

Further data on marine gastrotrichs from the State of São Paulo and the first records from the State of Rio de Janeiro (Brazil)

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Abstract

To increase our knowledge of the biodiversity and distribution of species of Gastrotricha along the tropical-subtropical Brazilian coasts, a second collection of a two-year study was made in September 2003. This qualitative investigation focused on 13 sites at 7 locations mostly along the northern coast of the State of São Paulo. Faunistic analysis of 46 records discovered a total of 30 species, an average of 6.85 ± 5.58 species per location and 1.63 ± 1.1 sites per species. Sixteen species in ten genera and four families belong to the Macrodasysida and fourteen species in six genera and two families belong to the Chaetonotida. Ten species appear new to the Brazilian fauna whereas the remainder 20 are taxa already encountered during the 2002 survey. Of the species new to Brazil, five belong to genera unreported from the country thus far i.e., the macrodasysidans *Dolichodasys* sp. 1, *Mesodasys* sp. 1 (Lepidodasysidae), *Urodasys viviparus* (Macrodasysidae) and *Turbanella* sp. 1 (Turbanellidae), and the chaetonotidan *Draculiciteria tessellata* (Xenotrichulidae). The *Turbanella*, two *Macrodasys* and two *Chaetonotus* species are undescribed taxa and thus far endemic to the Brazilian coast whereas *Urodasys viviparus* and *Draculiciteria tessellata* are known as regional cosmopolitans and *Aspidiophorus tentaculatus* is ampho-Atlantic in distribution. The macrodasysidans, *Paraturbanella* sp. 1 and *Pseudostomella* sp. 1, and the chaetonotidan *Heteroxenotrichula* sp. 1, are the most common species, in agreement with our previous 2002 findings. However, this time, in contrast with the previous survey we found *Tetranchyroderma* sp. 1 only once, whereas in spring 2002 the species was very common. It is possible that seasonality has much to do with the contrasting findings. Overall data indicate that the investigated area supports a good number of gastrotrich species (c. 50 spp) of both orders Macrodasysida and Chaetonotida. Our knowledge of biodiversity is likely to increase as new locations are surveyed; to maximize results, studies should concentrate on sandy bottom made up of fine-to-medium grain size surrounded by clear waters.

Key-words: Gastrotricha, Brazilian meiofauna, biodiversity, biogeography, taxonomy.

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Introduction

A two-year study aimed at shedding light on the diversity of marine gastrotrichs along the northern coast of the State of São Paulo was started in 2002. The study spawns from the BIOTA/FAPESP program (Migotto & Tiago 1999) and represents an initial contribution to knowledge of marine Gastrotricha from Brazil as a whole (for fresh water taxa see Kisielewski 1991). The initial and most intensive research was carried out during the spring 2002, when 22 localities were investigated, yielding about 40 species several of which are new to science (Todaro & Rocha 2004). A second sampling campaign was carried out in September 2003 and focused on seven locations (13 sites) mostly on the northern shores of the state of São Paulo with some located in the southern region of the State of Rio de Janeiro. This paper presents

the results of the faunistic analysis of samples collected during the latter campaign.

Materials and methods

Qualitative sandy samples were collected from four localities in the neighborhood of Ubatuba, one near São Sebastião and two at the boundary between the States of São Paulo and Rio de Janeiro, in the district of Parati. More than 200 digital pictures including virtually all of the investigated localities are available on request from the authors. Generally, at any given location, we manually collected 500 ml of sediment from different points in the littoral zone (site I) and 500 ml from different points in the shallow sub-littoral zone (site sl). In some circumstances we did not collect material from the sl site because of its unsuitable

Table 1. Sampling locations along the coast of the States of São Paulo (SP), and Rio de Janeiro (RJ), Brazil; date of collection, water depth and physical and chemical characteristics of the interstitial water at the sublittoral sites.

Location	Latitude (South)	Longitude (West)	Date	Salinity (‰)	Temp. (° C)	pH	Depth (m)
1, Praia do Engehno (RJ)*	23°12'23"	44°39'30.4"	07/09/03	32	24	8.2	–
2, Praia Vermelha (RJ)	23°11'47.3"	44°38'35.6"	07/09/03	32	23	8.2	2.5-3.0
3, Ilha de Prumirim (SP)	23°21'55.1"	44°56'30.2"	06/09/03	32	23	8.1	2.5 & 4.0
4, Praia Prumirim (SP)	23°22'39.1"	44°57'18.2"	06/09/03	31	22	8.1	2.5
5, Praia do Tenório (SP)	23°22'57.5"	45°03'41.1"	06/09/03	32	23	8.2	1.5
6, Praia Grande (SP)	23°23'04.4"	45°03'49.9"	06/09/03	32	22	8.0	1.5
7, Praia do Segreda (SP)*	23°37'50.0"	45°23'06.3"	05/05/02	35	22	8.0	–

*, data refer to littoral site.

Table 2. Granulometric characteristics of the substratum at the seven investigated locations; values are in phi.

Location and site	Mean grain size and size class	Sorting and Sorting class	Skewness	Kurtosis
1, l	1.07, medium sand	0.69, moderately well sorted	2.38	3.17
2, l	0.21, coarse sand	0.71, moderately well sorted	0.48	3.10
2, sl	1.30, medium sand	1.00, moderately sorted	0.29	2.11
3, l	1.46, medium sand	0.95, moderately sorted	7.88	2.20
3, sl (so)	1.62, medium sand	1.04, poorly sorted	-0.42	2.22
3, sl (no)	2.39, fine sand	0.69, moderately well sorted	-1.20	6.98
4, l	1.72, medium sand	1.00, moderately sorted	-1.17	2.70
4, sl	1.98, medium sand	1.04, poorly sorted	-4.82	2.31
5, l	2.36, fine sand	0.49, well sorted	-0.84	4.63
5, sl	2.28, fine sand	0.59, moderately well sorted	-0.61	3.90
6, l	2.58, fine sand	0.5, moderately well sorted	0.15	5.55
6, sl	2.70, fine sand	0.87, moderately sorted	-1.28	4.69
7, l	2.26, fine sand	0.86, moderately sorted	-1.56	5.56

l, littoral site; sl, sublittoral site; so, southern side; no, northern side.

sediment characteristics (i.e. too muddy); yet, two distinct sub-littoral samples were collected from Ilha do Prumirim, from the southern (so) and the northern (no) sides, respectively, of the crescent shaped beach facing the mainland. During sampling, the physical and chemical characteristics of the seawater were measured using a Horiba U-10 water quality checker while the geographic coordinates of the locations were recorded from a Garmin GPS portable receiver. A list of the surveyed locations, including geographic coordinates, dates of sampling and characteristics of the interstitial water are reported in Table 1. Samples were taken during different collecting trips (see dates in Table 1) and brought as soon as possible to the USP-CEBIMar laboratory in São Sebastião. In the laboratory, within one week from collection, specimens were extracted daily with the narcotization-decantation technique using a 7 % magnesium chloride solution (Pfannkuche & Thiel, 1988). Supernatant was poured into 3.0-cm diameter plastic Petri dishes and scanned for gastrotrichs at 40× under a Wild M38 stereo-

microscope. When located, gastrotrichs were mounted on glass slides, and observed *in vivo* with Nomarski differential interference contrast optics using a Zeiss Axioscop 2 Plus microscope. During observation, specimens were measured using an ocular micrometer and photographed with a Nikon coolpix 995 high definition digital camera (3.34 Mpixel). Specimens of several species were fixed overnight in a 1.0 M phosphate buffered (pH 7.3) solution of paraformaldehyde, glutaraldehyde and picric acid, following Ermak & Eakin (1976) and stored for later SEM analysis.

Granulometric analysis of the substrata was carried out according to Giere et al. (1988) and the principle parameters (Table 2) were calculated by a computerized program based on the Seward-Thompson & Hail's (1973) equation.

Results and Discussion

We encountered 30 putative species from the 13 sites, yielding a total of 46 records (species × site)

Table 3. Macrodasysida species list and distribution in littoral (l) and sublittoral (sl) sites at seven localities along shores (praias) of the states of Rio de Janeiro and São Paulo.

	Parati		Ubatuba			São Sebastião	
	1, Praia Engenho	2, Praia Vermelha	3, Praia de Prumirim	4, Ilha de Prumirim	5, Praia do Tenorio	6, Praia Grande	7, Praia do Segredo
MACRODASYIDA							
Lepidodasyidae							
<i>Dolichodasys</i> sp. 1**	-	-	-	-	-	-	1
<i>Paradasys</i> sp. 1	-	sl	-	sl [†]	-	-	-
<i>Mesodasys</i> sp. 1**				sl			
Macrodasysidae							
<i>Macrodasys fornerisae</i>	-	-	-	-	-	-	1
<i>Macrodasys</i> sp. 2							1
<i>Macrodasys</i> sp. 4	-	sl	-	sl [†]	-	-	-
<i>Macrodasys</i> sp. 5*	-	sl	-	-	-	-	-
<i>Macrodasys</i> sp. 6	-	sl	-	-	-	-	-
<i>Macrodasys</i> sp. 7*	1	sl	-	-	-	-	-
<i>Urodasys viviparus</i> **	-	sl	-	sl [†]	-	-	-
Thaumastodermatidae							
<i>Pseudostomella</i> sp. 1	-	-	sl	l	sl	l	-
<i>Tetranchyroderma</i> sp. 1	-	-	sl	-	-	-	-
<i>Thaumastoderma</i> sp. 1	-	sl	-	-	-	-	-
Turbanellidae							
<i>Paraturbanella</i> sp. 1	-	-	sl	sl	sl	sl	-
<i>Paraturbanella</i> sp. 2	-	-	l	sl	-	-	-
<i>Turbanella</i> sp. 1**	-	-	-	l	-	-	-
Total Macrodasysida per locality	1	7	4	8	2	2	3

*, species new to Brazil; ** genus and species new to Brazil; [†] finer sediment (no).

or an average of 6.85 ± 5.58 species per location and 1.63 ± 1.1 sites per species. Sixteen species from ten genera and four families belong to the order Macrodasysida (Table 3) and fourteen species in six genera and two families belong to the order Chaetonotida (Table 4).

Ten species appear as new to the Brazilian fauna. Of these, five belong to genera also unreported from Brazil thus far; namely the macrodasysidans *Dolichodasys* sp. 1, *Mesodasys* sp. 1 (Lepidodasyidae), *Urodasys viviparus* (Macrodasysidae) and *Turbanella* sp. 1 (Turbanellidae), and the chaetonotidan *Draculiciteria tessellata* (Xenotrichulidae). Unfortunately, of the first two species we found only a single juvenile specimen of each so that it is impossible to say whether or not they represent a species new to science. *Turbanella* sp. 1 as well as *Macrodasys* sp. 5, *Macrodasys* sp. 7, *Chaetonotus* sp. 6 and *Chaetonotus* sp. 7 appear to be undescribed taxa and thus far endemic to Brazilian coast; their definitive affiliation however will be made at the end of the ongoing taxonomical surveys. On the other hand *Urodasys viviparus* and *Draculiciteria tessellata* are known to be regional cosmopolitans whose widespread occurrence is

probably related to the way they reproduce, i.e. parthenogenesis (Ruppert 1977). The finding of the parthenogenetic *Aspidiophorus tentaculatus*, previously reported from the Mediterranean Sea and the US coast of Florida (Hummon 2001) reinforce this notion. The remaining 20 species had already been found in our past survey of the gastrotrich-fauna of the northern beach of the State of São Paulo.

The macrodasysidans *Paraturbanella* sp. 1, *Pseudostomella* sp. 1 and the chaetonotidan *Heteroxenotrichula* sp. 1 were the most common species, in agreement with our previous findings (Todaro & Rocha 2004). In contrast, this time we found *Tetranchyroderma* sp. 1 only once whereas in the previous survey it was very common. Possibly seasonality has much to do with the contrasting findings.

In localities where collections of both littoral and sublittoral sediments were made, the abundance of species was higher in the latter, which is in accordance with what is known from nearby atidal areas e.g., Mediterranean Sea and Gulf of Mexico (cf. Todaro et al. 1995, 2001). As far as the tidal distribution of taxa is concerned, although

Table 4. Chaetonotida species list and distribution in littoral (l) and sublittoral (sl) sites at seven localities along shores (praia) of the states of Rio de Janeiro and São Paulo.

	Parati		Ubatuba			São Sebastião	
	1, Praia Engenho	2, Praia Vermelha	3, Praia de Prumirim	4, Ilha de Prumirim	5, Praia do Tenorio	6, Praia Grande	7, Praia do Segredo
CHAETONOTIDA							
Chaetonotidae							
<i>Aspidiophorus mediterraneus</i>	-	-	-	-	-	-	1
<i>Aspidiophorus tentaculatus*</i>	-	1	-	sl†	-	-	-
<i>Chaetonotus apechochaetus</i>	-	-	-	sl†	-	-	-
<i>Chaetonotus atrox</i>	-	sl	-	sl	-	-	-
<i>Chaetonotus dispar</i>	-	sl	-	-	-	-	-
<i>Chaetonotus neptuni</i>	-	-	-	sl	-	-	-
<i>Chaetonotus</i> sp. 6*	-	-	-	sl	-	-	-
<i>Chaetonotus</i> sp. 7*	-	sl	-	-	-	-	-
<i>Halichaetonotus cf. decipiens</i>	-	-	-	-	-	-	1
Xenotrichulidae							
<i>Draculiciteria tessellata**</i>	-	-	-	sl†	-	-	-
<i>Heteroxenotrichula squamosa</i>	-	-	-	sl	-	-	-
<i>Heteroxenotrichula pygmaea</i>	1	-	-	-	-	-	-
<i>Heteroxenotrichula</i> sp. 1	-	1	L	l,sl	-	-	-
<i>Xenotrichula intermedia</i>	-	-	Sl	l, sl	L	1	-
Total Chaetonotida per locality	1	5	2	9	1	1	2
Total species of	2	12	6	17	3	3	5
Gastrotricha per locality	(1M+1C)	(7M+5Cc)	(4M+2C)	(8M+9C)	(2M+1C)	(2M+1C)	(3M+2C)

*, species new to Brazil; ** genus and species new to Brazil; † finer sediment (no).

at higher taxonomic ranks there does not seem to be a substantial difference between the littoral and the sublittoral sites, several species do show a clear preference for one or the other. For instance, among species found in locations for which data are available for both sites, *Turbanella* sp. 1, *Paraturbanella* sp. 2 (order Macrodasysida), and *Halichaetonotus decipiens* and *Heteroxenotrichula* sp. (order Chaetonotida) were found almost exclusively in littoral samples. On the other hand, the macrodasysidans *Paraturbanella* sp. 1, *Pseudostomella* sp.1 and *Tetranchyroderma* sp. 1 can be considered characteristic of the sublittoral areas. Once again, in Brazil *Heteroxenotrichula intermedia* has been found with the same frequency in both areas. This is quite surprising, since elsewhere in the world the species is considered typical of the littoral domain (Todaro et al. 1996).

Conclusion

Data indicate that the northern coast of the State of São Paulo (and southern Rio de Janeiro) supports a good number of gastrotrich species (about 50 spp. in total) almost evenly distributed between the orders Macrodasysida and Chaetonotida. Our knowledge of biodiversity is likely to increase as new locations characterized by clear water, clean sediment of fine to medium grain size are investigated. This conclusion is born out by the present results from the Ilha do Prumirim (17 species found) and Praia Vermelha (11 species found) and also from previous results obtained in areas with such characteristics (Todaro & Rocha 2004; Todaro et al. 1995). Although in the investigated region there appears to be no sharp seasonal climatic change (water temperature rarely falls below 20 °C), the abundance of some species does undergo a major change during the year, as testified by the finding of only a single specimen of *Tetranchyroderma* sp. 1 in this survey (September), whereas during the previous one (April-May 2002) it was one of the most abundant and frequent taxon (Todaro & Rocha 2004).

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