International Journal of Global Science Research **ISSN: 2348-8344 (Online)**
Vol. 9, Issue. 2, October 2022, pp. 1884-1891 **DOI: 10.26540/ijgsr.v9.i2.2022.218**
***Available Online* at www.ijgsr.com**

Research Paper

Novel reports of moss inhabitant Testate Amoebae (Protozoa : Amoebozoa) from Jim Corbett National Park, Uttarakhand

Bindu. L.* and Sathish Kumar, V. M.
Western Ghat Regional Centre, Zoological Survey of India, Kozhikode, Kerala, India
Northern Regional Centre, Zoological Survey of India, Dehradun, Uttarakhand, India
*Corresponding author E mail : bindulajapathi40@gmail.com

Received: 01/09/2022
Revised: 06/09/2022
Accepted: 10/09/2022:

Abstract: A study was conducted to explore the diversity of free-living testate amoebae in India's first National park, the Jim Corbett National Park named after Jim Corbett, the famous naturalist which is the first study of this group in the park. The study resulted the occurrence of 18 species of testate amoebae coming under 9 genera and 7 families and also recorded 4 species as new record to Indian testate fauna viz., Cyclopyxis aplanata (Penard, 1911) Deflandre, 1929; Cyclopyxis puteus Thomas, 1960; Euglypha simplex Decloitre, 1965 and Corythion constricta (Certes, 1889) Jung, 1942.

Keywords : *Testate amoebae, Jim Corbett National Park, Moss biotope, Western Himalaya*

Introduction:

Jim Corbett National Park is located between 29°13'-29°35'N Latitude and 78°33'-79° 46'E Longitude in the foothills of Himalayas, in the districts of Nainital, Pauri and Almora. districts of Uttarakhand (Map. 1). The altitude of the region ranges between 360 and 1,040 meters. Administratively, Jim Corbett National Park area comprises 912.62 .km2 of the Pauri, 355.75 km2 of the Nainital and 19.95 km2 of Almora Districts of Uttarakhand State. Altitude of the Reserve ranges from 400m to the peak of Kanda at 1210 m above msl. (Editor-Director, 2008. Fauna of Corbett Tiger Reserve). The park is the first Tiger Reserve in India, named after the hunter turned conservationist Jim Corbett who played a key role in the establishment of this oldest national park in India in the year 1936 then known as Hailey National Park and renamed as Ramganga National Park in 1952. Jim Corbett National Park, got its present name in 1957 after Jim Corbett, the famous naturalist. In spite of its diverse and rich floral and faunal elements no work has been done so far on the free living protozoans of this renowned national park. 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). The distribution of testate amoebae is cosmopolitan and ranges from terrestrial to marine environment and they are very sensitive to

International Journal of Global Science Research
Vol. 9, Issue. 2, October 2022, pp. 1884-1891
Available Online at www.ijgsr.com

ISSN: 2348-8344 (Online)
DOI: 10.26540/ijgsr.v9.i2.2022.218

changes in its environment. These testate amoebae are seen abundantly in sphagnum biotopes where they play a key role in the functioning of the microbial loop (Mitchell *et al.*, 2008; Gilbert and Mitchell, 2006). 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). Despite the important role in food chain and also as bioindicators for environmental monitoring the immense majority of protist diversity in many protected areas and other parts of India have not so far been seriously analysed and the perusal of literature revealed that from Uttarakhand so far only 21 species of testate amoebae were reported (Chattopadhayay and Das, 2003).In this context this article is the first-time effort to provide information on testate amoebae fauna of Jim Corbett National Park, the most prestigious National Park of India in Western Himalaya, one of the biotic provinces of India.

Map. 1. Jim Corbett National Park, Uttarakhand
(Source: Editor-Director. 2008. Fauna of Corbett Tiger Reserve)

Materials and Methods:

Moss samples (100-200grams) were collected by quadrant sampling ($1m^2$) by scrapping from rock, tree bark and from top soil with spatula from the study area during the faunistic survey to Western Himalaya in November 2019. 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 hrs. about 2-3 ml of run off collected by tilting the petri dish and was thoroughly examined under a compound microscope for species level

International Journal of Global Science Research **ISSN: 2348-8344 (Online)**
Vol. 9, Issue. 2, October 2022, pp. 1884-1891 **DOI: 10.26540/ijgsr.v9.i2.2022.218**
***Available Online* at www.ijgsr.com**

identification (Mazei and Tsyganov, 2006) at a magnification of 400x (Nikon 50i microscope) and images were taken using 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 slides were deposited in the National Zoological collections of Marine Biology Regional Centre, Chennai.

Results:

The systematic details of the species recorded from Jim Corbett National Park is provided as per the classification Adl *et al*., 2019. Also the distribution status of these species in Indian states is depicted.

Phylum Tubulinea Smirnov *et al*., 2005
Class Elardia Kang *et a*l., 2017
Order Arcellinida Kent, 1880
Family Netzeliidae Kosakyan *et al*., 2016
Genus *Cyclopyxis* Deflandre, 1929
1. Cyclopyxis aplanata (Penard, 1911) Deflandre, 1929. *Cyclopyxis aplanata* Deflandre, *Archiv fur Protistologie*, 67 : 322-375. *Distribution* : Present record from India
2. Cyclopyxis arcelloides (Penard, 1902) Deflandre, 1929 *Centropyxis arcelloides* Penard, *Faune Rhizopodique du bassin du Leman, Geneve*, p. 309.1929.*Cyclopyxis arcelloides* Deflandre, *Arch. Protistenkd*., 67, p. 367. *Distribution* : Andhra Pradesh , Arunachal Pradesh, Himachal Pradesh, Manipur, Meghalaya, Mizoram, Sikkim, Uttarakhand , West Bengal
3. Cyclopyxis eurystoma Deflandre, 1929
1929. *Centropyxis (Cyclopyxis) eurystoma* Deflandre, *Arch. Protistenkd.*, 67, p. 371.
Distribution : Assam, Arunachal Pradesh, Himachal Pradesh
4. *Cyclopyxis puteus* Thomas, 1960
1960. *Cyclopyxis puteus* Thomas, Linneenne de Bordeaux, 98: 27-53.
Distribution : Present record from India
Incertae sedis : Infraorder Sphaerothecina
Genus : *Trigonopyxis* Penard, 1912
5. Trigonopyxis arcula Penard, 1912
1912. *Trigonopyxis arcula* Penard, *Rev. Suisse Zool.*, 20 (1), pp. 9 & 13, pl.1, figs. 6 & 8.
Distribution : Sikkim, Manipur , Himachal Pradesh, West Bengal, Assam
Family Difflugiidae Wallich, 1864
Genus *Difflugia* Leclerc, 1815
6. Difflugia globulosa (Dujardin, 1837) Penard, 1902
1837. *Difflugia globosa*Dujardin, *Ann. Sci. Nat. Zool.* (2) 8:310, pl.9. Fig. 1.
1874. *Difflugia acropodia.* Hertwig and Lesser: Arch. mik. Anat. X, supl. 107 ,Taf. ii, fig.G
Distribution: Andhra Pradesh, Meghalaya, West Bengal
Family Centropyxidae Jung, 1942
Genus *Centropyxis* Stein, 1857
7. Centropyxis aerophila Deflandre, 1929
1929. *Centropyxis aerophila* Defaldre, *Arch. Protistenkd.*, 67, p. 330.
Distribution : Arunachal Pradesh, Andhra Pradesh, Sikkim, Chandigarh, Himachal Pradesh, Jammu & Kashmir, Manipur, Mizoram, Meghalaya, Nagaland, Tripura, Uttarakhand, West Bengal
8. Centropyxis constricta (Ehrenberg, 1841) Penard, 1890
1841. *Arcella constricta* Ehrenberg, *Abh. Akad.Wiss. Berlin.*
1902. *Difflugia constricta* Penard, *Faune Rhizopodique du basin du Leman*, Geneve, p. 299.
Distribution : Assam, Andhra Pradesh, Chandigarh, Himachal Pradesh, Meghalaya, Mizoram, Sikkim,Uttarakhand West Bengal
9. Centropyxis plagiostoma Bonnet et Thomas, 1955
1955. *Centropyxis plagiostoma* Bonnet and Thomas, *Bull. Soc.Hist. Nat. Toulouse*, 110, p.415
Distribution : Assam, Mizoram, Nagaland, Uttarakhand
Family Heleoperidae Jung, 1942

ISSN: 2348-8344 (Online)
DOI: 10.26540/ijgsr.v9.i2.2022.218

Genus *Heleopera* Leidy, 1879
10. Heleopera sphagni Leidy, 1874
1874. *Difflugia (Nebela) sphagni* Leidy, *Proc. Acad, Nat., Sci.*, p. 157
1875. *Nebela sphagni* Leidy, *Proc. Acad. Nat. Sci*., p. 119
1879. *Heleopera picta* Leidy, *Freshwater Rhizopods of North America*, p. 162.
Distribution : Sikkim, Uttarakhand ,West Bengal
Phylum Cercozoa Cavalier-Smith, 1998, emend. Adl *et al*., emend. Cavalier-Smith, 2018
Class Silicofilosea Adl *et al*., 2005, emend. Adl *et al*., 2012
Order Euglyphida Copeland, 1956, emend. Cavalier-Smith, 1997
Family Assulinidae Lara *et al*., 2007
Genus *Assulina* Ehrenberg, 1872
11. Assulina muscorum Greeff, 1888
1879. *Assulina seminulum*(partim) Leidy, *freshwater Rhizopods of North America*, pl.37, figs. 15, 16, 26. 1915. *Assulina muscorum*: Cash, Wailes, and Hopkinson, *The Brit ish Freshwater Rhizopoda and Heliozoa,* **3,** p. 55.
Distribution :Assam , Arunachal Pradesh, Himachal Pradesh, Manipur, Sikkim), Tripura, West Bengal, Mizoram, Assam
12. Assulina seminulum (Ehrenberg, 1848) Leidy, 1879
1848. *Difflugia seminulum* Ehrenberg, *Ber. Akad. Berlin,* p. 379
1879. *Assulina seminulum* Leidy, *Freshwater Rhizopods of North America*, p. 225.
Distribution : Andhra Pradesh, Assam, Manipur, Nagaland, Sikkim, West Bengal
Family Euglyphidae Wallich, 1864, emend. Lara et al., 2007
Genus *Euglypha* Dujardin, 1841
13. Euglypha laevis Perty, 1849
1845. *Difflugialaevis* Ehrenberg, *Ber. Akad., Berlin*, p.307.
1915. *Euglypha laevis* : Cash, Wailes and Hopikinson, *The British Freshwater Rhizopoda and Heliozoa,* **3**, p. 32,pl. 34, figs. 10-12, pl.39, figs. 5-7, text figs.118 & 122.
Distribution : Assam, Andhra Pradesh, Himachal Pradesh, Tripura, Meghalaya, Sikkim, West Bengal, Uttarakhand.
14. Euglypha rotunda Wailes & Penard, 1911
1911. *Euglypha rotunda* Wailes and Penard, *Proc. R. Irish Acad*., 31, pp.17, 41, 60-62, pl.4, Figs. 19a-g.
1915. *Euglypha rotunda* : Cash, Wailes and Hopkinson, *The British Freshwater Rhizopoda* and *Heliozoa,* 3, p. 31. Pl.34, fig9; pl. 35, figs.14-16, text-fig. 121
Distribution : Andhra Pradesh, Arunachal Pradesh, Meghalaya, Himachal Pradesh,Manipur, Jammu & Kashmir, Nagaland, Mizoram, Uttarakhand, Sikkim, West Bengal.
15. Euglypha simplex Decloitre, 1965
1965. *Euglypha simplex* Decloitre, *Bull. De la societe des sci. Nat. et. Phy. Du Maroc,* 45 : 17-28.
Distribution : Present record from India
Family Trinematidae Hoogenraad and De Groot, 1940, emend Adl *et al*., 2012
Genus *Corythion* Taranek, 1881
16. Corythion constricta (Certes, 1889) Jung, 1942
1942. *Corythion constricta* Jung, *Archv für Protistenkdunde*, 95, p. 325, Abb. 68.
Distribution : Present record from India
Genus *Trinema* Dujardin, 1841
17. Trinema complanatum Penard, 1890
1890. *Trinema complanatum*Penard, *Mem. Soc. Geneve,* 31: 187, pl.10, figs. 1-4.
1915. *Trinema complanatum*:Cash, Wailes and Hopikinson, *The British Freshwater Rhizopoda and Heliozoa,* **3**, p.94, pl.48,Figs.4-5
Distribution : : Andhra Pradesh, Arunachal Pradesh, Himachal Pradesh, Mizoram, Sikkim, Uttarakhand
18. Trinema lineare Penard, 1890
1890. *Trinema linear*ePenard, *Mem. Soc. Geneve, 31,* p.187, pl.11.Figs.5-17.
1915. *Trinema lineare Cash*, Wailes and Hopkinson, *The British Freshwater*

International Journal of Global Science Research
Vol. 9, Issue. 2, October 2022, pp. 1884-1891
***Available Online* at www.ijgsr.com**

ISSN: 2348-8344 (Online)
DOI: 10.26540/ijgsr.v9.i2.2022.218

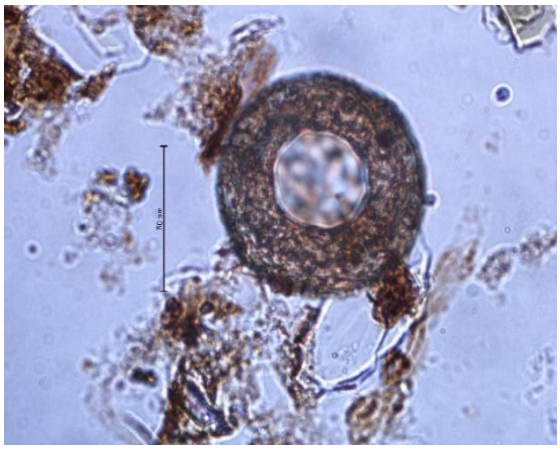
Rhizopoda and Heliozoa, 3:91, pl.47, figs.11-21.
Distribution : Assam, Andhra Pradesh, Arunachal Pradesh, Himachal Pradesh, Meghalaya, Manipur,Mizoram, Nagaland, Sikkim, Tripura, West Bengal

Conclusion

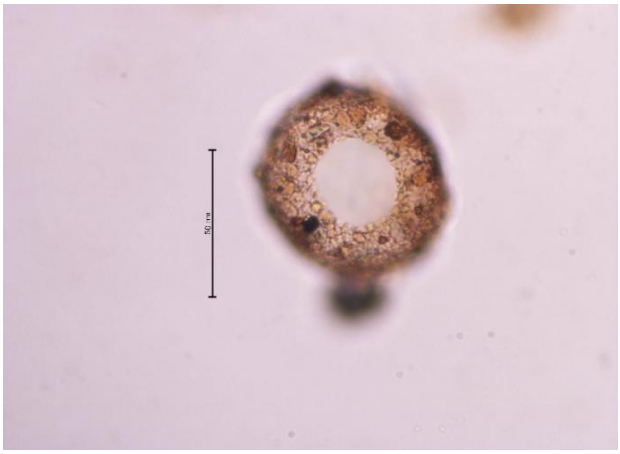
A total of 18 species of testate amoebae span over 9 genera and 7 families under 2 classes and 2 phyla were identified from the National park. The study also revealed the occurrence of 4 species of testate amoebae as new additions to Indian fauna *viz***.,** *Cyclopyxis aplanata* (Penard, 1911) Deflandre, 1929; *Cyclopyxis puteus* Thomas, 1960; *Euglypha simplex* Decloitre, 1965 and *Corythion constricta* (Certes, 1889) Jung, 1942. This is only a baseline study and intensive studies are required to explore the actual diversity of this biologically rich National park.

Acknowledgement:

The authors are thankful to the Director**,** Zoological Survey of India, Kolkata for sanctioning the project and also thanks are due to the forest officials in Uttarakhand and the survey team from NRC, Dehradun for their invaluable support during the survey.

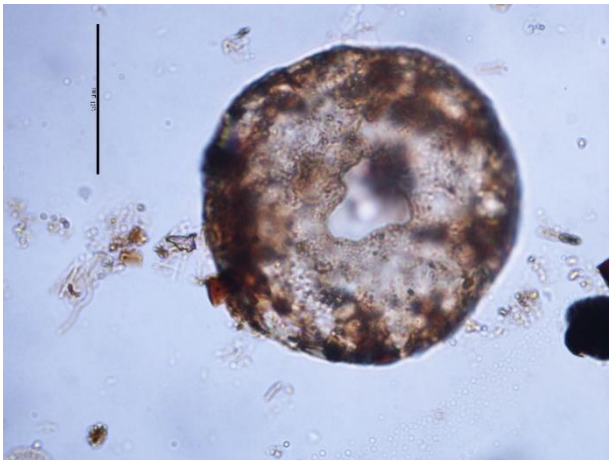


Cyclopyxis aplanata (Penard, 1911)Deflandre, 1929



Cyclopyxis arcelloides (Penard, 1902)

Cyclopyxis puteus Thomas, 1960



Trigonopyxis arcula Penard, 1912

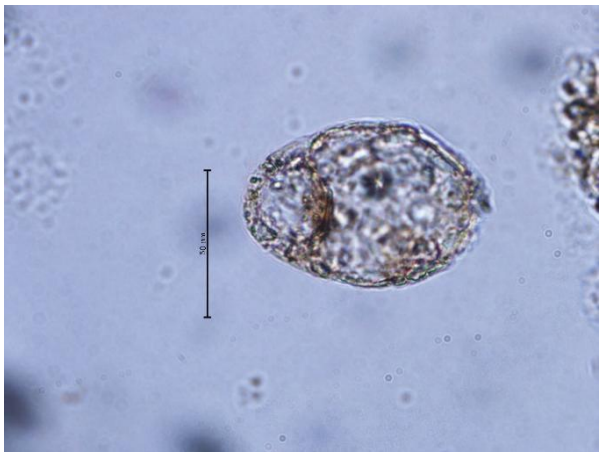
International Journal of Global Science Research
Vol. 9, Issue. 2, October 2022, pp. 1884-1891
***Available Online* at www.ijgsr.com**

ISSN: 2348-8344 (Online)
DOI: 10.26540/ijgsr.v9.i2.2022.218

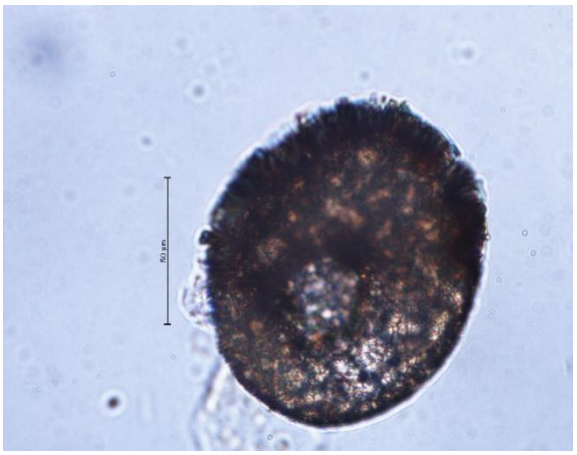
Difflugia globulosa (Dujardin, 1837) Penard, 1902

Centropyxis aerophila Deflandre, 1929

Plate-2

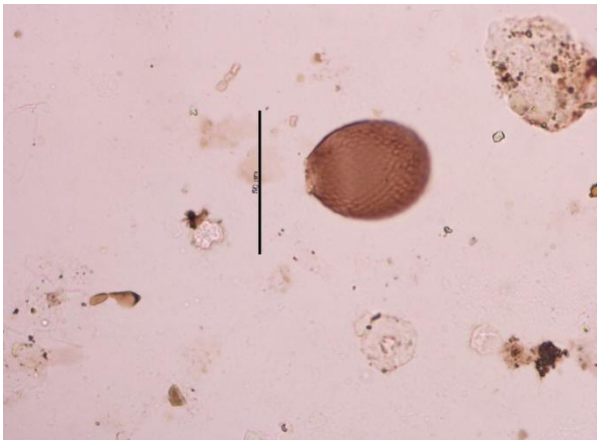


Centropyxis constricta (Ehrenberg, 1841)Penard, 1890



Centropyxis plagiostoma Bonnet et Thomas, 1955

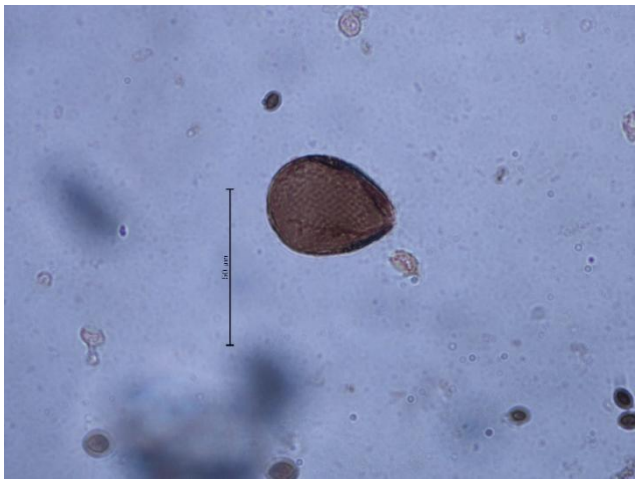
Heleopera sphagni Leidy, 1874



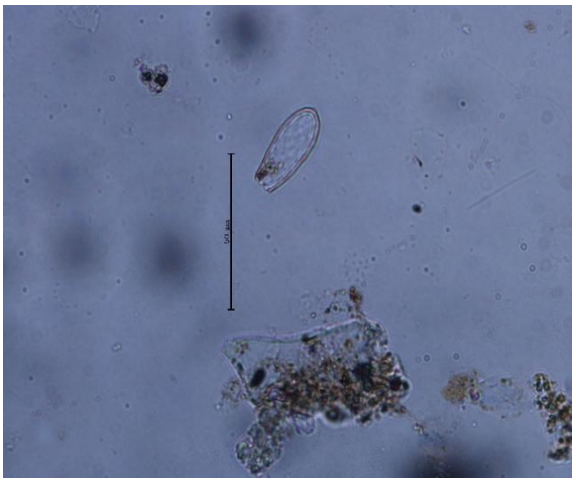
Assulina muscorum Greeff, 1888

International Journal of Global Science Research
Vol. 9, Issue. 2, October 2022, pp. 1884-1891
***Available Online* at www.ijgsr.com**

ISSN: 2348-8344 (Online)
DOI: 10.26540/ijgsr.v9.i2.2022.218

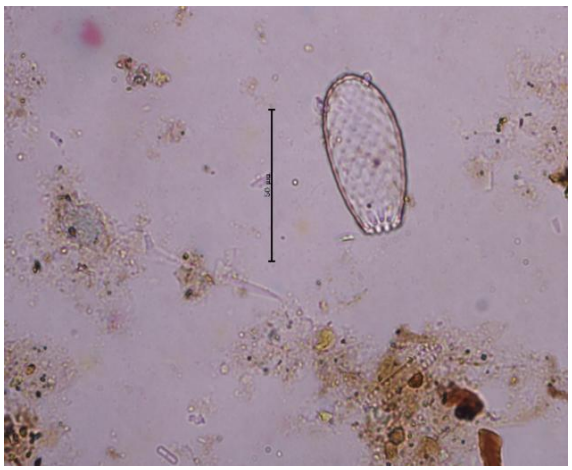


Assulina seminulum (Ehrenberg, 1848)Leidy, 1879

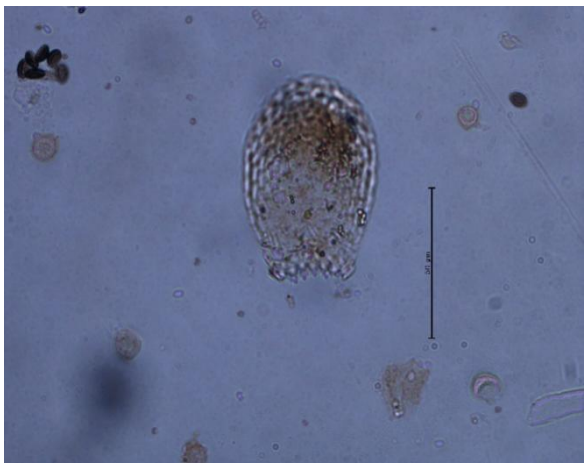


Euglypha laevis Perty, 1849

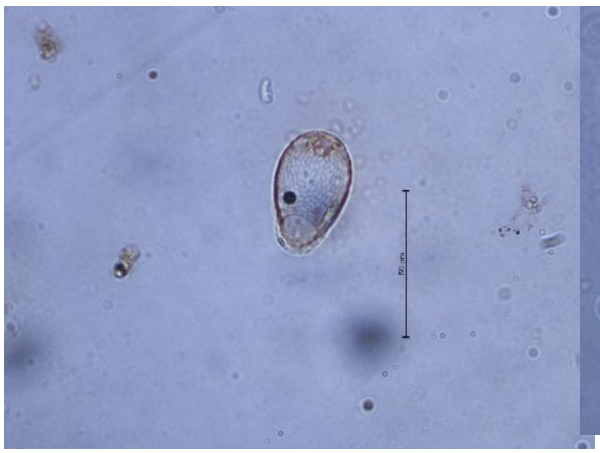
Plate-3



Euglypha rotunda Wailes & Penard, 1911



Euglypha simplex Decloitre, 1965

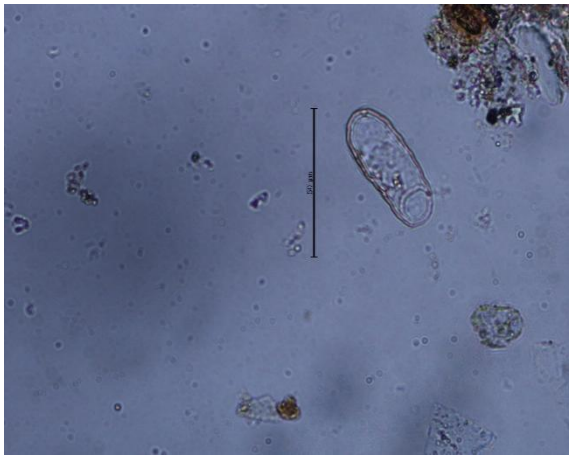


Corythion constricta (Certes, 1889)Jung, 1942

Trinema complanatum Penard, 1890

International Journal of Global Science Research
Vol. 9, Issue. 2, October 2022, pp. 1884-1891
***Available Online* at www.ijgsr.com**

ISSN: 2348-8344 (Online)
DOI: 10.26540/ijgsr.v9.i2.2022.218



Trinema lineare, Penard, 1890

Cyclopyxis eurystoma Deflandre, 1929

References:

Editor-Director (2008) Fauna of Corbett Tiger Reserve, Conservation Area Series, 35, 1-230. Published by the Director, *Zool. Surv. India*, Kolkata

Nguyen H., Gilbert D., Bernard N., Mitchell E.A. D and Badot P. M (2004) Relationship between atmospheric pollution characterized by NO_2 concentration and testate amoebae abundance and diversity. *Acta Protozoologica* 43, 233-239.

Payne R. J (2013) Seven reasons why protists make useful bioindicators, *Acta protozool*. 52, 105.

Mitchell E. A. D., Charman D. J and Warner, B. G. (2008) Testate amoebae analysis in ecological and paleoecological studies of wetlands; past, present and future.*Biodiversity and conservation*, 17:2115-2137.

Gilbert D and Mitchell E.A.D (2006) Microbial diversity in sphagnum peatlands. In : *Peatlands* : Evolution and records of Environmental and climatic changes. Elsevier, Amsterdam. Pp. 289-320.

Qin Y., Mitchell E. A. D., Lamentowicz M., Payne R. J., Lara E., Gu Y., Huang X., Wang H.(2013) Ecology of testate amoebae in peatlands of central China and development of a transfer function for paleohydrological reconstruction. *Journal of paleolimnology*, 50(3), 319-330.

Chattopadhyay P. and Das A. K. (2003) Morphology, morphometry and ecology of moss dwelling testate amoebae (Protozoa: Rhizopoda)of North and North-East India. *Memoirs of the Zoological Survey of India*, Vol. 19 (4), 1-113.

Foissner W(1992) Estimating the species richness of soil protozoa using the ‘’non-flooded petri dish method’’. In *protocols* in *Protozoology*. Lee, J. J. and Soldo, A.T.(eds.), Allen Press, Lawrence, Kanas B-10.1-B-10.2.

Mazei Y and Tsyganov A. (2006). Freshwater testate amoebae. KMK Sci. press, Moscow.pp.300.