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Anitha PS

Fisheries Extension Officer,
Office of the Deputy Director of
Fisheries, Kamaleswaram,
Manacud P. O.
Thiruvananthapuram – 695009.

Rani Mary George

Central Marine Fisheries
Research Institute, Cochin-18,
Kerala, India

Contributions to the rotifer fauna of Kerala (India) with two new records and remarks on some species

Anitha PS, Rani Mary George

Abstract

The present study reports on rotifer fauna from two low-saline backwaters namely Veli-Aakulam (latitude 8° 25' – 8° 30' N & longitudes 76° 55' - 77° 00' E) and Poonthura - Thiruvallam (latitude 8° 25' – 8° 35' N & longitude 76° 50' – 76° 58' E) along the southern part of Kerala, India. The survey for rotifers was carried out from February 2000 to January 2001. A total of 42 species of rotifers belonging to 16 genera and 12 families are recorded. Of these, the family Brachionidae is represented by the highest number of 22 species followed by Lecanidae (5 species), Filinidae (4 species) and Mitiliniidae (2 species). The rotifers, *Brachionus dichotomus reductus* (Koste & Shiel) and *B. kostei* (Shiel) are reported here for the first time from Indian waters while *B. quadridentatus mirabilis* (Daday), *B. calyciflorus borgerti* (Apstein), *Mytilina crassipes* (Lucks), *Filinia opolensis* (Zacharias) and *F. cornuta* (Weisse) are reported for the first time from Kerala waters. The existence of *B. forficula keralaiensis* (Nayar & Nair) and *B. rotundiformis* (Tschugunoff) in Kerala waters is confirmed through the present study since they have been reported so far only from Kerala. Diagnostic features of some interesting species are also illustrated in the present account with remarks on their distribution in India.

Keywords: Rotifera, Kerala, Taxonomy, *Brachionus*, Kerala, Rotifer

Introduction

Taxonomic studies of rotifers from Kerala (India) are very scanty and are confined to freshwater habitats^[1-3]. Studies on the estuarine rotifer fauna have received very little attention till date even though they constitute a predominant portion of zooplankton during certain seasons^[4]. A total of 30 species of brackish water rotifers were reported from three estuaries of Kerala^[5]. As the State is characterized by a number of lagoons and backwaters associated with estuaries, it is likely that many more species may be present than recorded. The present study is based on plankton samples collected from two brackishwater habitats (Veli-Aakulam & Poonthura-Thiruvallam) in the western part of Thiruvananthapuram coast, Kerala (India) in order to increase our knowledge in this group from the estuarine areas of Kerala. Forty-two species were identified and most of them belong to the order Ploimida. A list of species, varieties and forms, classified according to their families has been given. Among the examined taxa, two are new records to India, while five are new to Kerala. Some of these important taxa are briefly described and illustrated in this paper, with remarks on their distribution in India.

Material and Methods

Plankton samples were collected from Veli - Aakulam (latitude 8° 25' – 8° 30' N & longitudes 76° 55' - 77° 00' E) and Poonthura - Thiruvallam (latitude 8° 25' – 8° 35' N & longitude 76° 50' – 76° 58' E) estuaries. The samples were collected by horizontal hauls using plankton net of 32 cm mouth diameter with a mesh size of 70µm. Samples were immediately preserved in 4% formaldehyde. The sorting and identification of rotifers were done with a stereo-dissecting microscope. All the illustrations given are camera Lucida drawings made with the aid of a compound microscope and the measurements are given in micrometers (µm). Rotifers were identified to species level using standard taxonomic references^[6-8].

Results

A list of all the identified rotifers with varieties and forms from the samples is provided in list. Account of some taxonomically interesting taxa

Correspondence**Anitha PS**

Fisheries Extension Officer,
Office of the Deputy Director of
Fisheries, Kamaleswaram,
Manacud P. O.
Thiruvananthapuram – 695009.

Platyiias leloupi: Gillard (Fig. 1)

Material: Six parthenogenetic females were obtained from Poonthura and Thiruvallam.

P. leloupi is the first report from Kerala. The specimens are identical with the description given by Koste & Shiel^[9]. This taxon has been reported so far from West Bengal^[10] and Delhi^[11].

Measurements: total length 352-429; maximum width 225-278; anterior spine 65-78; posterior spine 98-107

Brachionus angularis: Gosse (Fig. 2a-d)

Material: Several parthenogenetic females were observed in the samples collected from all the stations.

B. angularis has been reported from most of the states of India namely Rajasthan^[12], Andhra Pradesh^[13], West Bengal^[14], Orissa^[15], Tamil Nadu^[16], Bihar^[17] and Kerala^[18].

Measurements: total length 88-116; maximum width 76-96; median spines 7-11; egg size 67 x 47 (L x W).

A few numbers are represented by the *f. aestivus* Skorikov (Fig. 2c,d). This form is characterized by the presence of

highly reduced median spines, circular outline of lorica and the greatly converged caudal protuberance. The measurement of this small morph is: total length 80-84; maximum width 73-76; egg size 64 x 42. It is recorded for the first time from Kerala and second from India. This morph has been reported so far from Rajasthan^[12].

Brachionus calyciflorus: Pallas (Fig. 3a-f)

Material: Several ovigerous and non-ovigerous females were noted in the samples collected from all the stations.

B. calyciflorus is one of the most common species and extremely variable in its size, length of occipital spines and, the presence and length of posterior spines. This taxon has wide spread distribution in India and been recorded from West Bengal^[14, 15], Maharashtra^[19] Kerala^[1], Andhra Pradesh^[13], Tamil Nadu^[16], Bihar^[17] and Kerala^[18]. This species is represented by *f. typica* Koste (Fig. 3a), *f. heterospina* Saksena (Fig. 3b), *f. asymmetrica* Koste (Fig. 3c), *f. anuraeformis* Brehm (Fig. 3d), *f. amphicerus* Ehrenberg (Fig. 3e) and *f. dorcus* Gosse (Fig. 3f).

Measurements						
Morphs	Total Length	Maximum width	Anterior Middle	spines Lateral	Posterior Foot opening	spines lateral
<i>f. typica</i>	264	190	52	3535	35	-
<i>f. heterospina</i>	260	173	52	35	35	21
<i>f. asymmetrica</i>	243	156	40	33	52	13/24
<i>f. anuraeformis</i>	277	190	47	30	11	34
<i>f. amphicerus</i>	255	121	52	43	52	87
<i>f. dorcus</i>	381	242	121	69	52	-

Brachionus dichotomus reductus: Koste & Shiel (Fig. 4)

Material: A total of 18 parthenogenetic females were collected from Poonthura and Thiruvallam.

Description of the female: Lorica with long median anterior spines, which protrude as a 'v' shape; anterior lateral spines are absent; anterior sub-median spines are rudimentary, long caudal spines; lorica at the posterior end, overhanging the base of the foot opening.

Measurements: total length 125-144; maximum width 76-113; antero-median spine 13-27; postero-median 36-47; Egg size 58 x 24.

This is the first report of *Brachionus dichotomus reductus* from the Indian waters.

Brachionus forficula keralaiensis: Nayar & Nair (Fig. 5a, b)

Material: Two parthenogenetic females from Poonthura station

Description of the female: Lorica is firm and divided into dorsal and ventral plates; occipital margin with six spines, medians and laterals are almost equal in length or laterals slightly longer than medians; intermediate spines are highly reduced but invariably present in the examined materials; the pectoral margin is rigid, elevated with a wide 'U'-shaped sinus, flanked with two pointed spines; lorica terminates posteriorly in a pair of stout sub-equal spines, which are widely separated at their bases.

Measurements: total length 129-159; maximum width 73-91; antero-median spine 13-18; antero-intermediate spine 2-3; antero-lateral spine 18-22; posterior spine 34-49

B. forficula keralaiensis is originally established as a variety of *forficula* by Nayar & Nair^[1] but in our observation it showed some distinct morphological difference to that of *Brachionus forficula*, and they are as follows:

- the presence of *occipital intermediate* spine, which is absent in *B. forficula*;
- absence of *internal swelling* on the posterior spines, which is a characteristic feature for *forficula*; and
- the pectoral margin (fig. 5a, b) of the present taxon is elevated towards the centre with a deeply notched sinus ('U'-shaped), whereas the same for *forficula* has a shallow 'U' sinus to almost straight line (Sudzuki, 1964: 106, pl. 12, figs. 1-18; 1999: 48, pl. 31, figs.1-6, 49, pl. 32, fig. 1). According to Sudzuki^[20] pectoral margin is also a significant morphological feature for the identification of a species. Therefore, the taxonomic validity of this rotifer needs a further confirmation that would facilitate the future reorganization of this taxon since it is reported so far only from Kerala.

Brachionus kostei: Shiel (Fig. 6a, b)

Material: One parthenogenetic female from Thiruvallam station

Description of the female: Six pointed occipital spines and two characteristic dorsally convoluted foot-opening spines; lorica stippled; pectoral margin is elevated and notched medially; the ventral plate with two cuticular ridges with granular borders.

Measurements: total length 133; maximum width 89; antero-median spine 13; antero-intermediate spine 3; antero-lateral spine 13; posterior spine 13.

The present record is the first and fourth for this species from India and the world respectively. The species is observed from a single locality and also only one. The general morphology of the specimen from Kerala in the present study closely resembles that of Australian^[21] and Thailand^[22] specimens.

Brachionus quadridentatus mirabilis: Daday (Fig. 7)

Material: Single female was collected from Poonthura station and is identical with the description given by Koste [7].

Measurements: total length 247; maximum width 136; antero-medial spine 38; antero-intermediate spine 18; antero-lateral spine 27; postero-medial spine 89; postero-lateral spine 129; greatest width - total length ratio 0.56.

B. quadridentatus mirabilis is the first report from Kerala and has been reported so far from West Bengal [14], Assam [23] and Bihar [17].

Koste [7] classified this rotifer as a subspecies of *B. quadridentatus*, but according to Sharma [14, 15, 23] and Sharma *et al.* [17] it is a separate species. However, in our study we observed that this taxon has close resemblance with *B. quadridentatus* except in the relative length of the postero-lateral spine. Because of the close similarities between these two species, Koste's opinion seems to be more applicable for this taxon than that of Sharma. One of the interesting observations on this species is its occurrence. The occurrence is very rare. Only one specimen was represented in the present collection.

Brachionus plicatilis: Müller (Fig. 8a, ssssb)

Material: Several parthenogenetic females were observed in the samples collected from all the stations and the specimens are identical with the description given by Koste [7] and subsequent authors [24].

Measurements: total length 171-277; maximum width 156-225; antero-medial spine 20-43; antero-intermediate spine 9-34; antero-lateral spine 15-30; greatest width - total length ratio 0.81-0.91; egg size 98x 87 (Length x Width)

Measurements						
forms	Total length	Max. width	Occipital median	spines sub-med.	Lateral	caudal spine
<i>f. tecta</i>	111	86	27	7	13	13
<i>f. recurvispina</i>	157	47	51	20	11	33

Filinia pejlari: Hutchinson (Fig. 11)

Material: Several females were obtained from Veli-Aakulam estuary.

The specimens are well agreeing with the description given by several authors [7, 12]. This taxon is so far reported from West Bengal [23], Rajasthan [12] and Bihar [17].

Filinia longiseta: Zacharias (Fig. 12)

Material: A large number of specimens collected from Veli and -Aakulam stations.

The specimens are identical with the description given by Koste [7] and Koste & Shiel [9]. It has been reported earlier from Kerala [1, 5], West Bengal [14] and Bihar [17].

Filinia opolensis: Zacharias (Fig. 13)

Material: A few numbers of this species was observed in the samples collected from Poonthura station and the specimens are well agreeing with the description given by Sharma [14].

It is the first report from Kerala and has been reported earlier from Maharashtra [19], Rajasthan [12] and West Bengal [14, 15].

Filinia cornuta: Weisse (Fig. 14)

Material: Numerous specimens were collected from Veli and Aakulam stations and the specimens are identical with the description given by Sarma [11].

It is the first record from Kerala. It has been recorded so far

Brachionus plicatilis has been reported so far from Andhra Pradesh [13], Tamil Nadu [16], Bihar [25], and Kerala [5, 26]. This rotifer is cosmopolitan and common in alkaline waters of India.

Brachionus rotundiformis: Tschugunoff (Fig. 9a-c)

Material: Five parthenogenetic females were observed in samples of Veli station.

Description of the female: Lorica small more rounded and not sharply separated into dorsal and ventral plates; occipital margin with small based acutely pointed spines; pectoral margin four-lobed, lateral ones roughly triangular; foot opening with sub square aperture ventrally and rather ovoid aperture dorsally.

Measurements: total length 98-156; maximum width 87-125; antero-medial spine 11-22; antero-intermediate spine 9-13; antero-lateral spine 9-13; maximum width- total length ratio 0.80-0.89.

B. rotundiformis is a common halobiont rotifer observed along with *B. plicatilis* and it has been reported so far only from the estuaries and backwaters of Kerala [5, 26].

Keratella cochlearis: (Gosse) Fig. 10a-c)

Material: Several females were observed in the samples collected from Poonthura and Thiruvallam.

Our record is the first from Kerala. *K. cochlearis* has been recorded earlier from Andhra Pradesh [13]. This is also a variable species, the variability mainly on size of the spines and dorsal lorica pattern. This species is represented by *f. recurvispina* Jägerskiöld (Fig. 9b) and *f. tecta* Lauterborn (Fig. 9c).

only from Delhi [11].

Comparative measurements of *Filinia* species is as follows

Table 1: List of Rotifera recorded from Kerala habitat is given by V= Veli, A= Aakulam, P= Poonthura, T= Thiruvallam; * New to Kerala, ** New to India

Species	Body length	Maximum width	Dorsal bristles		caudal bristles
			Left	Right	
<i>F. pejlari</i>	84-87	34-38	314-355	298-312	173-198
<i>F. longiseta</i>	133-167	83-86	283-333	267-315	183-211
<i>F. opolensis</i>	168-176	69-73	421-436	412-422	194-225
<i>F. cornuta</i>	65-85	55-64	24-29	22-27	37-43

MONOGONONTA

Family: Epiphanidae

Epiphanes macrourus Barrois & Daday: A

Family: Brachionidae

Platylas quadricornis (Ehrenberg): A, P, T

**P. leloupi* Gillard: P, T

Brachionus angularis Gosse: V, A, P, T

**f. aestivus* Skorikov: V, A

B. budapestinensis Daday: V, A

B. calyciflorus Pallas: V, A, P, T

f. typica Koste: V, A, P, T

**f. heterospina* Saksena: V, A

f. asymmetrica Koste: V

- **f. dorcas* Gosse: V, T
- f. anuraeformis* Brehm: V, A, P
- f. forficula* Rudescu: V, A, T
- f. amphiceros* Ehrenberg: V, A, P, T
- f. monstrosa* de Ridder: V
- **B. calyciflorus borgerti* Apstein: V, A
- **f. willeyi* Apstein: A
- **f. brycei* de Beauchamp: A
- B. caudatus* Barrois & Daday: A, P, T
- **f. majusculus* Ahlstrom: A, T
- f. apsteini* Ahlstrom: T
- **f. vulgatus* Ahlstrom: T
- f. personatus* Ahlstrom: T
- ***B. dichotomus reductus* Koste & Shiel: P, T
- B. forficula keralaiensis* Nayar & Nair: P, T
- B. falcatus* Zacharias: A, P, T
- f. lyratus* Lemmerman: P, T
- f. hamatus* Lemmerman: P, T
- B. patulus* (Müller): A, T
- ***B. kostei* Shiel: T
- B. rubens* Ehrenberg: T
- B. urceolaris* Müller: A, P, T
- B. quadridentatus* Hermann: A, P, T
- **f. brevispina* Ehrenberg: T
- **f. monospina* Saksena & Kulkarni: A, T
- **f. divergens* Tschugunoff: T
- **f. melheni* Barrois & Daday: P, T
- **f. curvata* Tschugunoff: T
- **B. quadridentatus mirabilis* Daday: T
- B. plicatilis* Müller: V, A, P, T
- B. rotundiformis* Tschugunoff: V
- Keratella cochlearis* (Gosse): P, T
- **f. recurvispina* Jägerskiöld: P
- **f. tecta* Lauterborn: P
- K. tropica* (Apstein): V, A, P, T
- **f. aspina* Fadeew: P, T

- f. asymmetrica* Barrois & Daday: P, T
- Family: Euchlanidae
- Dipleuchlanis propatula* Gosse: A, P
- Family: Mytilinidae
- Mytilina ventralis* Ehrenberg: T
- **M. crassipes* Lucks: T
- Family: Trichotridae
- Trichotria tetractis* Ehrenberg: A, P, T
- Family: Lepadellidae
- **Lepadella crestata* Vasisht & Bathish: T
- L. ovalis* Müller: T
- L. patella* Müller: A, P, T
- Family: Lecanidae
- Lecane leontina* (Turner): P, T
- **L. ludwigi* (Eckstein): T
- L. luna* (Müller): T
- Monostyla quadridentata* (Ehrenberg): T
- M. bulla* (Gosse): V, A, P, T
- Family: Notommatidae Hudson & Gosse
- Scaridium longicaudum* (Müller): A, T
- Family: Synchaetidae (Hudson & Gosse)
- Polyarthra vulgaris* Carlin: V, A, P, T
- Family: Asplanchnidae Eckstein
- Asplanchna brightwelli* Gosse: V, A, P, T
- Family: Testudinellidae
- Testudinella patina* Hermann: A, P, T
- Family: Hexarthridae
- Hexarthra intermedia* (Wierzejski): V, A, P, T

- Family: Filiniidae
- F. longiseta* (Zacharias): V, A, T
- F. pejlery* Hutchinson: V, A
- **F. opolensis* (Zacharias): T
- **F. cornuta* (Weisse): V, A

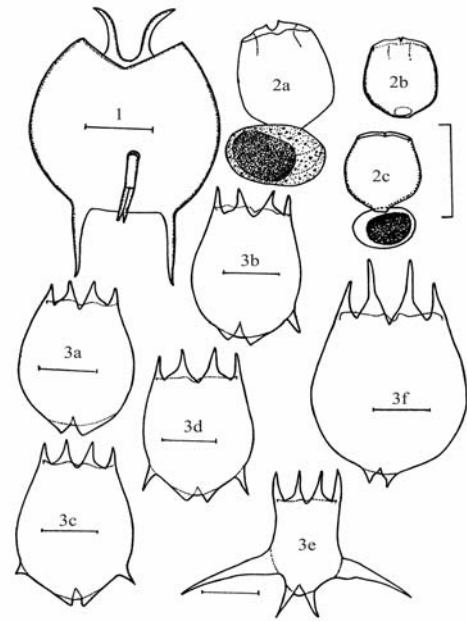


Fig.1: *Platyias leloupi* Gillard; Fig. 2a-c: *Brachionus angularis* Gosse; Fig. 2a: *B. angularis*; 2b-c: *B. angularis f. aestivus* Skorikov; Fig. 3a-e: *B. calyciflorus* Pallas; 3a: *f. typica* Koste; 3b: *f. heterospina* Saksena; 3c: *f. asymmetrica* Koste; 3d: *f. anuraeiformis* Brehm; 3e: *f. amphiceros* Ehrenberg; 3f: *f. dorcas* Gosse (Scale: 100µm)

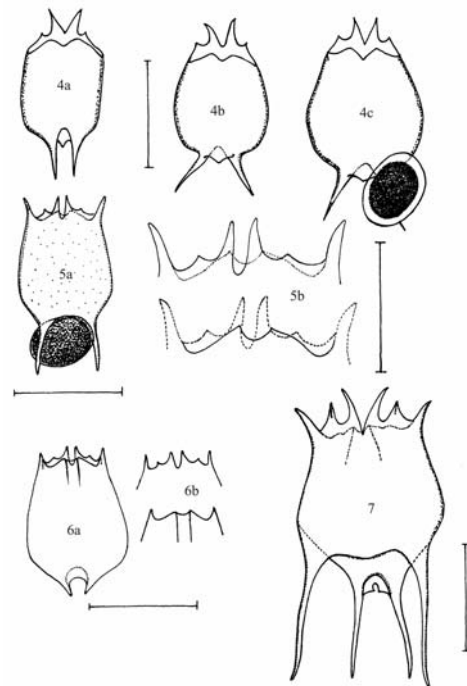


Fig. 4a-c: *Brachionus dichotomus reductus* Koste & Shiel; 4a: female dorsal view; 4b: female ventral view; 4c: female with egg; Fig. 5a: *Brachionus forficula keralaiensis* Nayar & Nair; 5b: enlarged view of occipital spines and pectoral margin of *B. forficula keralaiensis*; Fig. 6a-b: *Brachionus kostei* Shiel; 6b: dorsal and ventral view of occipital region of *B. kostei*; Fig. 7: *Brachionus quadridentatus mirabilis* Daday (Scale: 100µm)

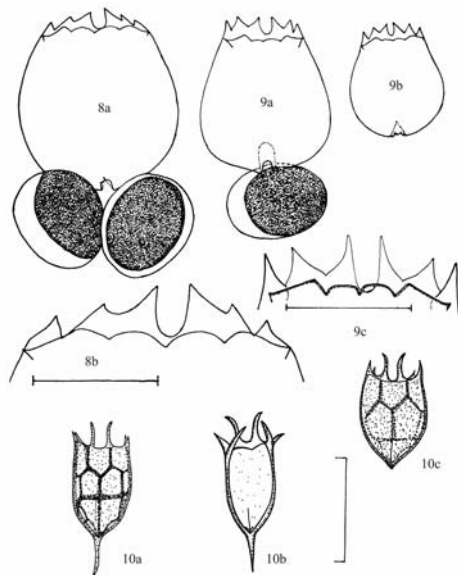


Fig. 8a-b: *Brachionus plicatilis* Müller; 8b: View of the occipital region of *B. plicatilis* showing scalar arrangement of occipital spines and four lobed pectoral margin; Fig. 9a-c: *Brachionus rotundiformis* Tschugunoff; 9a: female with egg; 9b: female without egg; 9c: View of the occipital region of *B. rotundiformis* showing the acutely pointed occipital spines and the four lobed pectoral margin with an elevated lateral projections; Fig. 10a-c: *Keratella cochlearis* (Gosse); 10b: *f. recurvispina* Jägerskiöld; 10c: *f. tecta* Lauterborn (Scale: 100µm)

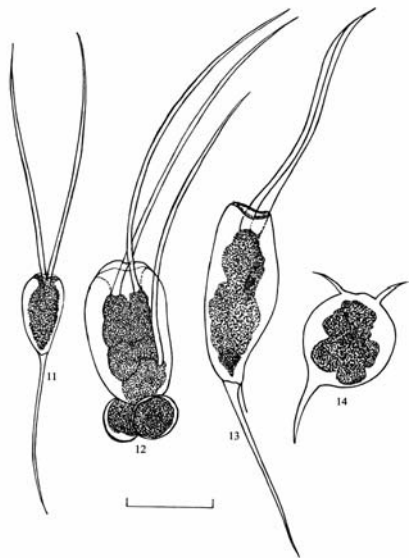


Fig. 11: *Filinia pejleri* Hutchinson; Fig. 12: *F. longiseta* Zacharias; Fig. 13: *F. opolensis* Zacharias; Fig. 14: *F. cornuta* Weisse (Scale: 100µm)

Discussion

Forty two rotifers belonging to 12 families and 16 genera are documented in the present account. According to Sharma [27], out of 310 rotifers belonging to 60 genera so far known from Indian waters, only 24 species have originally been described from Kerala, while Gopakumar [5] reported 30 species of rotifers from different estuarine habitats of Kerala. The present study raised the number of known species from this state to 42 as against 24 and 30 species reported by earlier workers. Cosmopolitan taxa comprise a dominant fraction (approximately 75%). The most diverse genus was *Brachionus*, which represented 15 species in the present

study. The abundance of *Brachionus* species in tropical rotifer fauna has been pointed out by a number of workers [5, 26, 28, 29]. Thus, the abundance of *Brachionus* species in the present study is in accordance with the findings of workers cited above.

The most frequently encountered rotifers were *Brachionus angularis*, *B. calyciflorus*, *B. plicatilis*, *B. falcatus*, *B. quadridentatus*, *Keratella cochlearis*, *Filinia longiseta* and *Asplanchna brightwelli*. The rotifers such as *B. dichotomus reductus* and *B. kostei* are previously considered endemic to Australian waters [9] were observed in the present collection. The other reports of this species from outside Australia are only from Thailand [22, 30, 31]. A number of other rare species such as *Brachionus quadridentatus mirabilis*, *B. forficula keralaiensis*, *B. rotundiformis*, *Filinia cornuta*, *F. opolensis* and *Lecane ludwigi* are also added to the Kerala rotifer record. It is interesting to note that the distribution of *B. rotundiformis* and *B. forficula keralaiensis* in India has been reported so far only from the state of Kerala. Because of their restricted distribution in Indian waters, further study is needed on the distribution and occurrence of these taxa in different water bodies of India. The new and rare species records in the present study clearly illustrated that the rotifer records of Kerala requires an updating. A detailed survey on various water bodies of Kerala will increase the number of species and also provide more information about Kerala rotifer biogeography.

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References

- 1 Nayar CKG, Nair KKN. A collection of brachionid rotifers from Kerala. Proceedings of the Indian Academy of Sciences (Animal Science). 1969; 69:223-233.
- 2 Segers H, Sarma SSS, Kakkassery FK, Nayar CKG. New records of Rotifera from India, Hydrobiologia. 1994; 287:251-258.
- 3 Segers H, Babu S. Rotifers from high altitude lake in southern India with a note on the taxonomy of *Polyarthra* (Ehrenberg, 1834). Hydrobiologia. 1999; 405:89-93.
- 4 Nair NB, Arunachalam M, Abdul Aziz PK, Krishna Kumar K, Dharmaraj K. Ecology of Indian estuaries: Distribution and seasonal variation of zooplankton in the Ashtamudi estuary. Proceedings of the Indian Academy of Sciences (Animal Science). 1984; 96:573-584.
- 5 Gopakumar G. Studies on brackishwater rotifers of Kerala with special reference to *Brachionus plicatilis* O. F. Müller as live feed for aquaculture. Ph.D. thesis, University of Kerala, Kerala. India.
- 6 Edmondson WT. Rotifera. In Ward, H. B & G. C. Whipple (eds). Freshwater Biology. Wiley Press, 1959. New York, 1998, 42-429.
- 7 Koste W. Rotatoria. Die Rädertiere Mitteleuropas. Ein Bestimmungswerk begründet von Max Voigt. Monogononta, Gebr. Borntraeger, 2. Auff. 1. Textband. 1978; II:673. Tefelband, 234 taf.

- 8 Sudzuki M. An approach to the identification of the common rotifers. Sanseido Publishing Co. Ltd., Tokyo, 1999, 1-150.
- 9 Koste W, Shiel RJ. Rotifera from Australian Inland waters II. Epiphanidae and Brachionidae (Rotifera: Monogononta). Invertebrate Taxonomy, 1987; 7:949-1021.
- 10 Sharma BK. Indian Brachionidae (Eurotatoria: Monogononta) and their distribution. Hydrobiologia. 1987; 144:269-273.
- 11 Sarma SSS. New records of freshwater rotifers (Rotifera) from Indian waters. Hydrobiologia. 1988; 160:263-269.
- 12 Nayar CKG. Rotifer fauna of Rajasthan. Hydrobiologia. 1968; 31:168-185.
- 13 Dhanapathi MVSS. Rotifers from Andhra Pradesh, India-I. Hydrobiologia. 1974; 45:357-372.
- 14 Sharma BK. Rotifers from West Bengal. III. Further studies on the Eurotatoria. Hydrobiologia. 1979a; 64:39-47.
- 15 Sharma BK. Rotifers from West Bengal. IV. Further contributions to Eurotatoria. Hydrobiologia. 1979b; 65:39-47.
- 16 Govindasamy G, Kannan L. Rotifers of the Pitchavaram mangroves (south east coast of India): A hydrobiological approach. Mahasagar. 1991; 24:39-45.
- 17 Sharma BK, Sharma SS, Dudani VR. Freshwater rotifers from Darbhanga city, Bihar, India. Record of Zoological Survey of India. 1992; 91:431-448.
- 18 Varghese M. Distribution of Brachionus species (Phylum Rotifera) in Cochin backwaters, Kerala, India J Mar Biol Ass India. 2006; 53:130-134.
- 19 Arora HC. Studies on Indian Rotifera. Part-V. On species of some genera of the family Brachionidae, subfamily Brachioninae from India. Archive fr Hydrobiologica. 1966; 61:482-483.
- 20 Sudzuki M. New systematical approach to the Japanese planktonic Rotatoria. Hydrobiologia. 1964; 23:1-124.
- 21 Shiel RJ. The genus *Brachionus* (Rotifera: Brachionidae) in Australia, with a description of a new species. Proceedings of the Royal Society of Victoria. 1983; 95:33-37.
- 22 Sanoamuang L, Segers H, Dumont HJ. Additions to the rotifer fauna of South-east Asia: new and rare species from northeast Thailand. Hydrobiologia, 1995; 313/314:35-45.
- 23 Sharma BK. The Indian species of the genus *Brachionus* (Eurotatoria: Monogononta: Brachionidae). Hydrobiologia. 1983; 104:31-39.
- 24 Ciros-Perez P, Gomez A, Serra M. On the taxonomy of three sympatric sibling species of the *Brachionus plicatilis* (Rotifera) complex from Spain, with the description of *Brachionus ibericus* n. sp. Journal of Plankton Research. 2001; 23:1311-1323.
- 25 Shakuntala P, Singh UN. The rotifer fauna of Champaran, north Bihar (India) *Brachionus*-2. Further contributions to the family Brachionidae. Proceedings of the Academy of Environmental biology. 1993; 2:143-147.
- 26 Varghese M. The rotifer, *Brachionus rotundiformis* Tschugunoff isolated from Cochin backwater, Kerala. Journal of Marine Biological Association of India. 2003; 45:9-19.
- 27 Sharma BK. Rotifera. In: Animal Resources of India (Protozoa to Mammalian). State of the Art Report. Zoological Survey of India, Calcutta, 1991, 69-88.
- 28 Pejler B. On the global distribution of the family Brachionidae (Rotatoria). Archiv fuer Hydrobiologie. Supplementband. 1977; 53:255-306.
- 29 Sharma BK, Michael RG. Synopsis of taxonomic studies on Indian Rotatoria. Hydrobiologia. 1980; 73:229-236.
- 30 Sanoamuang L. Rotifera of some freshwater habitats in the floodplain of the River Nan, northern Thailand. Hydrobiologia. 1998; 387/388:27-33.
- 31 Sukonthip S, Segers H. Rotifers from Kalasin Province, Northeast Thailand, with notes on new and rare species. Zoological studies. 2005; 44:361-367.