



Italian marine Gastrotricha: VI. Seven new species of Macrodasysida

WILLIAM D. HUMMON¹ & M. ANTONIO TODARO²

¹Department of Biological Sciences, Ohio University, Athens, Ohio 45701 USA. E-mail: hummon@ohio.edu fax: 001-740-593-0300

²Dipartimento di Biologia Animale, Università di Modena e Reggio Emilia, via Campi 213/d, I-41100 Modena, Italy

Abstract

Seven species new to science are described from Italian waters, some of which also occur along nearby coasts: *Macrodasys acrosorus* n. sp. and *M. digronus* n. sp. in the family Macrodasysidae, *Acanthodasys flabellicaudus* n. sp., *Diplodasys sanctimariae* n. sp., *Tetranchyroderma hyponiglarum* n. sp., *T. korynetum* n. sp. and *T. oligopentancrum* n. sp. in the family Thaumastodermatidae.

Key words: Mediterranean Sea, Red Sea, Benthos, Meiofauna, Systematics, Taxonomy, Italy, Cyprus, Egypt

Introduction

The coastline of Italy is the best known long coastline in the world, with 91 species of Gastrotricha Macrodasysida known as of this writing. This introduction reviews the taxonomy of new macrodasysid gastrotrichs from Italy. Only one reference was made to these animals in the 19th century, with the description of *Hemidasys agaso* by Claparède (1867), a species that is probably extinct, its never having been seen again. There were four papers in the first six decades of the 20th century – Remane (1927), Gerlach (1953), Wilke (1954) and Papi (1957)—describing several genera and species. Already, nearly two-thirds of the known genera were reported. The curve continued with three publications in the 1960's—Boaden (1965a, 1965b) and Clausen (1965)—four publications in the 1970's—Schrom in Wieser (1970), Luporini, Magagnini & Tongiorgi (1971, 1973) and Schrom (1972)—and two papers in the 1980's—Tongiorgi & Balsamo (1984) and Todaro, Balsamo & Tongiorgi (1988).

In the last decade of the 20th century, results expanded greatly, with numerous papers on systematics, biogeography and ecology—Todaro, Balsamo & Tongiorgi (1992), Hummon, Todaro & Tongiorgi (1993 “Italian marine Gastrotricha: II”), Balsamo, Fregni & Tongiorgi (1994), Hummon, Todaro, Balsamo & Tongiorgi (1996 “Italian marine Gastrotricha: III”), Hummon, Todaro, Tongiorgi & Balsamo (1998 “Italian marine Gastrotricha: V”), Fregni, Tongiorgi & Faienza (1998), and Fregni, Faienza, De Zio Grimaldi, Tongiorgi & Balsamo (1999). In the first decade of the 21st century one additional species was described—Todaro, Guidi, Leasi, & Tongiorgi (2006)—along with an illustrated key to genera of the phylum—Todaro & Hummon (2008). [Note that “Italian marine Gastrotricha: I” and “Italian marine Gastrotricha: IV” were on members of the order Chaetonotida.]

The first decade of this century saw a detailed inventory, cross referenced by site and species to Italian marine Gastrotricha—Todaro, Hummon, Fregni, Balsamo & Tongiorgi (2001). A global database for marine gastrotrichs was established on CD—Hummon (2001)—which was later revised and placed on line—Hummon (2004, 2007, 2009). A homepage web site was begun—Todaro (2002)—with periodic revision in progress—Todaro (2007). A video database was put on line—Hummon, Todaro & Evans (2005)—and to be periodically revised—Hummon (2007, 2009).

Materials and methods

Collections were made littorally using whole-beach transects from about 1991 to 1994, with 6 or more sites spaced more or less equally from lowest water level to high spring tide level, or sublitorally with 1 or more sites located at 0.5 to 5 m water depth. Sites were sampled at depth using a core tube (for wet samples) or shovel and plastic ice-cream scoop (for dry samples). Sampling depths in the sand were mostly continuous, ranging from 0–10 cm (low water and sublittoral levels) to 0–50 cm (high water levels), usually reaching down to ground water levels. Sand was placed in 250 ml whirl-pak bags, kept at temperatures of ca. 20° C and returned to the laboratory as soon as possible (1 to 2 days) for analysis. In the lab, samples were kept at temperatures from 5 to 10° C, where they will keep with little loss of gastrotrich fauna for up to 10 days. Analysis was carried out within a week, beginning with the earliest collected samples or samples with heavy organic loads.

For analysis, 20 ml of sand were placed in a 125 ml plastic cup, with an equal amount of 6 to 7 % MgCl₂ added. After a 10 minute relaxation period, about 30 ml of ambient sea-water were added, the contents swirled, the supernatant poured into a 60 ml plastic Petri dish, the process repeated and the contents of the dish split between two Petri dishes. After allowing the sedimentary and animal contents to settle, the dish was inspected for now-revived gastrotrichs using a Wild M8 stereo-microscope at 18 to 20 x magnification. A desired specimen was transferred to a drop of MgCl₂ on a microscope slide, covered with a 16 mm square coverslip, and the slide transferred to the rotating stage of a Nikon LabPhot 2 microscope having differential interference contrast (DIC) and numerical aperture (n.a.) of 1.00 to 1.25 at higher magnifications.

Videotaping (SVHS or Hi8) was done with a MTI CCD 72 camera system, outfitted with a primary image analyzer, yielding a composite black and white image. Videos have been digitized, edited, and rendered into MPEG 2 and WMV or MPEG 1 versions, to be placed on the server at Ohio University for read-only downloading by other workers (Hummon et al. 2005; Hummon 2009) once the species have been published.

Drawings were made by mapping millimeter units from the computer monitor onto graph paper. A finished drawing involves both dorsal and ventral views of an adult and a composite dorsal/ventral view of a juvenile and/or a subadult when available, all with appropriate scale bars. Light table and variable magnification photocopier aided the production. These views were inked, photocopied and scanned onto the computer. In these illustrations, dorsal and ventral views are mirror images of one another (meaning that the testis in *Tetranchyroderma* is on the left side as seen from below); other illustrators may do dorsal and ventral views as if focusing down through the specimen.

Most species described herein are based on but one or two specimens, all having been videotaped, but not originally identified. Where the species are dominant, co- or sub-dominant in samples, they often include juvenile, sub-adult and adult specimens, while non-dominant species tend to occur in one collection or another, often seen only occasionally in repetitive collections, or not to be seen again because of their rarity.

Abbreviations and conventions

Morphological symbols and conventions are as follows: L: Length; Lt: Length, total: from anterior tip of head to posterior tip of caudum and its adhesive tubes; LPh: Length, pharynx from anterior tip of head to PhJIn; PhJIn: Junction between pharynx and intestine; W: Width; WHd/WNk/WTr/WFrBs/WFrTp: Width of head, neck, trunk, furcal base and furcal tips; H: Height; TbA/TbL/TbD/TbV/TbP: adhesive tubes of the anterior, lateral, dorsal, ventral, and posterior (caudal) group; CO: Caudal organ; FO: Frontal organ; U: Percentage units of Lt from anterior to posterior; Columns: longitudinal in orientation; Rows: transverse in orientation; the caret ^ refers to a type species or locality. Latitude and longitude are given only for type localities; those for other localities can be found in the Global Data Base (Hummon 2009).

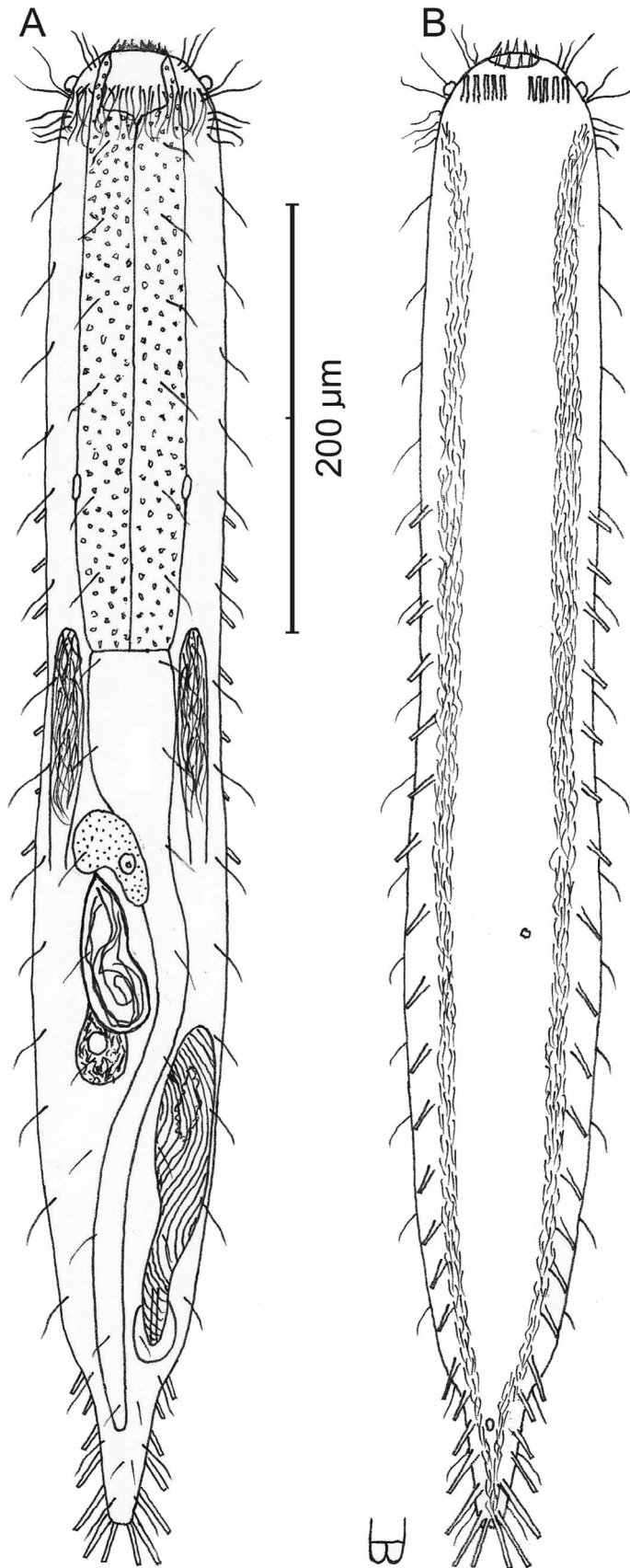


FIGURE 1. *Macrodasys acrosorus* n. sp. A—dorsal and B—ventral views of an adult (Lt=706 µm, LPh=250 µm), from Spiaggia d'Ischia Porto, Isola d'Ischia, Italy, dorsal with digestive and reproductive tracts; ventral with adhesive tubes and ventral locomotor ciliary bands.

Taxonomic account**Order Macrodasysida Remane, 1925 [Rao & Clausen, 1970]****Family Macrodasysidae Remane, 1927****Genus *Macrodasys* Remane, 1924*****Macrodasys acrosorus* new species [Mcd acsr]**

Figure 1 A, B

Macrodasys sp. E (Todaro, Hummon, Balsamo, Fregni & Tongiorgi 2001: p. 89); (Hummon 2001–2009: W Med Database)

Diagnosis: Adult Lt 706 μm ; PhJIn at U35. Head ovoid, without swelling, pestle organs at U02; trunk broad throughout, narrowing near the caudum. Glands inconspicuous. TbA 5 per side, in transverse rows that insert directly on the body; TbL 17 per side, symmetrical, from U30 to the rear, with 3 between the pharyngeal pores and the PhJIn, and 14 in the intestinal region; TbD and TbV absent; TbP 5 per side surrounding the caudum. Locomotor ciliature: paired tracts run from just behind the pestle organs, paralleling the body sides, and joining beneath the caudum rearward of the anus. Mouth sub-terminal, rim bears a corona of fine projections; buccal cavity cup-shaped, lightly cuticularized; pharyngeal pores are sub-basal; intestine broadest in front, narrowing quickly, circling around the reproductive structures to the rear; anus at U90. Hermaphroditic; testes extend rearward from just before the PhJIn; only one small egg was seen; caudal organ is elongate pyriform, homogeneous but hollow toward the front, with a more normal rear, having fine spiral striations throughout, but no coarse spiral or longitudinal musculature being seen; frontal organ has a sharp beak-like apex, a longitudinally bilobed interior chamber that contained active sperm, and a basal cell to the rear; caudal organ overlaps the rearmost part of the frontal organ itself.

Description: Adult Lt 706 μm ; LPh 250 μm to PhJIn at U35 (Fig. 1 A, B). Body medium in length as an adult, ventrally flattened, dorsally vaulted; head ovoid, without swelling, but bearing pestle organs at U02; trunk broad throughout, narrowing gradually to the caudum. Widths at pestle organs/pharyngeal pores/PhJIn/tip of CO/anus/caudum (min.) and locations along the length of the body are as follows: 59/85/79/91/39/11 μm at U02/U29/U35/U65/U90/U99, respectively. Epidermis unarmored, glands not conspicuous.

Adhesive tubes: TbA 5 per side (L 12 μm), in transverse rows, which insert directly on the postoral body surface at U03 and project forward; TbL 17 per side (L 12–15 μm), symmetrically placed, from U30 rearward, with 0 before the pharyngeal pores, 3 between the pores and the PhJIn, and 14 in the intestinal region; TbD and TbV are absent; TbP 5 per side surrounding the caudum posterior to the anus, all as long as or larger than the rearmost TbL.

Ciliation: Sensory cilia (L 14–28 μm) occur on either side of the mouth, with a circlet of cilia surrounding the head above the pestle organs; longer sensory hairs (L similar) arise in two columns on either side of the body, lateral and dorsal, with 16–18 per column. Ventral locomotor ciliature: paired tracts of short cilia (L 10–12 μm) run from just behind the pestle organs, paralleling the body sides, and joining beneath the caudum rearward of the anus.

Digestive tract: Mouth slightly subterminal, 24 μm in diameter; mouth rim bears a corona of a dozen fine projections (L 8 μm); buccal cavity expands with depth and is lightly cuticularized; pharynx has sub-basal pharyngeal pores at U29; intestine is broadest in front, narrowing quickly at about U50 and then circling around the reproductive structures to the rear; anus is at U90.

Reproductive tract: Testes extend rearward from just before the PhJIn, vasa deferentia not seen; eggs appear to develop from rear to front, only a small one being seen in this specimen, with no additional germinal vesicles; caudal organ is elongate pyriform, homogeneous with a hollow opening in the front but with a more

normal rear end, having fine spiral striations throughout, but no coarse spiral musculature or longitudinal musculature being seen; frontal organ has a sharp beak-like apex, a longitudinally bilobed interior chamber that contained active sperm, a ventral opening in the rear of the anterior chamber, and a basal cell to the rear; caudal organ overlaps the basal cell and the rearmost part of the frontal organ itself.

Ecology: Sparse in frequency of occurrence (fewer than 10% of samples), rare in abundance (less than 1% of a sample); *sublittoral* in fine, medium to medium-well sorted clean sand at 1.5–3.0 m water depth.

Geographical distribution: MED: EUROPE: ITALY: Campania Archipelago {Isola d'Ischia: Bagnetielli, Spiaggia d'Ischia Porto^ 40°,45'N/13°,56'E [video]}.

Remarks: The description of *Macrodasys acrosorus* n. sp. is taken from a single specimen, the only one found (WDH video #262, a holotype, ICZN Articles 73.1.2). Unusual is the ventral ciliation of paired lateral tracks, the homogeneous caudal organ, having fine spiral striations, and the longitudinally bilobed frontal organ with a beak-like apex.

Etymology: The species is named for the sharply pointed beak-like tip (Greek: *akros*) of the hollow (Greek: *soros*) frontal organ.

Taxonomic affinities: To the 28 species currently in the genus *Macrodasys* are being added two new species *M. acrosorus* n. sp. and one to be described below, bringing the number to 30. No other species of medium length in this genus has the following combination of characters: ventral ciliation with paired lateral tracks, a homogeneous caudal organ, having only fine spiral striations, and a longitudinally bilobed frontal organ with a beak-like apex, PhJIn at U35, TbA 5 per side, TbL/TbP 17/5 per side, occurring regularly from the pharyngeal pores rearward.

***Macrodasys digronus* new species [Mcd dgrn]**

Figure 2 A, B

Macrodasys sp. II (Evans, Todaro & Hummon 1993: Tab. I)

Macrodasys sp. C (Todaro, Hummon, Balsamo, Fregni & Tongiorgi 2001: p. 101); (Hummon 2001–2009: W Med Database)

Diagnosis: Adult Lt 753 µm; PhJIn at U41. Head ovoid, with slight swelling behind the pestle organs at U03; trunk broad, but constricting in the regions of the rear pharynx and the frontal organ, before narrowing to the caudum. Glands inconspicuous. TbA 5 per side, in transverse rows that insert directly on the body; TbL 25 per side, symmetrical, but variably spaced, from U37 to the rear, with 1 at the rear of the pharynx, 1 at the PhJIn, and 23 in the intestinal region; TbD and TbV absent; TbP 7 per side surrounding the caudum. Locomotor ciliation: complete ventral covering. Mouth sub-terminal, rim bears a corona of fine projections; buccal cavity lightly cuticularized; pharyngeal pores are sub-basal; intestine broadest in front, narrowing to the rear; anus at U94. Hermaphroditic; testes extend rearward from the PhJIn; an undeveloped egg and a germinal vesicle were seen; caudal organ has a narrow glandular forward portion and a broader rear portion, sinuous at its base, with an internal canal, but no coarse spiral or longitudinal musculature being seen; frontal organ has a double apical section, the one somewhat more ventrolateral to the other, with a bulge in the rear that contains a ventral opening, the interior not containing active sperm, and a basal cell to the rear; caudal organ overlaps part of the basal cell but not the frontal organ itself.

Description: Adult Lt 753 µm; LPh 310 µm to PhJIn at U41 (Fig. 2 A, B). Body medium in length as an adult, ventrally flattened, dorsally vaulted; head ovoid, with a slight swelling, behind the pestle organs at U03; trunk broad, but constricting in the regions of the rear pharynx and the frontal organ, before narrowing gradually to the caudum. Widths at pestle organs/pharyngeal swelling/pharyngeal pores/mid-testes/midFO/midCO/anus/caudum (min.) and locations along the length of the body are as follows: 62/86/65/93/75/79/29/20 µm at U03/U10/U30/U48/U64/U76/U94/U96, respectively. Epidermis unarmored, glands not conspicuous.

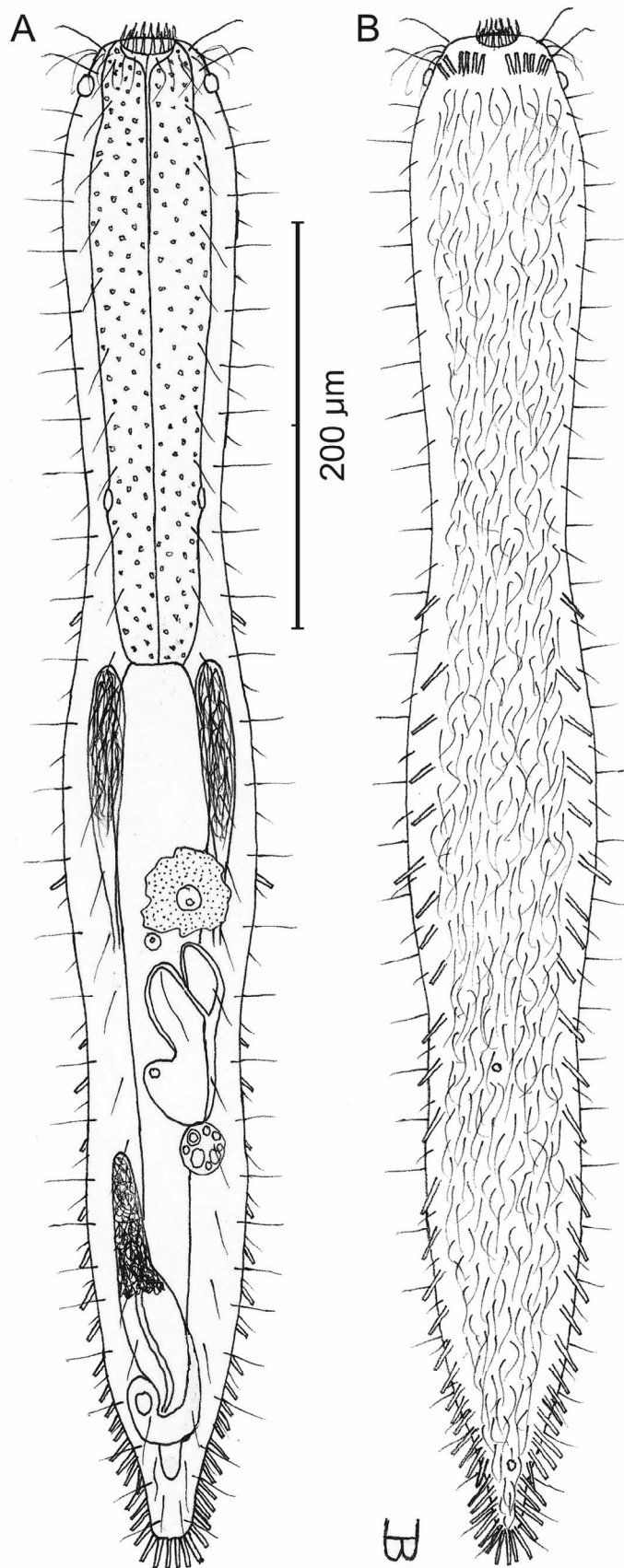


FIGURE 2. *Macrodasys digronus* n. sp. A—dorsal and B—ventral views of an adult (Lt=753 µm, LPh=310 µm), from Caorle W, Italy, dorsal with digestive and reproductive tracts; ventral with adhesive tubes and the ventral locomotor ciliary band.

Adhesive tubes: TbA 5 per side (L 12 μ m), in transverse rows, which insert directly on the postoral body surface at U01 and project forward; TbL 25 per side (L 16–22 μ m), symmetrically placed, but with variable spacing, from U37 rearward, with 0 before the pharyngeal pores, 1 at the rear of the pharynx, 1 at the PhJIn, and 23 in the intestinal region; TbD and TbV are absent; TbP 7 per side surrounding the caudum posterior to the anus, all as long as the largest TbL.

Ciliation: A few hooked sensory cilia (L 28–30 μ m) occur on either side of the mouth, with a cirlet of cilia surrounding the head in front of the pestle organs; other sensory hairs arise in three columns on either side of the body, lateral and dorsal (L similar), and ventrolateral (L 12–15 μ m) with 25–28 per column. Ventral locomotor ciliation: the entire ventral surface is covered with cilia (L 18–22 μ m), with bare spots beneath the frontal organ opening and the anus.

Digestive tract: Mouth slightly subterminal, 24 μ m in diameter; mouth rim bears a corona of a dozen fine projections (L 8 μ m); buccal cavity is lightly cuticularized; pharynx has sub-basal pharyngeal pores at U30; intestine is broadest in front, narrowing slowly to the rear; anus is at U94.

Reproductive tract: Testes extend rearward from the PhJIn, vasa deferentia not seen; eggs develop from rear to front, one undeveloped being seen in this specimen, with an additional germinal vesicle immediately to its rear; caudal organ is two parted, the fore part narrow and glandular, the rear part broader, sinuous at its rear with an internal longitudinal canal, but with no coarse spiral musculature or longitudinal musculature being seen; frontal organ has a double apical section, the one somewhat more ventrolateral to the other, with a medial bulge in the rear that contains the ventral opening, and a basal cell to the rear; sperm were not seen internally; caudal organ overlaps part of the basal cell but not the frontal organ itself.

Ecology: Sparse in frequency of occurrence (fewer than 10% of samples), rare in abundance (less than 1% of a sample); *littoral* in very fine, medium to medium-well sorted clean sand at 0–10 cm depth MLWN-MLWS.

Geographical distribution: **MED: EUROPE: ITALY:** *Veneto* {Caorle W[^] 45°,35'N/12°,52'E [video]}.

Remarks: The description of *Macrodasys digronus* **n. sp.** is taken from a single specimen, the only one found (WDH video #261, a holotype, ICZN Articles 73.1.2). Unusual is the frontal organ with its double apical section, one somewhat more ventrolateral to the other, with a medial bulge in the rear that contains the ventral opening, and the caudal organ that overlaps part of the basal cell of the frontal organ, but not the frontal organ itself.

Etymology: The species is named for the double (Greek: *di-*) apical section of the cavernous (Greek: *gronos*) frontal organ.

Taxonomic affinities: No other species in the genus *Macrodasys* has the combination of characters that occur in *M. digronus* **n. sp.**: a frontal organ having a double apical section, one more ventrolateral than the other, with a bulge containing the ventral opening, and a caudal organ that overlaps part of the basal cell of the frontal organ, but not the frontal organ itself, PhJIn at U41, TbA 5 per side, TbL/TbP 25/7 per side, occurring regularly from the rear pharynx back.

Family Thaumastodermatidae Remane, 1927

Subfamily Diplodasyinae Ruppert, 1978

Genus *Acanthodasys* Remane, 1927

Acanthodasys flabellicaudus new species [Acd fvcd]

Figure 3 A–E

Acanthodasys sp. B (Todaro, Hummon, Balsamo, Fregni & Tongiorgi 2001: p. 122); (Hummon 2001–2009: W Med Database)

Diagnosis: Adult Lt 592 μ m; PhJIn at U27. Head end nearly squared off; trunk broadens somewhat in the

pharyngeal region, becomes obesely broad in the mid-intestinal region, then narrows in two stages to the rounded caudum. Glands 30–32 per side, most dense behind the anus. Epidermis is covered with small T-shaped uniancres, similar both dorsally and ventrally, having no intervening cuticular elements; only the ciliated patches of locomotor cilia are free of uniancres. TbA 5 per side, inserting directly on the body, projecting forward to diagonally outward; TbVL 12 per side, 9 at U18-U57, with 3 at the rear of the pharynx, and 6 in the fore intestinal region, the remaining 3 at U73, U90 and U94, the final 2 being in the postanal region; TbDL 3 per side, asymmetrically placed at U29-U59; TbL *per se*/TbV absent; TbP 6, longer medially than laterally, occur on the rounded rear of the caudum. Locomotor ciliature: a field of ciliary patches, interspersed with the ventral uniancres. Mouth terminal, as broad as the fore end of the body, rim bears a corona of cilia; non-cuticularized buccal cavity narrows quickly; narrow pharynx has inconspicuous basal pharyngeal pores; intestine broadest in the middle, narrowing gradually fore to aft; anus at U89. Hermaphroditic; testes are bilateral in this subfamily, beginning just behind the PhJIn, with vasa deferentia continuing rearward before joining medially at U73 and leading rearward to an irregularly shaped longitudinal caudal organ with a medial canal and some glandular material; a developing egg and 2 germinal vesicles occur in the mid-intestinal region; a spherical frontal organ is hyaline and bears motile sperm; another spherical structure bearing small round objects occurs between the germinal vesicles and the frontal organ; a dorsal rosette occurs in the fore-intestinal region at U38.

Description: Adult Lt 592 μm ; LPh 158 μm to PhJIn at U27 (Fig. 3 A, B). Body long as an adult, ventrally flattened, dorsally vaulted; head end nearly squared off; trunk broadens somewhat in the pharyngeal region, becomes obesely broad in the mid-intestinal region, then narrows in two stages to the rounded caudum. Widths at and just behind mouth/PhJIn/mid-intestine/anus/caudum and locations along the length of the body are as follows: 44,40/62/92/40/15 μm at U01,U02/U27/U60/U89/U97, respectively. Glands 30–32 per side (2–4 μm diam.) are scattered in lateral and dorsal columns, most densely clustered behind the anus.

Cuticular Armature: Epidermis is covered with small T-shaped uniancres (Fig. 3 E), of similar size ventrally and dorsally (L 8 μm), having no intervening cuticular elements. Only the ciliated patches of locomotor cilia are free of uniancres.

Adhesive tubes: TbA 5 per side (L 5–7 μm), in a broad, shallow arc, inserting directly on the postoral body surface at U02-U03 and project forward to diagonally outward; TbVL 12 per side (L 12–14 μm), with 9 at U18-U57, most symmetrically placed, 0 of these in the fore pharyngeal and 3 in the rear pharyngeal regions, and 6 in the fore intestinal region, the remaining 3 occurring symmetrically at U73, U90 and U94, the final 2 being in the postanal region; TbDL 3 per side, asymmetrically placed at U29-U59; TbL *per se*/TbV are absent; TbP 6 (L 14–17 μm), longer medially than laterally, occur on the rounded rear of the caudum.

Ciliation: Mouth rim bears a corona of cilia (L 8–12 μm); sensory hairs arise in lateral columns on either side of the body (L 6–10 μm), numbering c. 45 each. Ventral locomotor ciliature forms a field of ciliary patches (cilia L 10 μm), interspersed with the ventral uniancres (Fig. 3 D).

Digestive tract: Mouth terminal, as broad as the fore end of the body, width 39 μm ; non-cuticularized buccal cavity narrows quickly; narrow pharynx has inconspicuous basal pharyngeal pores; intestine is broadest in the middle, narrowing gradually to the rear; anus is at U89.

Reproductive tract: Testes are bilateral in this subfamily, beginning just behind the PhJIn, with vasa deferentia continuing rearward before joining medially at U73 and leading rearward in the hind-intestinal region to a longitudinally oriented caudal organ of irregular shape that has a medial canal, followed to the rear by some glandular material; a developing egg (39 x 52 μm) and 2 germinal vesicles occur in the mid-intestinal region; a spherical frontal organ occurs that is hyaline and bears a cell-like structure and some motile sperm; another spherical structure with a dozen small round objects occurs between the germinal vesicles and the frontal organ; a dorsal rosette occurs in the fore-intestinal region at U38.

Ecology: Sparse in frequency of occurrence (less than 10% of samples), scarce in abundance (3–5 % of a sample); *sublittoral* in fine, medium-well sorted, clean sand, 5.0 m water depth, 0–10 cm depth.

Geographical distribution: MED: EUROPE: ITALY: Campania Archipelago {Isola d'Ischia: Spiaggia degli Inglesi^ 40°,45'N/13°,56'E [2-videos]}

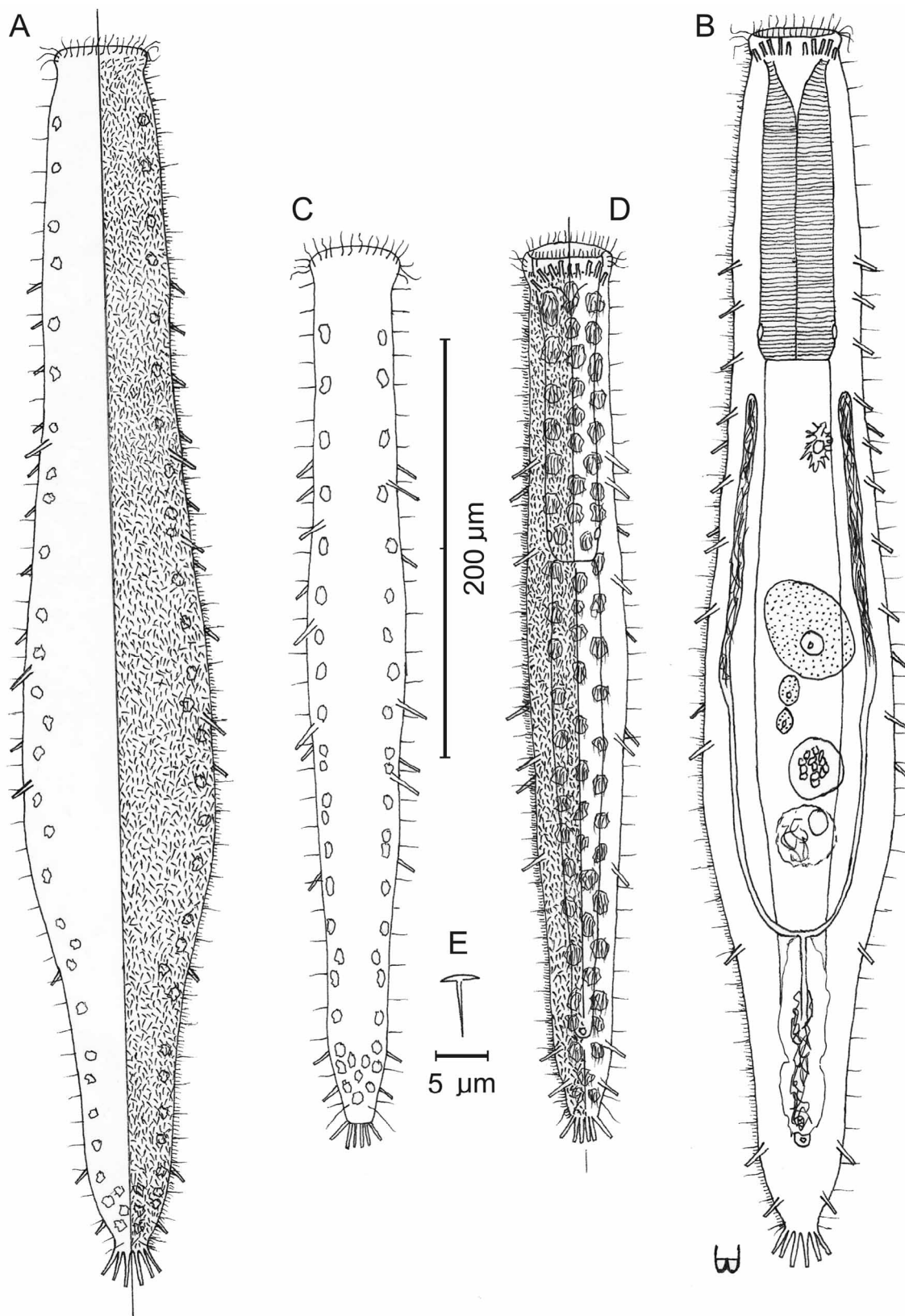


FIGURE 3. *Acanthodasys flabellicaudus* n. sp. A—dorsal and B—ventral views of an adult (Lt=592 μ m, LPh=158 μ m); C—dorsal and D—ventral views of a subadult (Lt=428 μ m, LPh=152 μ m), both from Spiaggia degli Inglesi, Isola d'Ischia, Italy, dorsal with glands, adhesive tubes and the cuticular armature of uniancres (shown only on the left side as seen from below, (A) or just glands and tubes (C)); ventral with digestive and reproductive tracts, and adhesive tubes (B) or with cuticular armature of uniancres shown on the side, along with digestive tract, adhesive tubes and the ventral locomotor ciliary patches (D). E—a uniancre with its separate scalebar.

Remarks: The description of *Acanthodasys flabellicaudus* n. sp. is taken from two specimens, both from the same location. One (WDH video #9, Fig. 3 A,B, a holotype, ICZN Article 73.1.1) is a mature adult. The other (WDH video #10, Fig. 3 C,D, a paratype, ICZN Article 72.4.5) is a subadult: Lt 428 µm; LPh 152 µm, with TbA 4 or 5 per side, TbVL 7 per side, TbD 3 per side, and TbP 6 per side.

Etymology: The species is named after the small fan-shaped (Latin *flabellum*) array of rear (Latin *cauda*) adhesive tubes.

Taxonomic affinities: There are currently eight described species of *Acanthodasys*, including: *Acanthodasys flabellicaudus* n. sp., the latter being the only species having a rounded rather than a furcated caudum, together with TbA 5 per side, TbDL 3 per side, and T-shaped uniancres of similar size dorsally and ventrally, with no additional elements in between.

Genus *Diplodasys* Remane, 1927

Diplodasys sanctimariae new species [Dpd smar]

Figure 4 A–D'

Diplodasys sp. A (Todaro, Hummon, Balsamo, Fregni & Tongiorgi 2001: p. 122); (Hummon 2001–2009: W Med Database)

Diagnosis: Adult Lt 375 µm; PhJIn at U32. Head with broadly ovoid mouth, oral hood rounded, without pestle organs; neck narrows twice to the PhJIn, then swells in the trunk region, before narrowing slowly, then quickly to a narrow caudum, bearing short pedicles. Glands 7 per side, of various shapes and sizes. Laterally are 32–33 spines per side in profile, 3–4 each on the pharyngeal swellings and the rest on the trunk. Squamous scales cover the dorsum in 5 columns, imbricated mid-trunk to oral hood from the upper-most 14th scale at U53 and in the opposite direction back to the caudum; each scale appears fenestrated throughout, with 6–8 apertures in an oblong section that is distinct from the remainder of the scale, which is filled with apertures; the oblong section is central in the middle scale, but is rearward in the other scales; ventral scales occur in 5 columns, being diamond to rhomboidal in shape, but without fenestrations. TbA 8 per side bordering the ventral rim (L 8 µm), with an arc of 5 tubes inserting medial to lateral, and a set of 3 lying behind the outermost tubes of the arc, all projecting forward and inserting directly on the postoral body surface at U14–U17; TbVL 2 per side, both duo-gland, at U90 and U97; TbV 24 per side, at U33–U94, all being of similar size and regularly spaced along to just behind the intestinal region, with 2 of these in the post-anal region; TbD are absent; TbP 10 (L 6–8 µm), 3 per side on the caudal pedicles, all duo-gland, forming the fused ‘two fingers and a thumb’ typical of the family, but lacking a cirratum-like element inserting between the ‘fingers,’ and 4 total forming a transverse row just behind the anus. Locomotor ciliature: forms two lateral bands that run the length of the body, merging behind the anus. Mouth subterminal, as broad as the fore end of the body, rim bears tactile hairs of two lengths; non-cuticularized buccal cavity narrows quickly; broad pharynx has inconspicuous basal pharyngeal pores at U30; intestine narrows front to rear; anus at U91. Hermaphroditic; testes bilateral, beginning just behind the PhJIn, with vasa deferentia running rearward and joining just before the anus; 2 developing eggs were seen in the hindgut region; caudal organ not seen; small hyaline sac-like frontal organ, oblong in shape and bearing motile sperm, occurred before the foremost egg.

Description: Adult Lt 375 µm; LPh 97 µm to PhJIn at U32 (Fig. 4 A, B). Body medium-short in length as an adult, ventrally flattened, dorsally vaulted; head end with broad ovoid mouth, oral hood rounded, without pestle organs; neck narrows twice to the PhJIn, then swells in the trunk region, before narrowing slowly, then quickly to a narrow caudum, bearing short pedicles. Widths at ventral rim to PhJIn/fore trunk to rear trunk/caudal base and locations along the length of the body are as follows: 83/76,82,75/95,66/30 µm at U13/U21,U27,U32/U55,U82/U97, respectively. Glands 7 per side, of various shapes (roundish to oblong) and sizes (4 x 7 to 6 x 16 µm).

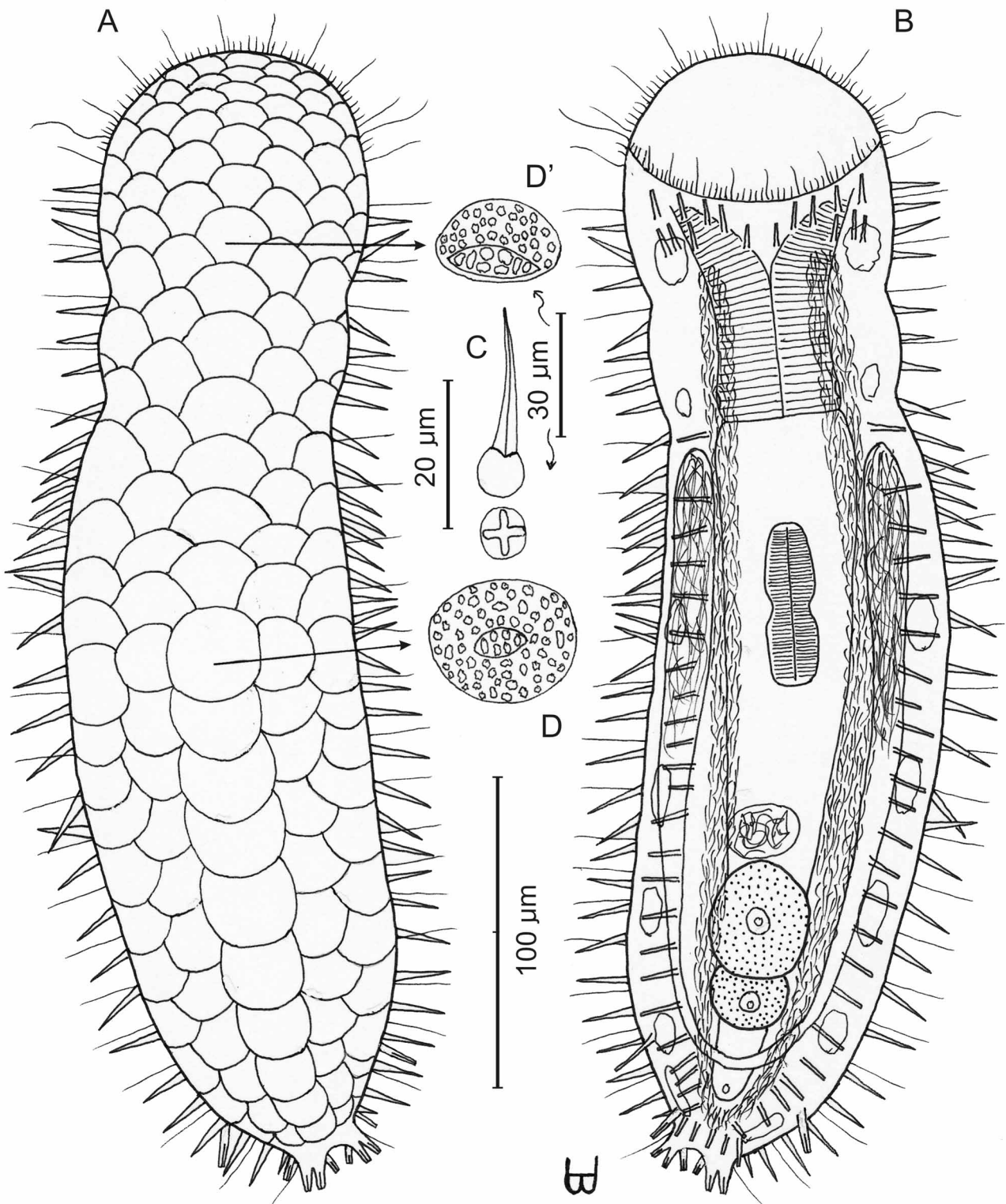


FIGURE 4. *Diplodasys sanctimariae* n. sp. A—dorsal and B—ventral views of an adult (Lt=375 μ m, LPh=97 μ m) from Santa Maria di Leuca, Italy, dorsal with lateral spines and dorsal scales; ventral with digestive and reproductive tracts, locomotor ciliary bands, lateral spines and adhesive tubes. C—spine in longitudinal and cross-sectional views with its separate scalebar; D and D' dorsal scales with apparent fenestrations and their separate scale bar.

Cuticular Armature: Laterally are 32–33 spines per side as seen in profile, 3–4 each on the two pharyngeal swellings and the remainder on the trunk (Fig. 4 C); they are longest on the foretrunk (16 μ m), shortest on the hindtrunk (6 μ m), and are + shaped in cross-section. Squamous scales cover the dorsum in 5

columns, imbricated mid-trunk to oral hood from the upper-most scale (the 14th scale in Fig. 4 D, and the 7th in Fig. 4 D') centering at U53 and in the opposite direction back to the caudum; each scale appears fenestrated throughout, with 6–8 apertures in an oblong section that is distinct from the remainder of the scale, which is filled with apertures; the oblong section is central in the middle scale, but is rearward in the forward and rearward scales. Ventral scales occur in 5 columns, being diamond to rhomboidal in shape, but without fenestrations.

Adhesive tubes: TbA 8 per side bordering the ventral rim (L 8 μ m), with an arc of 5 tubes inserting medial to lateral, and a set of 3 lying behind the outermost tubes of the arc, all projecting forward and inserting directly on the postoral body surface at U14-U17; TbVL 2 per side, both duo-gland, at U90 and U97; TbV 24 per side (L 10–13 μ m), from U33 to U94, all being of similar size and regularly spaced in, to just behind, the intestinal region, with 2 of these in the post-anal region; TbD are absent; TbP 10 (L 6–8 μ m), 3 per side on the caudal pedicles, all duo-gland, forming the fused 'two fingers and a thumb' typical of the family, but lacking a cirratum-like element inserting between the 'fingers,' and 4 total forming a transverse row just behind the anus.

Ciliation: Mouth rim bears a corona of some 65 short (L 3 μ m) tactile and 18 longer (L 14–18 μ m) vibratile cilia; other sensory hairs (L 20–26 μ m) occur in lateral columns on either side of the body, numbering 20–22 per side. Ventral locomotor cilia form two lateral bands that run the length of the body, merging behind the anus.

Digestive tract: Mouth subterminal, as broad as the fore end of the body, width 83 μ m; non-cuticularized buccal cavity narrows quickly; broad pharynx has inconspicuous basal pharyngeal pores at U30; intestine is broadest in front, narrowing slightly to the rear; anus is at U91.

Reproductive tract: Testes occur bilaterally in this subfamily, beginning just behind the PhJIn, with vasa deferentia running rearward and joining just forward of the anus; 2 developing eggs were seen in the hindgut region; caudal organ not seen, but a hyaline, sac-like frontal organ, oblong in shape (14 x 20 μ m) and bearing motile sperm, was seen before the foremost egg.

Ecology: Occasional in frequency of occurrence (10–30% of samples), rare to prevalent in abundance (less than 1% to greater than 30% of a sample, sometimes occurring as a co-dominant [cdom]); *sublittoral* in fine to very coarse, medium to poorly sorted, sand at 1–12 m water depth, sometimes between patch reefs of coral, sometimes in depressions in reef platforms.

Geographical distribution: MED: EUROPE: CYPRUS: {Protaras [2-videos]}; **ITALY: Puglia:** Santa Maria di Leuca[^] 39°47'N/18°18'E}. **MED: AFRICA: EGYPT:** {Abu Ramada 2 [video], Tareef el-Reeh S [cdom] [video], Tip RM [video]}.

Remarks: *Diplodasys sanctimariae* n. sp. does not have an extant specimen, the description and Fig. 4 being based on the drawing of a live type specimen (ICZN, Article 73.1.2) from Santa Maria di Leuca, which was lost in the process of transfer. There being no adult on video, we designate as paratypes (ICZN, Article 72.4.3) WDH video #2534, from Protaras, Cyprus in the Mediterranean Sea: Lt 315 μ m, LPh 155 μ m; WDH #827, a subadult also from Protaras: Lt 200 μ m; LPh 102 μ m; and WDH #824, a juvenile from Abu Ramada, Egypt in the Red Sea: Lt 122 μ m; LPh 62 μ m The 12 m water depth collection from Abu Ramada was taken by SCUBA, the 4 m collections by snorkling.

Etymology: The species is named (ICZN Article 32.5.2.4.1) after the location in Puglia, Santa Maria di Leuca, from which it was first found.

Taxonomic affinities: *Diplodasys sanctimariae* n. sp. is the only medium sized animal (compare Clausen 2004: Tab. 3) that has two incisions in the pharyngeal region, single spines along the sides (with 3 or 4 before the first incision and 3 or 4 between the first and second, 30 on the trunk), 5 columns of both dorsal and ventral scales, a caudum with paired pedicles, the central dorsal plate having an inner oblong with 6 fenestrations and an outer circle bearing fenestrations throughout, TbA in 2 rows of 5 and 3 per side, TbV 24 per side, and a transverse row of TbP that lies just behind the anus, as well as 3 each on the pedicles.

Subfamily Thaumastodermatinae Ruppert, 1978**Genus *Tetranchyroderma* Remane, 1926*****Tetranchyroderma hyponiglarum* new species [Tet hpng]**

Figure 5 A–C

Tetranchyroderma sp. AC (Todaro, Hummon, Balsamo, Fregni & Tongiorgi 2001: p. 128); (Hummon 2001–2009: W Med Database)

Diagnosis: Adult Lt 504 μm ; PhJIn at U28. Head end rounded, without tentacles or sensorial knobs; body narrowest at the PhJIn, broadest in the anal region, then narrowing to the broad caudal base; caudal pedicles medium, with a concave medial border indenting to U95. Epidermis fully covered with small tetrancres. Glands small, 16 per side, with a cluster of 8 in the rump region. TbA 4 per side, form a stepped transverse row, tubes inserting directly on the body, the most medial separated from the 3 more lateral by a small gap; TbL 13 per side, 1 in the fore pharyngeal region, the others regularly spaced and of similar size occur along the intestine at U31–U85, with 2 inserting behind the anus; TbV occur as a solitary tube or a fan of 3 tubes with a common base; TbD absent; TbP 3 per side on the caudal pedicles, forming the fused ‘two fingers and a thumb’ typical of the family, with a cirratum-like element inserting between the ‘fingers’, with 3 more tubes in the interpeduncular space (total 5). Locomotor ciliature: a single field covers the ventral body surface. Mouth subterminal, narrower than the fore end of the body, oral hood reaches only to U02; buccal cavity non-cuticularized; pharynx has basal pharyngeal pores; intestine broadest in the middle, narrowing to the rear; anus at U91. Testis is on left as seen from below; vas deferens opens into the rear of the bibulbed caudal organ in front of the anus; developing egg occurs in the rear mid-gut region; round frontal organ bears small spheres, and was without sperm.

Description: Adult Lt 504 μm ; LPh 140 μm to PhJIn at U28 (Fig. 5 A, B). Body elongate as an adult, ventrally flattened, dorsally vaulted; head end rounded, without tentacles or sensorial knobs; trunk narrows in the PhJIn region, broadens gradually to the anal region, then narrows to the broad caudal base; caudal pedicles medium (L 25 μm) naked, with a concave margin separating the two groups, indenting medially to U95. Widths behind mouth/PhJIn/midgut/anus/caudal base and locations along the length of the body are as follows: 42/38/51/59/48 μm at U04/U28/U60/U85/U97, respectively. Glands 16 per side (5–10 μm diam.) are scattered along the sides in lateral and dorsal columns, with a cluster of 8 lying just before the caudal base.

Cuticular Armature: Small tetrancres fully cover the dorsal, lateral and ventrolateral epidermis; aneres (Fig. 5 C; W 2–3 μm , H 3–5 μm) are smaller in the fore body than in the mid- and hindbody. They are absent from the oral hood and caudum.

Adhesive tubes: TbA 4 per side (L 10–12 μm), forming a stepped transverse row, the tubes inserting directly on the postoral body surface at U03–U04, the most medial occurring behind the others and pointing forward, and after a small separation the 3 more lateral pointing obliquely forward; TbL 13 per side (L 12–26 μm), with 1 in the fore pharyngeal region at U10, none in the hind pharyngeal region, 10 of varying size and irregular spacing in the intestinal region at U31–U85, and 2 inserting behind the anus; TbV occur as a solitary tube or a fan of 3 tubes with a common base (L 18–24 μm) at U78; TbD are absent; TbP 3 per side on the caudal pedicles, forming the fused ‘two fingers and a thumb’ typical of the family, (L terminal tubes 10–11 μm , L tube on the inner margin also 10 μm), with a cirratum-like element inserting between the ‘fingers,’ and with 3 additional tubes in the interpedicular space for a total of 5.

Ciliation: Short sensory cilia (L 4 μm) surround the entire oral opening, with longer vibratile cilia (L 16–18 μm) on each side of the oral hood; other hairs (L 14 μm) occur regularly along the lateral body surfaces, numbering 28–30 per side; other columns have not been seen. Ventral locomotor ciliature forms a single field of transverse rows beneath the body, extending from U04 to the anus at U92; individual cilia are 10–12 μm in length.

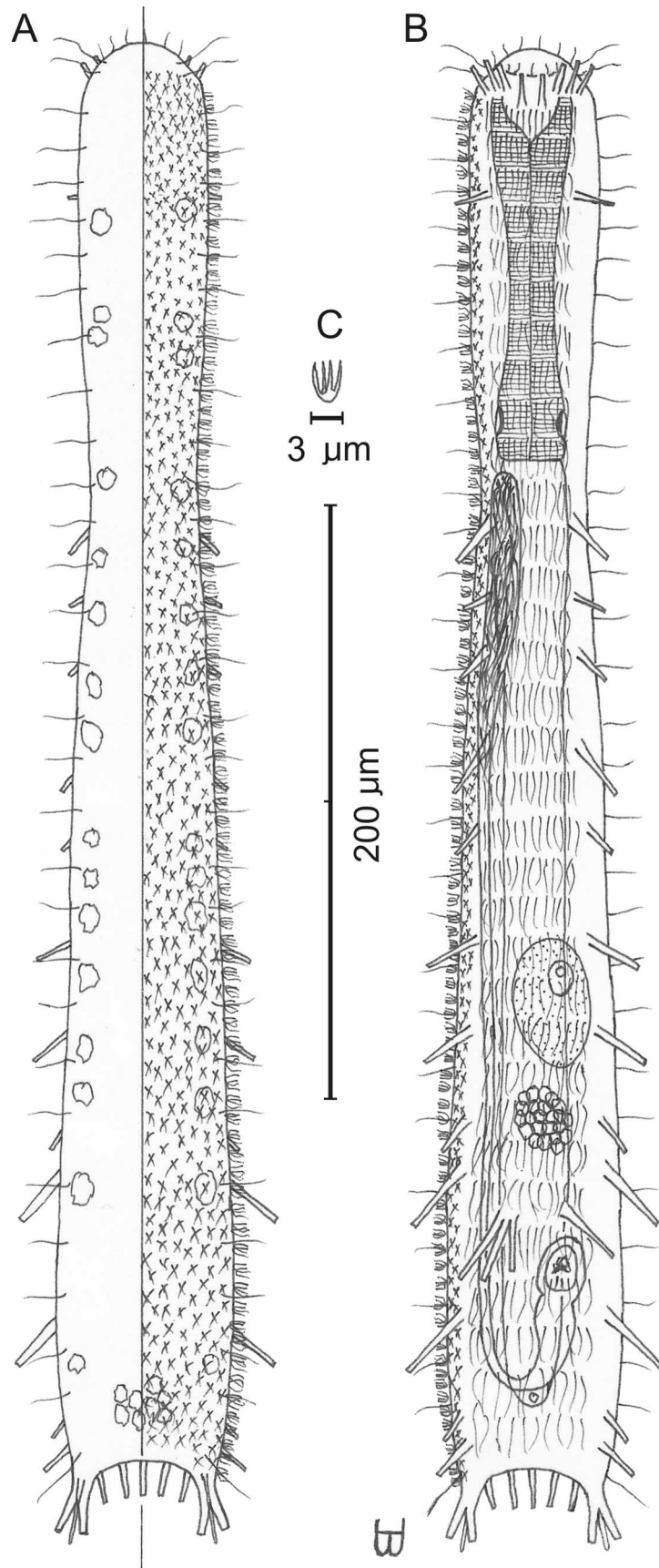


FIGURE 5. *Tetranchyroderma hyponiglarum* n. sp. A—dorsal, B—ventral views of an adult (Lt=704 µm, LPh=130 µm), and C—a tetrancra with a separate scalebar, from Spiaggia d'Ischia Porto, Isola d'Ischia, Italy, dorsal with glands and the cuticular armature of tetrancres shown on the right side; ventral with cuticular armature of tetrancres shown on the left side, along with digestive and reproductive tracts, adhesive tubes and the ventral locomotor ciliary band.

Digestive tract: Mouth subterminal, narrower than the fore end of the body, width 15 μm , the oral hood extending from its tip 10 μm rearward to U02; non-cuticularized buccal cavity narrows quickly; pharynx has basal pharyngeal pores at U25; intestine is broadest in the mid-body, narrowing gradually to the rear; anus is at U91.

Reproductive tract: Testis is on the left side as seen from below; vas deferens opens into the rear of the caudal organ near the anus; a developing egg occurs in the mid-gut region on the opposite side (largest 25 x 41 μm); bibulbous caudal organ (ca. 16 x 40 μm), with a hollow fore bulb, lies in front of the anus; frontal organ is a round cluster (ca. 20 μm diam.) of spheres (3 μm diam.), no sperm being seen.

Ecology: Sparse in frequency of occurrence (less than 10% of samples), rare in abundance (less than 1% of a sample); *sublittoral* in fine, medium-well sorted sand at 1.5–5.0 m water depth.

Geographical distribution: MED: EUROPE: ITALY: Campania Archipelago {Isola d'Ischia: Spiaggia degli Inglesi, Spiaggia d'Ischia Porto^ 40°,45'N/13°,56'E [video]}

Remarks: The description of *Tetranchyroderma hyponiglarum* n. sp. is taken from a single specimen, one of only two found, (WDH video #1521, a holotype, ICZN Article 73.1.2). *T. hyponiglarum* n. sp. is unusual among macrodasyids in being broader in the rear body than in the fore body.

Etymology: The species is named for the adhesive tubes that lie beneath the trunk (Greek: *hypo*) under, beneath (Greek: *niglaros*) small pipe, whistle.

Taxonomic affinities: *Tetranchyroderma hyponiglarum* n. sp. and the two species to be described below bring the total in this genus into the upper-60s. With this species, there are 4 that are tetrancous and have TbV, only 3 of which have been described (Todaro 2002: key to species in the genus, p. 561). *T. hyponiglarum* alone has but one group of TbV, fewer than 15 TbL per side with 1 in the fore pharyngeal and 0 in the rear pharyngeal regions, and only 4 TbA per side. *T. sp. 5* of Valbonesi & Luporini (1984: p. 20, Fig. 9) is closest in overall body shape, being broadest in the rear, but has 0 of 11 TbL in the fore pharyngeal and 3 in the rear pharyngeal regions, while it has 7 TbA per side.

Tetranchyroderma korynetum new species [Tet krnt]

Figure 6 A–C

Tetranchyroderma sp. AB (Todaro, Hummon, Balsamo, Fregni & Tongiorgi 2001: p. 128); (Hummon 2001–2009: W Med Database)

Diagnosis: Adult Lt 300 μm ; PhJIn at U42. Head end rounded, with prominent sensorial knobs; trunk narrows in the fore and hind pharyngeal regions, broadens gradually to the anal region, then narrows to the caudal base; caudal pedicles short naked, with a concave margin between, indenting medially to U98. Epidermis fully covered with relatively large pentaneres. Glands small, 7–8 per side. TbA 5 per side, tubes inserting directly on the body, 1 short and 1 long pair medially, and 3 more laterally; TbVL 16 per side, 1 in the fore pharyngeal region, 1 between pharyngeal pores and PhJIn, and the others with increasing size and spacing along the trunk, with 1 of these inserting behind the anus; TbL *per se*/TbV/TbD absent; TbP 2 per side on the caudal pedicles, forming the fused 'two fingers' typical of the family, lacking the 'thumb' and a cirratum-like element inserting between the 'fingers', but with 3 additional tubes in the interpeduncular space. Locomotor ciliature: a single field covers the ventral body surface. Mouth subterminal, nearly as wide as the fore end of the body, oral hood reaches to U09; buccal cavity non-cuticularized; pharynx has basal pharyngeal pores; intestine broadest in front, narrowing to the rear; anus at U88. Testis is on left as seen from below; vas deferens opens into the rear of the caudal organ near the anus; developing egg(s) not seen; oblong caudal organ lies above the anus; frontal organ is a small sphere.

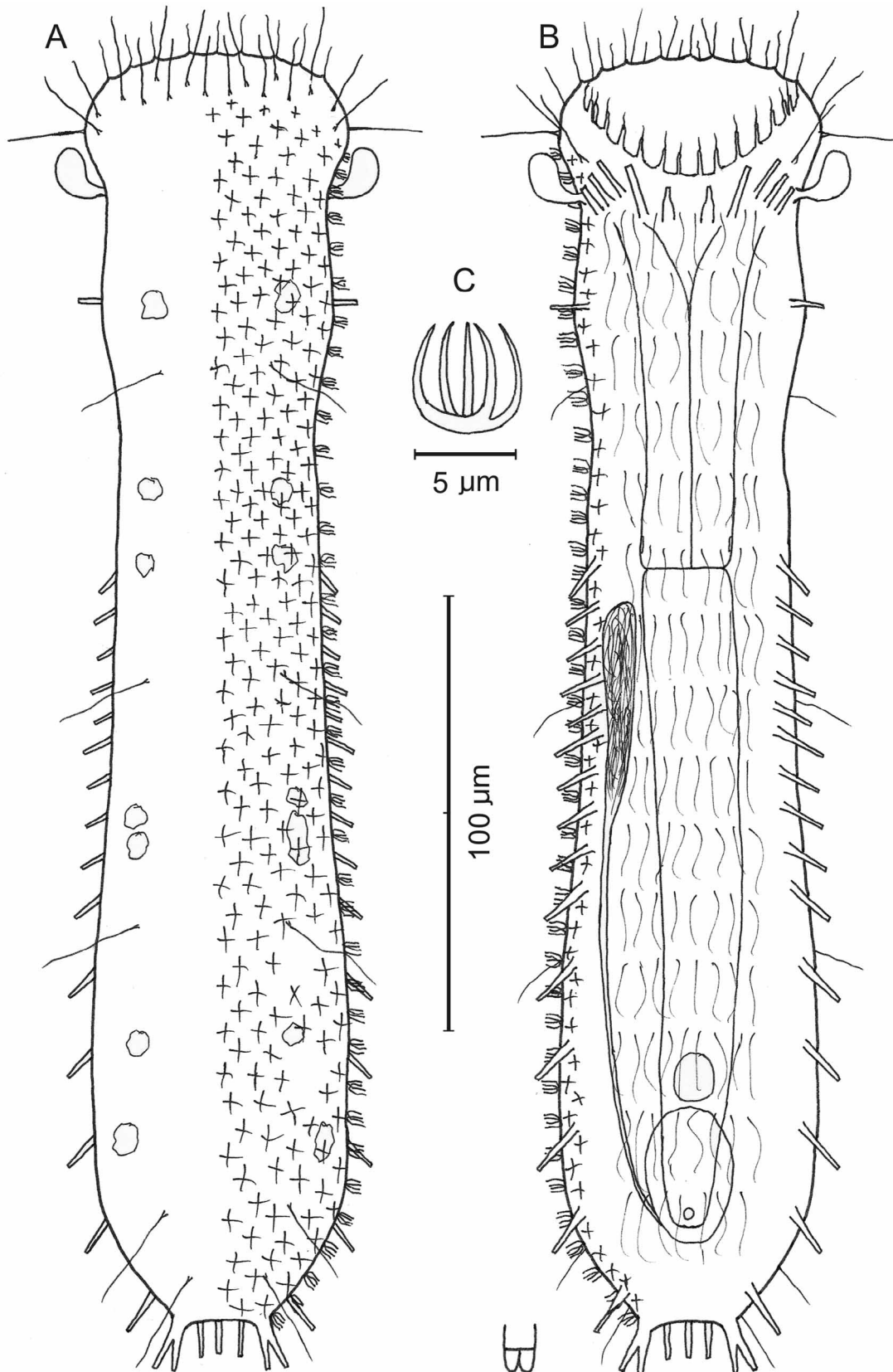


FIGURE 6. *Tetranchyroderma korynetum* n. sp. A—dorsal, B—ventral views of an adult (Lt=300 μ m, LPh=127 μ m), and C—a pentancre with a separate scalebar, from Spiaggia d'Ischia Porto, Isola d'Ischia, Italy, dorsal with glands and the cuticular armature of pentancre shown on the right side; ventral with cuticular armature of pentancre shown on the left side, along with digestive and reproductive tracts, adhesive tubes and the ventral locomotor ciliary band.

Description: Adult Lt 300 µm; LPh 127 µm to PhJIn at U42 (Fig. 6 A, B). Body compact as an adult, ventrally flattened, dorsally vaulted; head end rounded, with prominent sensorial knobs that are asymmetrical front to rear; trunk narrows in the fore and hind pharyngeal regions, broadens gradually to the anal region, then narrows to the caudal base; caudal pedicles short (L 8 µm) naked, with a concave margin separating the two groups, indenting medially to U98. Widths along pharynx/PhJIn/midgut/anus/caudal base and locations along the length of the body are as follows: 43,36,38,31/33/42/16 µm at U06,U11,U20,U29/U42/U85/U95, respectively. Glands 7–8 per side (3–5 µm diam.) are scattered along the sides in columns.

Cuticular Armature: Relatively large pentancreas fully cover the dorsal, lateral and ventrolateral epidermis; ancreas (Fig. 6 C; W and H 5 µm) are smaller on the middle of the oral hood than elsewhere on the body. They are absent from the fore part of the oral hood and caudum.

Adhesive tubes: TbA 5 per side (L 6–9 µm), the tubes inserting directly on the postoral body surface at U10–U12, the most medial occurring behind the others and pointing forward, then the longest tube and finally a set of three, pointing more and more obliquely forward; TbVL 16 per side (L 6–10 µm), with 1 in the fore pharyngeal region at U10, 1 in the hind pharyngeal region between pharyngeal pores and PhJIn, and 14 of varying size and spacing that increases rearward along the trunk, with 1 of these inserting behind the anus; TbL *per se*/TbV/TbD are absent; TbP 2 per side on the caudal pedicles, forming the fused ‘two fingers’ typical of the family, (L terminal tubes 5–6 µm), but lacking the ‘thumb’ and a cirratum-like element inserting between the ‘fingers,’ but with 3 additional tubes in the interpedicular space.

Ciliation: Short cilia (L 5–6 µm) insert on scallops along the dorsal border of the oral hood; shorter ones (L 2–3 µm) insert on finger-like projections (L 2–3 µm) along the ventral border of the oral hood; stout vibratile sensory cilia (L 10–12 µm) occur in two rows on the dorsal oral hood in front of the initial pentancreas, with other vibratile cilia (L 10–12 µm) on either side of the oral hood on lateral and ventral surfaces; other cilia (L 14–20 µm) occur along the dorsolateral body surfaces, numbering perhaps 5–6 per side; other columns have not been seen. Ventral locomotor ciliation forms a single field of transverse rows beneath the body, extending from U12 to the anus at U88.

Digestive tract: Mouth subterminal, nearly as broad as the fore end of the body, width 36 µm, the oral hood extending from its tip 19 µm rearward to U09; non-cuticularized buccal cavity narrows quickly; pharynx has basal pharyngeal pores at U37; intestine is broadest in front, narrowing gradually to the rear; anus is at U88.

Reproductive tract: Testis is on the left side as seen from below; vas deferens opens into the rear of the caudal organ near the anus; developing egg(s) not seen; oblong caudal organ (15 x 20 µm) lies above the anus; frontal organ is a sphere (7 µm diam.).

Ecology: Sparse in frequency of occurrence (less than 10% of samples), rare in abundance (less than 1% of a sample); *sublittoral* in fine, medium-well sorted sand at 1.5 m water depth.

Geographical distribution: MED: EUROPE: ITALY: Campania Archipelago {Isola d’Ischia: Spiaggia d’Ischia Porto^ 40°,45’N/13°,56’E [video]}

Remarks: The description of *Tetranchyroderma korynetum* n. sp. is taken from a single specimen (WDH video #1529, a holotype, ICZN Articles 73.1.2). *T. korynetum* n. sp. is unusual among pentancreous macrodasyids in having prominent sensorial organs that are highly asymmetrical.

Etymology: The species is named for the golf club-like sensorial organs borne laterally on the head (Greek: *korynetes*) club-bearer.

Taxonomic affinities: *Tetranchyroderma korynetum* n. sp. alone has pentancreas and prominent sensorial organs that are asymmetrical front to rear, without having dorsal cephalic tentacles, TbD or TbV. *T. hystrix* Remane, 1926 is a species from Northern Europe with prominent symmetrical sensorial organs that also lacks cephalic tentacles, TbD and TbV; it is also pentancreous as listed by Todaro 2002: key to species in the genus, p. 562; see Hummon & Todaro 2010).

***Tetranchyroderma oligopentacrum* new species [Tet olpn]**

Figure 7 A–E

Tetranchyroderma sp. II (Evans, Todaro & Hummon 1993: Tab. I)*Tetranchyroderma* sp. W (Todaro, Hummon, Balsamo, Fregni & Tongiorgi 2001: p. 128); (Hummon 2001–2009: W Med Database)

Diagnosis: Adult Lt 550 μm ; PhJIn at U23. Head end rounded, without tentacles or sensorial knobs; trunk broadest in the midgut region, narrowing to the caudal base; caudal pedicles short, with a concave medial border indenting to U97. Epidermis partially covered with small pentancreas that occur as epaulets or lateral stripes, sometimes with rump patches. Glands small, 50–60 per side, with a cluster of a dozen in the rump region. TbA 5 per side, form a shallow transverse arc, tubes inserting directly on the body, the most medial separated from the 4 more lateral by a small gap; TbL 25 per side, 1 in the fore pharyngeal region, the others regularly spaced and of similar size occur along the intestine at U25 to the anus, with 2 inserting behind the anus; TbD/TbV absent; TbP 3 per side on the caudal pedicles, forming the fused ‘two fingers and a thumb’ typical of the family, with 3 more tubes in the interpeduncular space (total 5), but lacking any element inserting between the ‘fingers’ Locomotor ciliature: a single field covers the ventral body surface. Mouth subterminal, as broad as the fore end of the body, oral hood reaches to U05; buccal cavity non-cuticularized; pharynx has basal pharyngeal pores; intestine narrows front to rear; anus at U93. Testis is on left as seen from below; vas deferens opens into the rear of the small caudal organ that lies in front of the anus; developing eggs (3, plus 2 germinal vesicles) occur in the rear-gut region; small frontal organ is spherical, hyaline, and contains mobile sperm.

Description: Adult Lt 550 μm ; LPh 129 μm to PhJIn at U23 (Fig. 7 A, B). Body long and thin as an adult, ventrally flattened, dorsally vaulted; head end rounded, without tentacles or sensorial knobs; trunk narrows in the PhJIn region, broadens gradually to the midgut region, then narrows to the caudal base; caudal pedicles short (L 19 μm) naked, with a concave margin separating the two groups, indenting medially to U97. Widths at mouth/PhJIn/midgut/caudal base and locations along the length of the body are as follows: 45/36/54/40 μm at U08/U23/U63/U97, respectively. Glands 50–60 per side (4–8 μm diam.) are scattered along the sides in lateral and dorsal columns, with a cluster of 10–12 lying just before the caudal base.

Cuticular Armature: Small pentancreas, show variable coverage, including most, some or none of the dorsal and lateral epidermis; ancreas (Fig. 7 E; width and height 2–3 μm) are rather constant in size from one location to another. They may occur as epaulets (Fig. 7 A) of 0, 2, 7, or 25 ancreas, or they may occur as stripes down the sides of the body (Fig. 7 C), with perhaps small to larger patches in the neck and/or rump region, or they may occur as interrupted patches (Fig. 7 D) down the sides and across the rump.

Adhesive tubes: TbA 5 per side (L 6–10 μm), forming a shallow transverse arc, the tubes inserting directly on the postoral body surface at U05–U06, the most medial pointing forward, and after a small separation the 4 more lateral pointing obliquely forward; TbL 25 per side (L 8–12 μm), with 1 in the fore pharyngeal region at U10, none in the hind pharyngeal region, 22 regularly spaced in the intestinal region between U25 and the anus at U93, and 2 inserting behind the anus; TbD/TbV are absent; TbP 3 per side on the caudal pedicles, forming the fused ‘two fingers and a thumb’ typical of the family, (L terminal tubes 8 μm , L tube on the inner margin also 8 μm), with 3 additional tubes in the interpedicular space for a total of 5, but lacking any element inserting between the ‘fingers’.

Ciliation: Short sensory cilia (L 4–7 μm) surround the entire oral opening, with longer vibratile cilia (L 16–19 μm) on each side of the oral hood; other hairs (L 18–20 μm) occur regularly along the lateral, dorsolateral and dorsal body surfaces, numbering 16–18 per side. Ventral locomotor ciliature forms a single field of transverse rows beneath the body, extending from U07 to the anus at U94; individual cilia are 10–12 μm in length.

Digestive tract: Mouth subterminal, as broad as the fore end of the body, width 42 μm , the oral hood extending from its tip 26 μm to U05; non-cuticularized buccal cavity narrows quickly; pharynx has basal pharyngeal pores at U22; intestine is broadest in the mid-body, narrowing gradually to the rear; anus is at U93.

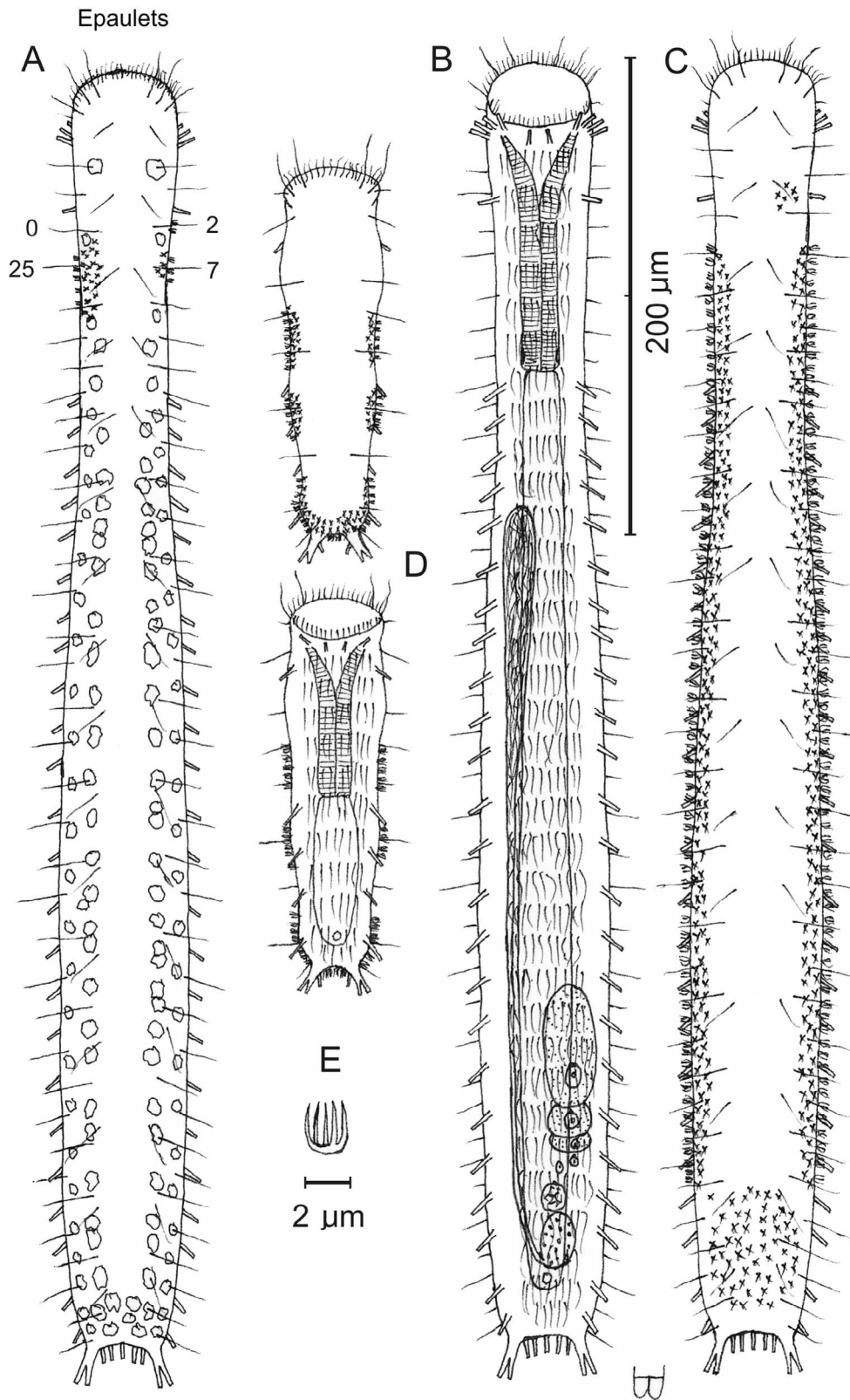


FIGURE 7. *Tetranchyroderma oligopentacrum* n. sp. A—dorsal, B—ventral views of an adult (Lt=550 µm, LPh=148 µm), from Diano Marina, Italy, dorsal with glands and the cuticular armature shown as epaulets of 0, 2, 7 and 25 pentaneres in the pharyngeal region, ventral with digestive and reproductive tracts, adhesive tubes and the ventral locomotor ciliary band. C—dorsal view showing a more complete covering of pentaneres on both sides, D—dorsal and ventral views of a juvenile (Lt=167 µm, LPh=70 µm), from Diano Marina, Italy, and E—a pentancre with a separate scalebar.

Reproductive tract: Testis is on the left side as seen from below; vas deferens opens into the rear of the ovoid caudal organ (14 x 23 μm) that lies in front of the anus; developing eggs (3, plus 2 germinal vesicles) are in the mid-gut on the opposite side (largest 21 x 50 μm); frontal organ is a hyaline sphere (11 μm diam.), containing mobile sperm.

Ecology: Occasional in frequency of occurrence (10–30% of samples), rare in abundance (less than 1% of a sample); *littoral* in very fine, well to medium sorted, sand at 0–10 cm depth MLW–MLWS; *sublittoral* in very fine to fine, well to medium–well sorted sand at 1.0–2.0 m water depth.

Geographical distribution: MED: EUROPE: ITALY: *Campania* {Lido di Fusaro [video]}; *Friuli Venezia Giulia* {Grado [video], Foce dell'Isonzo [video]}; *Liguria* {Diano Marina[^] 43°54'N/08°05'E [2-videos], San Remo [video]}; *Puglia* {Siponto}; *Toscana* {Tombolo di Feniglia, Mortelliccio}; *Veneto* {Bibione [video]}.

Remarks: The study is based on 10 specimens, 7 of which were captured on video. The description follows (WDH video #1543, Fig. 7 A, B, a holotype, ICZN Article 73.1.1). Two other videos, designated as paratypes (ICZN Article 72.4.5), include WDH #1544, a subadult from Lido Fusaro: Lt c. 300 μm ; LPh c. 130 μm , with TbA 3 per side, TbL 7 per side, and TbP 3 per side; and WDH #1541, a juvenile from Diano Marina: Lt 167 μm ; LPh 70 μm , with TbA 2 per side, TbL 5 per side, and TbP 3 per side. *Tetranchyroderma oligopentacrum* **n. sp.** represents one of six scantily clad members of the genus, its pentancrous covering being incomplete and even more variable than usual for such species. It is the eidostic pattern of morphology and the presence of pentancrous specimens collected from the same location that allowed us to assign the specimen with no ancrs to this species. Juvenile: (#1541 Fig. 7 D) Lt=167 μm ; L to PhJIn =83 μm at U49; TbA 2 per side, TbL 5 per side, TbP 3 per side.

Etymology: The species is named for the few (Greek: *oligos*) pentanrcs (Greek: *penete*, Greek: *ankyra*), present on the body.

Taxonomic affinities: *Tetranchyroderma oligopentacrum* **n. sp.** is among six species that are scantily clad with ancrs. Of these, 3 species are tetrancrous, 2 of which have been described, and with *T. oligopentacrum* there are now 3 species that are pentancrous. *T. oligopentacrum* is longer and thinner than the others, and alone has 0 TbL in the rear pharyngeal region, and when ancrs occur in stripes has lateral but no medial elements. *T. hypopsilancrum* Hummon, Todaro & Tongiorgi, 1993 (p. 122, Fig. 13) is closest in overall body shape and morphology, despite having tetrancres. In fact, the first *T. oligopentacrum* that we saw, one with epaulets from Mortelliccio, we thought was *T. hypopsilancrum*, except that it had pentanrcs rather than tetrancres. Note that only these two species thus far have been found to have epaulets, with *T. oligopentacrum* often having fewer ancrs per epaulet than *T. hypopsilancrum*. Subsequently, we have had to assess the type of ancrs that are present in an individual as part of the identification process. This of course raises the question of the relationship and importance of tine numbers in ancrs as taxonomic characters.

Concluding remarks

With the species included herein, the total number of described macrodasyid gastrotrichs increases to 295 worldwide, distributed in 31 genera and 7 families. *Tetranchyroderma* (Thaumastodermatide) and *Macrodasys* (Macrodasysidae) constitute the most speciose taxa with 65 and 30 species respectively. On the other hand *Acanthodasys* and *Diplodasys* figure among the least speciose taxa as they include only nine and eight species respectively. The four genera have a cosmopolitan distribution (*sensu* Sterrer 1973) and have been recorded in all regions of the World where searches have been carried out with some intensity (e.g. at least 4–5 locations being studied). The only exception seems to be *Macrodasys* unreported from an extensive research carried out along the northern Gulf of Mexico (Todaro, Fleeger & Hummon 1995), though they are abundant both in species and frequency along the west coast of Florida from Tampa southward (Hummon 2009).

In the Mediterranean Sea 106 described species of Macrodasysida have been reported, equal to 36% of total species known world-wide (Todaro, Matinato, Balsamo & Tongiorgi 2003; Todaro, Guidi, Leasi &

Tongiorgi 2006; and the present study). The percentage of *Diplodasys* species reported in the Mediterranean follows the trend of the entire order, with 33% of total species been found in this basin; on the other hand the genera *Macrodasys* and *Acanthodasys* are represented proportionally by a lower number of species, 20% and 25% of total species respectively; whereas *Tetranchyroderma* appears over represented with over 46% of the species known in the world reported from this Sea. As taxonomic and faunistic research progresses it will become most clear whether Gastrotricha represent a faunistic exception in a basin known to harbor only somewhat 4–18% of the world marine macroscopic species (Bianchi & Morri, 2000).

Acknowledgments

This research was supported by a grant from the U. S. National Science Foundation (NSF BSR-9006798) to W.D. Hummon and a MIUR grant to M.A. Todaro (PRIN-2007 - Approccio integrato all'identificazione dei Gastrotrichi marini). We wish to thank Dr. Paolo Tongiorgi and Dr. Maria Balsamo for their collegiality throughout our work. We also appreciate comments and suggestions given us by three anonymous reviewers.

References

- Balsamo, M., E Fregni & P. Tongiorgi. (1994) Marine and freshwater Gastrotricha from the Island of Montecristo (Tuscan Archipelago, Italy), with the description of new species. *Bollettino di Zoologia*, 61, 217–227.
- Bianchi, C.N., C. Morri. (2000) Marine biodiversity of the Mediterranean Sea: situation, problems and prospects for future research. *Marine Pollution Bulletin*, 40, 367–376.
- Boaden, P.J.S. (1965) Two new interstitial Gastrotricha of the family Thaumasto dermatidae. *Pubblicazioni della Stazione Zoologica di Napoli*, 34, 219–225.
- Claparède, E. (1867) *Miscellaneous zoologiques*, III. Type d'un nouveau genre de Gasterotriches. *Ann. Sci. Natur. Zool.*, 8, 16-23; Pl. 4, Figs. 5-9.
- Clausen, C. (1965) New interstitial species of the family Thaumastodermatidae (Gastrotricha Macrodasyoidea). *Sarsia*, 21, 23-36.
- Clausen, C. (2004) Gastrotricha from the Faroe Bank. *Sarsia* 89: 423-458.
- Fregni, E., P. Tongiorgi & M.G. Faienza. 1998. Two new species of *Urodasys* (Gastrotricha, Macrodasysidae) with cuticular stylet. *Italian Journal of Zoology*, 65, 377–380.
- Fregni, E., M.G. Faienza, S. De Zio Grimaldi, P. Tongiorgi & M. Balsamo. (1999) Marine gastrotrichs from the Tremiti Archipelago in the southern Adriatic Sea, with the description of two new species of *Urodasys*. *Italian Journal of Zoology*, 66, 183–194.
- Gerlach, S.A. (1953) Gastrotrichen aus dem Küstengrundwasser des Mittelmeeres. *Zoologischer Anzeiger*, 150, 203–211.
- Hummon, W.D. (2008) Gastrotricha of the North Atlantic Ocean: 1. Twenty four new and two redescribed species of Macrodasysida. *Meiofauna Marina*, 16, 117–174.
- Hummon, W.D. (2009) (revision of 2001, 2004, 2007). Global database for marine Gastrotricha (Taxonomic, Geographic, Bibliographic, Analytic Systematics and Video). Server: <http://132.235.243.28> or <http://hummonnas.biosci.ohiou.edu>.
- Hummon, W.D., M.A. Todaro & W.A. Evans. (2005) Video database for described species of marine Gastrotricha. *Meiofauna Marina*, 14, 23–26. [see Hummon, 2009]
- Hummon, W.D., M.A. Todaro, M. Balsamo & P. Tongiorgi. (1996) Italian marine Gastrotricha: III. Four new pentancrous species of the genus *Tetranchyroderma* (Macrodasysida, Thaumastodermatidae). *Italian Journal of Zoology*, 63, 73–79.
- Hummon, W.D., M.A. Todaro & P. Tongiorgi. (1993) Italian marine Gastrotricha: II. One new genus and ten new species of Macrodasysida. *Bollettino di Zoologia*, 60, 109–127.
- Hummon, W.D., M.A. Todaro, P. Tongiorgi & M. Balsamo. (1998) Italian marine Gastrotricha: V. Four new and one redescribed species of Macrodasysida in the Dactylopolodidae and Thaumastodermatidae. *Italian Journal of Zoology*, 65, 109–119.
- Hummon, W.D. & M.A. Todaro, (2010) Analytic taxonomy and notes on marine Gastrotricha. *Zootaxa* (submitted for publication)
- ICZN (1999) *International Code of Zoological Nomenclature*, 4th ed. International Commission on Zoological Nomenclature, London.

- Luporini, P.G. Magagnini & P. Tongiorgi. (1971) Contribution a la connaissance des Gastrotriches des côtes de Toscane. Cahiers de Biologie Marine, 12, 433-455.
- Luporini, P.G. Magagnini & P. Tongiorgi. (1973) (for journal year 1970). Gastrotrichi macrodasyoidei delle coste della Toscana. Pubblicazioni della Stazione Zoologica di Napoli, 38, 267-288.
- Papi, F. (1957) Tre nuovi Gastrotrichi mediterranei. Pubblicazioni della Stazione Zoologica di Napoli, 30, 176-183.
- Remane, A. 1927. Neue Gastrotrichen Macrodasyoidea. Zoologischer Jahrbücher, Abteilung für Systematik und Morphologie, 54, 203-242.
- Schrom, H. (1972) Nordadriatische Gastrotrichen. Helgoländer Wissenschaftliche Meeresuntersuchungen, 23, 286-351.
- Schrom, H. in R. Riedl. 1970. Klasse: Gastrotricha, pp. 216-218. In: Fauna und Flora der Adria, 2nd ed. Verlag Paul Parey, Hamburg
- Sterrerr, W. (1973) Plate tectonics as a mechanism for dispersal and speciation in interstitial sand fauna. Netherlands Journal of Sea Research, 7, 200-222.
- Todaro, M.A. (2002) An interesting new gastrotrich from the intertidal meiobenthos of Long Beach Island, New Jersey (USA), with a key to the species of *Tetranchyroderma* (Gastrotricha, Macrodasysida). Journal of the Marine Biological Association of the United Kingdom, 82, 555-563.
- Todaro, M.A. (2007) (revision of 2002, 2004). Gastrotricha – Home Page (Taxonomic, Geographic, Bibliographic). Web Site: www.gastrotricha.unimore.it.
- Todaro, M.A., M. Balsamo, & P. Tongiorgi. (1988) *Tetranchyroderma sardum*, a new species of the family Thaumastodermatidae (Gastrotricha, Macrodasysida). Bollettino di Zoologia, 55, 69-72.
- Todaro, M.A., M. Balsamo & P. Tongiorgi. (1992) Marine Gastrotricha from the Tuscan Archipelago (Tyrrhenian Sea): I. Macrodasysida, with description of three new species. Bollettino di Zoologia, 59, 471-485.
- Todaro, M.A., J.W. Fleeger & W.D. Hummon. (1995) Marine gastrotrichs from the sand beaches of the northern Gulf of Mexico: species list and distribution. Hydrobiologia 310, 107-117.
- Todaro, M.A., L. Guidi, F. Leasi, & P. Tongiorgi. (2006) Morphology of *Xenodasys* (Gastrotricha): The first species from the Mediterranean Sea and the establishment of *Chordodasiopsis* gen. nov. and Xenodasyidae fam. nov. Journal of the Marine Biological Association of the United Kingdom, 86, 1005-1015.
- Todaro, M.A. & W.D. Hummon. (2008) An overview and a dichotomous key to genera of the phylum Gastrotricha. Meiofauna Marina, 16, 3-20.
- Todaro, M.A., W.D. Hummon, E. Fregni, M. Balsamo & P. Tongiorgi. (2001) (for the journal year 2000). Inventario dei Gastrotrichi marini Italiani: Una checklist annotata. Atti Società Toscana di Scienze Naturali, Memorie Serie B, 107, 75-137.
- Todaro, M.A., L. Matinato, M. Balsamo & P. Tongiorgi. (2003) Faunistics and zoogeographical overview of the Mediterranean and Black Sea marine Gastrotricha. Biogeographica, 24, 131-160.
- Todaro, M.A.D., P. Tongiorgi & M. Balsamo. (1988) *Tetranchyroderma sardum*, a new species of the family Thaumastodermatidae. Bollettino di Zoologia, 55, 171-174.
- Tongiorgi, P. & M. Balsamo. (1984) A new *Tetranchyroderma* species (Gastrotricha, Macrodasyoidea) from the Adriatic coast. Bollettino di Zoologia, 51, 335-338.
- Valbonesi, A. & P. Luporini. (1984) Researches on the coast of Somalia: Gastrotricha Macrodasyoidea. Monitore zoologico italiano, N.S. Supplemento 19(1), 1-34.
- Wilke, U. (1954) Mediterrane Gastrotrichen. Zoologische Jahrbücher für Systematik, 82, 497-550.