FREE LIVING PROTOZOAN DIVERSITY IN SELECTED STATIONS OF KRISHNA RIVER IN SATARA DISTRICT, M. S., INDIA

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ABSTRACT

Satara district of state Maharashtra prove to be the most appreciated region for the study of biodiversity as it includes Mahabaleshwar, the hill station with thick forest and the Kas plateau, the world heritage for floral diversity. It has ample number of lentic and lotic perennial water bodies which can be explored for zooplankton and other kind of floral and faunal studies. Current efforts are made to study free living protozoan diversity of selected stations from the Krishna River at Wai, Satara and Karad. As like other floral and faunal diversity good number of varieties are seen representing almost every group of free living protozoa.

Key words: protozoa Krishna river rhizopoda ciliophoran mastigophora

1. INTRODUCTION

Satara district is located in Maharashtra state in western India with an area of 10,480km^2. The Sahyadri range which is the main range of Western Ghats runs north and south along the western edge of the district. The district is part of two main watersheds, the Bhima River watershed which is tributary of Krishna River includes the north and northeast of the district and the rest of the district is collecting water by the upper Krishna and its tributaries. The stations considered for the study of the diversity of protozoan are selected from the Krishna River for the purpose to prepare the database of protozoan diversity of the region. The river originates in the Western Ghats near Mahabaleshwar at an elevation of about 1,300 meters. It is one of the longest rivers and is around 1290 km in length. (1) The biodiversity of the Western Ghats, Satara District, and Krishna River has been studied by several workers in Zoology, Botany and by nature lovers. Kas Plateau near Satara and Mahabaleshwar, the hill station are the hot spots among these. In all, Satara district provides a good opportunity for the students and scholars in life science to study terrestrial and aquatic biodiversity. A good list of the workers in the area can be given. Biodiversity of blue-green algae, diatoms, diversity of phytoplankton and zooplankton has been studied in almost all possible sampling stations. But the study on protozoa is still lacking which is also an important part of the same ecosystem with tremendous diversity and great ecological role. Protozoa are found in all types of aquatic environments and vary widely in both qualitative and quantitative terms. May be they are abundant and cosmopolitan in distribution studies on geographical distribution and ecology, when compared to other groups are still scarce. (Medeiros et al, 2013) Their presence or absence in water

indicates the quality of water. They play an important role in environmental management as soil conditioners, bio-indicators, bio-monitors, feed for the animal, and rehabilitators of degraded ecosystems through bio-absorption of pollutants (Corliss, 2002). Free-living protozoa are unicellular, heterotrophic, and may also contain mixotrophic organisms. They usually feed on bacteria, algae and even zooplankton, depending on their size, and play a vital ecological role in aquatic environments. (Sherr and Sherr, 2002).Bakare and Nalawade (2014) are most successful workers in the studying biodiversity of free living protozoa from soil and aquatic habitat around Wai Dist. Satara, Maharashtra. Proto-zooplankton is a key element in the food chain, since it controls the populations of various organisms.

2. MATERIAL AND METHODS

Study Area: The sampling stations selected for the current study are 1. Krishna River near Wai district Satara is located at 17.94°N 73.88°E, approximately 35 km north of the city of Satara. It has an average elevation of 718 meters (2355 ft). The river flows through the city and it is a famous pilgrimage center. 2. Krishna River near Satara: Is located at 17.69139°N 74.00092°E. The city is 709 (2320 ft.) above sea-level; the sampling station is close to Satara as the river flows about 5-6 km distance from the city. 3. Krishna River near Karad: is located at 17.28°N 74.2°E. It has an average elevation of 566 meters (1856 ft). This river also flows through the city and it confluences with the river Koyna.

Suitable sampling sites for collection were identified, having fewer disturbances of the tourists and local people. Samples were collected periodically covering all seasons. Temperature and pH of water at the sampling site was recorded every time during collection. The seasonal variations and chemical parameters are not discussed in detail as the intension of investigators is to collect the information about species variety only and to avoid inclusion of other parameters. As protozoan varieties exhibit great variability in their habits filtration methods for sample collection are also avoided. They found free floating, attached to waterweeds, in bottom soil, attached to the body of other phytoplankton and zooplankton etc. Freshwater samples along with some waterweeds, algae, bottom ooze and flocculent matter arising out of washing waterweeds and aquatic plants from littoral zone were collected and brought to the laboratory; stored in wide-mouthed specimen glass jars. Then observed for occurrence of protozoa under low and high power of the compound microscope. Protozoa were analyzed without the use of fixatives to preserve morphological characteristics and to make identification more accurate. It is necessary to keep the collected sample in the laboratory for at least fifteen days so as to allow less populated protozoan to increase its number by division and to study progressive and retrogressive changes in varieties in the stipulated time. Drop by drop sample was tested for several times to observe the occurrence of protozoan. Some of the ciliate and flagellate varieties are so fast-moving that it may become difficult to chase them under view. To minimize their movements a dilute solution of methyl cellulose was added. Photographs and videos of movements and binary fission and conjugation were recorded with Abbot digital eyepiece 5 MP and objectives as per required by the magnification of 10X, 40X. Protozoan seen were identified using taxonomic criteria given by Westphal (1976), Jahn (1979) and Kudo (1977) and online references. Nutrition of various species are defined according to Kudo (1977) and Pratt and Cairns (1985).

3. RESULTS AND DISCUSSION

We could catalogue 91 protozoan taxa. 20 were flagellates, 32rhizopods and 39 ciliates in sum total of three rivers. However taxa observed are given station wise and discussed accordingly. The physical and chemical characteristics are mostly similar including average temperature and pH. Their relative occurrence is shown by + signs.

Phylum Protozoa (Cohn-1853)

No.	Class - Mastigophora (Flagellates)	Station 1	Station 2	Station 3
1	*Chrysamoeba radians*Klebs	+	+	+
2	*Spondylomorumquaternarium* Ehrenberg	+	+	+
3	*Eudorinaelegans* Ehrenberg	+	+	+
4	*Dinobryonsertularia*Ehrenberg	+	+	+
5	*Synurauvella* Ehrenberg	++	++	+++
6	*Cryptomonasovata*Ehrenberg	++	+	+++
7	*Chilomonas parameciumEhrenberg*	++++	++++	++++
8	*Euglena acus*Ehrenberg	++++	++++	++++
9	*Euglena spiroides*Ehrenberg	++++	++++	++++
10	*Euglena oxyuris*Schnarda	++++	++++	++++
11	*Euglena rubra*Hardy	++++	++++	++++
12	*Euglena tripteris*Dujardin	++++	++++	++++
13	*Euglena anabaena*Mainx	++++	++++	++++
14	*PhacusacuminateStokes*	+	+	
15	*Phacuspleuronectes*Muller	++	++	++
16	*Phacuslongicauda* Ehrenberg	++	++	++
17	*PhacushelikoidesPochm*	+	+	
18	*Lepocinclis ovum*Ehrenberg	+	+	+
19	*Peranematrichophorum*Ehrenberg	++++	++++	++++
20	*Palmella stage of flagellates* Stein	+++	+++	+++

No.	Class – Rhizopoda (Pseudopodia)	Station 1	Station 2	Station 3
1	*Amoeba proteus*Pallas	++	++	++
2	*Amoeba radiosa*Ehrenberg	+++	+++	+++
3	*Amoeba gorgonian* Penard	+	+	+
4	*Amoeba discoides* Schaeffer	+	+	+
5	*Hartmanella hyaline* Alexeieff	+	+	+
6	*Polychaos dubia* Schaeffer	+	+	+
7	*Pelomyxa palustris* Greeff	+	+	+
8	*Mayorellavespertilo*Penard	+	+	+
9	*Astramoeba radiosa* Ehrenberg	++	++	++
10	*Pelomyx acarolinensis* Wilson	+	+	+
11	*Vexillifera ambulacralis*	+	+	+
12	*Thecamoeba verrucosa*	++	+	+
13	*Sappiniadiploidia* Hartmann	+	+	+
14	*Arcella vulgaris* Ehrenberg	++++	++++	++++
15	*Arcella bathystoma* Deflandre	+++	+++	+++
16	*Arcella catinus* Penard	++	++	++
17	*Arcella megastoma* Penard	++	++	++
18	*Arcella mitrata* Leidy	+	+	+
19	*Arcella artocrea* Leidy	+	+	+
20	*Arcella gibbosa* Penard	+	+	+
21	*Arcella arenaria* Greeff	+	+	+
22	*Arcella excavate* Cunnigham	+	+	+
23	*Difflugiaoblonga* Ehrenberg	++	++	+
24	*Centropyxis aculeate* Ehrenberg	+	+	+
25	*Actinophrys sol* Ehrenberg	++	++	+
26	*Actinosphaerium eichhorni* Ehrenberg	+++	++	++
27	*Astrodisculus radians* Penard	+		
28	*Heterophrys myriopoda* Penard	+	+	+
29	*Lithocola globosa* Schulze	+	+	+
30	*Rhaphidiophrys pallida* Schulze	++	++	++
31	*Rhaphidiocystis tubifera* Penard	++	+	+
32	*Acanthocystis aculeate* Hertwig	+	+	+

No.	Class – Ciliophora (Ciliates)	Station 1	Station 2	Station 3
1	*Prorodon ovum*Ehrenberg	+		
2	*Lacrymariaolor*Muller	+		+
3	*Colepshirtus* Muller	++++	++++	++++
4	*Colepsoctospinus*Noland	++++	++++	++++
5	*Didiniumnasutum*Schewiakoff	++	+	+
6	*Litonotusfasciola*Ehrenberg	+++	+++	++
7	*Trachelius ovum*Ehrenberg	+	+	+
8	*Dileptusanser* Muller	+	+	+
9	*Dileptusamericanus*Kahl	+	+	+
10	*Loxodus rostrum*Ehrenberg	+	+	+
11	*Chilodonella cucullulus*Muller	+	+	+
12	*Nassula elegans* Ehrenberg	+	+	+
13	*Paramecium caudatum* Ehrenberg	+++	+++	+++
14	*Paramecium multimicronucleatum* Powers	++	++	++
15	*Paramecium aurelia* Ehrenberg	+	+	+
16	*Paramecium bursaria* Ehrenberg	+	+	+
17	*Spirostomum intermedium* Kahl	+++	++	++
18	*Spirostomum minus* Roux	+++	++	++
19	*Stentor polyphagus* Muller	++	++	++
20	*Stentor roeseli* Ehrenberg	++	++	++
21	*Halteria grandinella* Muller	+++	+++	++
22	*Oxytrichafallax* Stein	++	+++	+++
23	*Uroleptus limnetis* Stokes	++	++	++
24	*Uroleptu slongicaudatus* Stokes	++	++	++
25	*Stylonychia mytilus* Muller	+++	+++	+++
26	*Stylonychia pustulata* Ehrenberg	++	++	++
27	*Stylonychia notophora* Stein	++	++	++
28	*Euplotus patella* Muller	+++	+++	+++
29	*Euplotes eurystomus* Wrzesniowski	++++	+++	+++
30	*Euplotes aediculatus* Pierson	++	++	++
31	*Vorticella campanula* Ehrenberg	++++	++++	++++
32	*Vorticella microstoma* Ehrenberg	+	+	+
33	*Carchesium polypinum* Linnaeus	+	+	+
34	*Epistylis plicatilis* Ehrenberg	+	+	+
35	*Zoothamnium adamsi* Stokes	+	+	+
36	*Vaginicola leptosome* Stokes	+		
37	*Podophrya fixa* Muller	+	+	+
38	*Tokophrya infusionum* Stein	+	+	+
39	*Acineta lacustis* Stokes	++	++	++

The diversity of protozoa found in the rainy season is greater than found in the draught season. This is because of the amount of phosphorous and nitrogen in water in rainy season is greater than in draught season. (Yuwarad Polameesanaporn, 2007). This impact of season was observed in the samples collected from the stations near Wai, as during summer season water level in Krishna River drops considerably. The amount of organic matter in water is more near the margin of the river where eutrophication and stagnant water is seen most of the part of the year, whereas during the rainy season these areas get flush off due to speedy water currents. In district still it is a practice to release sewage water and industrial

effluents in river which depletes the quality of water. Washing of clothes in the vicinity of town again has an impact on water in the stagnant spots.Increase in phosphate salts cause eutrophication of accumulated water which remains most of the part of the year. Coefficient of correlation between seasonal variation and occurrence of some zooplankton in pond has been studied by Bhutiyan A. S. and Nessa Q. (1998). According to their study the coefficient of correlation in concern with water temperaturesprotozoa is -0.09, pH vs. protozoa is 0.03, DO vs. protozoa is 0.06, CO_2 vs. protozoa is -0.04 and Bicarbonates vs. protozoa is 0.08. Corresponding studies doesn't include chemical parameters but this reference gives idea at what time one should practice samplings for study of biodiversity. No doubt seasonal variations are seen while collecting the samples and some of the varieties get completely unavailable during some part of the year, the current studies are confined to understand only biodiversity, the varieties found are grouped no matter when they are collected during the year.

4. REFERENCES

1. Bakare R. and Nalawade S. 2014: Study of testate amoebae (Thecamoebeans) diversity from water bodies and wet soil around Wai, Dist. Satara, State Maharashtra. *Journal of Association of Zoologists, India,* Vol5 (1):31-36
2. Bakare R. and Nalawade S. 2014 Study of freshwater protozoan biodiversity in seasonal and perennial water bodies around Wai Dist. Satara M. S. India. *Science Park Research Journal* ISSN 2321-8045; Vol 1, Issue41:1-9
3. Bhutiyan A. S. and Q. Nessa 1998: Seasonal variation in the occurrence of some zooplankton in a fish pond. Bangladesh J. Fish. Res., 2(2), 1998: 201-203
4. Corliss John 2002: Biodiversity and Biocomplexity of the Protists and an Overview of Their Significant Roles in Maintenance of Our Biosphere. *Acta Protozoologica, 41 (3):*199-219
5. Kudo R. R. 1954: Protozoology, 4th Ed. Published byCharles C Thomos, Bannerstone House, Illinois, 1954.
6. Maria Luisa Quinino de Medeiros, Magnolia Fernandes Florencio de Araujo, Luiz Sodre Neto and Aline de Souza Amorim 2013: Spatial and temporal distribution of free-living protozoa in aquatic environments of a Brazilian semi-arid region. Revista Ambients and Agua – An Interdisciplinary Journal of Applied Science: V. 8, N. 2
7. Pratt and Cairns 1985: Functional Groups in the Protozoa: Roles in Differing Ecosystems, Journal of Eukaryotic Microbiology, https://doi.org/10.1111/j.1550-7408.1985.tb04037.x
8. Theodore Louis Jahn et al 1979: How to know the protozoa, 2nd Ed. Wim C. Brown Company Publishers, Dubuque, Lowa.
9. Westphal Albert 1976: Protozoa. Published by Blakie and Son Limitd.
10. Yuwarad Polameesanaporn 2007: Proceedings of Taal, 2007: The 12th World Lake Conference: 484-489