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Extended distribution of testate amoebae (Protozoa: Rhizopoda) to Indian fauna from Sangla Valley, Himachal Pradesh, India

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Testate amoebae are a group of free-living heterotrophic protists that have an organic shell or test and play a very good role as bioindicators in the ecological monitoring of environment. Inspite of the importance the percentage contribution of free living protozoans recorded from the Himalayan landscape is only about 12% of the total free living protozoans of India. This portrays a meagre diversity of species from such a highly diversified ecosystem of Himalaya and the true diversity may be far above the recorded number of species. In this study it is herewith reporting two species of testate amoebae viz., Assulina quadratum Van Oye, 1958 and Cyclopyxis leidy Couteaux et Chardez, 1981 for the first time from India from Sangla Valley, Himachal Pradesh.

Key words: *Assulina quadratum*, *Cyclopyxis leidy*, bioindicator protists, moss-dwelling testate amoebae, soil protists, new biogeographic records, Sangla Valley, Himachal Pradesh, India.

INTRODUCTION

Testate amoebae are a group of shelled protozoa that occur in high density populations in all environments and form a very environmental sensitive group of organisms (Nguyen-Viet et al., 2007). Their short generation times make them useful indicators of environmental changes (Vincke et al., 2004a; Mattheeussen et al., 2005). Nguyen et al. (2004) suggested that testate amoeba might be considered as potential biomonitors for atmospheric pollution. Testate amoebae are sensitive to physical changes of the surrounding environment; e.g., the moisture content (Beyens et al., 1986; Sullivan and Booth, 2011), temperature (Tsyganov et al., 2013) and they can be used as a model organism for environmental studies and ecotoxicology (Payne et al., 2012). In spite of the importance of this group of microorganisms for ecological monitoring not much research has been done in India. Even though Chattopadhyay and Das (2003) reported an appreciable number of moss dwelling testate amoebae from North and North-East India, no species have been reported from Sangla Valley, the present study area in the state of Himachal Pradesh, which is a Western segment of the Indian Himalayan region. The Himalayan region is a rich repository of extremely varied native and endemic biodiversity and is recognized as one of the globally important biodiversity hotspots (Rana et al., 2012; Sharma and Samant, 2014). This study is as part of the comprehensive study of the faunal diversity of Sangla Valley by Zoological Survey of India, India. It is

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Figure 1. *Assulina quadratum* Van Oye, 1958.

herewith a report of 2 species of testate amoebae for the first time from India from moss habitats of Sangla Valley viz., *Assulina quadratum* Van Oye, 1958 and *Cyclopyxis leidy* Couteaux et Chardez, 1981.

MATERIALS AND METHODS

The moss samples for the study were obtained from high altitude regional centre of zoological Survey of India, Solan. Moss samples were collected (100-200 g) by quadrant sampling (1 m^2) by scraping with a spatula from rock from Sangla Valley. Sangla Valley is located at latitudes 31° 10' 1.00''-31° 30' 17.16'' N and longitudes 78° 10' 26.52''-78° 52' 41.75''E and with altitudes varying from 1800 to 4600 m. The samples were processed using a non-flooded petri dish method as described by Foissner (1992) and kept 24 h for culture. The samples were then placed dropwise on glass slides with a micropipette and investigated under a compound microscope Nikon 50i for identification up to species level. The magnification used was 400X.

RESULTS

The study revealed the addition of two species of testate amoebae to Indian testate fauna from Sangla Valley. All the slides were registered and deposited in the National Zoological collections of Marine Biology Regional Centre of Zoological Survey of India, Chennai, Tamil Nadu, India.

(i) Systematic position of *Assulina* Ehrenberg (1872)
Phylum Cercozoa Cavalier-smith (1998)
Class Silicofilosea Adl et al. (2005)
Order Euglyphida Copeland (1956)
Family Assulinidae Lara et al. (2007)
Genus *Assulina* Ehrenberg (1872)

This genus is characterized with brown colour and ovoid test formed of compressed, elliptical, imbricated, siliceous platelets arranged more or less regularly in diagonal rows; aperture oval, terminal truncate or with a short neck bordered by a thin chitinous dentate membrane.
Assulina quadratum Van Oye, 1958 (Figure 1).

Material examined includes: Slide Nos. Mi-680; Mi-655; 4 specimens; Date of collection, 10.10. 2017, Collected by Sidhu and party.

Description

Assulina quadratum van Oye, 1958 has a triangulate, oval-shaped, light-brown coloured test covered with small oval-shaped platelets arranged in a linear manner. The posterior end of the test is slightly bifurcated; the opening of the aperture is serrated with several fine lobes. The shell length ranges from 41 to 45 µm, breadth of the shell is 34 to 36 µm and length of oral aperture is 10 to 12 µm. The occurrence of *Assulina* is frequently seen among moss habitats.

(ii) Systematic position of *Cyclopyxis* Deflandre (1929)
Phylum Amoebozoa Luhe, 1913, emend. Cavalier-Smith (1998)
Class Tubulinea Smirnov et al. (2005)
Order Arcellinida Kent (1880)

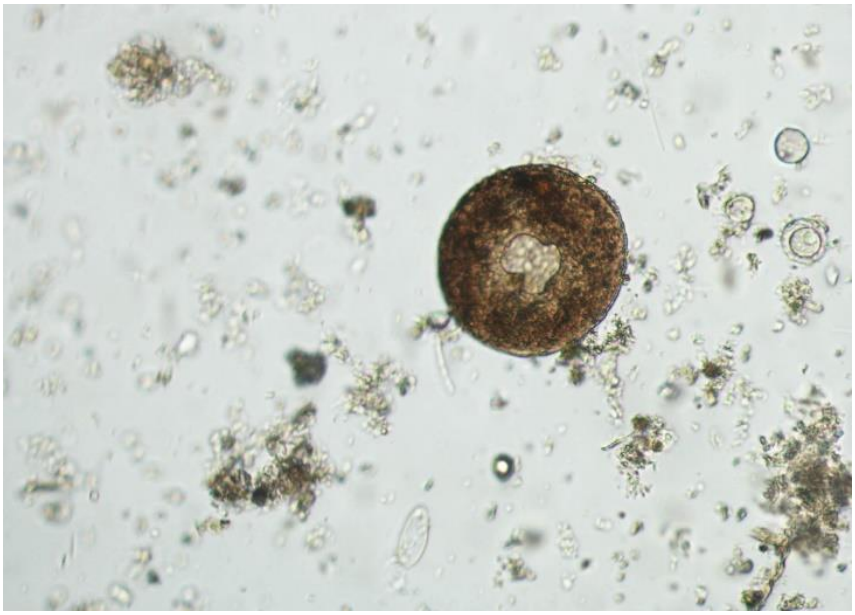

Figure 2. *Cyclopyxis leidy* Couteaux and Chardez, 1981.

Family Trigonopyxidae Loeblich and Tappan (1964)
Genus *Cyclopyxis* Deflandre (1929)

Test brown, regularly arched, in lateral view hemispherical, encrusted with mineral particles; aperture central, invaginated and circular; some species with lobed pseudostome, margin is never thick with organic lip, large sand grains encrusted in the test.

Cyclopyxis leidy Couteaux et Chardez, 1981(Figure 2). Material examined ivcludes Slide Nos. Mi. 681; Mi. 683; 3 specimens; Date of collection 9.10.2017, collected by Sidhu and party.

Description

Test hemispherical, ventral surface smooth; pseudostome is in the centre, bordered with three broadly rounded lobes which are bending downwards bordered by a smooth chitinoid rim. The shell length ranges from 70 to 80 µm and height 35 to 40 µm; aperture width 18-20 µm. The habitat of *Cyclopyxis* is mostly dry mosses.

DISCUSSION

Perusal of literature revealed that only two representative species of *Assulina viz*., *Assulina muscorum* Greeff, 1888 and *Assulina seminulum* (Ehrenberg, 1848) were reported from different states of North and North East India (Chattopadhyay and Das, 2003), Andhra Pradesh (Das et al., 2004) and Himachal Pradesh (Bindu, 2018). Thus, the present report of *Assulina quadratum* extends its distributional range to India and all the species reported under the genus *Assulina* from various states are from moss habitats and considered to be the typical inhabitants of mosses. The species under the genus *Cyclopyxis* reported from India are *C*. *arcelloides* Deflandre, 1929, C. *eurystoma* Deflandre, 1929 and *C*. *kahli* Deflandre, 1929 (Chattopadhyay and Das, 2003; Das et al., 2004; Bindu, 2018) and in this communication reporting an additional species of *Cyclopyxis viz*., *Cyclopyxis leidy* Couteaux and Chardez, 1981 to Indian testate fauna. The testate amoebae fauna of India is not thoroughly studied and further intensive study of this group may add many more species to the list of Indian fauna.

CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

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