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Testate amoeba diversity in Chilapata Forests: An elephant corridor of West Bengal, India

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Abstract

A preliminary study on the testate amoeba diversity in the Chilapata forests, a protected area in West Bengal was carried out during 28th November to 3rd December 2022 and a total of 25 species were recorded. The phylum Tubulinea dominated in the study area while the prominent Genus was *Arcella* Ehrenberg 1830, *Centropyxis* Stein 1857, *Difflugia* Leclerc 1815, *Euglypha* Dujardin 1841 and *Trinema* Dujardin 1841. The species richness and abundance of testate amoeba in this moist deciduous forest indicates healthy soil dynamics, nutrient recycling and resilient ecosystem in this region. Protecting and enhancing the health of this forest will help this elephant corridor to conserve the biodiversity in the region and also in the connecting protected areas.

Key words : Testate amoeba, diversity, elephant corridor, biodiversity, conservation.

Testate amoeba are the unicellular eukaryotic protozoans currently recognized as an assemblage of three unrelated groups Amoebozoa, Stramenopiles and Cercozoa[2]. They are of size ranging from 5-300 µm; enclosed in a shell which can withstand a wide range of environmental circumstances[10,25,34]. They are cosmopolitan in distribution ranging from fresh water to marine environment, from terrestrial to sub-aerial environment. They are important bacterial consumers[20,21] in terrestrial ecosystems and aids in nutrient recycling. They are responsive to changes in their habitat[6,7,9,22,27,35] and the response can be studied through observations of changes in their test morphology and composition. Their huge variety and abundance, well-defined ecological preferences, rapid response and faster identification makes them an ideal bioindicators of environmental changes. This study is the first attempt to analyze the diversity and distribution of TA in Chilapata forests, which itself play a crucial role in maintaining the ecological health of the protected areas connected by it.

Study area :

Chilapata forest is a protected area of West Bengal which is situated in the Alipurduar district, nearby to Jaldapara National Park in

Dooars. This dense forest covers an area of 200 square kilometers which is limited by Bania River in east and Torsa River in the west and is situated at 26.550556 °N and 89.379722 °E. The alluvial soil brought by these two rivers during monsoon nurtures the grassland ecosystem of this forest. The Chilapata forest has primarily a moist deciduos forest with patches of evergreen and semi-evergreen forests, having predominantly latterite soil rich in iron and aluminum oxide. The area receives an annual average rainfall of 382 cm which commences from mid of May and continues till mid of October. The average temperature in the area varies from 4°C to 32°C between summer and winter seasons. The enriched flora in this forest includes a variety of tree species such as Sal (*Shorea robusta*), Teak (*Tectona grandis*), Sishu (*Dalbergia sissoo*) and various species of bamboo. The forest is a home to diverse range of wildlife including Asian elephants, Indian Rhinoceros, Indian Bison, Sambar, deer, barking deer, wild boars, reptiles such as python, krait, cobra, water monitor and fresh water turtles, numerous species of birds including hornbills, peafowl, woodpeckers, fishing eagle, jungle fowl, Bengal florican and pied hornbill. This study is the first attempt to record the diversity of testate amoeba in this forest.

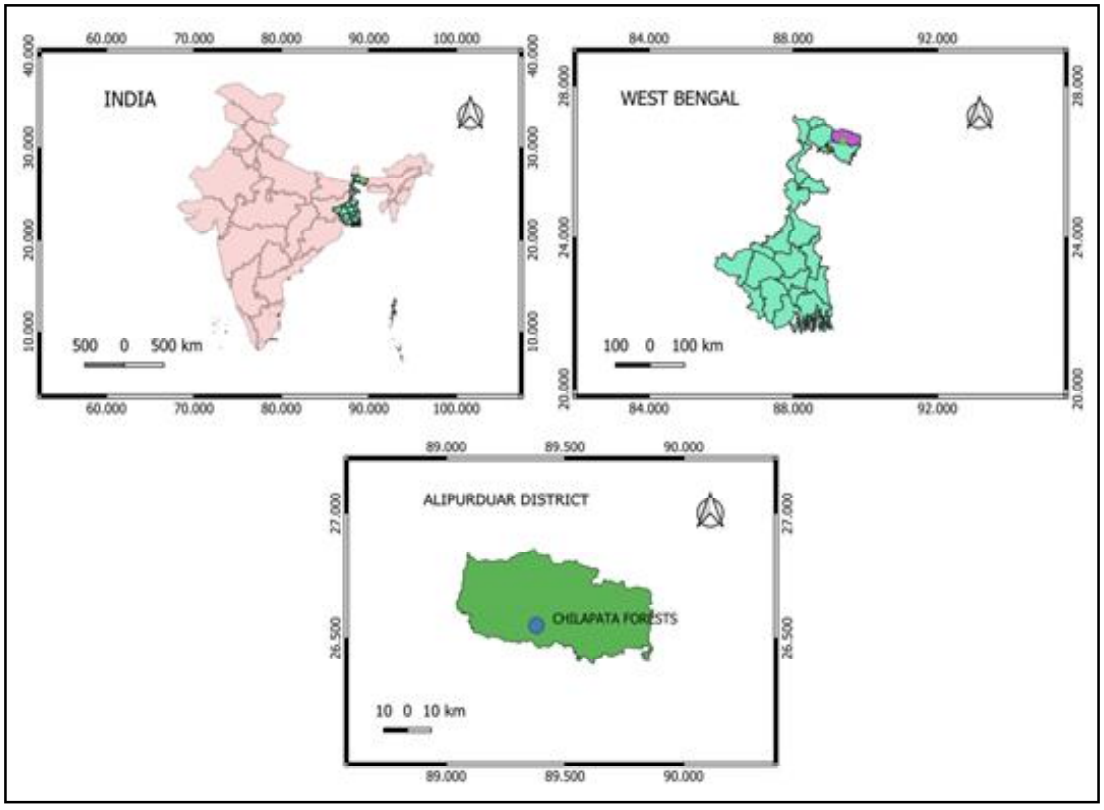


Figure 1: Map of the Study area (Chilapata Forests).

Sampling :

To investigate the diversity in the study area, the sample was collected from the water bodies, soil and moss habitats during 28th November to 3rd December 2022. After collection, the samples were studied thoroughly to record the testaceans diversity. The isolated testacids were kept on slide for air drying; after two or three washings in absolute alcohol, they were mounted in DPX[11,14,15]. The identification of the testate amoeba was carried using the key and guidelines of Ogden and Hedley[32], Hoogenraad and de Groot[19], Charman *et al*.,[10], Adl *et al*.[2].

A total of 25 species to 10 Genera, 8 Families, and 2 orders was recorded during this study. Among these, 19 species were described under Phylum Tubulinea and remaining 6 species belongs to the Phylum Cercozoa. *Arcella* Ehrenberg 1830, *Centropyxis* Stein 1857, *Difflugia* Leclerc 1815, *Euglypha* Dujardin 1841 and *Trinema* Dujardin 1841 were found to be the dominant genera in the study.

Systematic List

Phylum **Tubulinea** Smirnov *et al*., 2005

Class **Elardia** Kang *et al*., 2017

Order **Arcellinida** Kent, 1880

Family **Arcellidae** Ehrenberg, 1843

Genus ***Arcella*** Ehrenberg, 1830

1. *Arcella gibbosa Penard, 1890*
2. *Arcella hemisphaerica Perty 1852*
3. *Arcella intermedia* Deflandre 1938; Tsyganov and Mazei 2006

Family Arcellidae Ehrenberg, 1843

Genus *Galeripora* Gonzalez miguens et al 2021

4. *Galeripora catinus* Penard 1890; Gonzalez miguens *et al*., 2021
5. *Galeripora discoides* Ehrenberg 1871; Gonzalez miguens *et al*., 2021

Family Netzeliidae Kosakyan *et al.*, 2016

Genus *Cyclopyxis* Deflandre, 1929

6. *Cyclopyxis eurystoma* Deflandre 1929

Genus *Netzelia* Ogden, 1979

7. *Netzelia corona* Wallich 1864; Gooma *et al*., 2017

Family Difflugiidae Wallich, 1864

Genus *Difflugia* Leclerc, 1815

8. *Difflugia dujardini* Chardez 1957
9. *Difflugia globularis* Wallich 1864, Chardez 1956
10. *Difflugia globulosa* Dujardin 1837; Penard 1902
11. *Difflugia oblanga* Ehrenberg 1938
12. *Difflugia penardi* Cash & Hopkinson 1909

Family Lesquereusiidae Jung, 1942

Genus Lesquereusia Schlumberger, 1845

13. *Lesquereusia modesta* Rhumbler 1895

Family Centropyxidae Jung, 1942

Genus *Centropyxis* Stein, 1857

14. *Centropyxis aculeate Ehrenberg 1838; Stein 1859*
15. *Centropyxis aerophila* Deflandre, 1929
16. Centropyxis constricta (Ehrenberg, 1838) Penard, 1902
17. Centropyxis elongata (Penard, 1890) Thomas, 1959
18. Centropyxis minuta Deflandre, 1929

Family Plagiopyxidae Bonnet et Thomas, 1960

Genus Plagiopyxis Penard, 1910

19. *Plagiopyxis declivis Bonnet 1955*

Phylum Cercozoa Adl et al., 2005; emend. Cavalier-Smith, 2018

Class Silicofilosea Adl et al., 2005, emend. Adl et al., 2012

Order Euglyphida Copeland, 1956, emend. Cavalier-Smith, 1997

Family Euglyphidae Wallich, 1864, emend. Lara et al., 2007

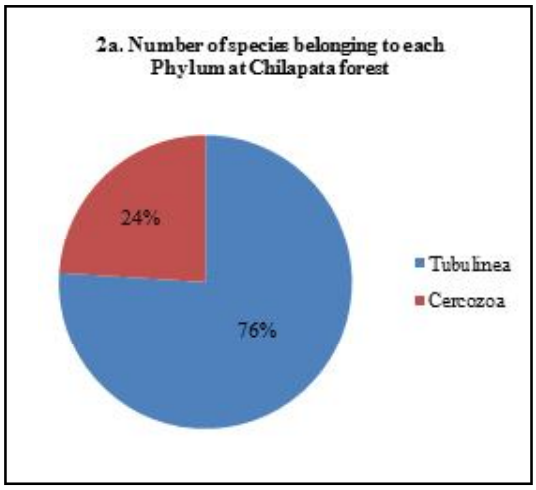
Genus *Euglypha* Dujardin, 1841

20. *Euglypha laevis* (Ehrenberg, 1845)
21. *Euglypha rotunda* Wailes, 1911
22. *Euglypha simplex* Decloitre, 1965

Family Trinematidae Hoogenraad and De Groot, 1940, emend Adl et al., 2012

Genus *Trinema* Dujardin, 1841

23. *Trinema complanatum Penard 1890*
24. *Trinema enchelys Ehrenberg 1838*
25. *Trinema lineare Penard 1890*



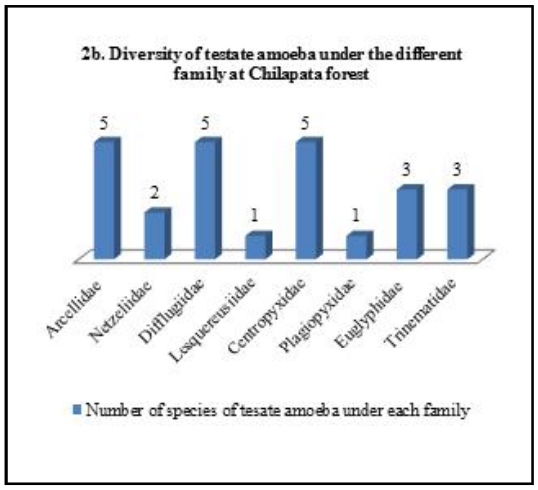


Figure 2. Diversity of testate amoeba (a) classified under different Phylums and (b) classified under different families.

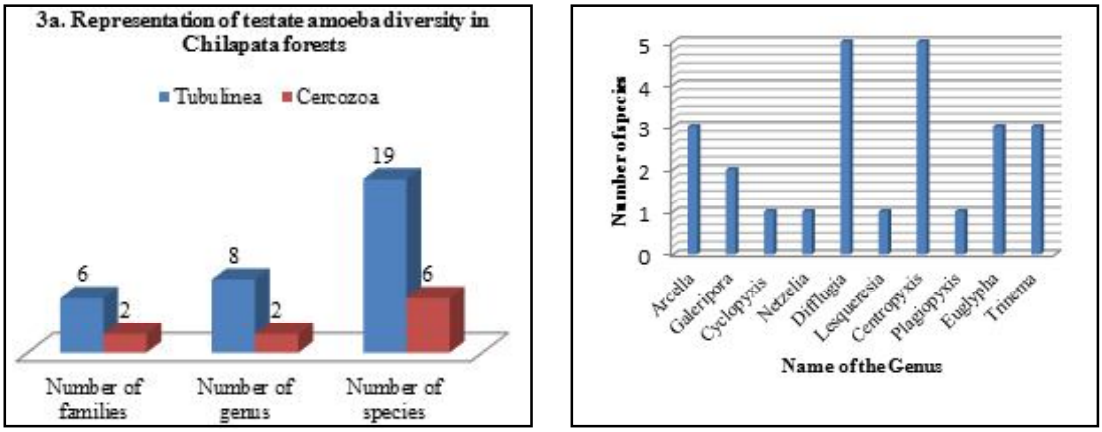


Figure 3: Diversity of testate amoeba (a) taxa classification under different Phylums and (b) classified under different genus.

Chilapata forest is a wildlife corridor, which facilitates the movement of key species like elephant and tiger to and fro the various connecting protected areas (Jaldapara National Park and Buxa tiger Reserve) in the region. It helps to maintain the biodiversity and supports ecological balance in and around the region. The species richness and abundance of testate amoeba recorded here is a proof of healthy ecological and resilient ecosystem in this region. Timber extraction for livelihood, ecotourism to generate revenue and exploitation of forest resources and non-timber products by the locals for survival is a potential threat to these forests. The large scale changes due to deforestation[33] and use of fertilizer and pesticide, is highly reflected in the testate amoeba communities. Soil pollution[36,37] due to input of harmful chemicals and heavy metals and atmospheric pollution[4,30] due to increased load of pollutants are reflected by aquatic and sub-aerial habitat resident testate amoeba. Chaudhary and Purushothaman[12,13] recorded the diversity of testate amoeba in two protected areas of West Bengal which enumerate the implication of soil and vegetation on community structure of testate amoeba. The soil type, changing parameters and differences in microhabitat, impact in the shaping of test structure and shape. This significant morphological response of testate amoeba makes it a very useful bioindicators. Integrating the monitoring of testate amoeba in forest management will enable to assess the ecosystem condition, identify potential threats; formulate guidelines to conserve them by mitigating threats and strategies to enhance their health further. Integrated sustainable development system for conservation of forest ecosystems and traditional human settlements will enable to curb the threats to this ecosystem degradation.

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