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Brachionid rotifer diversity in Andaman waters

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Andaman rotifers are least studied and authenticated records are not available for sufficing the data on their biodiversity. Rotifers were collected from brackish water to see their species diversity. Rotifers identified during this study are *Brachionus plicatilis, B. rotundiformis, B.murrayi, B.urceolaris, B. calyciflorus, B. falcatus and Kellicotia sp.* This is a primary record on Brachionids of saline waters of Andaman. The detailed description of the rotifers recorded during the study in the coastal waters of S. Andaman is presented for substantiating the taxonomic relevance of the study.

[**Keywords**: Rotifer, Brachionidae, Brackish water, Andaman and Nicobar Islands]

Introduction

Rotifers make up a phylum of microscopic and near-microscopic pseudocoelomate animals. There were some pioneering efforts towards the end of eighteenth century to provide a systematics for rotifers based on morphological details[1]. Rotifers may be free swimming or truly planktonic, others move by inch worming along the substrate whilst some are sessile, living inside tubes or gelatinous holdfasts. Most species of rotifers are about 200 to 500 micrometers long. However a few species, such as *Rotaria neptunia* may be longer than a millimeter. Rotifers are microscopic animals, their diet consist of matter small enough to fit through their tiny mouths during filter feeding. Rotifers are primarily omnivorous, but some species have been known to be cannibalistic. The diet of rotifers most commonly consists of dead or decomposing organic materials, as well as phytoplankton that are primary producers in aquatic communities. Such feeding habits make some rotifers primary consumers.

There are about 2000 species of rotifers, divided into two classes, *Monogononta* and *Bdelloidea*. *Monogononta* is the largest group with around 1500 different species. *Bdelloida* is of particular note because of the absence of males and the ability of cryptobiosis. In Indian context the study about rotifers are few when compared to the global research. The history of Indian rotifers dates back to the initial period of rotifer systematics started with a brief note on rotifers in Indian waters[2]. The available literature shows that the earlier works on Indian rotifers were limited to certain regional water bodies[3,4]. A broad based spatial distribution about the rotifer fauna present in Indian waters was carried out and described in two series of a publication in mid 70's and 80's[5,6]. But the expanse of Indian waters covered in this effort ignored many probable areas rich in rotifer diversity. Over the last three decades there were a few research priorities to address these lacunae on observing and classifying rotifer fauna in Indian waters[7,8,9,10,11,12]. Hitherto, the study about the rotifers present in the brackish waters is meagre. Since coastal ecosystems like mangroves and coral reefs harbour a variety of fishes, it is imperative to study the rotifers in the ecosystem which are the driving force behind the survival of most of them.

Materials and Methods

Rotifer samples were collected from the brackish waters of Andaman (Fig.1). Since the density of rotifers present in pure saline waters of Andaman are very less, the present study is restricted to the brackish water areas only. Samples were collected over a period of four months extending from December 2007 to March 2008. Rotifer samples were collected by filtering 5 litres of water from a particular site[11]. Water samples at a site were collected from various depths instead of a particular point to avoid sampling errors.

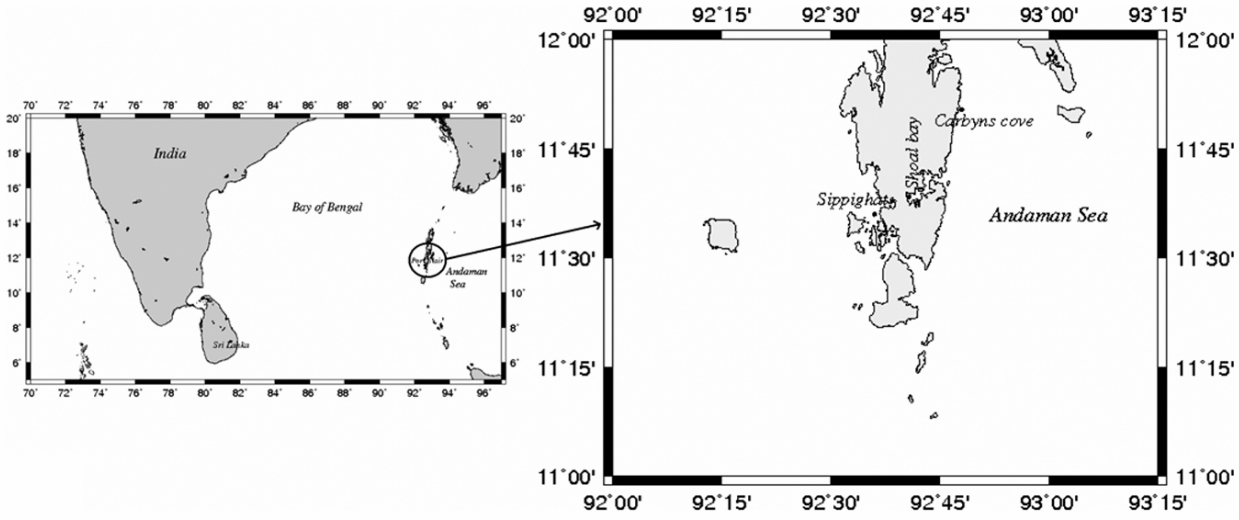

Fig. 1—Site map showing the various sampling points in Andaman.

In the present study, the samplings were done in the evening time between 3 to 5 pm, as rotifers have the tendency to migrate vertically for grazing on nutrient rich phytoplankton in the upper water column. During the filtering process, water was collected from various depths and different points using a small bucket of 5 litres and was filtered through the net of mesh size 40 µm. Collected samples were transferred to a 100 ml sampling bottle and fixed with 5% formaldehyde immediately to avoid clumping of rotifers. Fixed samples were carried to the laboratory for further analysis.

Samples were kept in dark and cool area. Primarily all the samples were analysed for the density of the rotifers present in the sample. The density was counted using sedge wick-rafter plankton counting cell. Further analysis for the species identification was done with binocular microscope (OLYMPUS CH 40). The samples were thoroughly analysed for the presence of various rotifer species and photographs of the desired species were taken using OLYMPUS SC 30 camera.

The rotifers were identified using various keys[13,11, 14] as well as image based identification provided by various websites (http://rotifer.acnatsci.org/science, http:// cfb.unh.edu, www.glerl.noaa.gov/seagrant/ GLWL/zooplankton/rotifers).

Results and Discussion

Rotifer fauna of Andaman waters is rich in *Brachionus sp*. The presence of *Brachionus plicatilis* species complex is a notable character of the rotifers present in Andaman waters. Backwaters of Kochi describe the *Brachionus* species complex as a combination of *B.plicatilis*, *B.rotundiformis* and *B.murrayi.* But there is a slight variation in the description of this complex as *B.murrayi* is less envisaged in the complex with a majority of them being a combination of *B.plicatilis* and *B.rotundiformis.* Earlier study describes the *Brachionus* species complex in Andaman waters as *Brachionus* 'S' and 'L' and 'SS' forms as smaller *Brachionus*, larger *Brachionus* and super small *Brachionus*[15]. But the present study reveals that they are *Brachionus rotundiformis, B. murrayi and B. plicatilis* respectively in concurrence with the reports from Cochin backwaters[12]. But the difference observed among Andaman species is with respect to the lesser availability of *B. murrayi* among the various samples of the complex collected from Andaman waters. Other species of rotifers are present in very less number. The representatives of other species are specific for certain areas but *Brachionus* species complex consisting of *Brachionus rotundiformis and B. plicatilis* is common for most of the areas (Table 1). The rotifers identified during this study are *Brachionus plicatilis, B. rotundiformis, B.murrayi, B.urceolaris, B. calyciflorus, B. falcatus and Kellicotia sp.* (Fig. 2).

The maximum density of rotifers was noticed from the sample collected from a discarded cement tank at Central Agricultural Research Institute's brackishwater aquaculture farm at Sippighat (Table 1). The tank was getting inundated only during highest

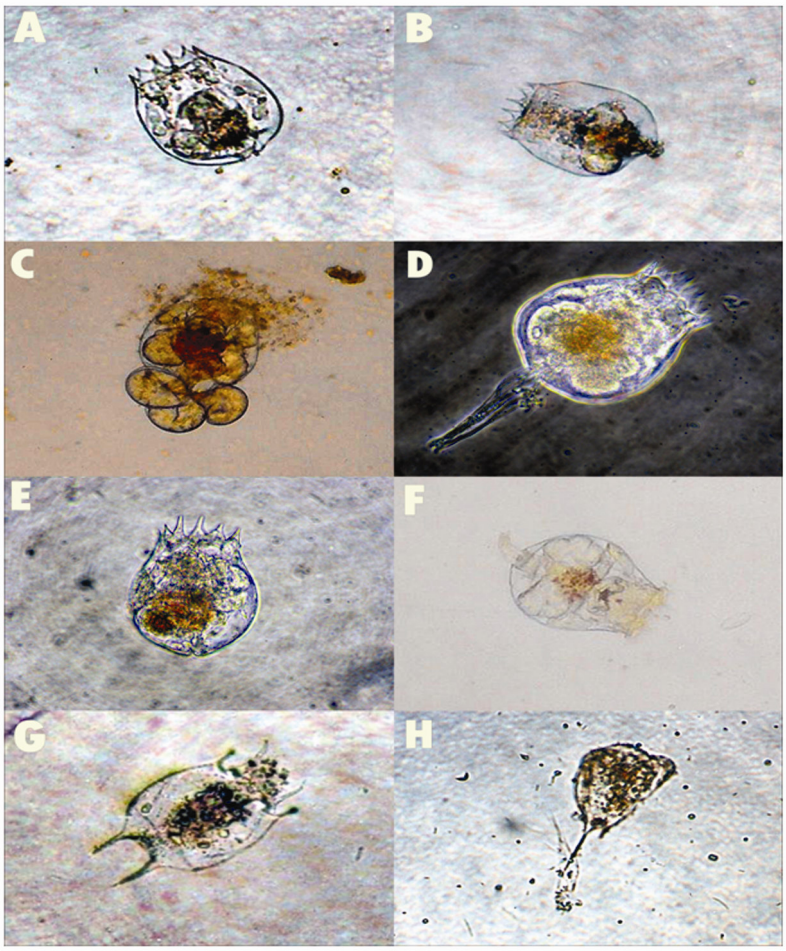

Fig. 2—A) *B. urceolaris* B) *B. rotundiformis* C) *B. rotundiformis* with egg mass D) *B. plicatilis* E) *B.murrayi* F) *B. calyciflorus,* G) *B.falcatus* H) *Kellicotia* sp.

high tide and fishes were not getting trapped in that. The sample from that tank consisted of *Brachionus rotundiformis* only. Various other rotifers are mainly identified from the samples collected from mangrove areas.

Key to the genera of family Brachionidae recorded from Andaman.

1a. Foot present	*Brachionus*
1b. Foot absent	*Kellikottia*

Key to the species of *Brachionus* recorded from Andaman.

1a. Three pairs of occipital spines	2
1b. Two pairs of occipital spines	3
2a. Lorica elliptical; occipital spines saw-teethed	*B. plicatilis*
2b. Lorica vase shaped; base of the occipital spines small	*B. rotundiformis*
2c. Lorica elongated; intermediate spines comparatively short	*B. murrayi*
3a. Postero lateral spines/foot opening spines present	4
3b. Postero lateral spines/foot opening spines absent	*B. urceolaris*
4a. Occipital intermedian spine longer	*B. falcatus*
4b. Occipital intermedian spine not longer	*B. calyciflorus*

This work is an earnest attempt to add to the knowledge of the occurrence of rotifers in brackish water systems in India. Since, the identified rotifers show some new records for the locality, description of identified rotifers in Andaman waters are given below in concurrence with the similar descriptions earlier for the species in India[12,13] and their original description:

Table 1—Density and location specific availability of rotifers (+ indicates presence of the species)

Sl. No.	Place of collection	Density (No/100 mL)	*B. plicatilis*	*B. rotundiformis*	*B. murrayi*	*B. calyciflorus*	*B. urceolaris*	*B. falcatus*	*Kellicotia sp*
1	Sippighat(a cement tank) (11° 36' 38.8", 92° 40' 39.5")	49		+					
2	Sippighat(brackish water pond) (11° 36' 38.8", 92° 40' 39.5")	24	+	+		+	+		
4	Sippighat(mangroves) (11° 36' 19.3", 92° 41' 11.7")	16	+	+	+			+	+
5	Sippighat(culture pond) (11° 36' 10.6", 92° 41' 16.5")	22	+	+			+		
7	Sippighat(near bridge) (11° 36' 10.6", 92° 41' 16.5")	20	+	+				+	
8	Carbyns cove(culture pond) (11° 38' 50.0", 92° 44' 53.3")	6		+			+		
9	Carbyns cove (mangroves) (11° 38' 47.8", 92° 44' 56.8")	14	+	+	+				
10	Carbyns cove (road side pond) (11° 38' 49.5", 92° 44' 41.6")	8	+				+		
11	Shoal bay (mangroves) (11° 50' 43.6", 92° 43' 63.9")	18				+			
12	Shoal bay (mangroves) (11° 50' 43.6", 92° 43' 63.9")	16 (unidentified sp.)							

Brachionus urceolaris (Muller, 1773)

Muller, O. F. (1773). *Vermium terrestrium et fluviatilium, seu Animalium infusorium, helminthicorum et testaceorum, non marinorum, succincta Historia. Vol. I.* Infusoria, Copenhagen, Leipzig.

Description: Lorica even, rounded posteriorly, the greatest width is a little below the central point of lorica; anterior dorsal margin with six pointed spines, medians longer than laterals, laterals longer than intermediates or equal in length; pectoral margin undulate, with a shallow central sinus flanked on either side by a sharp protuberance; foot opening with a rectangular aperture dorsally and a large oval aperture in the ventral plate; all the anterior spines have strengthening ribs.

Remarks: New record for the Andaman waters. Uncommon in the samples collected.

Brachionus rotundiformis (Tschugunoff, 1921)

Tschugunoff, H. L. (1921). A study of the plankton of the arctic regions of the Caspian Sea (In Russian). Report of the Volga Biological Station 6: 364-411.

Description: Lorica miniature more rounded and not sharply split into dorsal and ventral plates; occipital margin with small based acutely sharp spines; pectoral margin four-lobed, lateral ones roughly triangular; foot opening with sub square aperture ventrally and fairly ovoid aperture dorsally.

Remarks: The most common species seen in Andaman waters. Widely used in ornamental fish larval feeding. The uniform distribution of this species is a possible reason for better fish abundance in Andaman waters as fish larvae feed on this species.

Brachionus plicatilis (Muller, 1786)

Muller, O. F. (1786). Animalicula infusoria fluviatilia et marina, quae defexit, systematice descripsit et ad vivum delineari curavit.(Copenhagen).

Description: Lorica fairly flexible, oval, not sharply split into dorsal and ventral plates, but little compressed dorso-ventrally; anterior dorsal margin with six broad-based saw-tooth spines, nearly equal in length; pectoral margin firm, split into four lobes with considerable variations ; lorica without posterior spines; smooth or lightly stippled; foot opening small sub square aperture ventrally.

Remarks: Common species used for feeding the ornamental fishes[16]. The spatial distribution of this species is also very high and hence may be a possible live feed support for fishes in brackish as well as coastal waters in Andaman.

Brachionus murrayi (Fadeew, 1925)

Fadeew, N. N. (1925). Sur la connaissance de la fauna de lacsdu Transcucasie. Raboty sev. Kavkazskoj. Gidiobiol. Stancii., 1: 17-25(in Russian).

Description: Lorica small ovoid to elliptical and not sharply separated into dorsal and ventral plates; occipital spines six in number which are narrow markedly above the broad, inflated base and end in thin acutely pointed tips or small based equilateral, equidistant triangular spines; the pectoral margin rigid and scalloped, shows considerable variations, irregularity of the four rounded projections; the occipital spines also show considerable variations especially in the relative length of intermediate spines ; posterior spines absent; foot opening with a small sub square aperture ventrally.
Remarks: New record for this region. Very rarely seen in Andaman. But the species is wide spread and regularly reported from other coastal waters of India.

Brachionus calyciflorus (Pallas, 1766)

Pallas, P. S. (1766). Elenchus zoophytorum sistens generum adumbrations generaliores et specierum cognitarum succinctas descriptions cum selectis auctorum synonymis, Hage, Comitum.
Description: Lorica supple, oval to sub-circular, not split into dorsal and ventral plates; body slightly compressed dorso-ventrally, anterior dorsal margin with four broad based spines of variable length, medians longer than laterals; pectoral margin flexible, usually somewhat elevated with shallow 'v' or 'u' shaped notch; posterior spines may or may not be present.
Remarks: New record for this region and was uncommon during the study period.

Brachionus falcatus (Zacharias, 1898)

Zacharias, O. (1898). Untersuchungen uber das plankton der Teichgewasser. Forsch Ber. Bioo. Stn Plon., 6: 89-139.
Description: Lorica firm, lightly stippled, greatly compressed dorso-ventrally and composed of dorsal and ventral plates; occipital margin with six spines, intermediates much longer than laterals and medians and curved ventrally; medians and laterals are short and almost equal in length; posterior spines widely separated basally, long, their width much more than anterior spines, parallel or bow outwards, converge, then twist towards their apices, thus competing full arch; dorsal plate often with pustules or granulated; foot opening terminal; pectoral margin firm and wavy without elevation towards the centre.
Remarks: New record to this region. During the sampling only two specimens of this species was observed.

Kellicottia sp.
Description: Lorica firm, greatly compressed dorso-ventrally, dorsal surface marked off into polygonal areas, mostly seen in group of 5-10 individuals attached with small particles or leaves, a longer spine anteriorly and longer spine and foot at posterior end for attachment.
Remarks: Very common in the samples of Sippighat region, but the species is reported for the first time from Andaman waters.

Apart from the basic taxonomy interest in this effort, the notable absence of *B. murrayi* among the *Brachionus* species complex in Andaman waters is a cue for further studies. It is imperative to investigate the potential of these complexes and other rotifers in determining the diversity and abundance of aquatic organisms in Andaman waters. Further, the taxonomic cues provided by the study calls upon intensive exploratory works to strengthen the database on rotifers of Indian waters to promote the various ongoing captive seed production programmes of marine ornamental and food fishes[16].

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References

1 Hudson C T, & Gosse P H, The Rotifera or Wheel animalcules, both British and foreign. *Vol. 1&2, Longman, London, Green 7 Co., (*1886-1889) 272pp.
2 Anderson H H, Notes on Indian rotifers. *J. Asiat. Soc. Beng*., 58 (1889) 345-358.
3 Arora J & Mehra N K, Species diversity of planktonic and epiphytic rotifers in the back waters of the Delhi segment of the Yamuna River, with remarks on new records from India. *Zoological studies*, 42 (2) (2003) 239-247.
4 Nayar C K G, *Rotifer* fauna of Rajasthan**.** India. *Hydrobiologia*, 31 (1968) 168-185.
5 Sharma B K, On a Small collection of rotifers (Class: Rotifera) from Orissa. *Newsl. Zool. Surv. India*. 3 (1977) 189-190.
6 Sharma B K, Indian Brachionidae (Eurotaria: Monogononta) and their distribution. *Hydrobiologia*, 144 (1987) 269-273.

7 Rao R K, & Chandra Mohan P, Brackish water rotifera from Vishakhapatnam harbour, *Indian. J. Mar. Sci*. 13 (1984) 92-93.

8 Shakunthala Pandey & Singh U N, The rotifer fauna of Champaran, north Bihar (India) Brachionus-2. Further contributions to the family Brachionidae. *Proc. Acad. Environ. Biol*., 2 (1993) 143-147.

9 Dhanapathy M V S S S, Taxonomic notes on the rotifers from India (from 1889-2000). *Indian Association of Aquatic Biologists*-Publication, 10 (2000) pp. 178.

10 Gopakumar G & Jayaprakash V, Community structure and succession of brackish water rotifers in relation to ecological parameters. *J. Mar. Biol. Ass. India*, 45 (2003) 20-30.

11 Molly Varghese, Krishnan L & Kuttyamma V J, Systematic account on rotifers of the genus Brachionus from Cochin Backwaters. *J. Mar. Biol. Ass. India*, 48(2) (2006) 147-155.

12 Anitha P S, & Rani Mary George, The taxonomy of *Brachionus plicatilis* species complex (Rotifera: Monogononta) from the Southern Kerala (India) with a note on their reproductive preferences. *J. Marine. Biol. Ass. India*. 48 (1) (2006).

13 Anitha P S, Rani Mary George & George J P, Brachionid Rotifers of Kerala - A manual for Identification. 2006, 106 pp.

14 Francis T, Ramanathan N, Athithan S, Rosalind P, Daisy Rani & Padmavathy P, Rotifer diversity of fish ponds manured with live-stock waste. *Indian J. Fish*., 50 (2) (2003) 203-209.

15 Madhu K, Rema Madhu & Soundrarajan R, *Annual Report-2003-2004* Central Agricultural Research Institute, Port Blair, Andaman. (2004) 65.

16 Ajith Kumar T T, Subodh Kant Setu, Murugesan P & Balasubramanian T, Studies on captive breeding and larval rearing of clown fish Amphiprion sebae (Bleeker 1853) using estuarine water. *Indian. J. Mar. Sci*. 39 (1), (2010) 114- 119.