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Isolation of freshwater protozoan from Gomti river, Lucknow

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Abstract

Freshwater protozoa are integral components of aquatic ecosystems, playing crucial roles in nutrient cycling, energy flow and microbial community dynamics. Protozoa also plays vital role in food chain. The environmental condition in which protozoa can live and multiply, there is always an optimum range for each group. In this study total 7 sites were selected for water samples collection from different regions of Lucknow. During this study, total 16 species of protozoa are observed like *Amoeba*, *Paramecium*, *Vorticella* etc. The identification is made on the basis of the body shape, size, type of locomotion, and structure of macro and micro nucleus. With the help of recent study, we highlighted the taxonomic diversity of freshwater protozoa, including ciliates, flagellates, amoebae and sporozoans in Gomti River, Lucknow.

Keywords: Protozoa; *Amoeba*; *Vorticella*; Water bodies

1. Introduction

Protozoa, are minute animalcules visible only under the microscope, about 50,000 species of protozoa are so far known. Being minute in size, protozoans outnumber members of any other animal group. These are mostly aquatic. Some lie in moist soil, and some as parasites in the bodies of other organisms. A protozoan is an independent eukaryotic cell i.e., a complete unicellular organism; it locomotes, feeds, respire, excretes, grows and reproduces. Obviously, it is comparable, structurally to a single cell, but functionally to the whole body of a metazoan or multicellular organism.

Protozoa moves with the help of the locomotory organelles like flagella, cilia or cellular extensions like pseudopodia and myonemes. Pseudopodia are of different types. Pseudopodia help in amoeboid movement e.g. *Amoeba*. The older pseudopodia usually appear as wrinkles of body for some time, forming what has been called Uroid. Cilia and flagellate help in swimming in *Paramecium* and *Euglena* respectively. Myonemes help in gliding movement in *Euglena* and *Sporozoans*. Nutrition in protozoa is holozoic or osmotrophic. Protozoa require organic material in the form of solution or particulate matter. In *Amoeba* mouth is absent or fixed at place for ingesting food. Ingestion occurs as the advancing body comes in contact with a food particle. Digestion is intracellular. Some forms like *Euglena* are mixotrophic. Excretion in protozoa occurs by the diffusion across general body surface or by contractile vacuoles. Contractile vacuoles serve mainly for osmoregulation and are common in freshwater forms. Asexual reproduction takes place by binary fission or multiple fission or plasmotomy. Sexual reproduction takes place by syngamy or conjugation. The functional totipotency of protozoans coupled with the presence, in some protozoans, of more than one nucleus and of certain such specialized organelles that are not found in ordinary cells, have prompted modern biologists to define protozoans as acellular or noncellular rather than unicellular organisms. The special branch of their study is called protozoology. Free living protozoa are excellent source model for providing information about the vital process of life. Many forms undergo encystment to tide over unfavorable conditions. Protozoa play a major role in the ecosystem that defines and design nature; they are a reliable indicator of pollution. Protozoa also help in improving the water quality. The most common

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types of protozoans which occur in soil, water, sewage and decaying matter are flagellates, amoeba, testaceans, heliozoans and ciliates. Free-living parasites are found in large numbers in nature and diverse habitats.

They are ubiquitous and ecologically very important. They are not only an important component of food chain in water, but also attribute to the structure and function of an aquatic ecosystem. Aquatic protozoans are considered as an important predator of bacteria and are small phyto and zooplanktons. They are also mediator for recycling nutrients essential for microbial growth and also for micro-ecosystem. Their sensitivity to the environmental changes makes them valuable indicators of water quality and other environmental changes. Ciliated protozoan plays an important role in environmental monitoring of water quality and can also be used for studying aquatic habitats in which mosquito larvae their intermediate host and different forms reside (Ahmad and Sharma, 2009; Anand and Paul, 2022). Ciliates are the most commonly occurring protozoan. Division is longitudinal in the flagellates and transverse in the ciliates; amoebas have no apparent anterior-posterior axis. Some protozoans rely on two host for the completion of their life cycle while other require only one host to complete them. Many protozoa have a permanent mouth, the cytostome or micropore, through which ingested food passes to become enclosed in food vacuoles. Compared to other microorganisms such as algae and bacteria protozoa are understudied despite of their ecological importance.

2. Material and methods

The water samples were collected from various water bodies of Lucknow city. Water samples were collected in plastic bottles (1 Liter) and care was taken that water must be collected along with submerged plants, decaying leaves, surface scum, ooze and bottom water sample were collected mostly in the morning because temperature also affects the abundance of ciliated protist. Seven water samples were brought to the laboratory and examined under the microscope for the study and observation. The protozoan taxa richness was determined by examining 3-4 drops of well mixed deposit material of water under microscope 10x and 40x magnification. Identification was done using standard protozoological keys (Kudo, 1977 and Patterson, 1996). The examination of all the water samples was completed within eight hours of collection. The identification of most of the protozoans was difficult and was rarely attempted beyond generic level; ciliates were frequently identified to species level, and no attempt was made to identify cysts or other resting stage. Water samples were observed directly by taking a water drop on a slide and observed under the low power of microscope for further study.

Table 1 List of areas of water sample collection

S.No.	Area from where water sample were collected for study
1	Daliganj bridge
2	Nishatganj bridge
3	Gomti Nagar bridge
4	Kukrail
5	Arjun Ganj
6	Chinhat
7	Jankipuram

3. Results and discussion

In the present study total sixteen species have been found. For identification of ciliated protist done after Bick (1972). For taxonomic identification the ciliate were immediately observed, on the day of collection, because as time goes, population is changing radically both in terms of number of individuals and species composition. Ciliates can be identified by their appearance. The species identification has been made mainly on the basis of arrangement of cilia, size and shape of body and structure of macro- and micronucleus (Shaikh et.al. 2014). Microscope with lens 10 and 40 are used in examination of the collected water. In the water samples were collected from Nishatganj bridge, Daliganj bridge and Kukrail (Gomti river water) were contains 7 different species protozoan (Table 1 and Table 2) that were observed under the microscope on the lens of 10X and 40X (*Paramecium caudatum*, *Euplotes*, *Euglena peranema*, *Spirostomum*, *Actinophry*, *Paramecium sp.*) (Plate 1). Total 4 samples of water (Table 1 and Table 2) were collected from Gomti river, Arjunganj, Chinhat and Jankipuram that contains 10 species of protozoa which were observed under the

microscope under the lens of 10X and 40X (*Paramecium caudatum*, *Paramecium aurelia*, *Vorticella*, *Euplotes*, *Dileptus*, *Amoeba proteus*, *Amoeba radiosa*, *Amoeba gorgonia*, *Amphileptus sp.*, *Arcella*, *Vannella sp.*) (Plate 1).

Results of the study revealed a diverse array of freshwater protozoa, including ciliates, flagellates, amoebae, and sporozoans, exhibiting distinct distribution patterns across different habitats. Ciliates were found to be the most abundant and diverse group, followed by amoebae and heliozoans. The ciliates are grazer of bacteria, unicellular algae and other protozoan. In many ciliates in *Spirostomum* a dense row of membranelles was noted to generate the water current containing food particles during feeding (Anand and Paul, 2022). Some large protozoans were also observed running fast and also moving with the help of cirri in *Euplotes*. Among observed amoebae, particular species were identified with the help of pseudopodia in *Amoeba proteus*, *Amoeba gorgonia*, *Amoeba radiosa* (Plate 1). Characteristic pseudopodia were observed in heliozoans (axopodia in *Actinophrys*) (Plate 1).

Considering their abundance and their potential role, protozoa are undoubtedly active participants within phytoplankton food webs. Surprisingly these communities and microbial food webs in the ecosystem have not yet been considered seriously. The present study records the occurrence of diversity among protozoans, their taxonomic composition and abundance in fresh water from different regions of Gomti river of Lucknow, Uttar Pradesh, India.

Table 2 Protozoa taxa collected from Lucknow city

Sr. No	Variety of Genera	Relative abundance
	Flagellates	
1	<i>Euglena peranema</i>	P
	Rhizopoda	
2	<i>Amoeba proteus</i>	P+
3	<i>Amoeba radiosa</i>	P+
4	<i>Amoeba gorgonia</i>	P
5	<i>Arcella vulgaris</i>	P
	Ciliates	
6	<i>Paramecium caudatum</i>	P+
7	<i>Paramecium sp.</i>	P+
8	<i>Paramecium Aurelia</i>	P++
9	<i>Euplotes</i>	P
10	<i>Vorticella</i>	P++++
11	<i>Dileptus</i>	P
12	<i>Spirostomum</i>	P+
13	<i>Amphileptus sp.</i>	P+
	Heliozoans	
14	<i>Actinosphaerium</i>	P++
15	<i>Actinophrys</i>	P+
16	<i>Vannella sp.</i>	P

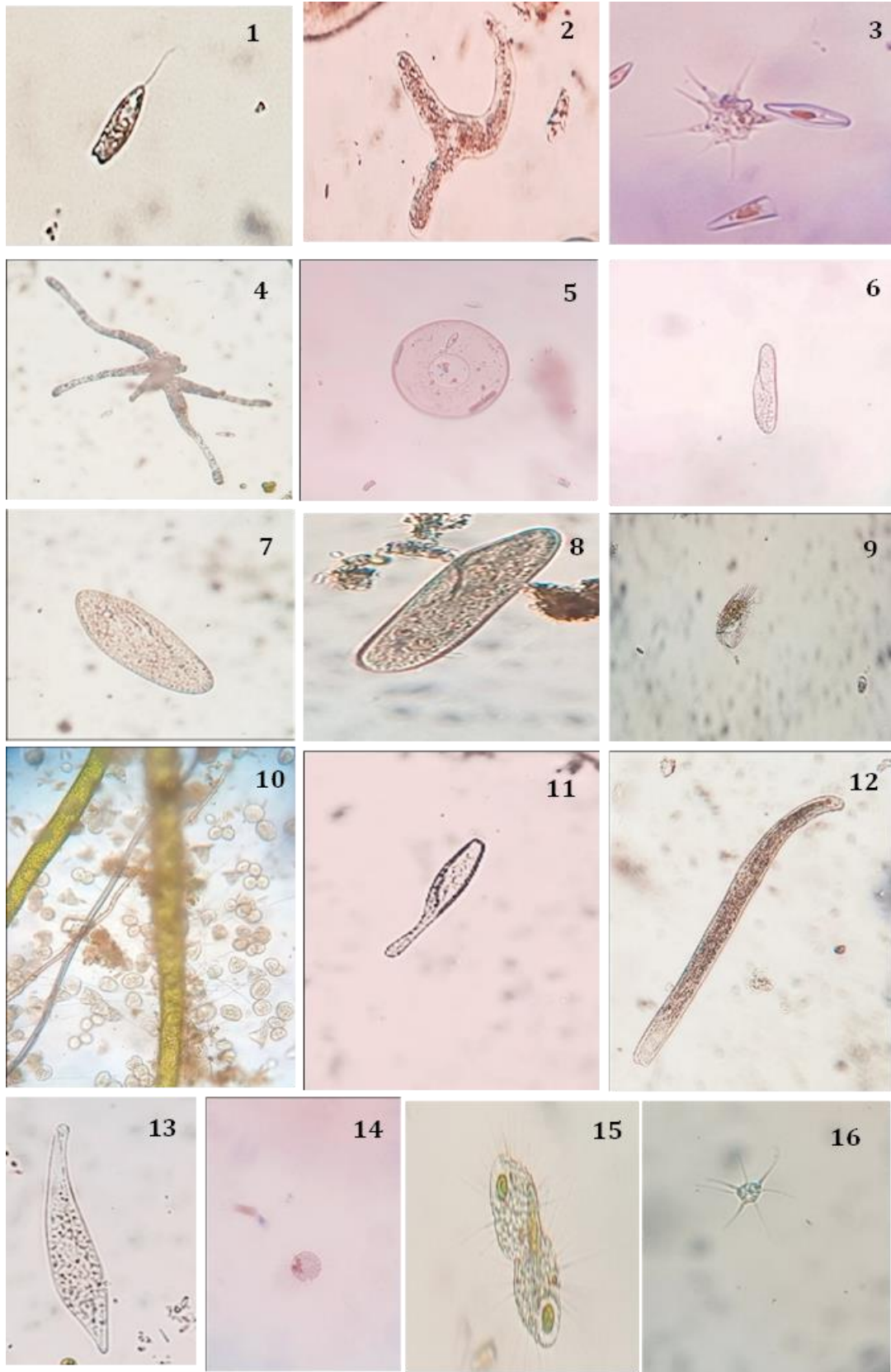


Plate 1 Fresh water Protozoans. Flagellate: 1 *Euglena peranema*. Rhizopoda: 2 *Amoeba proteus* 3. *Amoeba radiosa* 4. *Amoeba gorgonia* 5. *Arcella* sp. Ciliates: 6. *Paramecium caudatum* 7. *Paramecium* sp. 8. *Paramecium aurelia* 9. *Euplotes* 10. *Vorticella* 11. *Dileptus* 12. *Spirostomum* 13. *Amphileptus* sp. Heliozoans: 14. *Actinosphaerium* 15. *Actinophry* 16. *Vannella* sp.

4. Conclusion

Present observation shows abundance of fresh water protozoan in different site of Gomti river. The protozoan is good ecological indicator that provided ambient ecological condition for survival of other microorganism by cleaning aquatic debris and also present as good source of food for other organism survival. Different genera of protozoa survival fluctuate as per the ecological condition, there population minimize during heavy rain fall when water become turbid. After sometime when water settle down then protozoan population again increase due to abundance of inorganic ion in the water bodies.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors have no any conflict of interest for publishing this article.

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