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A study of fresh water protozoans with special reference to their abundance and ecology

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Abstract: Ecologically protozoa represent a model of interacting communities that exhibit various characters of structure and function of a micro-ecosystem and also an important component of food-chain. The present paper presents the first record of taxonomic composition and abundance of fresh water protozoans from ponds and Gomti River of Lucknow, U.P. India. A total forty seven protozoans were observed, studied thoroughly and identified. Total ten strains of flagellates, sixteen of amoebae, two testaceans; two heliozoans and seventeen different strains of ciliates were observed.

Keywords: Protozoa, Ecology, Food-Chain, Ponds, River Gomti

INTRODUCTION

Flagellates, amoebae, testaceans, heliozoans and ciliates are the most common protozoans occurring in a wide variety of natural habitats such as water, soil, sewage and decaying vegetations (Foissner *et al*; 1999 and Dolan, 2006).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 (Xu and Wood,1999 and Patterson, 2007).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 (Pratt and Cairns, 1985 and Baldock, 1986).To the best of our knowledge, no previous thorough investigation has been done on fresh water protozoans from Lucknow. The objective of this investigation was to study and record the protozoan taxa composition, variation of taxonomic richness and abundance of fresh water protozoans.

MATERIALS AND METHODS

Five ponds from different localities (Hussainabad pond, Raitha pond, Basawanpurwa pond, Dhatingara pond and Raipur pond) and six important Gomti river sites (Up stream, Pakka pul, Daliganj bridge, Hanuman setu, Nishatganj bridge and Down stream) from Lucknow city, Fig.1. UP, India were selected during a period of one year. Three samples of 500ml of water, each were collected in sterilized plastic bottles. The ponds were selected from rural areas, where local people used pond water for bathing, swimming, washing clothes and recreation. The river sites were selected on the basis of having intensive activities of human beings. The protozoan taxa richness was determined by examining 3-4 drops of well mixed deposit material of water under microscope (10X and 40Xmagnification). Identification was done using standard protozoological keys (Kudo,1966;Grell,1973; Lee *et al*,1985 and Patterson,2007).The examination of all the water samples was completed within eight hour 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.

RESULTS AND DISCUSSION

A total of forty seven protozoan taxa have been identified from the examination of approximately total sixty seven samples collected from July to December in the year 2007.The 47 protozoan taxa were comprised of ten flagellates, seventeen ciliates, twenty sarcodines (Table-1 and Plate 1).Of twenty sarcodines, sixteen were amoebae, two testaceans and two heliozoans. The list is almost certainly not exhaustive and new protozoan species may be found with further investigation of the sampling site. Out of all the observed protozoans; flagellates and ciliates were found abundantly and also quite frequently, where as, heliozoans and testaceans were found in least number and also rarely. Amoebae were found less frequently and not as richly as ciliates and flagellates. Prevalence rate of ciliates was 36.17%, flagellates show 21.28%, amoebida has 34.04%, testaceans and heliozoans shows similar prevalence rate i.e. (4.26%) (Fig.2.).

The ciliates are grazer of bacteria, unicellular algae and

Table 1. Protozoan taxa collected from Lucknow city.

Flagellates	Amoebida
Euglena viridis	*Amoeba proteus*
Euglena acus	*Amoeba radiosa*
Euglena spirogyra	*Thecamoeba sp.*
Euglena oxyuris	*Hartmannella crumpae*
Peranema trichophorus	*Hartmannella vermiformis*
Phacus longicaudus	*Naegleria fowleri*
Phacus acuminata	*Naegleria gruberi*
Anisonema costatum	*Acanthamoeba culbertsoni*
Volvox sp.	*Acanthamoeba rhysodes*
Cryptomonas sp.	*Acanthamoeba polyphaga*
	Acanthamoeba glebae
Ciliates	*Schizopyrenus russelli*
	Schizopyrenus jugosa
Stylonchia mytilus	*Amoeba spumosa*
Euplotes patella	*Stereomyxa angulosa*
Stentor roeseli	Testaceans
Paramecium caudatum	
Paramecium bursaria	*Arcella vulgaris*
Dileptus gigas	*Difflugia sp.*
Loxodus rostrum	
Spirostomum sp.	**Heliozoans**
Colpoda sp.	
Vorticella sp.	*Actinosphaerium sp.*
Carchesium sp.	*Actinophrys sp.*
Opercularia sp.	
Epistylis niagarae	
Coleps hirtus	
Tokophyra lemnarum	
Amphileptes sp.	
Cyclidium sp.	

other protozoans. In many ciliates (eg. *Spirostomum* and *Oxytricha*) a dense row of membranells was noted to generate water current containing food particles while feeding. In the literature much information is available for the ciliate species that are characteristic of fresh water sediments(Finlay *et al*,1988).It is also true that marine planktonic ciliates are generally different from those in the fresh water plankton, although interestingly, the ciliate community in the brackish-water column resembles that in fresh water at least at the genus level(as reported by Fenchel *et al.*,1987).We observed that Ciliates like *Cyclidium, Paramecium ,Euplotes, Loxodes, Stylonychia* are usually abundant in pond sediments.

Some of the large protozoans were also observed running fast and also walking with the help of "cirri"(eg *Euplotes* and *Stylonchia*) or creating a stalk like extension of the body, aligned perpendicular to the substrate(eg. *Stentor* and *Vorticella*).The occurrence of ciliates (*Epistylis* and *Zoothamnium*) in the pond water may also cause infection in aquatic animals such as prawns, fishes and shrimps etc; which are consumed as food. There are reports of

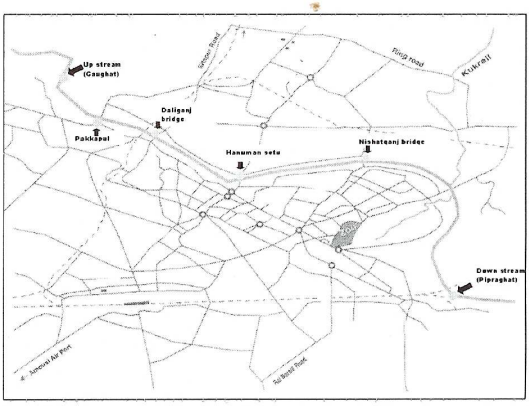

Fig. 1. *Map of Lucknow city indicating major location and water sampling sites selected for the study.*

the occurrence of different species of *Epistylis* on Cray fish, prawns and other crustaceans (Harlioglu, 1999; Brown *et al.*, 1993 and Utz, 2007).

Among observed amoebae; particular species was identified with the help of pseudopodia (i.e. lobopodia or acanthopodia).In larger amoebae (*Thecamoeba* and *Amoeba proteus*) pseudopodia were used for locomotion and food intake (as also reported by Canter-Lund and Lund,1995).Characteristic pseudopodia were observed in testaceans (lobopodia in *Arcella*) and heliozoans (axopodia in *Actinophrys*). The majority of sarcodines apart from the heliozoans are usually associated with surfaces, and especially sediments. The amoebae and testaceans have also been reported from lake(Finlay and Esteban,1998).In a similar type of study from Northern Ireland, 108 protozoan taxa were observed from a fresh water lake(Xu and Wood,1999) comprising 18 flagellates, 71 ciliates and 19 sarcodines. Page and Siemensma (1991) reported 109 species of heliozoans from fresh water. Foissner (1992) recorded a list of 282 species of heterotrophic flagellates isolated from various fresh water

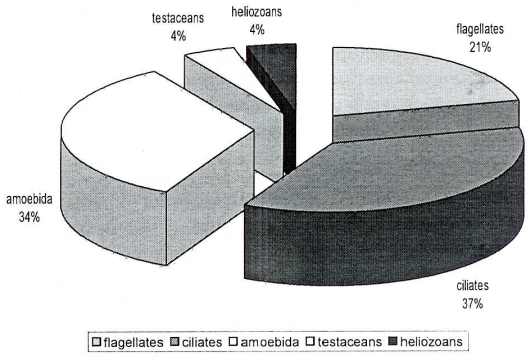

Fig. 2. *Showing percentage of fresh water protozoans from water samples.*

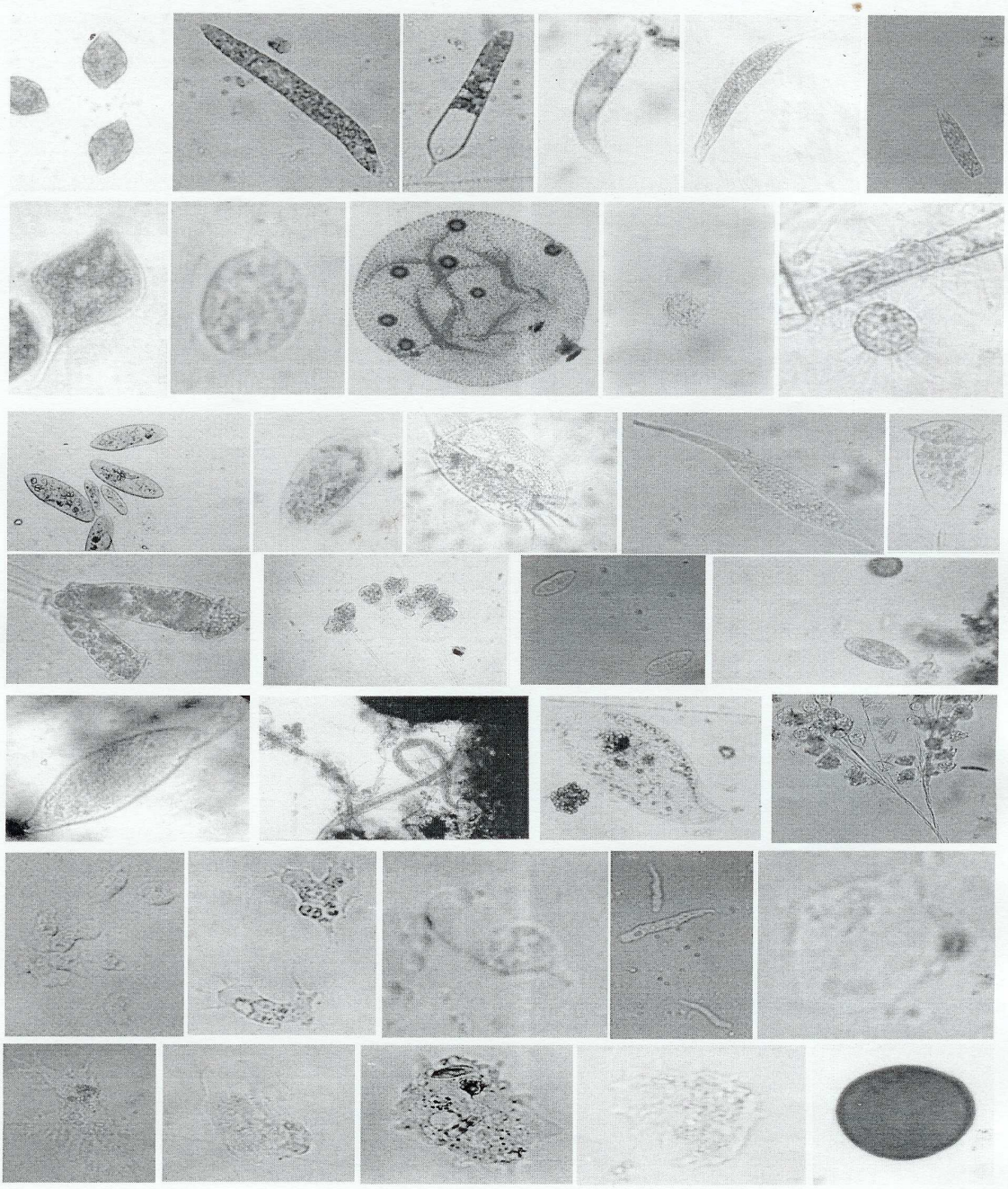

Plate 1. *Showing fresh water Protozoans. Flagellates 1. Euglena viridis, 2. Euglena spirogyra, 3-4. Euglena oxyuris, 5. Euglena acus, 6. Peranema trichophorus, 7. Phacus longicaudus, 8. Phacus acuminate, 9. Volvox sp. Heliozoans, 10. Actinosphaerium sp., 11. Actinophrys sp . Ciliates, 12. Paramecium caudatum, 13. Stylonchia mytilus, 14. Euplotes patella, 15. Amphileptes sp., 16. Vorticella sp., 17. Opercularia sp., 18. Epistylis niagarae, 19. Cyclidium sp., 20. Coleps hirtus, 21. Dileptus gigas, 22. Spirostomum sp., 23. Loxodus rostrum, 24. Carchesium sp. Amoebida 25. Naegleria fowleri, 26. Acanthamoeba culbertsoni, 27. Schizopyrenus russelli, 28. Hartmannella vermiformis, 29. Vannella sp., 30. Stereomyxa angulosa, 31. Thecamoeba sp., 32. Amoeba proteus, 33. Amoeba spumosa Testaceans 34. Arcella vulgaris*

sources. Wilkinson and Smith (2006) described 52 taxa of terrestrial protozoa in which 11 flagellates, 8 gymnamoebae, 1 heliozoan, 11 ciliates and 21 testate amoebae were reported. These findings are in conformity with our results.

Hawthorn and Ellis-Evans (1984) reported 82 species of benthic protozoa comprising 33 flagellates, 15 rhizopods, 4 heliozoans and 30 ciliates from a variety of Maritime Antarctic fresh water lakes and pools. According to them flagellates and ciliates showed the greatest species diversity but flagellates and amoebae dominant numerically. Seasonal fluctuations, both in major groups (flagellates and rhizopod amoebae) and individual species were linked with fluctuations in numbers and activity of algae and bacteria. Similar studies were also reported from different parts of world(Bamforth *et al.*,1987;Cairns,1965, Laybourn-Parry and Rogerson,1993 and Finlay,1998).There are much evidence to indicate that each protozoan species thrive best wherever it finds a specific combination of suitable environmental conditions. The same species will be found wherever this combination occurs world wide and the protozoan species appears therefore to be cosmopolitan in their spatial distribution (Finlay, 1997).

Considering their abundance and their potential role, protozoa are undoubtedly active participants within phytoplankton food webs .Surprisingly these communities and microbial food webs in this ecosystem have not yet been considered seriously. Thus the present study records the occurrence of diverse protozoans, their taxonomic composition and abundance in fresh water from Lucknow, U.P, India.

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