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RECORDS OF SOME TESTATE AMOEBAE (RHIZOPODA: PROTOZOA) FROM VELLAYANI LAKE, KERALA, INDIA

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ABSTRACT
This communication gives an account of 15 species of testate amoebae (Rhizopoda: Protozoa) from the fresh water lake 'Vellayani' in the Thiruvananthapuram district of Kerala. All the 15 species of testate amoebae are recorded for the first time from the lake and 8 species constitute new records for Kerala.

KEYWORDS: Protozoa, Rhizopoda, Vellayani Lake, Thiruvananthapuram, Kerala.

INTRODUCTION

Free living protozoans play an important role in the aquatic ecosystemS and form an important component of the environment monitoring surveillance. These protozoans show their significance as biological indicators and occupy an important position in the aquatic food chain. Perusal of literature reveals that there is no detailed taxonomic study of free-living protozoa of Indian lakes till date excepting those of Chilka lake in Orissa (Das and Nair, 1987; Das, 1995) and three lakes of Rajasthan *viz*., Kailana lake, Sambar lake and Sardar Samand, (Mahajan, 1963, 1965, 1977). Recently Ranju *et al*. (2013) reported 17 species of protozoans from Vembanad lake, Kerala and this is the only consolidated work from this state. Therefore the present study is proposed.The Vellayani Lake, the second largest fresh water lake of Kerala is located in the outskirts of Thiruvananthapuram the capital city of Kerala. But no serious study was conducted for the protozoans of Vellayani Lake and hence a study was conducted from April 2012 to September 2012 for the exploration of the free living protozoans.

MATERIALS & METHODS

Eight different stations were chosen for studying the diversity of protozoa especially the super class Rhizopoda. Water samples were collected from 8 sites (i) Kulangara, (ii) Pallathukavu, (iii) Kakkamoola, (iv) Vavvamoola, (v) Manamukkuvila, (vi) Venniyoor, (vii) Elavinvila and (viii) Muttakkadu along with some algae, water weeds, flocculent matter and bottom oozes and were kept in the laboratory for subsequent study. Plankton net of suitable mesh size, 63µm was used for the collection of fresh water forms. Collections were done in early morning hours from 6 am. to 8 am. These samples were brought to the laboratory and examined under a compound microscope at a magnification of 400X. All the samples were collected by Lekshmi

RESULTS

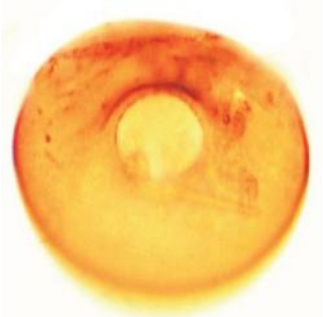
A total of 15 species were identified *viz., Arcella discoides, Arcella hemispherica, Arcella megastoma, Centropyxis aculeata,Centropyxis aerophila, Centropyxis oblonga, Centropyxis spinosa, Difflugia corona, Difflugia globulosa, Difflugia lebes, Difflugia lucida, Heleopera rosea, Heleopera sphagni, Euglypha acanthophora and Difflugia lobostoma.*

Systematic account
Subkingdom: Protozoa
Phylum: Sarcomastigophora
Subphylum: Sarcodina
Super class: Rhizopoda
Class: Lobosea
Order: Arcellinida
Family: Arcellidae

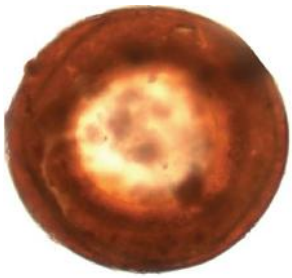
***1. Arcella discoides* Ehrenberg, 1843**

Material examined: 2exs., Pallathukavu site, 20.v.2012
Diagnosis: Test light yellow or brown, smooth, flattened, circular in front view and Planoconvex in lateral view with a rounded border, and has a shallow conical aboral region, the height of test about one-third toone-fourth the diameter. The whole of the shell surface appears to have small pores, although they are less apparent on the basal collar.Oral aperture large and circular.
Distribution:Assam, Andhra Pradesh, Arunachal Pradesh, Chandigarh, Himachal Pradesh, Kerala (Nilgiri Biosphere Reserve), Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura, Uttarakhand, West Bengal
Remarks: First record from Vellayani Lake

2. *Arcella hemispherica* Perty ,1852

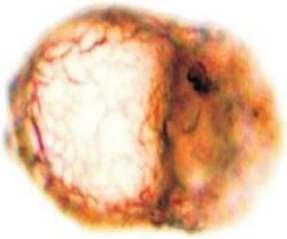


Material examined: 3exs., Pallathukavu site, 24.v.2012, freshwater, coll. Lekshmi
Diagnosis: Test distinctly hemispherical in lateral view and circular in front view; usually brown or yellow in colour; shell surface is either smooth or irregular with more or less fine areoles. The aperture is slightly invaginated, circular, and bordered by a lip; mouth without or with short buccal tube.
Distribution: India: Assam, Andhra Pradesh, Manipur, Orissa, West Bengal
Remarks: First record from Vellayani lake
3. *Arcella megastoma* Penard,**1902**



Material examined: 2exs., Manamukkuvila, 25.v.2012, freshwater, coll.Lekshmi
Diagnosis: The test is a low dome, regularly arched in an even curve from one side to the other, not angled nor flattened above. Shell very flattened with a wide aperture, 0.4 to 0.5 of the entire diameter, which varies from 190-365 um.. With 36 to 200 nuclei. Habitat marshes and ponds, among algae. Diameter of the tests 195-300; diameters of pseudostomes85-140 um.
Distribution: Andhra Pradesh
Remarks: First record from Kerala.
Family : Centropyxidae
4. *Centropyxis aculeata* (Ehrenberg, 1832) Stein, 1857

Material examined: 2exs., Kulangara13.vi.2012, freshwater, coll. Lekshmi
Diagnosis: The shell is yellow or brown, ovoid or circular and usually has about four or more lateral spines. In lateral view it is spherical and tapers towards the aperture. The shell surface is rough, except for a smooth region around the aperture, and is often covered with sand grains or diatom frustules. Specimens cultured in the absence of extraneous particles produce a shell that is proteinaceous and similar in structure to species of Arcella. The aperture is invaginated, oval and sub-terminal. Deflandre (1929) in his review of the genus described three varieties of C.aculeata which differ in size, shape, and the number of spines.
Distribution :India :Assam, Andhra Pradesh, Arunachal Pradesh, Chandigarh, Himachal Pradesh, Kerala (Nilgiri Biosphere reserve), Manipur, Meghalaya, Mizoram, Nagaland, Rajasthan, Sikkim, Tripura, West Bengal
Remarks: First record from Vellayani Lake
5. *Centropyxis aerophila* Deflandre, 1929



Material examined: 3exs., Manamukkuvila, 25.v.2012, freshwater, coll.Lekshmi
Diagnosis: The shell is yellow or brown, ovoid and flattened in the apertural
region. In lateral view the aboral region is spherical but tapers sharply near the
aperture to form an apertural rim. The shell surface is usually rough and covered
with extraneous material, except around the aperture and apertural rim where the
surface is smooth. The aperture is invaginated, oval and sub-terminal.
Distribution: Andhra Pradesh, Sikkim, Uttarakhand, West Bengal
Remarks: First record from Kerala
6. *Centropyxis oblonga* Deflandre, 1929

Material examined: 3exs., Vavvamoola, 6.vi.2012, freshwater,coll.Lekshmi
Diagnosis: The test is yellow or brown built with fine sand grains, usually noted in the genus Centropyxis. Test grayish, oblong-elliptical or oval in outline; with 3-6 divergent spines located in the distal part. Fundus of the test more elevated. Oral aperture elliptical and eccentric.
Distribution: Assam, Meghalaya, Nagaland, Sikkim
Remarks: First record from Kerala

7. *Centropyxis spinosa* (Cash & Hopkinson, 1905) Deflandre, 1929

Material examined: 2exs., Vavvamoola, 7.vi.2012, freshwater, coll. Lekshmi

Diagnosis: The shell is yellow or brown, ovoid or circular and has about six lateral spines. In lateral view it is spherical but tapers towards the apical region. The shell surface is usually rough and covered with sand grains or diatom shells, whilst the area around the aperture is smooth. The latter region is occasionally encrusted with extraneous matter, but usually shows the organic matrix of the shell. The aperture is invaginated, oval or uneven in outline, has two lateral internal extensions that divide the opening, and is excentric in position.

Distribution :India : Andhra Pradesh, Arunachal Pradesh, Chandigarh, Himachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal

Remarks: First record from Vellayani lake

Family : Difflugiidae

8. *Difflugia corona* Wallich, 1864

Material examined: 2exs.,Pallathukavu, 24.v.2012, freshwater, coll. Lekshmi

Diagnosis: The shell is brown, spherical or ovoid and has a variable number of spines on the aboral region. It is composed of quartz particles, with the small pieces being cemented into the gaps between larger pieces to produce a relatively uniform surface. The aperture is circular and surrounded by a denticular collar. The tooth-like structures are evenly spaced, number between 12 t0 20, and are composed of small particles cemented together. The study of cultured and wild specimens of D.corona by Jennings (1916 and 1937) showed that the aboral spines are easily broken because they projected some distance from the shell, so that variation of this feature should be expected.

Distribution: Assam, Andhra Pradesh, Kerala (Nilgiri Biosphere Reserve), Tripura, West Bengal

Remarks: First record from Vellayani Lake

9. *Difflugia globulosa* Dujardin, 1837

Material examined: 2exs., Pallathukavu, 12.vi.2012, freshwater, coll.Lekshmi

Diagnosis: The shell is brown, spherical or hemispherical, usually composed of large quartz particles but may also include diatom frustules. The general appearance is a rough shell although some smoother forms have been seen. The aperture is circular, and surrounded by smaller particles which often appear smooth due to the overlying cement. Variation in this species is prolific, both in the composition of the shell and the size of the aperture in relation to the diameter of the shell.

Distribution: India: Andhra Pradesh, Rajasthan, Meghalaya, and West Bengal

Remarks: First record from Vellayani lake

10. *Difflugia lebes* Penard, 1899

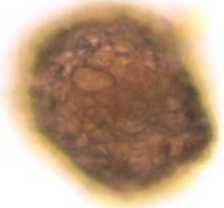
Material examined: 2exs., Pallathukavu, 28.vi.2012, freshwater, coll. Lekshmi.

Diagnosis: Neck sometimes indistinct, aperture large and entire. Shell very fragile, covered with siliceous flattened particles. Collar straight, rarelyrecurved. Sometimes more than 100 nuclei. Feeds on large diatoms. Habitat ooze at the bottom of lakes, ponds. One of the greatest *Difflugia*, some reaching 400 um in length, or more.

Distribution: Himachal Pradesh

Remarks: First record from Kerala

11. *Difflugia lobostoma* Leidy, 1879

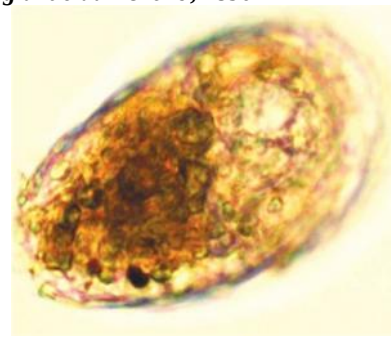


Material examined: 4exs., Kulangara, 20. vii. 2012. freshwater, coll. Lekshmi

Diagnosis: Test ovoid or sub spherical, circular in cross section. Test composed of small and medium pieces of quartz, bounded together by organic cement. Aperture with variations of the opening, trilobed or four lobed or irregular with indistinct lobes, bordered by an irregular

raised ridge of small particles. Lobes range from squarish to curve. Aperture often with an indication of a collar. Nucleus with a number of small nucleoli.Zoochlorellae may be present.
Distribution: India: Andhra Pradesh, Arunachal Pradesh, Chandigarh, Himachal Pradesh, Kerala (Nilgiri Biosphere Reserve), Manipur, Meghalaya, Nagaland, Rajasthan, Tripura, West Bengal
Remarks: First record from VellayaniLake

12. *Difflugia lucida* Penard, 1890



Material examined: 2exs., Kulangara, 25.v.2012, freshwater, coll. Lekshmi
Diagnosis: Shell slightly compressed, covered with flat quartz particles. Living individuals accumulate mainly inorganic material round the elliptic aperture. This aggregation of particles is probably drawn into the shell when the amoebae encysts and is lost when the cell dies. It possesses a peculiar kind of apertural "plug" to avoid desiccation of the cytoplasma during short periods of dryness. Nucleus with a central nucleolus is present.
Distribution: Nagaland, Sikkim, Uttarakhand
Remarks: First record from Kerala
Family : Nebelidae

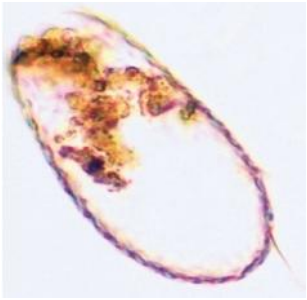
13. *Heleopera rosea* Penard, 1890

Material examined: 2exs., Kakkamoola, 25.v.2012, freshwater, coll. Lekshmi
Diagnosis: The shell is red, ovoid and laterally flattened. It is composed mainly of irregularly arranged siliceous shell plates, with only a few quartz particles or diatoms added to the aboral region. The aperture is terminal, angular in outline and appears to be a thin, linear slit, bordered by a thin band of organic cement.
Distribution: Assam, Arunachal Pradesh, Himachal Pradesh, Manipur, Nagaland, Sikkim
Remarks: First record from Kerala

14. *Heleopera sphagni* (Leidy, 1874) Leidy, 1875

Material examined: 2exs.,Kakkamoola, 20.vi.2012, freshwater, coll. lekshmi
Diagnosis: The shell is yellow or brown, ovoid and laterally compressed. The sides diverge from the aperture to form a broad semi-circular aboral region, which is rough and composed mainly of sand grains. The anterior half of the shell is smooth and composed of siliceous shell plates. The aperture is terminal, slightly convex in broad view and is narrow, linear opening bordered by a thin collar of organic cement. This species varies as much as in size and shape as the other species of Heleopera, but it can usually be separated from them by the broader and rougher aboral region and the narrow slit-like aperture.
Distribution: Sikkim, Uttarakhand, West Bengal
Remarks: First record from Kerala
Class: Filosea
Order: Testaceafilosa
Family: Euglyphidae

15.*Euglypha acanthophora* (Ehrenberg, 1842) Perty, 1849



Material examined: 2exs.,Venniyoor, 28.v.2012, freshwater, coll. Lekshmi
Diagnosis: The shell is ovoid, circular in transverse section and composed of about two hundred, oval, shell-plates and up to six elongated shell-plates. The elongated shell-plates are about twice as long as the usual shell-plate and normally project from the aboral region of the shell, but often they follow the curvature of the shell and are not easily seen. The aperture is circular and surrounded by ten to thirteen evenly spaced apertural-plates. Each apertural-plate is roughly circular and carries a large median tooth with either four or five smaller lateral teeth on each side. Apertural-plates not only border the aperture, but are also seen in the second and third row of plates inside the aperture.
Distribution: Assam, West Bengal, Manipur, Nagaland, Andhra Pradesh, Meghalaya
Remarks: First record from Kerala

DISCUSSION

A total of 15 species of testate amoebae spread over 2 orders, 2 classes and 5 families (Superclass Rhizopoda) have been collected from 8 stations of Vellayani lake. Perusal of literature reveals that there are no detailed taxonomic studies of freeliving protozoa of lakes in Kerala except the study of Ranju *et al*. (2013). Therefore, the present work constitutes the first detailed taxonomic study of Vellayani Lake, Kerala. The highest species diversity appears to be in station 3 (Pallathukavu) where vegetation is found to be more compared to the other stations. Of these 15 species 8 species *viz.*, *Arcella megastoma*, *Centropyxis aerophila*, *Centropyxis oblonga*, *Difflugia lebes*, *Difflugia lucida*, *Heleopera rosea*, *Heleopera sphagni*, *Euglypha acanthophora* constitute first records for Kerala

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