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Phytoplankton Status of Water Ponds of Ranthambhore fort in District Sawai Madhopur

Dr. Jyoti Rajawat

Department of Botany, Vedanta P.G. Girls' College, Reengus-332404 (Sikar), Rajasthan, India

Abstract: ***During present investigation has been made to study the phytoplanktonic variation of three different water pond in Ranthambhore fort, district Sawai Madhopur, Rajasthan (India) The water sample were collected for two year (2014-2016) from Padmala pond, Rani sagar & Jangali Pond of Ranthambhore fort located in district SawaiMadhopur (Rajasthan). Total 35 algal genera and 69 species belonging to 4 classes have been accounted from the allselected pond. Few species were recorded throughout the year while others were fluctuating in different seasons, mainly in summer and winter. The most common algal species reported from the ponds were Microcystis aeruginosa, Anabaena azollae, Nostoc muscorum, Microcystisflos– aquae, Scenedesmus quadricauda, and Spirogyra sp. throughout the investigation.***

Keywords: Ranthambhore fort, Phytoplanktonic diversity, Water pollution

1. Introduction

Water is a life-supporting factor of ecosystem, every cell (microcosm), individual organism and cosmos (WHO, 2011) required water for their life. Freshwater is required for drinking, several domestic and household purposes, sanitary use, protection of the ecology and ecosystems, industrial use, agriculture, irrigation and for hydroelectric power generation (Gleick, 1996).

Environmental pollution is the result of urbanization, rapid exploitation and industrial technological revolution. River water pollution has been a major threat to aquatic environment. Pollution in the river causes deleterious or toxic effect to the aquatic organism (Kushwaha *et al*., 2012, Nagpure *et al.,* 2015). The peoples of rural areas are used unprotected water drown from well, rivers, ponds, dam, and lakes and pond for drinking and domestic purpose. Dwivedi and Pandey (2002) reported that the constant addition to water reservoirs of sewage, home waste and municipal garbage, which alter the physicochemical quality of water and are also unsuitable for the equal use of farmers and other organisms. In India, the protected water is still a far cry from reality at many places (National Water policy of India, 2012). Clean and safe drinking water is an internationally accepted human right (WHO, 2011)). Aquatic organisms must dwell in a healthy environment and have enough nutrients to develop. The productivity of these organisms depends on water physico chemicals. The preservation of a healthy water environment depends on the physical and biological characteristics of the water (Western, 2001; UNESCO, 2003; Venkatachalapathy and Karthikeyan, 2013; Verma *et al*., 2012). Plankton signals and indicators that indicate the condition of an aquatic environment are used for early warning (Soni and Thomas, 2014)). Ponds are a traditional source of water supplies in India since time immemorial. Domestic waste water has been eutrophated into pools via uncontrolled outflow (Pandey and Pandey, 2003).A study in phytoplankton are very valuable tools for the quality and productivity assessment of water in any water body and also helps to understand lentic water bodies (Pawar et al., 2006).During the recent past, many studies on microscopic forms of algae (phytoplankton) have been highlighted their important role in monitoring the human-modified aquatic ecosystems. Phytoplanktons, also regarded as biological indicator organisms, are essential component of any aquatic habitat and their presence are good source for the assessment of water quality. The productivity of an aquatic system is directly dependent on phytoplankton, The annual variability in phytoplankton dynamics is being controlled by several factors ranging from meterological, climatic fluctuation to quick recovery of nutrients by the system. Enrichment of nutrients has been considered as a major threat to the health of many water-bodies (Andersen *et al*., 2004).Due to some human activities, the word undergoes fast environmental changes and consequently the nature balance that produces environmental pollution.

2. Study Area

The Ranthambhore fort, a famous place of historical importance, is situated 14 km away from Sawai Madhopur, which is surrounded by the Vindhyas and Aravalli hills of the desert ecology of Rajasthan state. Ranthambhore Fort lies within the RNP. The 8th century and world famous temple namely 'Trinetra Ganesh Temple' of Hindu Lord Ganesha is a major attraction in the fort. The fort is characterized by the temples, ponds, massive gates and huge walls.There are five ancient artificial (man-made) water-bodies situated in and around the Ranthambhore fort. These are Padmala Pond, RaniSagar Pond, Jangali Pond, SukhSagar Pond and BadaSagar Pond. Some of these ponds are the major source of water for inhabitants living in the fort. For the present investigation, we have chosen three freshwater ponds situated. These water ponds are: (1) Padmala Pond, (2) Rani Sagar Pond, and (3) Jangali Pond.

Padmala Pond (also known as Padam, Padmala or Padmawati Talab) is spread over a large area. It is located behind the Hammir Palace and a little ahead from Ganesh Temple. The majority of natives of the fort like shopkeepers, local public and also tourists make use of this water for various purposes like drinking, washing, bathing and cooking.

Rani Sagar Pond is popularly known as Rani Sagar or Jal-Mandir. There is a water body near the tomb which is known as Rani Hod and Queen's Pond.. It is also the major source of water for the local public of fort and pilgarism for drinking washing and bathing and other activities.

Few distance from the Ganesh Temple, Jangali Pond (also called Jangali Talab) was developed as an extremely effective water harvesting region which was made to flow through a channel of hard, impermeable rock, ultimately flowing into Jangali Pond.

3. Material & Methods

These water ponds are Padmala Pond, Rani Sagar Pond and Jangali Pond. A systematic survey for sample collection, identification of phytoplankton and the physicochecal properties of water was done for a period of two years i.e. from November, 2014 to October, 2016.

The samples for algal forms (phytoplankton) were collected with the help a plankton net.with a long bamboo stick. After the collection, the algal material was kept in wide mouthed plastic bottles for studying in a living state and the samples were not allowed to be exposed to strong light.A part of the algal water samples were preserved in 4% formalin and labeled with code number to be used for further identification and/or microphotography. These samples were kept in the Laboratory for further study). Camera Lucida diagrams of various species were drawn with the help of Japan make mirror type Camera Lucida and for drawing 3HB pencil was used. Microphotographs were taken with Digital Optik Camera (Olympus) and digital microscope (Olympus).

4. Observation & Result

A thoroughly survey of the selected three freshwater bodies namely Padmala Pond, Rani Sagar Pond and Jangali Pond was made. Literature survey shows that no studies have been conducted so far on water pollution with regard to phytoplankton diversity and physicochemical properties of these freshwater bodies.

The present research work was carried out for a period of two years i.e. from November, 2014 to October, 2015 (I Year) and November, 2015 to October, 2016 (II Year). The algal samples were examined in the living state without staining to avoid the loss of characters in preserved samples.

Table 1: Algal species identified from three freshwater bodies namely Padmala Pond, Rani Sagar Pond and Jangali Pond situated in Ranthambhore Fort, SawaiMadhopur (Rajasthan)

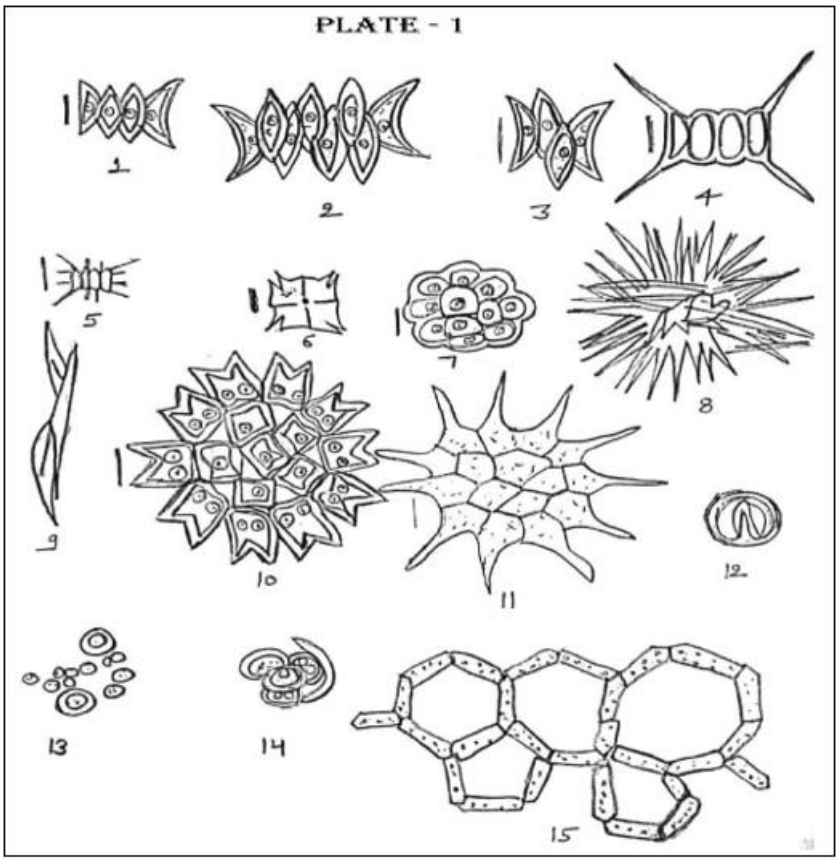
Division/Class	Order	Family	Species
1. Cyanophyta/ Cyanophyceae	1. Chroococcales	1. Chroococaceae	1.*Merismopediaminima*
			2. *M. glauca*
			3. *M. punctata*
			4.*Microcystisflos-aquae*
			5. *M. aeruginosa*
			6. *M. robusta*
			7.*Dactylococcopsisraphidioides*
			8. *Gloeocapsagelatinosa*
			9. *Aphanothecepallida*
	2. Nostocales	2. Nostocaceae	10. *Anabaena azollae*
			11. *Anabaenopsisarnoldii*
			12. *Cylindrospermummajus*
			13.*Nostocmuscorum*
			14. *N. passerinianum*
			15. *N. punctiforme*
		3. Oscillatoriaceae	16. *Oscillatoriasubbrevis*
			17. *O. perornata*
			18. *O. proteus*
			19. *O. limosa*
			20. *O. proboscida*
			21. *Lyngbyaaestuarii*
			22. *L. hieronymusii*
			23. *Phormidiumretzii*
			24. *P. pachydermaticum*
			25.*Spirulina major*
		4. Rivulariaceae	26. *Gloeotrichiapilgeri*
2.Chlorophyta/ Chlorophyceae	3. Charales	5. Characeae	27. *Charabranchy us*
		6. Selenastraceae	28. *Ankistrodesmusspiralis*
			29. *A. falcatus*
	4. Chlorococcales	7. Hydrodictyaceae	30. *Pediastrum duplex*
			31. *P. simplex*
			32. *P. tetras*
		8. Scenedesmaceae	33. *Hydrodictyonreticulatum*
			34. *H. indicum*
			35. *Scenedesmusabundans*
			36. *S. dimorphus*

			37. *S. obliquus*
			38. *S. quadricauda*
			39. *Coelastrummicroporum*
		9. Oocystaceae	40. *Chlorella vulgaris*
	5. Oedogoniales	10. Oedogoniaceae	41. *Oedogoniumpratense*
			42. *O. curtum*
	6. Zygnematales	11. Zygnemataceae	43. *Spirogyra jungalis*
			44. *S. punctulata*
		12. Desmidiaceae	45. *Closteriumdinae*
			46. *C. ehrenbergii*
			47. *C. venus*
			48. *Cosmariumgranatum*
			49. *C. quadrifarium*
			50. *C. botrytis*
			51. *Staurastrumhexacerum*
			52. *S. cuspidatum*
			53. *S. bieneanum*
3. Euglenophyta/ Euglinophyceae	7. Euglenales	13. Euglenaceae	54. *Euglena acus*
			55. *E. viridis*
			56. *E. polymorpha*
			57. *E. spirogyra*
			58.*Phacus torus*
4. Chrysophyta/ Chrysophyceae or Basilariophyceae	8. Centrales	14. Stephanodiscaceae	59. *Cyclotella*sp.
	9. Pennales	15. Fragillariaceae	60. *Fragilariapinnata*
			61. *Synedra ulna*
			62. *S. acus*
		16. Naviculaceae	63. *Naviculacuspidate*
			64. *N. abrupta*
			65. *Pinnularia major*
		17. Cymbellaceae	66. *Cymbellaaspera*
			67. *C. excise*
		18. Nitzschiaceae	68. *Nitzschiaamphibian*
			69. *N. palea*

In the present study, algal community of three ponds in Ranthambhore fort was represented by 35 genera with 69 species of which belonging to 26 species of Cyanophyceae, 27 species of Chlorophyceae, 5 species of Euglenophyceae and 11 species of Bacillariophyceae.

Table 2: Number of algal flora recorded in three freshwater bodies namely Padmala Pond, Rani Sagar Pond and Jangali Pond situated in Ranthambhore Fort, SawaiMadhopur (Rajasthan)

Algal Class	Algal Order	Padmala Pond		Rani Sagar Pond		Jangali Pond	
		Genera	Species	Genera	Species	Genera	Species
1. Cyanophyceae	1. Chroococales	2	4	4	5	1	1
	2. Nostocales	5	7	6	9	5	9
2. Chlorophyceae	3. Charales	1	1	0	0	0	0
	4. Chlorococcales	5	7	4	6	3	6
	5. Oedogonales	1	2	2	3	1	1
	6. Zygnematales	2	3	4	7	2	3
3. Euglenophyceae	7. Euglenales	1	2	2	4	1	2
4. Bacillariophyceae	8. Centrales	0	0	0	0	1	1
	9. Pennales	3	4	4	4	3	3
Total		20	30	26	38	17	26



Scale Denotes To 10 µm

1. *Scenedesmus obliquus* 2, *Scenedesmus dimorphu* 3.: *Scenedesmus dimorphus* 4 *Scenedesmus quadricauda*
5 *Scenedesmus abundans* 6 *Pediastrum tetras* 7: *Coelastrum microsporum* *8, Ankistrdesmus spiralis*
9. :*Ankistrodesmus falcatus* 10 *Pediastrum duplex* 11. *Pediastrum simplex* 12 *Chlorella vulgaris*
13*Chlorella vulgaris* 14: *Chlorella vulgaris* 15: *Hydrodictyon indicum*

The maximum population of Chlorophyceae, Cyanophyceae and Euglinophyceae was recorded in summer (March-June) while Bacillariophyceae was recorded in winter season (November-February). India has a broad range of climate variables in various months and regions are clear that different water-bodies have a variation in phytoplankton population and physicochemical parameters (Valecha and Bhatnagar, 1988).

The growth of Cyanophyceae species depends upon the different physicochemical factors and also on several other factors of the environment. As a result, the present investigations of Rani Sagar Pond revealed the highest pH, and DO values in the winter, indicating the highest abundance of Cyanophyceae. Humans can experience a variety of symptoms as a result of cyanobacterial blooms and associated cyanotoxins, including fever, headaches, muscle and joint discomfort, vomiting, and stomach and mouth ulcers, allergic reaction due to water containing mixture of *Microcystis, Merismopedia* and *Cylindrospermum* (Carmichael, 2001).

Algal blooms reduce oxygen and increase CO_2 level in the water due to waste water discharge and disposed at water pond (Rai*et al.*, 2008). Three species of *Microcystis* (*M. aeuruginosa*, *M. robusta*, *M. flos-aquae*) was found in Padamla.Pond, although one species *M. flos-aquae* was fond in two water ponds (Padmala Pond and Jangali Pond).

The genus *Oscillatoria* was almost occur in all type of water and was dominant in polluted water. *Oscillatoria* sp. was dominant in Padmala Pond, Rani Sagar Pond and Jangali Pond with 5 species. *O. proteus*and *O. limosa* were found in Padmala Pond, and *O. proboscida*, *O. subbrevis* and *O. perornata* were found in Rani Sagar Pond while *O. proteus and O. limosa* were present in Jangali Pond. Thus, present study confirmed the presence of *Oscillatoria*sp. in all selected water-bodies of Ranthambhore fort.

*Nostocpunctiform*e was recorded in all three ponds in the summer and rainy season but in Rani Sagar Pond and Jangali Pond it was recorded in all seasons (winter, summer and rainy). These species of cyanobacteria are marked as an indicator of water pollution and are pollution tolerant species. *Merismopediaglauca* and *Nostocpunctiforme Anabaena azollae* are also pollution indicator species (Malakar*et al*., 2012).

The maximum population of Chlorophyceae was recorded in summer season may be due to high concentration of nitrate (15.1 mg/l), phosphate (3.5 mg/l), low DO value (1.2 high pH value high temperature and slow water current. This view is supported by Kumar *et al*. (2008). In the present study, Chlorophyceae members were dominant in number at Padmala Pond, Rani Sagar Pond and Jangali Pond. At Rani Sagar Pond, Chlorophyceae members were high in quantitatively as compare to Padmala Pond and Jangali Pond.

In the present work, the maximum number of Bacillariophyceae were reported in the winter months due to regular supply of nitrate, silicate, total hardness and low temperature which are very important factors that promote the growth of diatoms (Ansari *et al*., 2015).

In the present study, Bacillariophyceae constituted a major part of phytoplankton species in all three water-bodies studied. Some diatoms are used as indicator of water pollution (Kelley, 2004; Onyema, 2007). *Synedra ulna*, *Synedra acus*, *Nitzschia amphibia*, *Naviculla cuspidata*, *Fragilaria pinnata* as indicator of pollution during the study period. *Syndera ulna Fragilaria pinnata* were found at two ponds similarly.

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