Novel records of testate amoebae (Amoebozoa and Cercozoa) from Shenthuriney WLS, Kerala

Comment [A1]: Please avoid using abbreviations in the title for a clear comprehension of the title.

ABSTRACT

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This report summarizes the results hitherto achieved in the study of moss inhabitant testate amoebae in Shenthuriney WLS, part of Western Ghats, Kerala. The study reveals the novel records of 28 species of testate amoebae span over 6 families and 9 genera from Shenthuriney WLS, Kerala.

Key words : Shenthuriney WLS, Kerala, Moss, Protozoa, Testate amoebae

1. INTRODUCTION

Comment [A3]: I would suggest the authors to shorten the geographical description of the WLS and add more information about the fauna of the study order that will provide a fair idea of the species diversity within this WLS, as the manuscript deals with the taxonomy.

Shendurney Wildlife Sanctuary,part of Western Ghats of Kerala owes its name to a tree, locally called as Chenkurinji, an endemic tree which is confined to this tract. Shendurney was declared as a Wildlife sanctuary in 1984 with a total extent of 172 sq. kms. The sanctuary lies on the western part of Agastyamala–Ashambu hill range with an altitudinal span of 100 to 1550m above sea level. This tract is drained by a good number of rivers, namely Shendurney, Kazhuthuruthy, Kulathupuzha and their tributaries such as Parappar,Uruliar, Pasmakandamthodu, Aruviar and Umayar.The sanctuary falls between 8°44´&9°14´N latitude and 76°59´&77°16´E longitude and is located in the Pathanapuram talukof Kollam district of Kerala state. The reserve forests of Thenmala, Thiruvananthapuram, Punalur forest divisions and Thirunelveli forest division of Tamil Nadu surrounds the sanctuary from all four sides. The terrain is undulating with elevation ranging from 100-1550m ASL. The sanctuary is a continuous stretch of vast and valuable forest area bounded on the east by the Sahyadri hills which act as a great barrier separating the two states, Kerala and Tamil Nadu. The sanctuary lies on the either side of the Shendurney river and is located on the north of Kulathupuzha valley separated by Churuttumala ridge. The whole area is hilly in character with a gentle slope towards the west. The upper slopes are rugged, steep and inaccessible in many places. The highest peak is Alwarkurichi peak.Eventhogh this sanctuary is admist in Western Ghats with rich biodiversity no attempts were so far made to explore the diversity of testate amoebae. Testate amoebae (TA) are a diverse and abundant group of protists found in

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a wide range of habitats around the world and are particularly abundant in wetlands [1]. Testate amoebae are routinely used as indicators of past changes in peatland hydrology [2,1]. These single-celled organisms respond quickly to environmental change, produce decay-resistant and taxonomically distinctive shells, and are generally well preserved and abundant in Holocene peat deposits andpresent in a variety of habitats like terrestrial, freshwater, estuarine and marine from the tropics to polar areas [3,4]. Testate amoebae form a very sensitive group of organisms [5]. Their short generation times make them useful indicators of environmental changes [6,7,8] Their well-defined ecological preferences in relation to important ecological variables in different type of ecosystems have made them useful in biomonitoring [9,10].

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 [11]. 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 [11,12]. Even though its wide range of applications, not much serious studies have been done and herewith reporting 29 species as new records to this sanctuary.

2. MATERIALS AND METHODS

Moss samples (100-200grams) were collected by quadrant sampling (1m2) by scrapping from rock and tree bark from the study area during the faunistic survey to Western Himalaya in October 2019. The samples were processed with non-flooded petri dish method as described by Foissner [13] and from each sample permanent mounts were prepared and studied under Nikon 50 i compound microscope for species level identification.

3. RESULTS AND DISCUSSION

The present study ~~results the~~ reports ~~of~~ 28 species of testate amoebae from Shenthuriney WLS belonging to 9 genera under 6 families (Images 1-29 as Annexure-1). Of these, Cyclopyxis aplanata Deflandre, 1929, Cyclopyxis leidyi (Coûteaux et Chardez, 1981), Cyclopyxis puteus Thomas, 1960 and Cyclopyxis tronconica Godeanu, 1972 were earlier reported only from Corbett NP[14] in India. Eventhough Western Ghats are rich in biodiversity only 26 species have been reported from Peppara WLS, part of Western Ghats in Kerala [15].Family hyalosphenidae represented the maximum number of

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Further, please ensure that abbreviations defined once are used consistently.

Comment [A7]: Materials and methods lacks the complete description about how the species were identified and which manuals or keys were used. I would suggest authors to include this information. Further, you may mention the taxonomically important features used to characterize species. In addition, it should be clearly mentioned that based on how many specimens a particular species was identified.

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Comment [A10]: Please ensure to italicized the names of genera and species.

Comment [A11]: In the introduction you have mentioned 29 species.

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species(7) followed by the families Netzeliidae and Centropyxidae (6 each).This is a part of study conducted by Zoological survey of India and this is only a baseline information from the rich biodiversity area and intensive studies should be done to reveal the actual testate fauna from this biodiversity hotspot.

Systematic list of testate amoebae recorded as per the classification of Adl *et al*., 2019

Phylum Tubulinea Smirnov *et al*., 2005

Class Elardia Kang *et al*., 2017

Order Arcellinida Kent, 1880

Family Arcellidae Ehrenberg, 1843

1. *Arcella conica* (Playfair, 1918)
2. *Galeripora arenaria*(Greeff, 1866) González-Miguéns *et al*., 2021
3. *Galeripora discoides*(Ehrenberg, 1871) González-Miguéns *et al*., 2021

Family Netzeliidae Kosakyan *et al*., 2016

4. *Cyclopyxis aplanata* Deflandre, 1929
5. *Cyclopyxis eurystoma* Deflandre, 1929
6. *Cyclopyxis kahli* Deflandre, 1929
7. *Cyclopyxisleidyi* (Coûteaux et Chardez, 1981)
8. *Cyclopyxis puteus* Thomas, 1960
9. *Cyclopyxis tronconica* Godeanu, 1972

Family Difflugiidae Wallich, 1864

10. *Difflugia oblonga* Ehrenberg, 1838
11. *Difflugia lithophila*Penard, 1902
12. *Difflugia globulosa* Penard, 1902
13. *Difflugia lebes* Penard, 1899
14. *Difflugia lucida*Penard, 1890

Family Centropyxidae Jung, 1942

15. *Centropyxis aculeata* Ehrenberg, 1838
16. *Centropyxis constricta* Penard, 1902
17. *Centropyxis elongata* (Penard, 1890)Thomas, 1959

18. *Centropyxis oblonga* Deflandre, 1929
19. *Centropyxis plagiostoma* Bonnet and Thomas, 1955
20. *Centropyxis platystoma* Deflandre, 1929

Family Plagiopyxidae Bonnet and Thomas, 1960

21. *Plagiopyxis declivis* Bonnet, 1955

Family Hyalospheniidae Schultze, 1977, emend. Kosakyan and Lara, 2012

22. *Nebela bohemica* Taranek, 1882
23. *Padaungiella lageniformis* (Penard, 1890) Lara and Todorov, 2012
24. *Padaungiella tubulata*(Brown, 1910) Lara and Todorov,2012
25. *Padaungiella wailesi* (Deflandre,1936) Lara and Todorov,2012
26. *Quadrulella*variabilis Kosakyan *et al*., 2016
27. *Quadrulella symmetrica (*Wallich, 1864)Schulze, 1875
28. *Quadrulella tropica* Wailes, 1912

4. ACKNOWLEDGEMENTS

The author is grateful to the Director, Zoological Survey of India for approving the project and for providing the facilities to do the work. Thanks are also due to the survey team for collecting the samples for the study.

5. COMPETING INTERESTS

Author has declared that no competing interest exists.

6. REFERENCES

Comment [A14]: Format the references per journal format.

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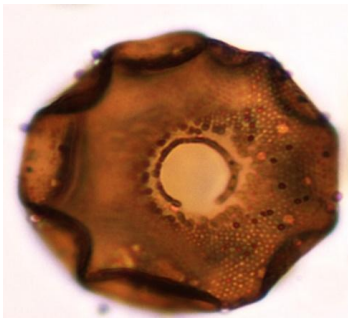
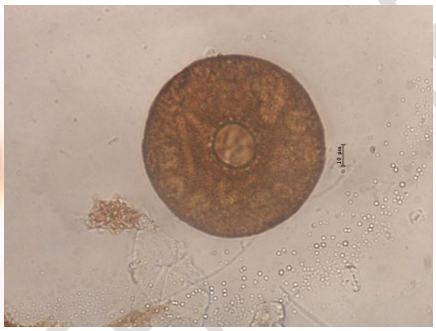
Annexure-1

Comment [A15]: These figures can be included in the main manuscript. You may prepare 2-4 figures by combining the species belonging to the same family in a single figure.

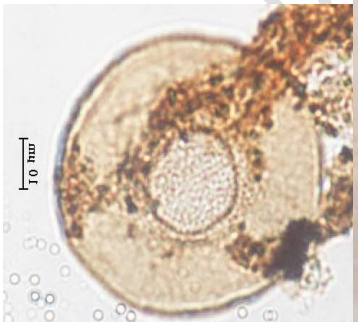


Arcella conica (Playfair, 1918)

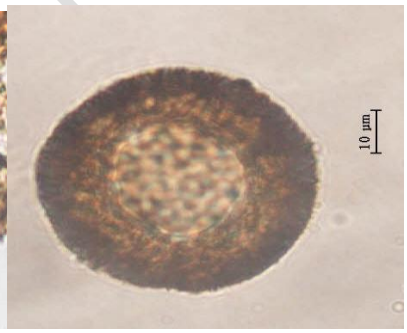


Galeripora arenaria (Greeff, 1866)

González-Miguéns *et al*., 2021

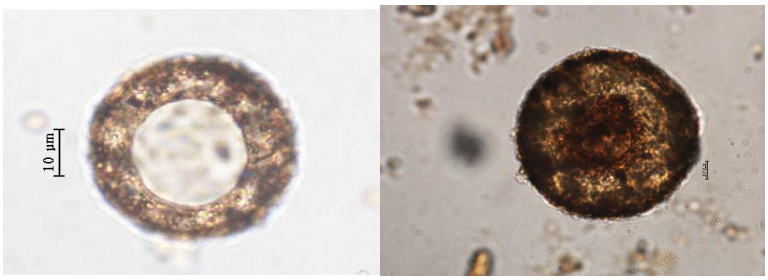


Galeripora discoides (Ehrenberg, 1871)

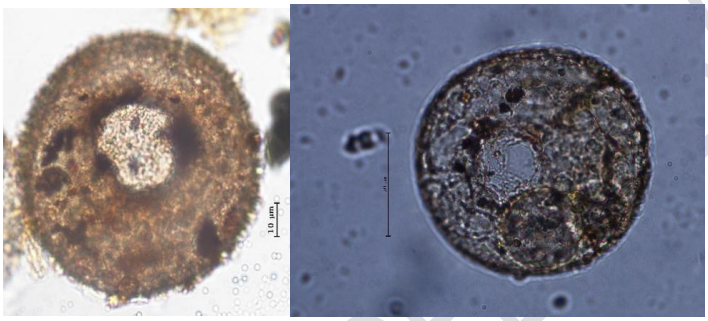


Cyclopyxis aplanata Deflandre, 1929

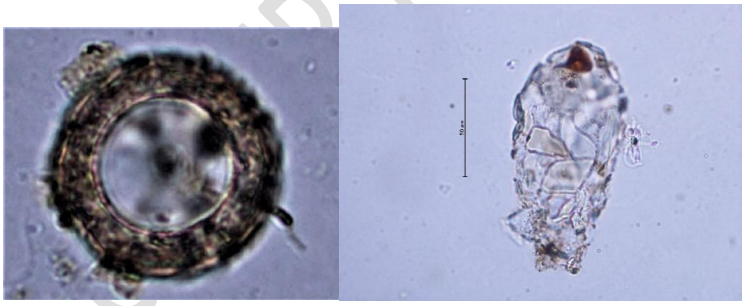
González-Miguéns *et al*., 2021



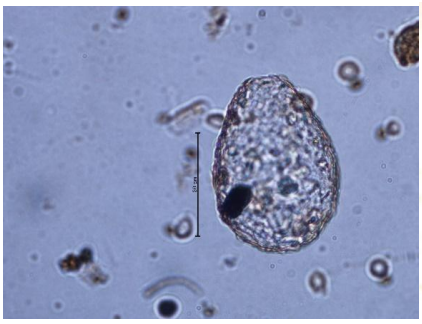
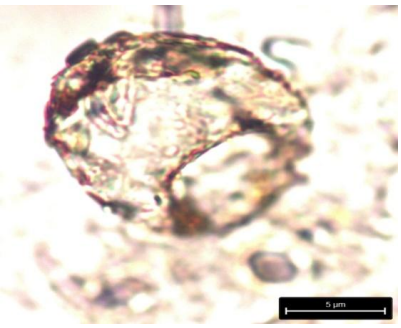
Cyclopyxis eurystoma Deflandre, 1929*Cyclopyxis kahli* Deflandre, 1929



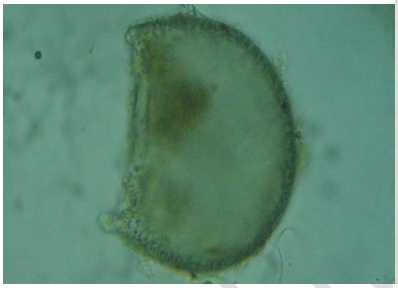
Cyclopyxisleidyi (Coûteaux et Chardez, 1981)*Cyclopyxis puteus* Thaomas, 1960



Cyclopyxis tronconica Godeanu, 1972*Difflugia oblonga*Ehrenberg, 1838

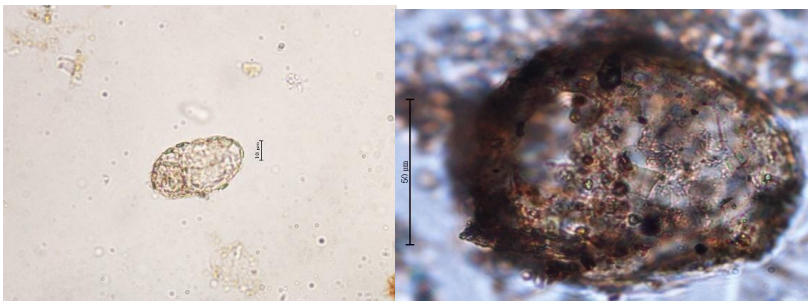



*Difflugia lithophila*Penard, 1902*Difflugia globulosa*Penard, 1902




Difflugia lebes Penard, 1899*Difflugia lucida*Penard, 1890


Centropyxis aculeata Ehrenberg, 1838 *Centropyxis constricta* Penard, 1902



Centropyxis elongata(Penard, 1890)Thomas, 1959 *Centropyxis oblonga*Deflandre, 1929

Centropyxis plagiostoma *Centropyxis platystoma* Deflandre, 1929

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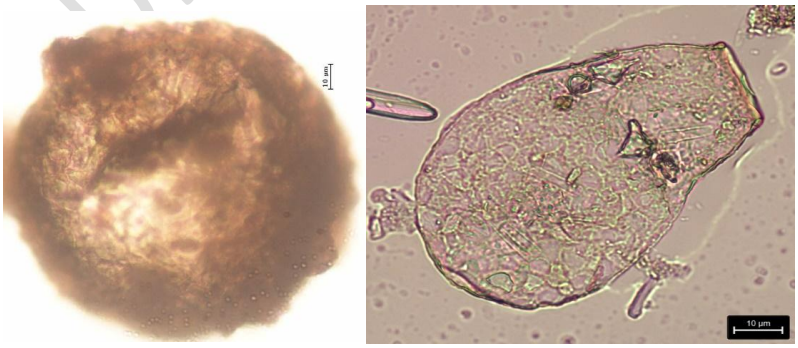
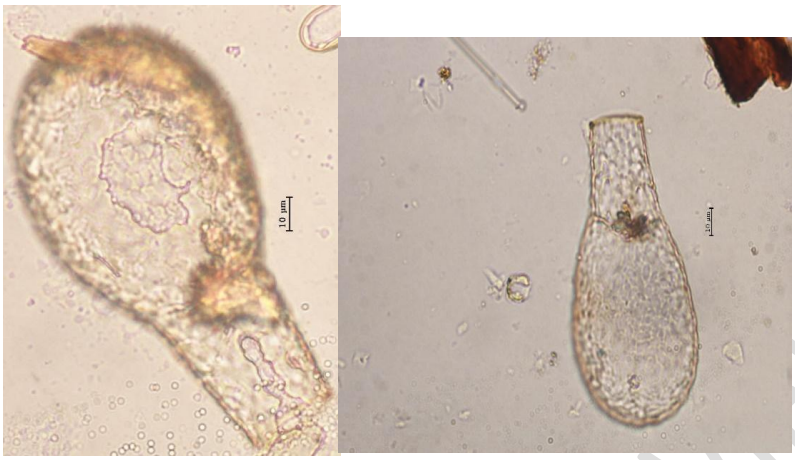
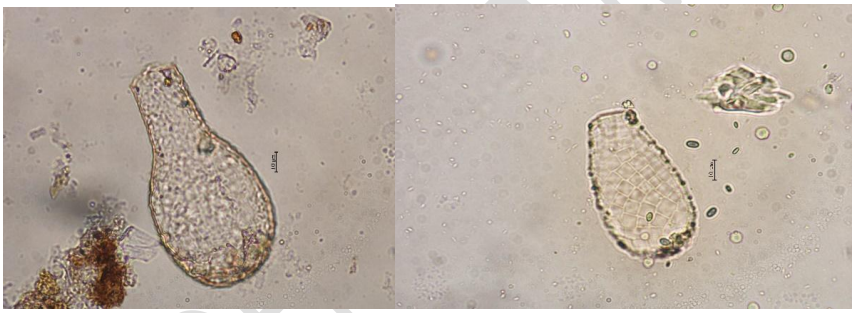


Plagiopyxis declivis Bonnet, 1955 *Nebela bohemica* Taranek, 1882



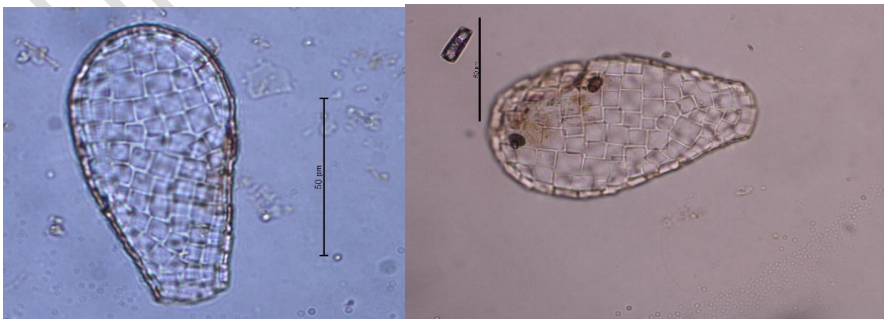
Padaungiella lageniformis (Penard, 1890) *Padaungiella tubulata*(Brown, 1910)

Lara and Todorov,2012 Lara and Todorov, 2012



Padaungiella wailesi (Deflandre,1936)*Quadrulella* variabilis Kosakyan *et al*., 2016

Lara and Todorov,2012



Quadrulella tropica Wailes, 1912*Quadrulella symmetrica*

(Wallich, 1864)Schulze, 1875