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Paraturbanella solitaria, a new psammic species (Gastrotricha: Macrodasyida: Turbanellidae), from the coast of California

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Abstract.—A new species of marine gastrotrich is described. Adults of *Paraturbanella solitaria* new species are simultaneous hermaphroditic, ribbon shaped, up to 530 μm long and up to 64 μm wide. The head bears a pair of sensorial piston pits and its anterior-most portion is hexagonally shaped. The adhesive apparatus consists of anterior and posterior adhesive tubules in addition to bilateral "Seitenfüßchen" organs that take origin in the middle of the pharyngeal region. The new species is placed and discussed within the "*teissieri*" species assemblage. This is the first gastrotrich reported from the coast of California.

Marine gastrotrichs in recent years have been the object of an increasing number of taxonomical and biogeographical studies; extensive faunistic surveys have been carried out in northern Europe (Hummon & Warwick 1992, Jouk et al. 1992), the Mediterranean Sea (Hummon et al. 1990, 1992, 1993, 1994; Balsamo et al. 1992; Todaro 1992; Todaro et al. 1992), the Atlantic coast of the United States (Todaro et al. 1991; Evans 1992, 1994), and the northern Gulf of Mexico (Todaro 1994, Todaro et al. 1995). Unlike fauna of these regions, gastrotrichs of the Pacific coast of the United States are poorly known, the only contributions being those of Wieser (1957) and Hummon (1966, 1969, 1972). Accounts of these authors were limited respectively to gastrotrichs from Puget Sound and the San Juan Archipelago, both within the state of Washington. In an attempt to expand the knowledge of the gastrotrich-fauna of the west coast of the United States, I arranged to obtain some sediment from California beaches. This paper deals with the description of a new *Paraturbanella,* the only gastrotrich species found in a sample of marine sand collected near Los Angeles.

Materials and Methods

Sand was collected on 26 November 1994, from Huntington Beach, California (Fig. 1). After digging a 30 cm deep hole at MLLW, 200 cm^3 of sediment was removed from the wall and bottom of the hole, placed in a plastic bag and shipped to the laboratory within 72 h. In the laboratory the sediment was kept in a cold-room at 14°C and processed within 3 days. Specimens were extracted by the narcotization-decantation technique using an isosmotic magnesium chloride solution (Pfannkuche & Thiel 1988). Supernatant was poured in 5-cm plastic dishes and gastrotrichs were located under a M 5 Wild dissecting microscope. Twenty-five sexually mature, living, relaxed individuals were transferred by a glass micropipette to slides and observed using either differential interference contrast optics with a Microphot-FXA Nikon microscope or phase contrast with a Wild M 20 microscope. At that time gastrotrichs were photographed and/or recorded on S-VHS video tape. Measurements of all specimens observed were obtained form the microscope using an ocular micrometer, or

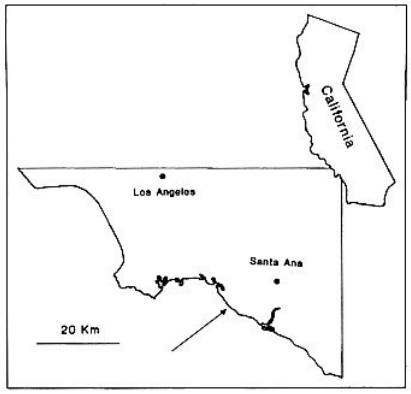

Fig. 1. Location of study site, Huntington Beach (arrow), in southern California.

from photographs or video images. A type specimen has been deposited at the National Museum of Natural History, Washington, D.C., U.S.A. (USNM). Photographs and video images of several individuals are kept in the author's collection (ref. no. PS23-28/94).

Granulometric analysis of the sediment was carried out according to Giere et al. (1988). Mean grain size, sorting coefficient, kurtosis, and skewness were calculated by a computerized program based on the equations of Seward-Thompson & Hail (1973).

Order Macrodasyida Rao & Clausen, 1970
Family Turbanellidae Remane, 1925
Genus *Paraturbanella* Remane, 1927
Paraturbanella solitaria new species
Fig. 2

Holotype.—An adult 460 μm long, formalin-glycerin wholemount (USNM ref. no. 169956).

Type locality.—Huntington Beach, California, U.S.A. (33°41′N; 118°24′W).

Etymology.—The specific name *solitaria* Latin meaning lonely, alludes to the fact that this was the only gastrotrich species found in the sample.

Diagnosis.—*Paraturbanella* with adults up to 531 μm long and 64 μm wide. Head bearing lateral sensorial piston pits and lacking ventral sensorial papillae. Anteriormost portion of the head hexagonally shaped. Eight to ten anterior and ten posterior adhesive tubules; lateral adhesive tubules absent. Caudal cone 7–9 μm long. Caudal lobe 40 μm long. "Seitenfüßchen" organs at the middle of the pharyngeal region, shorter tubules 13–17 μm, longer 25–28 μm. Large, heavily cuticularized buccal cavity; pharynx up to 150 μm long with pharyngeal pores 14–16 μm from the pharyngeal-intestinal junction.

Description.—Mature specimens attain a total body length of 460-531 μm and a width of 47–64 μm (Fig. 2; Table 1). The body is transparent, dorsoventrally flattened and slightly tapering towards the posterior end where it is 23–33 μm wide. The head is 29–30 μm wide and somewhat hexagonal in shape (Fig. 2A). It bears marginal cilia as well as several sensory bristles 10–14 μm long. The posterior margin of the head is demarcated from the rest of the body by a slight constriction, 25–26 μm wide. Located just posterior to the constriction, on each side, is a sensorial piston pit 3.8 μm in diameter (Fig. 2A, C). No other sensorial organ (i.e., ventral sensorial papillae) is present. The adhesive apparatus consists of anterior and posterior adhesive tubules in addition to bilateral "Seitenfüßchen" adhesive organs. Eight to ten anterior tubules (2–5 μm long) are arranged in two ventral symmetrical, hand-shaped, groups (Fig. 2C). Ten posterior tubules (6–21 μm long) are part of the 39–41 μm long caudal lobes. A caudal cone, 7–9 μm long, occurs between the symmetrical caudal lobes (Fig. 2A, B). The two "Seitenfüßchen" adhesive organs, literally "lateral foot," referred also as "dorni" tube groups by Evans & Hummon (1991), consist each of two tubules of unequal length originating ventrolaterally, about in the middle of the pharyngeal region, and directed backwards; the longer tube is 25–28 μm in length while the shorter one is 13–17 μm (Fig. 2C).

The body, dorsally and laterally, bears 18–20 pairs of sensory bristles (9–12 μm long); ventrally it bears the locomotory cil-

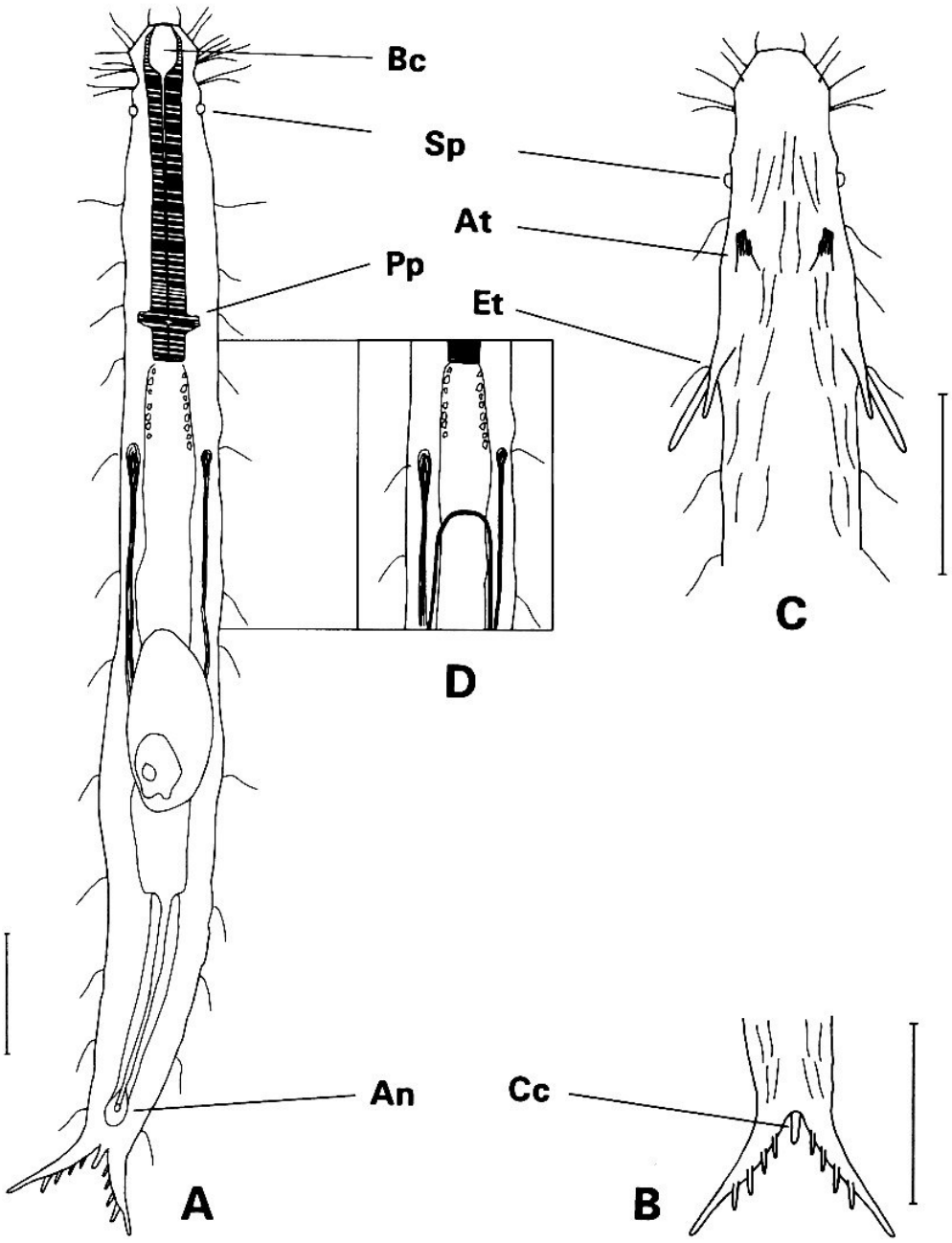

Fig. 2. *Paraturbanella solitaria* new species. A. Habitus; B. Caudal lobes, ventral; C. Anterior end, ventral. D. Mid intestine, ventral. An, anus; At, anterior adhesive tubules; Bc, buccal cavity; Cc, caudal cone; Et, Seitenfüßchen organs; Pp, pharyngeal pores; Sp, Sensorial piston pits. Scale bars represent 50 μm.

Table 1.—Morphometrical parameters of *Paraturbanella solitaria* new species (measurements are in μm).

	Range	$\bar{X}$	*SD*	*n*
Total body length	477.0–531.0	505.9	21.6	25
Caudal lobe length	35.2–41.1	37.5	2.4	24
Head width	29.4–30.4	29.8	0.5	23
Head constriction width	25.0–27.0	25.9	0.8	23
Maximum trunk width	47–64	53.9	6.6	19
Posterior trunk width	23.5–33.4	28.8	3.9	23
Pharynx length	125.0–144.0	132.0	5.2	20
Distance of the pharyngeal pores from the pharyngo-intestinal junction	14.6–17.6	15.6	1.1	21
Mouth length	19.4–21.6	19.6	1.3	20
Mouth width	10.5–11.7	10.9	0.4	19
Seitenfüßchen longer tubule length	25–28.4	27.2	1.3	17
Seitenfüßchen shorter tubule length	11.7–17.6	15.6	2.2	17
Piston pits diameter	3.0–3.9	3.6	0.3	20
Caudal cone length	7.0–9.8	8.9	1.1	19
Number of anterior tubules	8–10	9.6	0.8	25
Number of posterior tubules	10.0	10.0	0.0	25

$\bar{X}$, mean value. *SD*, standard deviation. *n*, number of specimens studied.

ia. The latter are arranged in two bands that run parallel to each other from the head to the base of the caudal lobes.

The buccal cavity is spacious with a thick cuticular wall and measures 19–21 μm in length by 10.7–12 μm in width. The pharynx is 125–150 μm long and 15–16 μm wide; the pharyngeal pores open about 14–16 μm from the pharyngeal-intestinal junction (Fig. 2A). The intestine is straight and morphologically recognizable in two parts. The anterior part is wider and has a thinner wall compared to the posterior part. The anus opens ventrally at 24–30 μm from indentation between the caudal lobes. The reproductive system is made up of paired bilateral testes and probably bilateral ovaries. Testes originate 32–38 μm posterior to the pharyngeal-intestinal junction, thence tapering in sperm ducts (vasa deferentia) that run backward laterally to the intestine until the mid-trunk, where apparently they turn anteriorly to join at the midline, ventrally to the intestine, 65–70 μm posterior to the pharyngeal-intestinal junction (Fig. 2D). A single mature ovocyte, 55–70 μm in length, was visible dorsal to the mid-intestine in most of the specimens studied. Neither additional accessory reproductive organs or genital orifices have been observed.

Habitat.—A large population of individuals representative of all age classes inhabits the fine, silicious, clean sand of the intertidal zone of Huntington Beach shore. There, sand granules are of low sphericity, sub-angular and moderately well sorted (Fig. 3). At the time of the collection, water temperature and salinity were 19°C and 35 ppt respectively. Major associated taxa were nematodes and turbellarians.

Remarks.—In these specimens the head lacks laterally projecting tentacles, the buccal capsule does not extend beyond the mouth, the anterior tubules are borne on fleshy projections (hands), and the "Seitenfüßchen" organs are located in the mid-pharyngeal region. These characteristics, according to Evans & Hummon (1991), affiliate them with the genus *Paraturbanella.* Among the thirteen species so far ascribed to this genus, because of the morphology of the cephalic region, the absence of lateral adhesive tubes and the morphology of the intestine, the present specimens resemble more closely to species that fall within the "*teissieri*" group, namely: *P. mesoptera*

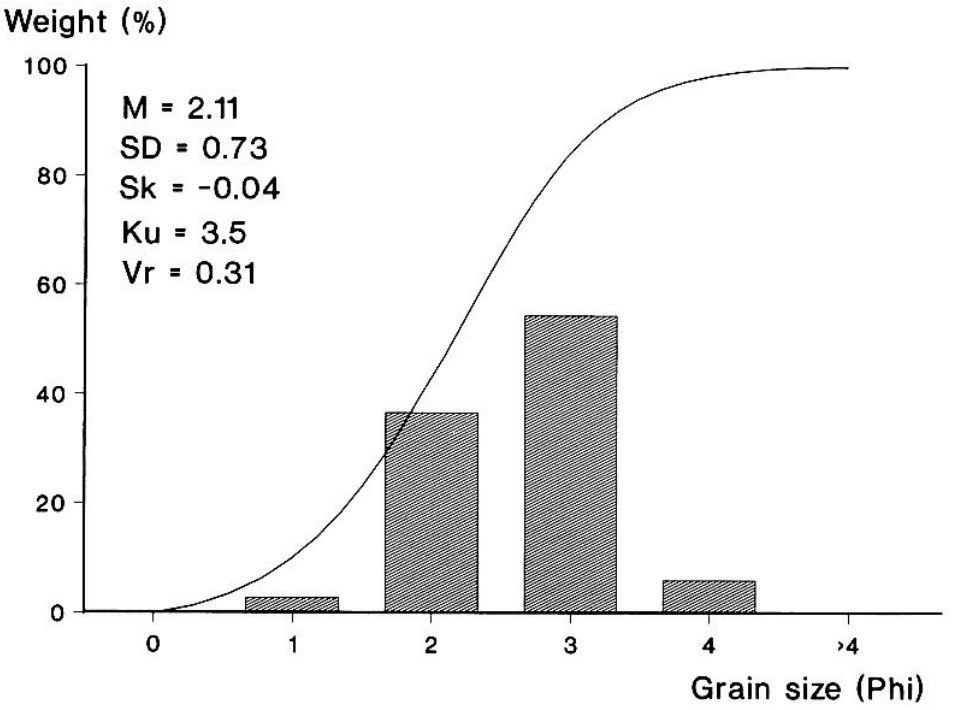

Fig. 3. Granulometric analysis: Histogram by weight and cumulative curve. M, mean grain size; SD, sorting coefficient; Sk, skewness; Ku, kurtosis; Vr, roundness value.

Rao, 1970, *P. microptera* Wilke, 1954, and *P. teissieri* Swedmark, 1954. The specimens from California differ from the ones described from India as *P. mesoptera,* in that they are of a larger size, 460–531 μm vs. 360–380 μm, and in that they bear fewer adhesive tubules in both the anterior groups, 4–5 vs. 9, and in the caudal lobes, 5 vs. 9. The present specimens differ from those affiliated with the European *P. teissieri* in that they lack the ventral sensorial papillae and also because they bear a smaller number of anterior as well as posterior adhesive tubules, 8–10 vs. 12 and 10 vs. 12–20 respectively. Recently Kisielewski (1987), discussed synonymizing *P. microptera* (originally found near Naples, Italy) with *P. teissieri* noticing that the two taxa were described almost simultaneously and that both species were considered by their authors as the second within the genus, and consequently only differences from *P. dorni* Remane, 1927, were included in their discussions. This clearly indicates that Swedmark and Wilke were unaware of each other's findings. The possible synonymy of *P. teissieri* and *P. microptera* was mentioned previously by Schmidt & Teuchert (1969), and an oversight of piston pits (one of the possible differences between the two species) by Wilke was suggested by these authors. On this subject Kisielewski (1987), pointed out that the piston pits were not mentioned either in the original description of *P. teissieri,* and thus, their later findings could not be used as an argument for separating both forms. Kisielewski's conclusions were agreed with by Todaro et al. (1993) on the basis of an extensive faunistic survey around the Italian peninsula that yielded only specimens whose morphological characteristics were in full accordance with the description of the north European *P. teissieri* (M. Balsamo, W. Evans, W. D.

Hummon, M. A. Todaro & P. Tongiorgi, unpubl. data). Among the morphological traits shared between the Italian and the north European specimens, were also sensorial piston pits and sensorial papillae. Since neither one of these organs were reported in the original description of *P. microptera* it was assumed by Todaro et al. (1993), that they were both overlooked by Wilke. On this ground, therefore, I think it is appropriate to affiliate the Californian specimens with a new taxon, proposing the name *Paraturbanella solitaria* new species for it.

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