Algal Diversity of Arulmigu Sri Thiyagarajaswamy Temple Tank Thiruvottiyur, Chennai, Tamil Nadu, India

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Abstract

Objectives: Arulmigu Sri Thiyagarajaswamy Temple, Thiruvottiyur, Tamil Nadu has a tank which is unexplored for its algal flora. Thus an attempt has been made to study the diversity of algae. **Methods:** Water samples were randomly collected in plastic bottles from different sites of the tank. Samples were also collected by scrapping the steps of the temple tank to get the epilithic algae. Habitat was checked for its pH and Temperature. Samples were brought to the laboratory and preserved in 4% formalin for further studies. Observation and documentation of the algae was done using HOVERLABS Research Photo Microscopic Unit. **Findings:** In the present study a total number of 28 genera 39 taxa belonging to the three different Classes namely Cyanophyceae, Chlorophyceae and Bacillariophyceae were recorded. Maximum number of 9 taxa was observed from the family Scenedesmaceae of Chlorophyceae. It was interesting to note that 16 families had only a single taxon. The result clearly shows that the temple tank has rich algal flora and greater diversity. **Applications:** This study divulges that the temple tanks are one of the best habitats for microalgae. Hence the algal diversity can be used for determining the pollution level of such tanks.

Keywords: Bacillariophyceae, Chlorophyceae, Cyanophyceae, Temple Tank

1. Introduction

Arulmigu Sri Thiyagarajaswamy - Vadivudai Amman Temple is one of the ancient temples of Lord Shiva, located at Thiruvottiyur in the northern part of Chennai, the capital city of Tamil Nadu State, The temple has been in vogue from Pallava times of 7th century, who was great patron on temple architecture of South India. Later, during 11th century it was expanded by Chola kings. It has a five tiered gateway tower, a tank, and the overall temple area covering one acre.

In India, temples are developed as the centres of civilization which are invariably associated with temple tanks. Since ancient era the construction of water storage has been very essential part in Indian Temple architecture and it became an art form¹. The devotees consider the water in the temple tanks as holy water and believe that it wash away all their sins². The temple tank is also known as pushkarinis, kalyani, kunda, sarovara, tirtha, talab, pukhuri, etc. in different languages and regions of India. They are peculiar and often mentioned either on account of their shape, size or religious sanctity. Water sources for these temple tanks are rain water apart from the water used for cleaning the temple premises and for ritual purposes. It is very interesting that the used water has been channelled to the temple tank, stored and reused. Since the water contains organic or inorganic materials used in rituals it is rich with nutrients. The tanks are always open with ambient light, serves as one of the best places for algal growth. Such condition prevails in Arulmigu Sri Thiyagarajaswamy temple, where water used in the rituals reaches the temple tank located inside the temple.

Algae are the primary producers in most of the aquatic ecosystems and the organisms like zooplanktons, small and

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larger fish serves as primary and secondary consumers thus forming a complete food chain. The environmental pollution can be measured using the phytoplankton community because they are the best indicators³. When the algal species diversity is rich it indicates that the nutrient level is high and there is no eutrophication^{4.5}. Eutrophication can be measured by studying the phytoplankton population of the water bodies⁶. Presence of pollution tolerating algae like Oscillatoria, Spirogyra, Scenedesmus, Pinnularia, Gomphonema and Euglena can be used as the pollution indicator⁷. Many algae occur according to the variations in the resources and the struggle for space and nutrients between and among themselves^{8.9}.

In Tamil Nadu there is 2359 Temple tanks¹⁰. The early work carried in temple tanks focusing algal diversity are notable¹¹⁻¹⁶. Contemporary studies of temple tanks for the diversity of algae in Chennai metropolitan



Entrance of temple

City includes AdhikesavaPerumal temple (Chindaripet), Dhandeeswarar temple (Velachery), Jaganatha Perumal temple (Thirumalisai), Kabaleeshwarar temple (Mylapore), Kandhakottam (Parrys), Karuneeshwarar Temple (Saidapet), Marutheeswarar temple (Thiruvanmiyur), Parthasarathy temple (triplecane), Thiruneermalai temple (Pallavaram), Vaidheeswarar temple (Poonamalle) and Velveshwarar temple (Valasarawakkam). The present study focused to explore algal diversity of Arulmigu Sri Thiyagarajaswamy temple tank, Thiruvottiyur, Chennai, India.

2. Materials and Methods

2.1 Collection Site

The algal samples were collected from Arulmigu Sri Thiyagarajaswamy temple tank, Thiruvottiyur, located



Temple Tank

Figure 1. Arulmigu Sri Thiyagarajaswamy temple – study area.



Map 1. Shows the collection site (Google maps).

around 12 km north from the Chennai city, the state capital of Tamil Nadu, India in Figure 1. The geographical coordinates of the collection site is 13° 9'40.85»N; 80°17'57.74»E in Map1.

2.2 Collection, Observation and Identification

Water samples were randomly collected in plastic bottles from different sites of the tank in July 2015. Samples were

also collected from the steps by scrapping with the scalpel to get the epilithic algae. The pH of the water and water temperature were noted down. The water available in the tank was green in color, and the water level was moderate. Samples were brought to the laboratory and preserved in 4% formalin for further studies. Observation and documentation of the algae was done using HOVERLABS Research Photo Microscopic Unit.

Table 1. Algal diversity	of Arulmigu Sri Thiyag	garajaswamy temple tank.
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S. No	Class	Family	Name of the Species
1	Cyanophyceae	Aphanizomenonaceae	Anabaenopsis circularis
2		Merismopediaceae	Merismopedia minima
3		Microcoleaceae	Microcoleus chthonoplastes
4		Oscillatoriaceae	Lyngbya birgei
5			Oscillatoria acuminata
6			Oscillatoria curviceps
7			Oscillatoria princeps
8			Phormidium ambiguum
9			Phormidium purpurascenhs
10		Nostacaceae	Nostoc humifusum
11	Chlorophyceae	Chlorellaceae	Chlorella conclomerata
12		Closteriaceae	Closterium dianae
13		Desmidiaceae	Cosmarium nitidulum
14		Hydrodictyaceae	Pediastrum duplex
15			Pediastrum tetras
16			Tetraedron trigonum
17		Radiococcaceae	Radiococcus nimbatus
18		Scenedesmaceae	Desmodesmus armatus
19			Scenedesmus bijuga
20			Scenedesmus dimorphus
21	Chlorophyceae	Scenedesmaceae	Scenedesmus incrassatulus
22			Scenedesmus longus
23			Scenedesmusobliquits
24			Scenedesmus obtusus
25			Scenedesmus quadricauda
26			Scenedesmussmithii
27		Selenastraceae	Ankistrodesmus falcatus
28			Kirchneriella contorta
29			Selenastrum gracile
30		Ulotrichaceae	Ulothrix zonata
31		Uronemataceae	Uronema elongatum
32		Oedogoniaceae	Oedogonium microgonium

33	Bacillariophyceae	Bacillariaceae	Hantzschia amphioxys
34			Nitzschia palea
35		Cymbellaceae	Cymbellaturgida
36		Gomphonemataceae	Gomphonemaparvulum
37		Catenulaceae	Amphora proteus
38		Cocconeidaceae	Cocconeis placentula
39		Stephanodiscaceae	Cyclotella glomerata

Identification was done using standard Monographs and various published research articles¹⁷⁻²².

3. Result and Discussion

The pH of the water was recorded as 7.5 and water temperature - 26°C. A total number of 28 genera and 39 species were recorded from Arulmigu Sri Thiyagarajaswamy temple tank belonging to three major Classes namely, Cyanophyceae, Chlorophyceae, and Bacillariophyceae in Table 1. The hierarch for the overall percentage of algal diversity falls as Chlorophyceae (56.41%) >Cyanophyceae (26%)>Bacillariophyceae (17.94%) in Figure 2.



Figure 2. Algal Diversity of study area.



Figure 3. Cyanophyceae – family.



Figure 4. Chlorophyceae – family.



Figure 5. Bacillariophyceae – family.

3.1 Chlorophyceae

The result of Arulmigu Sri Thiyagarajaswamy temple tank reveals that the Class Chlorophyceae was represented by the highest number of fourteen genera with twenty two species Plate 1 f - l. Ten families were recorded under the Class Chlorophyceae in Figure 4. The families Chlorellaceae, Closteriaceae, Desmidiaceae, Radiococcaceae, Ulotrichaceae, Uronemataceae and Oedogoniaceae were represented by single genus and species. The family Selenastraceae and Hydrodictyaceae shows equal number of three species each. The genus Scenedesmus of Scenedesmaceae was recorded with maximum number of species. Chlorophyceae plays an important role in fresh water ecosystem as most of the members are found to be ecologically important²³. The highest diversity of Chlorophyceae indicates relatively good health of water as suggested²⁴ in the river Shivnath. The presence of Scenedesmus in abundance can be concluded that the water body has high amount of organic nutrients². The occurrence of rich algal flora results generally at a place with high level of nutrient together with favourable environmental conditions.

3.2 Cyanophyceae

In the present study Cyanophyceae was found to be the second largest Class with seven genera and ten species Plate 1. a - e. Further, Cyanophyceae was represented by five families in which Oscillatoriaceae has the highest number of representatives with three genera and six spe-



Plate 1. Most Abundant Algal Species - Arulmigu Sri Thiyagarajaswamy Temple Tank.

cies. The rest of the families namely Aphanizomenonaceae, Merismopediaceae, Microcoleaceae and Nostocaceae were all represented by a single genus with one species each in Figure 3. Cyanobacteria are common in many freshwater bodies, where nitrogen (N) fixation by these organisms helps to maintain phosphorus (P) limitation of primary productivity²⁵. BGA are considered to be one of the remarkable groups of photosynthetic plant forms. According to²⁶ Microcystis is one of the main pollutants producing Blue Green Algae. Microcystis bloom is common phenomena observed in the tropical fresh water bodies²².

3.3 Bacillariophyceae

In the investigation of Arulmigu Sri Thiyagarajaswamy temple tank has been recorded with seven genera and seven species under six families of the Class Bacillariophyceae Plate 1.m – p. Bacillariaceae was only family with two species whereas other families Cymbellaceae, Gomphonem ataceae, Catenulaceae, Cocconeidaceae and Stephanodis caceae were all represented by single genera each with one species in Figure 5. The quality of water is generally assessed with the presence of Diatoms. Studies using diatom assemblages to predict environmental changes slowly progressed in India through the works of 2^{8-31} made an attempt to assess organic pollution using diatom species. In² has listed the algae with special reference to pollution index.

Biomass and community composition of phytoplankton is important to understand the structure and dynamics of an ecosystem³². The present investigation had an objective to explore algal diversity of Arulmigu Sri Thiyagarajaswamy Temple Tank. Fresh water and the biodiversity it supports is of vital importance to all life^{33,34}.

The results divulge that the study area has greater diversity of algae. Clean water support immense diversity of organisms, whereas polluted water would just yield a few organisms, with one or few dominant forms³⁵. Generally high species diversity results from low level of pollution. Arulmigu Sri Thiyagarajaswamy temple tank was recorded with great algal diversity showing that the water is not polluted.

4. Conclusion

Arulmigu Sri Thyagarajarswamy Temple tank has been studied for its algal flora for the first time 39 species belonging to three major classes were recorded. It accounts 28 genera with sensible species diversity and the family Scenedesmaceae of Chlorophyceae showing greater abundance.

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