



A new *Tetranchyroderma* species (Gastrotricha, Macrodasysida, Thaumastodermatidae) from the Canary Islands (Spain)

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Abstract: Shallow sublittoral sediment collected from Tenerife (Canary Islands, Spain) yielded several specimens of an undescribed thaumastodermatid gastrotrich species along with some specimens of *Paraturbanella teissieri* and one unidentifiable specimen belonging to the genus *Crasiella*. The paper deals with the description of *Tetranchyroderma canariense* sp. nov. The new species, which appears closely allied with *T. thysanogaster*, *Tetranchyroderma* sp. 4 and *Tetranchyroderma* sp. 5 (Valbonesi & Luporini 1984), is characterized by: 1. a complete cuticular covering made up of tetrancres, that are larger on the head and rear trunk region; 2. caudal pedicles each made up of two adhesive tubes; 3. up to 10 anterior adhesive tubes; up to 20 ventrolateral adhesive tubes per side, and two clusters of ventral adhesive tubes of 4 tubes each, located in the posterior trunk region. This represents the first record of marine Gastrotricha from the Canary Archipelago and the second marine gastrotrich species from Spain.

Résumé : Une nouvelle espèce de *Tetranchyroderma* (*Gastrotricha*, *Macrodasysida*, *Thaumastodermatidae*) des Iles Canaries (Espagne). Des sédiments sublittoraux peu profonds récoltés à Tenerife, ont révélé la présence de plusieurs spécimens d'une espèce non décrite de Gastrotriche Thaumastodermatidae, de quelques spécimens de *Paraturbanella teissieri* et d'un spécimen non identifiable du genre *Crasiella*. Cet article traite de la description de la nouvelle espèce *Tetranchyroderma canariense*. Elle paraît étroitement apparentée à trois autres espèces du genre *Tetranchyroderma* : *T. thysanogaster*, *Tetranchyroderma* sp.4 et *T. sp. 5*, mentionnées par Valbonesi & Luporini (1984). *Tetranchyroderma canariense* sp. nov. se caractérise : 1. par une couverture cuticulaire complète faite de tétrancres, plus larges sur la région céphalique et la région postérieure du tronc ; 2. par des pédicules caudaux formés chacun de deux tubes adhésifs ; 3. par 10 tubes adhésifs antérieurs ventraux, 20 tubes adhésifs ventro-latéraux de chaque côté du corps et deux groupes de tubes adhésifs ventraux, formés chacun de 4 tubes situés sur la région postérieure du tronc. Les Gastrotriches marins sont ainsi mentionnés pour la première fois dans l'archipel des Canaries ; cette nouvelle espèce est la seconde espèce de Gastrotriches marins pour l'Espagne.

Keywords: Gastrotricha, Macrodasysida, Meiofauna, Canary Islands, Spain, new species.

Introduction

In the last decade marine gastrotrichs have been the subject of a number of faunistic and taxonomic surveys in several

regions of the world including North America (Todaro, 1994, 1995; Todaro et al., 1995; Todaro, 2002), Asia (Chang et al., 1998a, b; Chang et al., 2002; Chang & Lee, 2001; Lee & Chang, 2002, 2003), Australia (Hochberg, 2002a, b) and especially Europe (e.g. Jouk et al., 1992; Hummon & Roidou, 1995; Clausen, 1996, 2000; Todaro et al., 2001 and references therein, 2002). Although in a world sense

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European marine gastrotrich fauna can be considered one of the best known, the coastlines of several countries remain still unexplored; thus from Spain only one species, *Turbanella cornuta* Remane, 1925 has been reported so far (cf. Giere, 1979). In an attempt to increase our knowledge on the gastrotrich fauna of the Iberian peninsula and adjacent areas we arranged to obtain some sediment from beaches of the Canary Islands, from which records of gastrotrichs were completely lacking. This paper deals with the description of a new *Tetranchyroderma* species, a small thaumastodermatid gastrotrich found in large numbers in samples collected along a transect on the coast of the island of Tenerife.

Materials and methods

Samples of volcanic sandy sediment were collected mostly from five shallow sublittoral sites at 5–8 m water depth from Candelaria, on the north-east coast of Tenerife, in September 2001 (Fig. 1). Additional bulk sediment was taken at a depth of 1.5–4.0 m using a 1.5 litre plastic scoop.

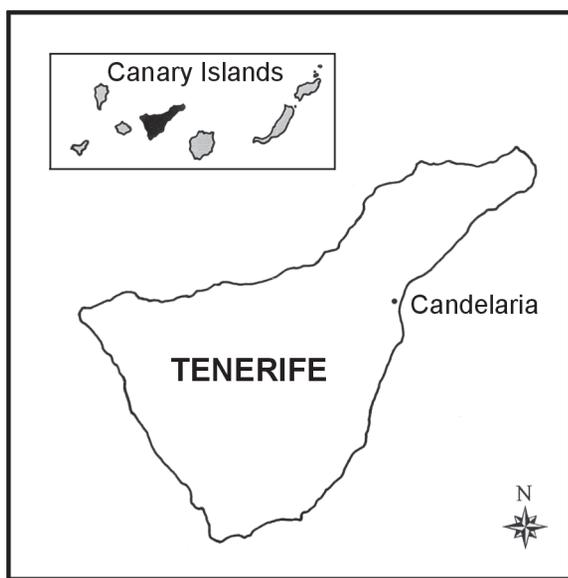


Figure 1. Study location in the Tenerife Island.
Figure 1. Emplacement du lieu de récolte sur l'île de Tenerife.

The sand samples were fixed in 7% formaldehyde, neutralized with borax; the animals were extracted by washing in fresh water and filtering through a 45 µm mesh sieve, then stained with Rose Bengal. Slow dehydration in glycerol and Kaiser's Glycerol Gelatine were used for permanent mounts.

Morphological analysis was carried out on fixed animals with Nomarski differential interference contrast (DIC) optics using a Leitz Dialux 20 microscope. Measurements

were made using an ocular micrometre and drawings made with the aid of a camera lucida. In the description of the new species, the terminology and the abbreviations used are as in Hummon et al. (1993), while the location of some morphological characteristics along the body is given in percentage units (U) of total body length measured from the anterior to the posterior.

Granulometric analysis of the substrata was carried out according to Giere et al. (1988).

Results

The black volcanic sand was very fine in all the samples, with a mean grain size of particles ranging between 105 µm and 125 µm ($\Phi 3.25 - \Phi 3.00$).

The faunistic analysis of the sediment yielded 3226 animals. Nematodes were the most abundant group (72,30%) followed by Crustacea (11,62%), represented by harpacticoid copepods, and ostracods, adults and nauplii. All other groups were less numerous: ciliates, gastrotrichs, annelids and turbellarians all together made up about 16% of the total meiofauna, whereas halacarids and tardigrades constituted less than 1% of the local meiobenthic community. The latter were present with only one species, *Orzeliscus belopus* du Bois-Reymond Marcus, 1952. The Shannon's and Pielou's indexes, $H' = 1.57$ and $J = 0.49$ respectively, revealed high values of biodiversity.

Gastrotrichs were found in all samples with 149 specimens, 30% of which were unfortunately injured or lost during the preparation of permanent mounts. All belonged to the order Macrodasida. One specimen was an unidentifiable species of the genus *Crasiella*, 14 specimens were identified as *Paraturbanella teissieri* Swedmark, 1954 whereas the remainder represented an undescribed species of the genus *Tetranchyroderma* which is here described.

Systematics

Order Macrodasida REMANE,
 1925 [RAO & CLAUSEN, 1970]
 Family Thaumastodermatidae REMANE, 1926
 Subfamily Thaumastodermatinae RUPPERT, 1978
 Genus *Tetranchyroderma* REMANE, 1926
Tetranchyroderma canariense sp. nov.
 (Figs 2, 3; Table 1)

Diagnosis

A *Tetranchyroderma* with an adult length up to 326 µm; pharyngo-intestinal junction (PhJIn) at U30; head bulbous anteriorly, without tentacles or pestle organs; broad oral hood with slightly lobed margins; slender body with a short, bilobed caudum. Cuticular armature complete, made up of tetrancres, small at anterior and posterior ends of body,

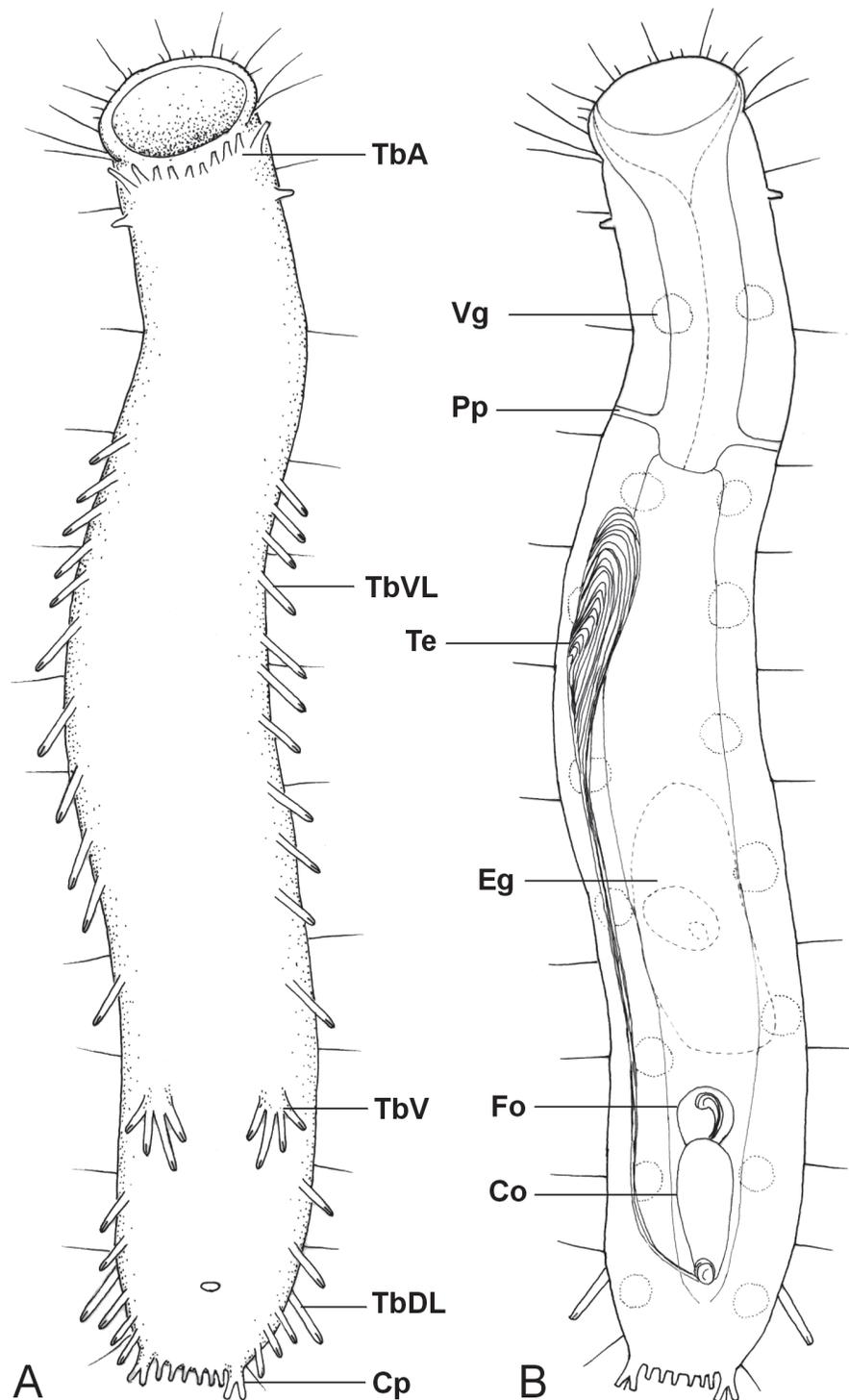


Figure 2. *Tetranchyroderma canariense* sp. nov. Habitus, animal drawn as if lying ventrally showing **A.** the adhesive apparatus (locomotor cilia not shown) and **B.** the internal structures. (*Co*) caudal organ; (*Cp*) caudal pedicles; (*Eg*) egg; (*Fo*) frontal organ; (*Pp*) pharyngeal pores; (*TbA*) anterior adhesive tubes; (*TbDL*) dorsolateral adhesive tubes; (*TbVL*) ventrolateral adhesive tubes; (*TbV*) Ventral adhesive tubes; (*Te*) testicle; (*Vg*) viscid glands. Scale bar: 50 μ m

Figure 2. *Tetranchyroderma canariense* sp. nov. Habitus en vue ventrale montrant en **A.** l'appareil adhésif (ciliature locomotrice non représentée) ; en **B.** les organes internes. (*Co*) organe caudal ; (*Cp*) pédicules caudaux ; (*Eg*) ovocytes ; (*Fo*) organe frontal ; (*Pp*) pores pharyngiens ; (*TbA*) tubes adhésifs antérieurs ; (*TbDL*) tubes adhésifs dorso-latéraux ; (*TbVL*) tubes adhésifs ventro-latéraux ; (*TbV*) tubes adhésifs ventraux ; (*Te*) testicule ; (*Vg*) glandes visqueuses. Echelle : 50 μ m.

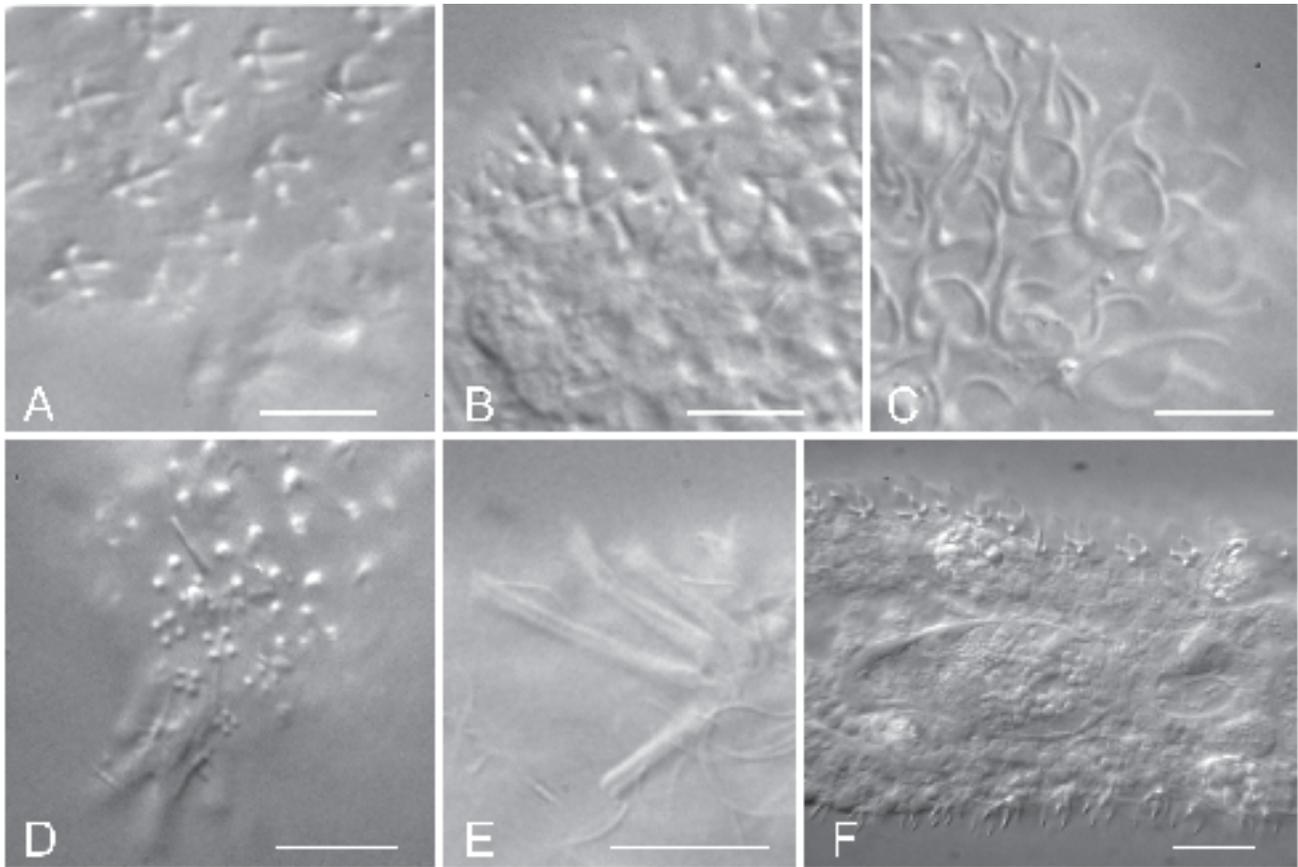


Figure 3. *Tetranchyroderma canariense* sp. nov. viewed under Nomarski optics. **A.** tetrancres of the anterior end; **B.** tetrancres of the anterior neck region; **C.** Tetrancres of the posterior trunk region; **D.** posterior end, showing the caudal pedicle and related hooks; **E.** ventral adhesive tubes of the right side cluster; **F.** caudal- and frontal-organ. Scale bars: A 5 µm, B-F 10 µm.

Figure 3. *Tetranchyroderma canariense* sp. nov. vues en contraste interférentiel Nomarski. **A.** téttrancres de l'extrémité antérieure ; **B.** téttrancres de la région antérieure du cou ; **C.** téttrancres de la région postérieure du tronc ; **D.** extrémité postérieure montrant un pédicule caudal et les ancrés ; **E.** tubes adhésifs ventraux du côté droit ; **F.** organe caudal et frontal. Echelles : A 5 µm, B-F 10 µm.

medium sized on mid-trunk, but larger on anterior pharyngeal region and posterior trunk. Thick sensory hairs on head margin, becoming sparse but evenly spaced on body and forming lateral columns from about U15 to U94. Few epidermal glands, 8 per side, round and of similar size, are regularly spaced along length of body from U19 to U92. Adhesive tubes: TbA, 5 per side at U08-09, a small one medially and four larger ones forming arc ventrolaterally; TbVL, up to 16 per side, a small one at U11, and 15 larger tubes along intestinal region from U30 to U88; TbV, up to four per side in a cluster at U77, TbP, eight per side, two forming one foot of the bilobed caudum, three flanking each foot medially and three others flanking each foot laterally from U92 to U95. Ventral locomotor cilia: a continuous field of transverse rows covering entire ventral surface except ano-genital region. Reproductive system: elongated testis on right side starting at U33; elongated caudal organ

connected to a vesicular frontal organ; one large egg in mid-trunk at U64.

Type locality

Candelaria offshore in the north-east coast of the Island of Tenerife, Canary Islands (28°21'03"N; 16°21'56"W).

Type material

The holotype is an adult hermaphroditic specimen collected by Mr. Marco D'Onghia on the 1st September 2001. The holotype has been deposited at the Museo Civico di Storia Naturale di Verona, Lungadige Porta Vittoria 9, I-37129 Verona, Italy (ref 633).

Etymology

The specific epithet alludes to where they were found.

Description

The description is mainly based on an adult specimen, 323 µm total body length (morphometric traits of additional

Table 1. Measurements of 17 main morphological traits in the studied population of *Tetranchyroderma canariense* sp. nov.. Values are expressed in microns.

Tableau 1. Dimensions pour les 17 principaux caractères morphologiques dans la population étudiée de *Tetranchyroderma canariense* sp. nov.. Valeurs exprimées en microns.

Trait	Min	Max	Mean	S. D.	n
Total body length	95.0	326.5	205.1	64.6	20
Pharynx length	54	80	69.2	11.1	4
Oral openings width	6	27.5	13.9	4.8	18
Head width	16.5	47.5	30.9	6.9	20
Neck width	21.5	53	32.1	7.7	20
Trunk width	31	65	43.9	9.4	19
Caudal base width	32.5	55	40.4	6.5	20
Small head hooks (width x height)	1.2 x 1	2.5 x 2	1.7 x 1.4	0.6 x 0.5	10
Large head hooks	3.4 x 3	6.6 x 4.8	5.8 x 3.8	0.7 x 0.6	13
Posterior trunk hooks	4.2 x 3	7.6 x 6.3	5.4 x 4.3	0.9 x 0.7	13
TbA length	3.5	12	5.7	2.4	8
TbVL length	6	12.5	10.0	1.7	6
TbDL length	6	15	11.3	2.5	12
TbV length	6-10	8-14	6,8-12	0.3-0.4	3
Foot TbP length	4	12	7.8	2.9	9
Between feet TbP length	4	9	5.9	1.8	10

specimens are reported in Table 1). Pharynx 74 μm in length, measured from the anterior margin of mouth to pharyngo-intestinal junction (PhJIn) at U30. Flared oral opening and quite smooth hood. Slender, medium length body, with a moderately inflated trunk that narrows quickly to the base of a short, bilobed caudum. Widths of the oral opening and at head/neck/trunk/caudal base are as follows: 39/38/48/25 μm at U04/U19/U64/U96, respectively. Cephalic tentacles, dorsal cirrata tubes and pestle organs are absent. Sensory hairs include a sparse ventral fringe around oral opening (ca. 5-8 μm long), a dorsal row just behind the leading edge of oral hood (8-14 μm) and scattered dorsal elements (10-14 μm) inserting in the bare region anterior to the cuticular armature. Other sensory hairs form lateral columns (about 11 per side) and are evenly spaced within

these. Individual hairs are ca. 10-16 μm long. Few (8 per side), large (up to 12 \times 10 μm) and round viscid glands arranged in two dorsolateral columns in the pharyngo-intestinal region from U19 to U92.

Cuticular armature: from U01 to U96 complete dorso-lateral covering of tetrancrous hooks that wrapping around lateral margins of body in 15-20 columns, each with about 40 hooks. The three-four foremost tetrancres of each dorsal column very small (2.5 \times 1.8 μm), bear slightly diverging tines; they are followed by five-seven large hooks (6.5 \times 4.3 μm) with slightly grasping tines, then by five-seven hooks, small in size (about 2.7 \times 2.1 μm) with diverging tines; the remaining tetrancres increase consistently in size backward, being very large (7.6 \times 6.3 μm) on rear end and with grasping tines; small hooks (2.5 \times 1.5 μm) with slightly diverging tines cover proximal portion of caudal pedicles (Fig. 3A-D).

Adhesive tubes: there are five anterior tubes (TbA) per side inserting directly on the body surface, a small one medially at U08, 4.0 μm in length, and four larger ones somewhat more lateral at U08-09, 6.0-8.0 μm in length. There are 16 ventrolateral tubes (TbVL) per side, a small one, 7.0 μm in length, in the anterior pharyngeal region at U11, and 15 larger ones, about 10-12 μm in length; of these 11-12 are evenly spaced from U30 to U67 and 2-3 originating after a relatively long gap in the region between U84 and U88. There is only one dorsolateral tube (TbDL) per side, 16-18 μm in length, originating at U90. Four ventral tubes (TbV), 10-16 μm in length, occur on either side forming a cluster originating from a common fleshy base at U77 (Fig. 3E). The caudum indents medially to U96, is formed by two feet born on short lobes, each comprised of two posterior tubes (TbP), 4-6 μm in length; the feet lack the thinner mid-dorsal tubes which projects beyond them from between and is characteristic of many congeneric species; here the tube is replaced by a short seta. A total of six (less frequently seven) additional TbP (6-8 μm) are present between the feet, along with three others (8-12 μm) per side, lying laterally from the level of anus, and continuing the lateral TbVL series to the rear.

Ventral ciliation: a continuous field of cilia arranged in transverse rows covers the entire ventral surface from U16 to U96, except for the ano-genital region, which is bare.

Digestive tract: the oral opening is broad (31.0-35.0 μm in width) with an oral hood extending forward above the mouth from U00 to U07. The pharynx narrows over its half to 15 μm and bears pores at the base. The intestine is broader and almost of same width over its front half (15-20 μm), then narrows gradually to the anus, which opens ventrally at U91.

Reproductive system: simultaneous hermaphrodites; solitary elongate testis on the right side; the vas deferens opens into the rear of an oval elongate caudal organ

(35 × 20 µm) which connects with a vesicular frontal organ (12 µm in diameter) containing several spermatozoa; ovary not seen; a large egg (65.0 × 24.0 µm) is located dorsally to the gut in the mid-intestinal region (Fig. 3F).

Remarks

The population from the Canary Islands was made up of specimens of different size (age) -classes, the smallest one being 95 µm in total body length (cf. Tab.1); adult-looking specimens have been seen as small as 250 µm though these were pre-reproductive sub-adults (i.e., with testicle but lacking accessory reproductive organs). In adult specimens we found some intra-population variation with regard to the number and distribution of adhesive tubes: a few specimens showed 8 vs. 10 anterior adhesive tubes while in three others ventrolateral adhesive tubes were 14, 16 and 20, respectively. In three instances specimens showed 7 tubes between the caudal pedicles instead of the 6 tubes shown by the vast majority of worms. Finally, other specimens were characterized by asymmetry regarding the number of ventral adhesive tubes, in the way that the cluster on the left side, in these cases, numbered two or three tubes.

Taxonomic affinities

To date, the genus *Tetranchyroderma* includes more than 55 species, 26 of which possess a cuticular covering made up of tetrancres (see Todaro, 2002). Of the latter, only five species like *T. canariense* have ventral adhesive tubes but no cephalic tentacles and/or pestle organs. These are: *T. littorale* Rao, 1981, *T. pachysomum* Hummon et al., 1993, *T. thysanogaster* Boaden, 1965, *Tetranchyroderma* sp. 4 (Valbonesi & Luporini, 1984) and *T. sp. 5* (Valbonesi & Luporini, 1984).

Tetranchyroderma littorale described from the coast of India, principally differs from all other species in having ventral adhesive tubes arranged in two bilateral clusters, one of which is located in the pharyngeal region. Furthermore, the Mediterranean *T. pachysomum* is peculiar in its very wide body shape (see also Todaro, 2002, Fig. 4D). Therefore we confine the comparison of the new species with the remaining three taxa, from which *T. canariense* can be distinguished by its smaller size, up to 323 µm vs. up to 487 µm in *T. thysanogaster* (see Todaro et al., 1992), 400 µm and 540 µm in *T. sp. 4* and *T. sp. 5* respectively, and the presence of very large hooks in the anterior neck region. Size differences among species still remain, even if a probable 10% decrease in total body length in our fixed specimens has to be taken into account. The new species differs moreover from *T. thysanogaster* for its generally lower number of adhesive tubes, particularly those of the TbVL and TbV series (up to 20 vs. up to 40 and up to 4 vs. up to 7, respectively). Regarding the arrangement of the TbV in *T. thysanogaster*, one of the differential traits used by Valbonesi & Luporini (1984) to discriminate the

Somalian *Tetranchyroderma* sp. 4 and *T. sp. 5*, from the apparent cosmopolitan *T. thysanogaster*, it should be pointed out that also in the Mediterranean form of the latter species the TbV originate from a common fleshy base (M. A. Todaro, personal observation) and are not borne on a paired broad and only faintly swollen base, as it appears from Boaden's (1965) original drawing.

The species from the Canary Islands differs from *Tetranchyroderma* sp. 4 also by a higher number of adhesive tubes particularly those of the TbA, TbVL and TbV series (up to 10 vs. 8, up to 20 vs. up to 13, and up to 8 vs. 6, respectively) whereas it also differs from *Tetranchyroderma* sp. 5 by a lower number of anterior adhesive tubes, 5 vs. 6 per side, a higher number and different arrangement of the tubes of the TbVL series: up to 20 tubes, one in the pharyngeal region and the other almost regularly spaced along the entire intestinal region in *T. canariense* vs. 11 tubes, of which three are in the pharyngeal region and the remainder confined to the first two third of the intestinal region in *Tetranchyroderma* sp. 5. Moreover, *T. canariense* differs from *Tetranchyroderma* sp. 4 and *Tetranchyroderma* sp. 5 in that each of its caudal feet ends with two tubes instead of three as in the other species.

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