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ORIGINAL ARTICLE

A new species of *Aspidiophorus* (Gastrotricha, Chaetonotida) from the Russian Far East with a key to marine species of the genus

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Abstract

The Russian gastrotrich fauna is virtually unknown, particularly the marine fauna. In the ocean, investigations have been restricted to the White Sea, from where only three fully described species have been reported so far. In this study we describe a new species of *Aspidiophorus* found in a sandy sample collected from off of Vladivostok (Peter the Great Bay, Sea of Japan). *Aspidiophorus oculatus* n. sp. is the first marine chaetonotid gastrotrich described from Russia and the first representative of the order Chaetonotida reported from the Sea of Japan. Specimens of the new species are characterized by a body up to 147.5 µm in total length; enveloped by 57 alternating columns of 65–70 keeled, elongate scales. Pharyngeal-intestinal junction at U27; the head bears cephalion, hypostomium, pleuria and a pair of eye-spots; the furca is 20 µm long including the 12-µm long adhesive tube; the ventral interciliary field is naked, with the exception of a pair of elliptical, keeled scales occurring near the anus. Morphological differences between the new species and the other 13 marine con-generic taxa are discussed. A key to the known marine species of the world based on easily identifiable traits, visible in both living and formalin-fixed specimens is provided.

Key words: *Gastrotricha*, *meiofauna*, *taxonomy*, *Russia*, *taxonomic key*, *Sea of Japan*

Introduction

Gastrotricha constitutes one of the most remarkable and taxonomically challenging groups of marine and freshwater microscopic invertebrates (Leasi & Todaro 2008). These worm-like micrometazoans constitute a phylum, which phylogenetically has been found nested within the Platyzoa (mainly on molecular data, see Todaro et al. 2006a) or as sister taxon to the Ecdysozoa (mostly morphological data, see Zrzavý 2003). In aquatic ecology, gastrotrichs are known as important components of the permanent meiofauna (Todaro et al. 2006b,c).

The phylum is cosmopolitan and includes about 750 species grouped into two orders: Macrodasysida, with about 280 strap-shaped species, all but two of which are marine, and Chaetonotida, with about 470 tenpin-shaped species, of which only 130 taxa

are marine or brackish (Hummon 2008a,b; Todaro 2008; Todaro & Tongiorgi 2008).

The gastrotrich fauna of Russia is virtually unknown, particularly the marine fauna. In the sea, investigations have been restricted to the White Sea, from which only two species of Macrodasysida (i.e. *Macrodasys buddenbrocki* Remane, 1924 and *Turbanella lutheri* Remane, 1952) and a single species of Chaetonotida (i.e. *Xenotrichula velox* Remane, 1927) have been reported (Manylov 1995, 1999; Manylov et al. 2004). More recently, representatives of the genera, *Cephalodasys*, *Lepidodasys*, *Tetranchyroderma* (Macrodasysida) and *Neodasys* (Chaetonotida) have been recorded from the same area (Petrov et al. 2007).

The aim of this study is to describe a new species of *Aspidiophorus* found in a sandy sample collected from Far East Russia; in a larger framework, it is

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hoped that the research will trigger more comprehensive faunistic and taxonomic studies on the country's gastrotrich fauna; in this regards investigation focusing on the Far East Coasts will allow us to shed light on the Sea of Japan fauna, from which so far have been reported representatives of the order Macrotrichida only (e.g. Chang et al. 1998; Lee and Chang 2002, 2003, 2007).

Species of the genus *Aspidiophorus* are easily discernible by virtue of their characteristic armature made up of stalked scales. In contrast to the ease of generic identification, species identification may be difficult. For this reason, in addition to describing the new species, we provide here a working key to the identification of all known marine species of *Aspidiophorus* worldwide. The key is based on easily identifiable traits of the external anatomy, visible in both living and formalin-fixed specimens. It will hopefully prove useful not only to gastrotrich specialists but also to marine ecologists who find these common metazoans in the course of research on interstitial meiobenthos.

Materials and methods

Gastrotricha-containing sediment was collected by ASM on 13 November 2007 at 1.5 m water depth near the Skrebцова (Kourizhka) Island (Peter the Great Bay, Sea of Japan). A single sample was collected manually by removing sediment from the top 10 cm layer with a 1000 ml, wide mouth, plastic jar. After collection the jar was placed in an insulated bag and brought within 2 days to the laboratory in Modena, Italy. In the laboratory, sand was kept in a thermostatic chamber at 4°C and analysed within 8 days of collection. The fauna were extracted daily with the narcotization-decantation technique using a 7% magnesium chloride solution; the supernatant was poured into 5.5 cm diameter plastic Petri dishes and scanned for gastrotrichs at 50× under a Wild M8 stereomicroscope (see also Todaro & Hummon 2008). When located, the gastrotrichs were removed from the Petri dish with a micropipette, fresh-mounted on slides and observed using a Nikon Eclipse 90i equipped with Differential Interference Contrast (DIC, Nomarski). During observation, the animals were photographed with a DS-5Mc Nikon digital camera and measured with the Nikon ACT-U2 software programme. The description of the new species follows the convention of Hummon et al. (1992), whereas the locations of some morphological characteristics along the body are given in percentage units (U) of total body length measured from anterior to posterior.

Granulometric analysis of the substrata was carried out according to Giere et al. (1988). Mean grain size, sorting coefficient, kurtosis, and skewness were

calculated by the computerized programme of Todaro (1992).

Taxonomy

Order Chaetonotida Remane, 1925

[Rao and Clausen, 1970]

Family Chaetonotidae Zelinka, 1889

[sensu Leasi and Todaro, 2008]

Genus *Aspidiophorus* Voigt, 1904

Aspidiophorus oculatus sp. nov.

(Figures 1–3)

Type material

The holotype: an adult parthenogenetic specimen, formalin-glycerin wholemount, deposited at The

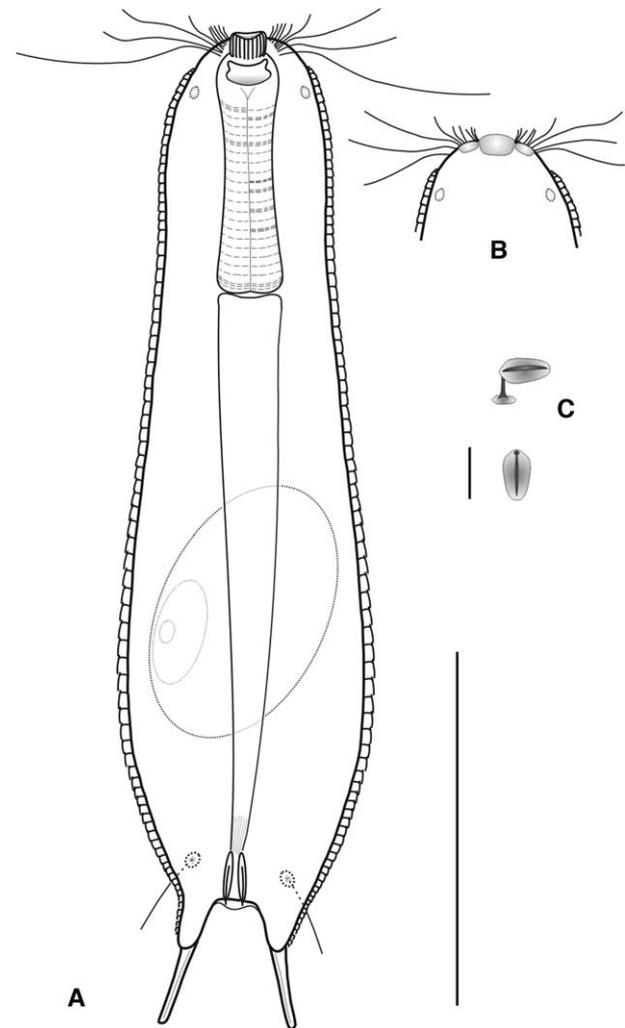


Figure 1. *Aspidiophorus oculatus* new species. Drawings. A, habitus, as seen from the ventral side; B, anterior end, as seen from the dorsal side; C, scales. Scale bars, A, B = 50 µm; C = 5 µm.



Figure 2. *Aspidiophorus oculatus* new species. DIC microphotographs. Habitus, showing the internal anatomy. Scale bar = 50 μm .

Natural History Museum, London, UK (NHM ref. n. 2008.49). Additional observed material: another adult specimen prepared on slides for DIC observation, but not extant.

Type locality

The samples were taken by skin diving along a sandy bar running from Skrebcova (Kourizhka) Island towards the coastal area off of Vladivostok, Russia (Lat. $43^{\circ}12'51.7''\text{N}$; Long. $131^{\circ}55'26.56''\text{E}$, see Table I for further details).

Etymology

The name of the new species allude to the presence of eye-spots (Latin '*oculatus*', having the eyes).

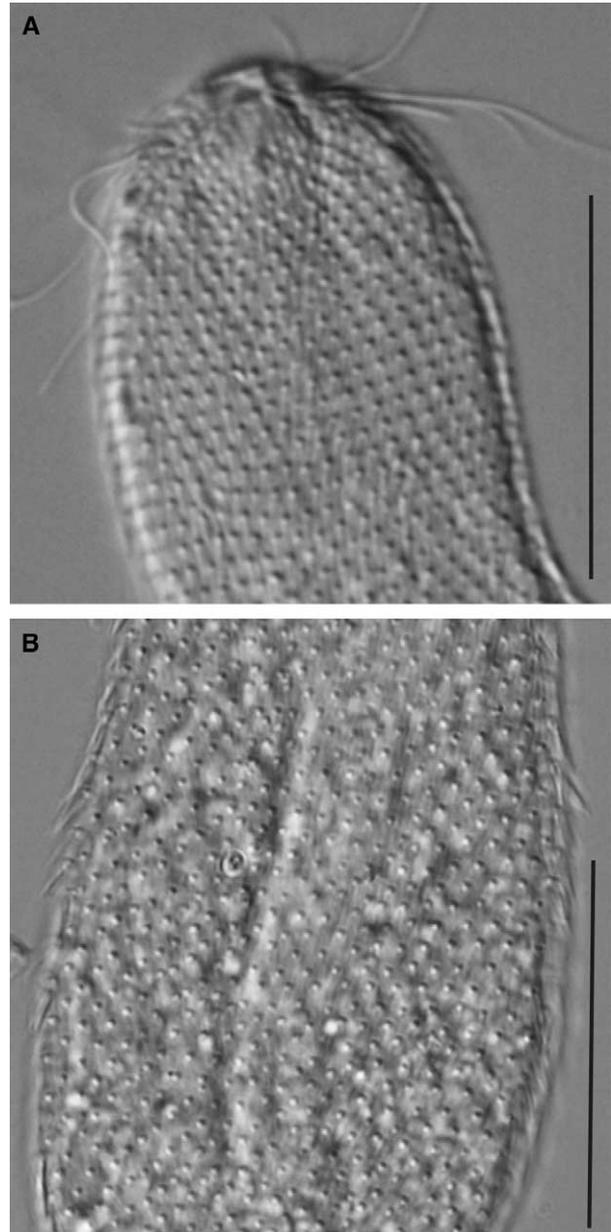


Figure 3. *Aspidiophorus oculatus* new species. DIC microphotographs showing the dorsal cuticular covering. A, Anterior end; B, mid-trunk. Scale bars = 25 μm .

Diagnosis

A medium-sized *Aspidiophorus* with total length up to 147.5 μm ; pharynx 33.5 μm long, with two slight swellings; pharyngo-intestinal junction (PhIJ) at U27; head slightly three-lobed, with cephalion, hypostomion and a pair of small pleuria; a pair of round, refringent, colourless eye-spots occurs at U6.5. Furca 20 μm long, indenting to U87; ratio of fleshy: naked portion 4:5. Body enveloped by 57 alternating columns of 65–70 stalked, keeled, elongate scales. Ventral ciliature forms two separate longitudinal bands; interciliary field naked, with a

Table I. Geographic coordinates, physical, chemical and granulometric characteristics of the sampled site.

Trait	Value
Longitude	43°12'51.7"N
Latitude	131°55'26.56"E
Depth	1.5 m
Salinity	32 ppt
Temperature	17°C
Mean grain size	0.24 mm; 2.05 phi
Size class	Fine sand
Sorting	0.59 mm; 0.76 phi
Sorting class	Moderately sorted
Kurtosis	3.39 phi
Skewness	-0.26 phi
Grain's roundness	High sphericity, very angular to angular

pair of elliptical, keeled scales occurring near the anus, at U83. Parthenogenetic.

Description

The description is based on an adult specimen, 147.5 µm in total length. Pharynx 33.5 µm in length from the posterior edge of the mouth to the junction with the intestine; pharyngo-intestinal junction (PhIJ) at U27. Head slightly three-lobed, with a cephalion that is 9 µm in width, a weakly developed pleurion per side, and a broadly trapezoidal hypostomion behind the mouth that measures 6 µm in breadth and 4 µm in height; body medium-sized, with head and neck weakly defined, but trunk and caudal base clearly distinct; widths of head/neck/trunk/caudal base are as follows: 25.2/22.5/36.7/18.5 µm at U8/U21/U65/U86, respectively; caudum of medium length with a distal furca (20 µm), that indents medially to U87 and has a border that constricts slightly over the fleshy half of its length but whose naked tubes, 12 µm in length, diverge obliquely to the rear over the remaining half of its total length. On either side of the head below are several sensory cilia, ranging, usually, from 7 to 20 µm in length; however, one is particularly long and may reach 31 µm in total length; a pair of round, refringent, colourless eye-spots are clearly visible in the head, at U6.5; a pair of dorsal tactile bristles, 15 µm long, arise near the posterior end at U78.

Cuticular armature: the body is enveloped by 57 alternating columns (35 dorsal and 11 + 11 ventrolateral) of about 65–70 stalked scales each, which extend posteriorly to cover the fleshy portion of the caudal furca. Scales are small, but elongate, slightly overlapping and roughly elliptical in shape, up to 2.5 µm in length and 1.9 µm in width in the dorsal mid-trunk region, and two-thirds of that size at their smallest on the front of the head and on the rear of the trunk; each scale bears an elongate keel throughout its length and is supported by a peduncle 0.5–0.8 µm in

length. The ventral interciliary field is bare. At the ventral posterior end, a pair of elliptical, keeled scales, 6–8 µm in length, with a short spine, 2 µm, occur near the anus.

Ventral ciliation: paired longitudinal bands extend from U6 to U82; each is wider in the head region and narrows from the posterior pharyngeal region; the bands approach each other immediately behind the hypostomion, but remain separate there, as they do throughout their entire length.

Digestive tract: the mouth is subterminal and of medium width, 5 µm; the pharynx is 6.5 µm in the middle region but shows weak swellings at both ends, 8–9 µm wide; the intestine is strait, slightly wider at the anterior end, where reaches 9 µm in width; the anus opens ventrally at U83.

Reproductive tract: specimens observed were in their parthenogenetic phase, showing a large egg in the middle of the trunk region, dorsal to the intestine.

Taxonomic remarks

The genus *Aspidiophorus* includes both freshwater and marine taxa (Todaro & Hummon 2008), so far 23 and 9 species, respectively (Todaro 2008; Todaro & Tongiorgi 2008). Four additional marine species, as yet unnamed, have been described from the coast of Somalia (4 spp, Valbonesi & Luporini 1987). A further unnamed marine species, *Aspidiophorus* sp., was reported from the surrounding of Marseille by Swedmark (1956); however, based on size and general morphology, it appears now clear this species is co-specific with *A. paramediterraneus* Hummon, 1974, a taxon recorded repeatedly in the western Mediterranean basin (see Todaro et al. 2001, 2003).

Of the marine taxa, *A. paramediterraneus* Hummon, 1974, *A. tentaculatus* Wilke, 1954, *Aspidiophorus* sp. 1 [Valbonesi & Luporini 1987] and *Aspidiophorus* sp. 3 [Valbonesi & Luporini 1987] have a total body length that exceeds 200 µm (up to 380 µm); hence, although they possess supplementary morphological peculiarities (see below), the size alone can be used to differentiate them from the remaining con-generic species. In our opinion, past occasional affiliation of specimens exceeding 200 µm to known *Aspidiophorus* species other than the four taxa reported above should be considered doubtful.

Among the small and medium-sized taxa, *A. bisquamosus* Mock, 1979 and *A. lamellophorus* Balsamo, Hummon, Todaro and Tongiorgi, 1997 differ from the other species mainly because they possess two columns of hydrofoil scales on the ventrolateral sides; on the other hand, *A. multitubulatum* Hummon, 1974 is unique due to its several accessory adhesive tubes on the caudum; *A. ornatus* Mock, 1974 bears a pair of keeled scales on the internal sides of the fleshy

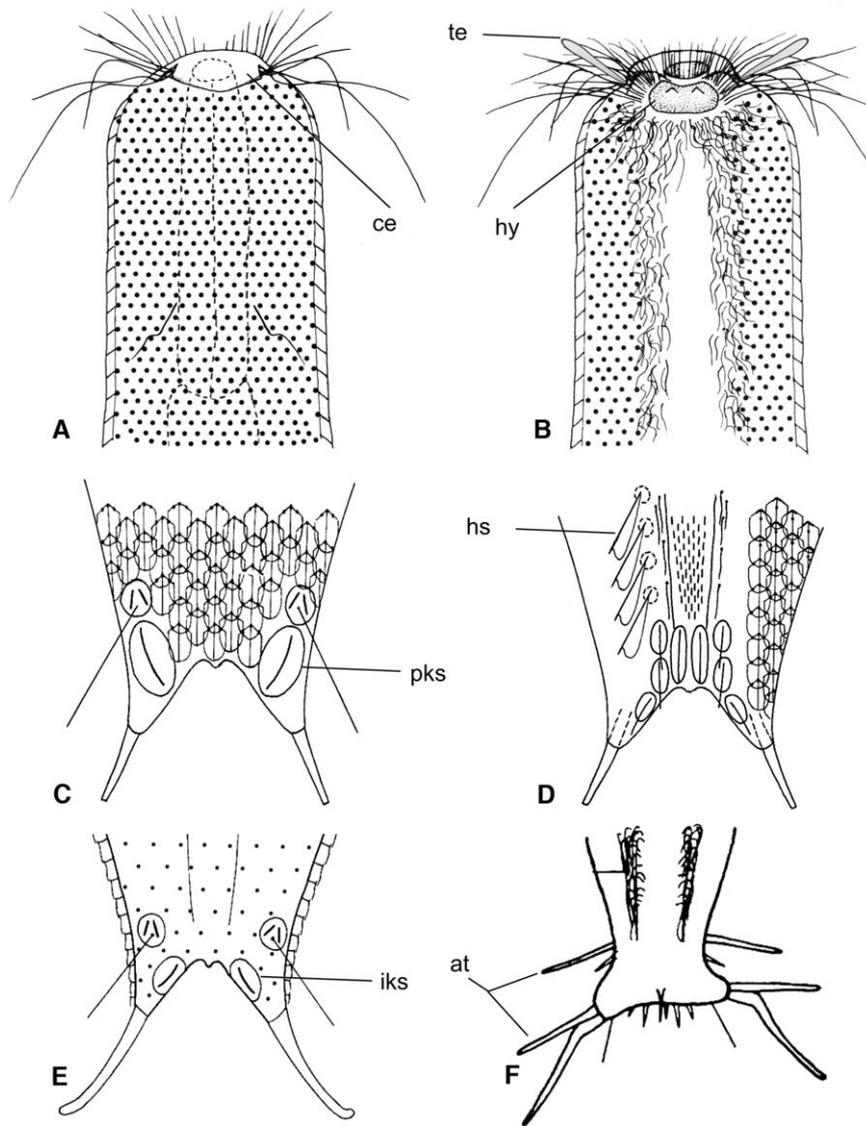


Figure 4. Hypothetical *Aspidiophorus* species showing some diagnostic characters used in the key. A, B, Anterior region; A, dorsal side, B, ventral side; C–F, posterior region, C, E, dorsal side; D, F, ventral side. at, accessory adhesive tubes; ce, cephalion; hs, hydrofoil scales; hy, hypostomium; iks, intrafurcal keeled scales; pks, posterior keeled scales; te, head tentacles. A, B modified from Balsamo & Todaro (1987); C–E, Modified from Mock (1979); F, modified from Hummon (1974).

portion of the caudal furca, whereas *A. polystictos* Balsamo and Todaro, 1987 is characterized by relatively large cephalion, a very high number of columns of scales, 78 on average, and scales which are subrectangular in shape and bear a median keel ending in a thick spine (Balsamo & Todaro 1987). Consequently, based on size and general morphology, the new species appears closer to the remaining four taxa, i.e. *A. marinus* Remane, 1926, *A. mediterraneus* Remane, 1927, *Aspidiophorus* sp. 2 [Valbonesi & Luporini 1987] and *Aspidiophorus* sp. 4 [Valbonesi & Luporini 1987]. *Aspidiophorus oculatus* new species differs from *A. mediterraneus*, *Aspidiophorus* sp. 2 and *Aspidiophorus* sp. 4 in virtue of the presence of eye-spots, and of a higher number of columns of scales, especially on the dorsal side: 35 vs. 22, 20–22 and 16,

respectively; furthermore, other differences pertain to the size and shape of the scales, which are elliptical in the new species but ovoidal in *A. mediterraneus*, and the cephalion and hypostomium that are absent in the Somalian taxa.

A number of morphometric characteristics (e.g. presence of eye-spots, furca length, pharynx length, etc.) associate *A. oculatus* n. sp. and *A. marinus*; however, the new species possesses a lower number of columns of scales, 57 vs. 67–75 (Kisielewski 1988), while the former shows a higher number of scales in each column, 65–70 vs. max 45–50 (see Naidu & Rao 2004); furthermore, scales of *A. marinus* are ovoidal (see Kisielewski 1988) or rhomboidal (see Naidu & Rao 2004) in shape, while those of *A. oculatus* appear elliptical.

Key to marine species of the genus *Aspidiophorus*

1. a) specimens of large size, total body length exceeding 200 µm 2
- b) specimens of medium-to-small size, total body length less than 200 µm 5
2. a) paired rod-like tentacles on the frontal end present (Figure 4B) 3
- b) tentacles absent 4
3. a) cephalion and hypostomion (Figure 4A, B) present *A. tentaculatus*
- b) cephalion and hypostomion absent *Aspidiophorus* sp. 3
4. a) cephalion and hypostomion present *A. paramediterranus*
- b) cephalion and hypostomion absent *Aspidiophorus* sp. 1
5. a) accessory adhesive tubes (two pairs), at the posterior end (Figure 4F) *A. multitubulatum*
- b) accessory adhesive tubes absent 6
6. a) two ventro-lateral columns of hydrofoil scales present (Figure 4D) 7
- b) ventro-lateral columns of hydrofoil scales absent 8
7. a) two large, unstalked, keeled scales on the dorsalside of the furcal base (Figure 4C) *A. bisquamosus*
- b) unstalked, keeled scales on the furcal base absent *A. lamellophorus*
8. a) a pair of unstalked, keed scales on the internal side of the fleshy portion of the furca *A. ornatus*
- b) unstalked, keeled scales on the internal side of the furca absent 9
9. a) eye spots present 10
- b) eye spots absent 11
10. a) scales elliptical in shape, arranged in 57 columns of 65–70 scales each *A. oculus*
- b) scales ovoidal or rhomboidal in shape, arranged in 76–75 columns of 45–50 scales each *A. marinus*
11. a) cephalion and hypostomion present 12
- b) cephalion and hypostomion absent 13
12. a) about 35 columns of elliptical scales on the dorsal side *A. polystictos*
- b) about 22 columns of ovoidal scales on the dorsal side *A. mediterraneus*
13. a) about 20–22 columns of 85–90 scales each on the dorsal side *Aspidiophorus* sp. 2
- b) about 16 columns of 30 scales each on the dorsal side *Aspidiophorus* sp. 4

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References

- Balsamo M, Todaro MA. 1987. *Aspidiophorus polystictos*, a new marine species (Gastrotricha, Chaetonotida) and its life cycle. *Bollettino di Zoologia* 54:147–53.
- Chang CY, Lee JM, Clausen C. 1998. Two new species of Thaumastoderma (Gastrotricha, Macrotrichida) from Korea. *Sarsia* 83:329–36.
- Giere O, Eleftheriou A, Murison DJ. 1988. Abiotic factors. In: Higgins RP, Thiel H, editors. *Introduction to the Study of Meiofauna*. Washington, DC: Smithsonian Institution Press. p 61–78.
- Hummon WD. 1974. Gastrotricha from Beaufort, North Carolina, U.S.A. *Cahiers de Biologie Marine* 15:431–46.
- Hummon WD. 2008a. Brackish-water Gastrotricha of the Polish Baltic coast. *Meiofauna Marina* 16:109–16.
- Hummon WD. 2008b. Gastrotricha of the North Atlantic Ocean: 1. Twenty-four new and two redescribed species of Macrotrichida. *Meiofauna Marina* 16:117–74.
- Hummon WD, Balsamo M, Todaro MA. 1992. Italian marine Gastrotricha: I. Six new and one redescribed species of Chaetonotida. *Bollettino di Zoologia* 59:499–516.
- Kisielewski J. 1988. New records of marine Gastrotricha from the French coasts of Manche and Atlantic. II. Chaetonotida, with descriptions of four new species. *Cahiers de Biologie Marine* 29:187–213.
- Leasi F, Todaro MA. 2008. The muscular system of *Musellifer delamarei* (Renaud-Mornant, 1968) and other chaetonotidans with implication for the phylogeny and systematisation of the Paucitubulatina (Gastrotricha). *Biological Journal of the Linnean Society* 94:379–98.
- Lee JM, Chang CY. 2002. *Pseudostomella* gastrotrichs (Macrotrichida, Thaumastodermatidae), from South Korea, with a brief review of the genus. *Korean Journal of Biological Sciences* 6:207–312.
- Lee JM, Chang CY. 2003. Two new marine gastrotrichs of the genus *Ptychostomella* (Macrotrichida, Thaumastodermatidae) from South Korea. *Zoological Science* 20:481–9.
- Lee JM, Chang CY. 2007. Two new marine gastrotrichs of the genus *Tetranchyroderma* (Macrotrichida: Thaumastodermatidae) from South Korea. *Zoological Studies* 46:474–82.
- Manylov OG. 1995. Regeneration in Gastrotricha – I. Light microscopical observations on the regeneration in *Turbanella* sp. *Acta Zoologica* 76:1–6.
- Manylov OG. 1999. First record of a microsporidian parasite in the gastrotrich *Turbanella lutheri* (Gastrotricha: Macrotrichida). *Protistology* 1:17–19.
- Manylov OG, Vladychenskaya NS, Milyutina IA, Kedrova OS, Korokhov NP, Dvoryanchikov GA, et al. 2004. Analysis of 18S rRNA gene sequences suggests significant molecular differences between Macrotrichida and Chaetonotida (Gastrotricha). *Molecular Biology and Evolution* 30:850–4.
- Mock H. 1980. Chaetonotoidea (Gastrotricha) from the North Sea Island of Sylt. *Mikrofauna des Meeresboden* 78:1–107.
- Naidu KV, Rao GC. 2004. Gastrotricha. In: Director ZSI, editor. *Fauna of India*. Kolkata, Zoological Survey of India. p 1–169.

- Petrov NB, Pegova AN, Manylov OG, Vladychenskaya NS, Mugue NS, Aleshin VV. 2007. Molecular phylogeny of Gastrotricha on the basis of a comparison of the 18S rRNA genes: Rejection of the hypothesis of a relationship between Gastrotricha and Nematoda. *Molecular Biology* 41:445–52.
- Swedmark B. 1956. Etude de la microfaune des sables marins de la région de Marseille. *Archives de Zoologie Expérimental et Général* 93:70–95.
- Todaro MA. 1992. Contribution to the study of the Mediterranean meiofauna: Gastrotricha from the Island of Ponza, Italy. *Bollettino di Zoologia* 59:321–33.
- Todaro MA. 2008. Marine Gastrotricha. <http://www.gastrotricha.unimore.it/marine.htm>
- Todaro MA, Guidi L, Leasi F, Tongiorgi P. 2006c. 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* 86:1005–15.
- Todaro MA, Hummon WD. 2008. An overview and a dichotomous key to genera of the phylum Gastrotricha. *Meiofauna Marina* 17:3–21.
- Todaro MA, Hummon WD, Balsamo M, Fregni E, Tongiorgi P. 2001. Inventario dei Gastrotrichi marini italiani: una checklist annotata. *Atti della Società Toscana di Scienze Naturali Memorie Serie B* 107:75–137.
- Todaro MA, Leasi F, Bizzarri N, Tongiorgi P. 2006b. Meiofauna densities and gastrotrich community composition in a Mediterranean sea cave. *Marine Biology* 149:1079–91.
- Todaro MA, Matinato L, Balsamo M, Tongiorgi P. 2003. Faunistics and zoogeographical overview of the Mediterranean and Black Sea marine Gastrotricha. *Biogeographia* 24:131–60.
- Todaro MA, Telford MJ, Lockyer AE, Littlewood DTJ. 2006a. Interrelationships of the Gastrotricha and their place among the Metazoa inferred from 18S rRNA genes. *Zoologica Scripta* 35:251–9.
- Todaro MA, Tongiorgi P. 2008. Freshwater Gastrotricha. <http://www.gastrotricha.unimore.it/freshwater.htm>.
- Valbonesi A, Luporini P. 1987. Researches on the coast of Somalia. Gastrotricha Chaetonotoidea. *Monitore Zoologico Italiano Suppl.* 14:235–61.
- Zrzavý J. 2003. Gastrotricha and metazoan phylogeny. *Zoologica Scripta* 32:61–81.

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