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Novel Records of Testate Amoebae (Protozoa: Tubulinea and Cercozoa) from Peppara Wildlife Sanctuary, Agastyamala Biosphere Reserve, Kerala

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ABSTRACT: Studies on testate amoebae in Western Ghats of Kerala is meagre inspite of its rich biodiversity and only one species *Quadrulella elegans* Gauthier-Lievre, 1958 is reported from Peppara WLS, part of Agastyamala BR. Therefore, a study to document the moss inhabitant testate diversity was carried out and has filled the lacuna of TA study in the sanctuary to form the foundation for further investigation. The study revealed the occurrence of a total of 26 species belonging to 9 genera and 7 families. This report forms the baseline information for testate amoebae of Peppara WLS suggesting the high diversity of testate fauna in the protected area which can be still higher if further explored.

Keywords: Agastyamala BR, Peppara WLS, Mosses, Protozoa, Testate amoebae, Kerala.

INTRODUCTION

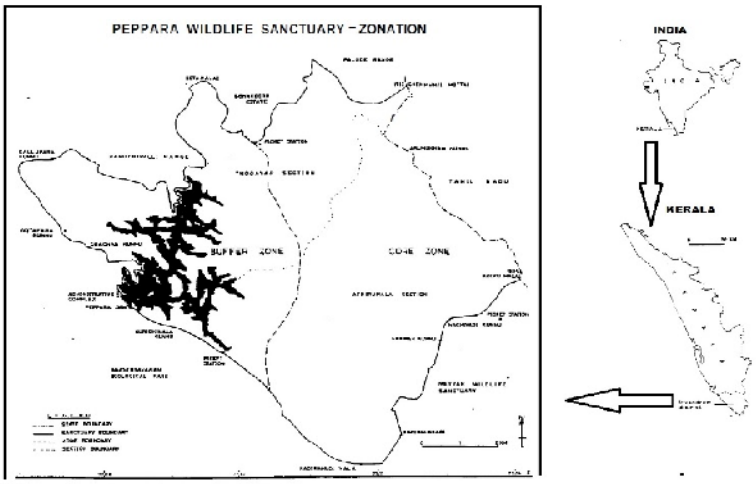
The Agastyamala Biosphere Reserve was established in the year 2001 which spreads over Kerala and Tamil Nadu located in the southernmost end of Western Ghats covers an area of 3500 km^2. Peppara Wildlife Sanctuary nestled in the Western slope of Southern region of Western Ghats forms the core area of the Agastyamala Biosphere reserve and is situated near Ponmudi in Thiruvananthapuram district, Kerala. Peppara was declared as a wildlife sanctuary in 1983 consequent to the construction of the dam at Peppara and has an extent of 53 sq. km of which 5.82 sq.km is the water spread area of the reservoir. The sanctuary falls between 8°34′ & 8°41 N latitude and 77° 6′ & 77° 14′ E longitude and shares its boundary with Neyyar Wildlife sanctuary in the southeast. Being a part of the Western Ghats, one of the 36 biodiversity hotspots in the world, the forests of Peppara have immense floral and faunal significance with a large percentage of biodiversity yet to be discovered and the testate amoebae study is totally unattended by the taxonomists in this biodiversity hotspot. Testate amoebae (TA) are a diverse and abundant group of protists found in a wide range of habitats around the world and are particularly abundant in wetlands (Mitchell *et al*., 2008). TA are present in most terrestrial environments, from desert soil crusts (Bamforth, 2008) to epilithic mosses (Mazei *et al*., 2016) and are polyphyletic eukaryotic unicellular shelled organisms (Bobrov *et al*., 1999; Lamentowicz *et al*., 2007) present in a variety of habitats like terrestrial, freshwater, estuarine and marine from the tropics to polar areas (Foissner, 1987, 1999). The pioneer work on testate amoebae was initiated by Penard (1907) and reported 15 species of testacid rhizopods from the Sikkim Himalayas. Consequently, considerable studies on testate amoebae were done by Mahajan and Nair (1965), Mishra *et al*. (1977), Mahajan *et al*. (1981), Das *et al*. (1993), Das (1995), Mukherjee and Das (2000) and reported an appreciable number of species from fresh water and brackish water wetland ecosystems of India. Further Sharma and Sharma (2008, 2010), Bindu and Das (2010), Bindu (2019) documented many more species of testate amoebae from freshwater environs and moss habitats.

Testate amoebae research has increased significantly over the past two decades due to their increasing use in different applied aspects as bioindicators for palaeoecological studies, in environmental monitoring, studies on their role in the cycling of elements in the terrestrial ecosystems and biogeographical and evolutionary studies (Qin *et al*., 2013). It is very important to understand the diversity of free living protists because it plays a very significant role in the ecological health and make up a large part of earth's biodiversity (Nguyen *et al*., 2004; Payne, 2013). Even though its wide range of applications not much serious studies have done and herewith reporting 26 species as new records to this sanctuary.

MATERIALS AND METHODS

Moss samples (100-200grams) were collected by quadrant sampling (1m^2) by scrapping from rocks, tree barks, walls and from topsoil with spatula from the study area (Map.1) as part of the departmental project on Agastyamala BR of Zoological Survey of India, Chennai. The samples were brought to the laboratory in closed polythene bags and processed with non-flooded petri dish method as described by Foissner (1992). After 48 hours about 2-3 ml of run off collected by tilting the petri dish and was thoroughly examined under a compound microscope for species level

identification (Mazei and Tsyganov, 2006) at a magnification of 400x(Nikon 50i microscope) and images were taken using the image analyzer and the observation was continued for 2-3 weeks depending up on the availability of protozoan specimens. The testate amoebae observed were fixed and air dried at room temperature and mounted in DPX for making permanent slides. All the identified specimens were registered and the slides were deposited in the National Zoological Collections of Marine Biology Regional centre of Zoological Survey of India, Chennai.



Map.1. Map showing the various localities in Peppara WLS, Agastyamala Biosphere reserve.

RESULTS AND DISCUSSION

The study has resulted the documentation of 26 species of testate amoebae belong to 9 genera and 7 families. The family Euglyphidae has proved to be the most species rich constituting 30.7% of the total species recorded (10). Further 19.2 % of the species (5) belonged to Centropyxidae making it the second dominant family and the family Assulinidae is represented by only one species. Perusal of literature revealed that only 15 species of testate amoebae have been reported from Western Ghats of Kerala (Nair, 2001) and only one species of testate amoeba *Quadrulella elegans* Gauthier-Lievre, 1958 from Peppara WLS (Bindu, 2020). The present documentation forms only the baseline information of TA from Peppara WLS suggesting the great diversity of the fauna from the protected area and all the 26 species are new reports from this sanctuary. It is suggested that intensive studies should be made to document the actual diversity of this important group of protozoans. The systematic list of species recorded from Peppara WLS is listed below following the classification of Adl *et al*., 2019.

Phylum Tubulinea Smirnov *et al*., 2005
Class Elardia Kang *et al*., 2017
Order Arcellinida Kent, 1880
Family Netzeliidae Kosakyan *et al*., 2016
Genus *Cyclopyxis* Deflandre, 1929

1. *Cyclopyxis arcelloides* (Penard, 1902) Deflandre, 1929.
2. *Cyclopyxis eurystoma* Deflandre, 1929.
3. *Cyclopyxis kahli* Deflandre, 1929

Family Diffligiidae Wallich, 1864
Genus *Difflugia* Leclerx, 1815.

4. *Difflugia achlora* (Penard, 1902) Ogden, 1980.
5. *Difflugia bryophila* (Penard, 1902) Jung, 1942.
6. *Difflugia globulosa* (Dujardin, 1837) Penard, 1902

Family Centropyxidae Jung, 1942
Genus *Centropyxis* Stein, 1857.

7. *Centropyxis aculeata* Ehrenberg, 1838.
8. *Centropyxis aerophila* Deflandre, 1929.
9. *Centropyxis constricta* (Ehrenberg, 1841) Penard, 1890.
10. *Centropyxis minuta*Deflandre, 1929.
11. *Centropyxis orbicularis* Deflandre, 1929

Family Hyalospheniidae Kosakyan and Lara, 2012
Genus *Argynnia* Vucetich, 1974.

12. *Argynnia dentistoma* Penard, 1890

Genus *Padaungiella* Lara and Todorov, 2012.

13. *Padaungiella wailesi* Deflandre, 1936

Phylum Cercozoa Cavalier-Smith, 2018
Class Silicofilosea Adl *et al*., 2012
Order Euglyphida Cavalier-Smith, 1997
Family Assulinida Lara *et al*., 2007
Genus *Assulina* Ehrenberg, 1872.

14. *Assulina seminulum* Leidy, 1879

Family Euglyphidae Lara *et al*., 2007
Genus *Euglypha* Dujardin, 1841.

15. *Euglypha capsiosa* Coûteaux, 1978.
16. *Euglypha ciliata* Ehrenberg, 1848.
17. *Euglypha cristata* Leidy, 1874.
18. *Euglypha compressa* Carter, 1864.
19. *Euglypha filifera* Penard, 1890.
20. *Euglypha laevis* Ehrenberg, 1845.
21. *Euglypha rotunda* Ehrenberg, 1845.
22. *Euglypha simplex* Decloitre, 1965

Family Trinematidae Adl *et al*., 2012
Genus *Trinema* Dujardin, 1841.

23. *Trinema chardezi* Decloitre, 1981.
24. *Trinema enchelys* Ehrenberg, 1838.
25. *Trinema penardi* Thomas & Chardez, 1958.
26. *Trinema complanatum* Penard, 1890.

FUTURE SCOPE

Testate amoebae are the least explored group of protozoans and the results of the present study gives the

baseline information on this important fauna and elaborate studies would be helpful to explore the bioindicator species and thus to assess the health of the forest ecosystem.

Conflict of interest. The author has no conflict of interest.

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