

PHYSICO-CHEMICAL PARAMETERS AND PHYTOPLANKTON OF THIRUVAIROOR MAHADEVAR TEMPLE POND, CHUNAKKARA, ALAPPUZHA DISTRICT, KERALA

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Abstract

The study mainly aimed to assess the physico-chemical parameters, phytoplankton community structure and algal flora of the *Thiruvairoor Mahadevar* Temple Pond at Chunakkara, Kollam. Sampling was carried out between February to March 2021, by regular field visit. Three sampling stations were fixed, Thiruvairoor Mahadevar Pond Stations (TMPS1, TMPS2, and TMPS3) based on the intensity of human interactions. The water samples were analyzed for dissolved oxygen (DO), pH, temperature and phytoplankton. All the three stations showed similar water temperatures (35°C) except TMPS1 (34°C). The highest p^H (6.3) and DO was recorded at TMPS2 (7Mg/L), and the lowest DO was at TMPS1 and TMPS3 (6.8Mg/L). The phytoplankton of the pond belongs to five groups, the *Chlorophyta*, the *Cyanophyta*, the *Bacillariophyta*, the *Charophyta* and the *Euglenophyta*. *Chlorophyta*, *Charophyta*, and *Bacillariophyta* were the dominant group. The density of phytoplankton per litre of three stations were 3667 (TMPS1), 3230 (TMPS2), and 3280 (TMPS3) respectively. Total 44 species of phytoplankton were identified. Among which 35 were identified up to the species level and the rest up to the genus level only. *Synedraulna*, *Pinnulariaviridis*, *Cosmarium* were the most common phytoplankton in all stations. *Melosira*, *Pediastrumduplex* *Phacustortus* were rare species.

Key words: *Thiruvairoor Mahadevar Temple Pond, Phytoplankton, Lythophyte, Periphyton, Physico-chemical parameters, Nutrient status, anthropogenic influence*

Introduction

The present study deals with the investigation on the physicochemical condition and associated phytoplankton community structure of one of the important and large Temple ponds in Central Travancore. Kerala is rich resources of water bodies lotic as well as lentic, and they are highly productive, and are unique ecosystems. Limited basic data exists on majority of such water bodies. They are biologically rich and physico-chemically different (Krishnan *et al.*, 2008).

Ponds are a major constituent in the life of people of Kerala- in both everyday life and religious aspects. Most of the protected public ponds in the State are possibly related to a religious institution and are used for any kind of religious ceremony (Kerala Gazette, 2019). The nearness of a pond, or any water body at that, may improve the water table of the area and will be helpful in the long term. Unfortunately, most of

the available ponds in Kerala are in completely polluted status or in the threat of being polluted, with most of them suffering from heavy amounts of eutrophication or algal bloom.

A major cause of this is general ignorance or over-use like excessive washing or dumping. Since most of these ponds are used as a bathing/washing point, the overall pollution is from being exposed to chemical compounds from soaps and detergents. This gradually results in the change in P^H of the water to be more alkaline. This increased alkalinity adversely affects the aquatic flora and phytoplankton wealth of the water body let alone the fauna. This 'passively conscious' pollution from the townsfolk has been continuing for so long that almost all public ponds, other than drinking water sources, are being affected by algal blooms and are becoming terrible ecosystems for supporting life. In the past years, numerous non-governmental and -

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governmental organizations did their part in cleaning, disinfecting, and protecting public ponds to prevent them from being eutrophicated.

Thiruvairoor Mahadevar Temple Pond is a publicly accessible pond owned by Devaswom Board of the Temple. This is one of the oldest temple ponds in Alappuzha District, with a medium amount of care being given into sanitation and security. The pond is one of the major parts in the annual festival conducted in the temple, known as ‘*Aarattu Ulsavam*’ that lasts for 10 days. It sees maximum usage into 3 to 4 days of the festival, as a ritual called ‘*urulichavaravu*’ is conducted where hundreds of devotees bathe in the pond before their visit to the temple. After the festive season, the townsfolk for washing mostly use the pond for bathing, hence it is being subjected to a lot of chemical pollution. The Devaswom board in past years tried to mitigate the external pollution by adding a side fence and protection to the main steps, but much less, people bathing in it put thought into controlling pollution. Even with such heavy pollution, we can still see a wide variety of phytoplankton and fish life there, upon which this study is conducted.

This detailed investigation enabled a comprehensive and systematic analysis of the physico-chemical and biological characters of this Temple Pond. This enables to account the basic information on phytoplankton resources in the Pond. Analysis and interpretation of the data on water quality parameters of the Pond helped in baseline data generation and that would help planning and deciding future policies and the better conservation and management.

Methodology

The pond lies in the latitude 9.202612° N and 76.601865° E longitude. Dimension wise, the pond is 58.12m broad, 112.33 m long, and about 2.5m deep. It has an area of 6,528.6m² and at full capacity; it can accommodate about 13,057.23 cubic meters of water. The pond is always open to the public for free use, and people use it for different activities like bathing,

washing clothes, irrigation etc. The pond has six main steps to approach, with four of them used frequently by the villagers. This is one of the major non-drinking water sources for the whole area during summers, and this pond enriches the available water source in the nearby wells. This water is often used for irrigation of the cultivars in the nearest paddy field. The pond water shows heavy to medium range of blue-green algae bloom throughout the year.

For convenient monitoring, systematic field survey and regular sampling of waters, three sampling stations were fixed in the Pond. These were fixed according to the differences in degrees of human interactions in the Pond. The stations were designated as ‘Thiruvairoor Mahadevar Pond Stations’ (TMPS1, TMPS2, and TMPS3) respectively. Water samples were collected from each station between February to March 2021 (First and Third week of each month). P^H, air and water temperature were measured on the spot. Separate water samples were collected for DO. The samples for analysis were packed in ice containers, and after reaching the laboratory, analysis were carried out. Dissolved oxygen was analyzed by Winkler iodometric method (APHA, 1995).

Phytoplankton of different category were collected in different pre-sterilized plastic containers. Samples for free-floating phytoplankton were collected from surface waters (2-4cm) in 1Ltr jars and were allowed to concentrate the plankton organisms, before counting. Periphyton were collected from the micro algae attached on the plants along the shores. Submerged plants with attached algae were collected from the twigs and dipped in jars containing 100ml distilled water. Lithophytes were collected using a scalpel. All the collected samples were fixed in Lugol's iodine in the ratio 1ml: 10ml, immediately after collection (Santhanam, *et al.*, 1989).

The phytoplankton were enumerated by Lackey's drop method (Schwoerbel, 1972), in the laboratory, using a light microscope having 45x

magnification. Microalgae were identified using standard keys provided by Palmer (1980), Sinha and Naik (1997), and Anand (1998). Photographs of the phytoplankton were taken using digital camera attached to the microscope.

Density of phytoplankton in each station was calculated. Percentage wise distribution of phytoplankton of different category were also calculated.

Results and Discussion

The water temperature ranged between 34⁰C to 35⁰C. The lowest was noticed at TMPS1 (34⁰C). The pH of surface water ranged between 6 to 6.3. The highest noticed at TMPS2 (6.3). The dissolved oxygen ranged between 6.4mgL⁻¹ to 7mgL⁻¹. The highest recorded at TMPS2 (7mgL⁻¹). In all the other two stations, it was 6.4mgL⁻¹.

Total 44 taxa of phytoplankton were identified, among them, 35 were identified up to species level and the remaining upto genus level only. Highest phytoplankton density was observed at TMPS 1 (3667/L) and the lowest at TMPS2

(3230/L). The number of species was high at TMPS2 (26) and low at TMPS3 (19) and at TMPS1 it was 24. The phytoplankton of the Pond belonged to three habits like plankton, epiphytic micro algae (periphyton) and lithophyte micro algae. *Chlorophyta* was the dominant group of algae in all stations. Next to *Chlorophyta*, Charophyta and *Bacillariophyta* were dominated. Least number of plankton was from class *Cyanophyta* and *Euglenophyta* (Table 1).

Conclusion

From this preliminary investigation, it is evident that, the water of *Thiruvairoor Mahadevar Temple* Pond is enriched with phytoplankton of an oligotrophic system. This indicates the pristine nature of the waters. However, due to the increased human activities, the quality of water is decreasing. The site needs long term major investigations to the detailed understanding of the unique ecological conditions and microhabitats existing there. These microhabitats are enriched with endemic flora and fauna, not all are well explored.

Table 1. Identified phytoplankton of Thiruvairoor Mahadevar Temple Pond

TMPS1	Scientific name	Class	Habit
1	<i>Ankistrodesmus spiralis</i>	Chlorophyta	Periphyton
2	<i>Closteriopsis longissima</i>	„	Periphyton
3	<i>Ulothrix aequalis</i>	„	Plankton, Periphyton
4	<i>Oedogonium sps.</i>	„	Periphyton
5	<i>Scenedesmus quadricauda</i>	„	Plankton, Periphyton
6	<i>Scenedesmus obliquus</i>	„	Plankton, Periphyton
7	<i>Spirogyra weberi</i>	„	Periphyton
8	<i>Spirogyra porticalis</i>	„	Periphyton
9	<i>Pediastrum duplex</i>	„	Plankton, Periphyton
10	<i>Eudorina elegans</i>	„	Benthic, Plankton
11	<i>Selenastrum minutum</i>	„	Benthic Periphyton
12	<i>Pandorina sps.</i>	„	Periphyton
13	<i>Cosmarium contractum</i>	Charophyta	Lithophyte
14	<i>Closterium acutum</i>	„	Periphyton

15	<i>Gonatozygonmonotaenium</i>	„	Plankton
16	<i>Euastrumpectinatum</i>	„	Plankton
17	<i>Euastrumspinulosum</i>	„	Plankton
18	<i>Euglena</i> sps.	Euglenophyta	Plankton
19	<i>Euglena viridis</i>	„	Plankton
20	<i>Melosiragranulata</i>	Bacillariophyta	Plankton
21	<i>Pinnulariaviridis</i>	„	Benthic
22	<i>Coccineisplacentulata</i>	„	Plankton, Periphyton
23	<i>Cymbellatumida</i>	„	Lithophyte, Plankton
24	<i>Oscillatorialimosa</i>	Cyanophyta	Lithophyte, Periphyton
TMPS2			
1	<i>Eudorinaelangas</i>	Chlorophyta	Lithophyte, Plankton
2	<i>Scenedesmusquadracauda</i>	„	Lithophyte, Plankton
3	<i>Scenedesmusobliquous</i>	„	Lithophyte, Plankton
4	<i>Ankistrodesmusspiralis</i>	„	Lithophyte, Plankton
5	<i>Monoraphidiumgriffithii</i>	„	Plankton, Periphyton
6	<i>Ulothrixaequalis</i>	„	Lithophyte, Plankton, Periphyton
7	<i>Closteriopsislongissima</i>	„	Plankton, Periphyton
8	<i>Oedogonium</i> sps.	„	Lithophyte, Periphyton
9	<i>Coelastrummicroporum</i>	„	Plankton, Periphyton
10	<i>Gloeocystis major</i>	„	Periphyton
11	<i>Euastrumpectinatum</i>	Charophyta	Plankton
12	<i>Euastrumspinulosum</i>	„	Plankton
13	<i>CosmariumContractum</i>	„	Periphyton
14	<i>Closteriumacerosum</i>	„	Plankton, Periphyton
15	<i>Closteriumpurvulum</i>	„	Plankton, Periphyton
16	<i>Spirogyra porticalis</i>	„	Lithophyte, Periphyton
17	<i>Phacusaccuminatus</i>	Euglenophyta	Lithophyte, Plankton
18	<i>Euglena acus</i>	„	Lithophyte, Periphyton
19	<i>Pinnulariaviridis</i>	Bacillariophyta	Plankton
20	<i>Coccineissps.</i>	„	Lithophyte
21	<i>Gomphonemaparvulum</i>	„	Lithophyte, Plankton, Periphyton
22	<i>Cymbellatumida</i>	„	Lithophyte, Plankton
23	<i>Amporaelliptica</i>	„	Lithophyte, Plankton
24	<i>Melosiragranulata</i>	„	Plankton
25	<i>Ocillatoriasps.</i>	Cyanophyta	Plankton
26	<i>Spirulinasp.</i>	„	Plankton

TMPS3			
1	<i>Scenedesmusobliquous</i>	Chlorophyta	Periphyton
2	<i>Coelastummicroporum</i>	„	Plankton, Periphyton
3	<i>Oedogoniumsps</i>	„	Lithophyte, Periphyton
4	<i>Gloeocystis major</i>	„	Periphyton
5	<i>Eudorinaelegans</i>	„	Lithophyte, Plankton
6	<i>Seleastrumminutum</i>	„	Lithophyte, Periphyton
7	<i>Cosmariumcontractum</i>	Charophyta	Plankton
8	<i>Euastrumpectinatum</i>	„	Lithophyte
9	<i>Gonatozygonmonotaenium</i>	„	Plankton
10	<i>Spyrogyrasps.</i>	„	Plankton
11	<i>Closteriumacutum</i>	„	Periphyton
12	<i>Closteriumpurvulum</i>	„	Lithophyte
13	<i>Staurastrumsps.</i>	„	Periphyton
14	<i>Euglena viridis</i>	Euglenophyta	Lithophyte
15	<i>Gomphonemaparvulum</i>	Bacillariophyta	Lithophyte, Plankton, Periphyton
16	<i>Amphora elliptica</i>	„	Plankton
17	<i>Synedra ulna</i>	„	Lithophyte, Plankton, Periphyton
18	<i>Pinnulariaviridis</i>	„	Plankton, Periphyton
19	<i>Oscillatoriasps</i>	Cyanophyta	Lithophyte, Periphyton

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