicana* sp. nov., not only because of the distinct shape of their prostomium, and their lack of eyes, but because their median crest is longer (extending to chaetiger 3), and also because they carry stout and curved modified neurochaetae, tapered to slender fine tips, from chaetiger 5.

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Fig. 5. World distribution of described *Trochochaeta* species.

ETYMOLOGY

The new species is named after the type locality, in the southern Mexican Pacific.

TYPE LOCALITY

Guerrero coast, southern Mexican Pacific (Mexican Biogeographic Region).

HABITAT

The specimens of *T. mexicana* sp. nov. are rare in the Mexican Pacific coasts; they were found at 40 m depth and in bottoms with sandy–muddy sediments (51.1% sand, 47.3% mud and 1.6% gravel).

DISCUSSION

Pettibone (1963, 1976), in her careful review of most of the species described until then, and having examined all available type material, concluded that only six of the ten species described were valid. Later, Mackie (1990) examined specimens of one of those six species from Hong Kong and the syntypes from the Philippine Islands (*T. orissae*) and agreed with Pettibone's (1976) decision to synonymize it with *T. diverapoda*. However, although Pettibone (1976) overlooked *T. cirrifera* described from the Arabian Sea (Hartman, 1974), this species could be considered valid because of its evident differences from other trochochaetid species: it is the only species with cirriform instead of subconical notopodial postchaetal lobes in the fourth chaetiger. Finally, Dean (1987) and Imajima (1989) described two more species which, together with *Trochochaeta* sp. A (Gilbert, 1984), add up to the nine species currently accepted (Table 1). No other species from this family were described in the intervening twenty years, until this study of the continental shelf of the southern Mexican Pacific.

The number of species described so far in this family (nine) is very small (Table 1). The detailed review made by Pettibone (1963, 1976) and the more recent studies carried out by Dean (1987), Imajima (1989), Mackie (1990), and Buzhinskaja & Jørgensen (1997) provided additional data to supplement the descriptions of previously identified species, and allowed the correct identification of specimens erroneously assigned to other species. Those studies increased our taxonomic knowledge of the family and usefully support the present discussion about the new species.

In this sense, before the description of *T. mexicana* sp. nov., only two species had been recorded from the eastern Pacific (Figure 5): (1) *T. multisetosa* from San Francisco, California, also widely recorded from temperate and cold waters from the north-eastern USA, West Greenland, Faroe Islands and Iceland, as well as in Swedish and Danish waters, the western Baltic and northern Japan (Pettibone, 1963); and (2) *T. kirkegaardi*, collected from the Gulf of Nicoya, Costa Rica (Maurer & Vargas, 1984; Maurer *et al.*, 1988; Dean, 1996), which is the trochochaetid found closest to the Equator, and which was originally recorded from Liberia and Nigeria coasts (eastern Atlantic) (Pettibone, 1976). All the species distributed in the American Pacific clearly differ among themselves: the temperate–cold species *T. multisetosa* has no antenna, and it is the only trochochaetid with serrated thoracic postchaetal lobes, whereas the tropical species *T. kirkegaardi* and *T. mexicana* sp. nov. both bear a small antenna but, in the latter, a pair of eyes are present and its median crest is shorter, extending only to the first chaetiger (Table 1).

Members of the Trochochaetidae occur rarely in the world seas (Figure 5). The north-eastern USA and the western littorals of the Pacific Ocean are the regions where most trochochaetids have been recorded (four species in each region), and this can be partly due to the fact that it is there where the studies on this family have been most numerous (Örsted, 1843; Birula, 1897; Pettibone, 1963, 1976; Dean, 1987; Imajima, 1989; Mackie, 1990).

Although *T. japonica*, *T. cirrifera*, *T.* sp. A and the newly described species *T. mexicana* have been recorded only from their type locality the other species of this family were reported from at least two oceans of the world. Moreover, the trochochaetids are mainly distributed in the temperate–cold regions of the northern hemisphere. *Trochochaeta carica* and *T. multisetosa* are the species with the widest distribution, since they were recorded in the northern Atlantic and Pacific. In contrast, *T. kirkegaardi*, *T. diverapoda*, *T. cirrifera* and *T. mexicana* have been recorded only in warm waters between the Tropic of Cancer and the Equator although, as mentioned above, the last two have been found only in their type locality (Figure 5).

Finally, given the irregular distribution of this particular family of polychaetes around the world, their scarce presence,

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and the record of only three species on the coasts of the eastern Pacific, we think that there may be many more undiscovered trochochaetids in this American region.

KEY TO THE SPECIES OF *TROCHOCHAETA*

1. With noto- and neurochaetae in all thoracic parapodia 2
   – Without notochaetae in chaetiger 2. 4
2. Postchaetal lobes thick and subconical 3
   – 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 2. 5
   – Stout acicular neurochaetae on chaetigers 2 and 3 6
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 fimbriated 7
7. Prostomium without antenna; median crest projects on chaetiger 1 . . . . . *T. japonica* Imajima, 1989
   – Prostomium with antenna; median crest arising upwards from the prostomium. 8
8. Prostomium with nuchal crest extending on chaetiger 1; with four eyes; without modified neurochaetae . . . . . *Trochochaeta mexicana* sp. nov.
   – Prostomium with nuchal crest extending on chaetiger 3; without eyes; with stout and curved modified neurochaetae, tapered to slender fine tips, from chaetiger 5 9
9. 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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Correspondence should be addressed to:
V. Solís-Weiss
Laboratorio de Ecología y Biodiversidad de Invertebrados Marinos
Instituto de Ciencias del Mar y Limnología
Universidad Nacional Autónoma de México
Apartado Postal 70–305, México, D.F. 04510, México
email: solisw@cmarl.unam.mx

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