

## BIODIVERSITY OF FRESHWATER ALGAE FROM SELECTED PONDS OF COIMBATORE CITY – TAMIL NADU, INDIA

P. ARULMURUGAN<sup>1\*</sup>, R. HEMAVATHY<sup>1</sup>, N. SOUNDARYA<sup>1</sup>  
AND S. NAGARAJ<sup>2</sup>

<sup>1</sup>Department of Botany, Vivekanandha College of Arts and Sciences for Women (Autonomous), Elayampalayam, Tiruchengode, Namakkal District, 637 205, India.

<sup>2</sup>Centre for Advanced Studies in Botany, University of Madras, Guindy Campus, Chennai, 600 025, India.

Email: arulmurugan308@gmail.com

**Received: 01 July 2019**

**Accepted: 02 September 2019**

**Published: 04 September 2019**

**Original Research Article**

### ABSTRACT

Phytoplankton communities of algae are essential of the water bodies. The aim of present studies to assess the biodiversity of freshwater algae from selected ponds of Coimbatore city in the year of 2018 and 2019. Collection of microalgae was followed as a random sampling method and the images were captured with digital photomicrograph and identified with the help of standard well known monographs. The phytoplanktons are recorded from the study area as 21 species belongs to Chlorophyceae, 2 species belongs to Bacillariophyceae and 2 species from Cyanophyceae were identified and documented. The commercially important species are isolated and maintained at culture collection of algae for future application studies.

Keywords: Phytoplankton; freshwater algae; biodiversity; documentation.

### INTRODUCTION

The earth is surrounded by the biodiversity and sustainable biological resources. The biodiversity is not only variability biological organisms, its express the ecological complexes [1-5]. Algae are the primary photosynthetic and world largest oxygen-producing organism. They are major contributed 80% of oxygen produced in the phytoplankton community of the world [6-9]. Algae are commonly found in all moist environments and widely distributed in the world. The diverse habitats of algae are separated based on the occurrence; they are freshwater algae, marine algae, and terrestrial algae [9-12]. The freshwater algae are growing in below 10ppm of salt concentrated aquatic places. In this alga found in stagnant water (Lentic) ecosystem

of the reservoir, lakes, ponds, tanks, ditches, pools and puddles and running water (Lotic) ecosystem of falls, rivers, canals, and rivulets, etc. Pond ecosystem has an unusual temperature from top to bottom, mud, degrading micro-organism, phytoplankton, zooplankton, plants, and fishes, etc [13-15]. Phytoplankton communities and periphytic algae are primary producers, they produce a huge amount of oxygen and dissolved in water. Algae are decided the wealth of the pond ecosystem [16,17].

The stagnant ecosystem of the pond is the smallest water bodies and it smaller than a lake. It formed from rivers naturally in plain environments and sometimes arises from rain waters. The Indian ancient civilization creates the manmade pond ecosystem [18-

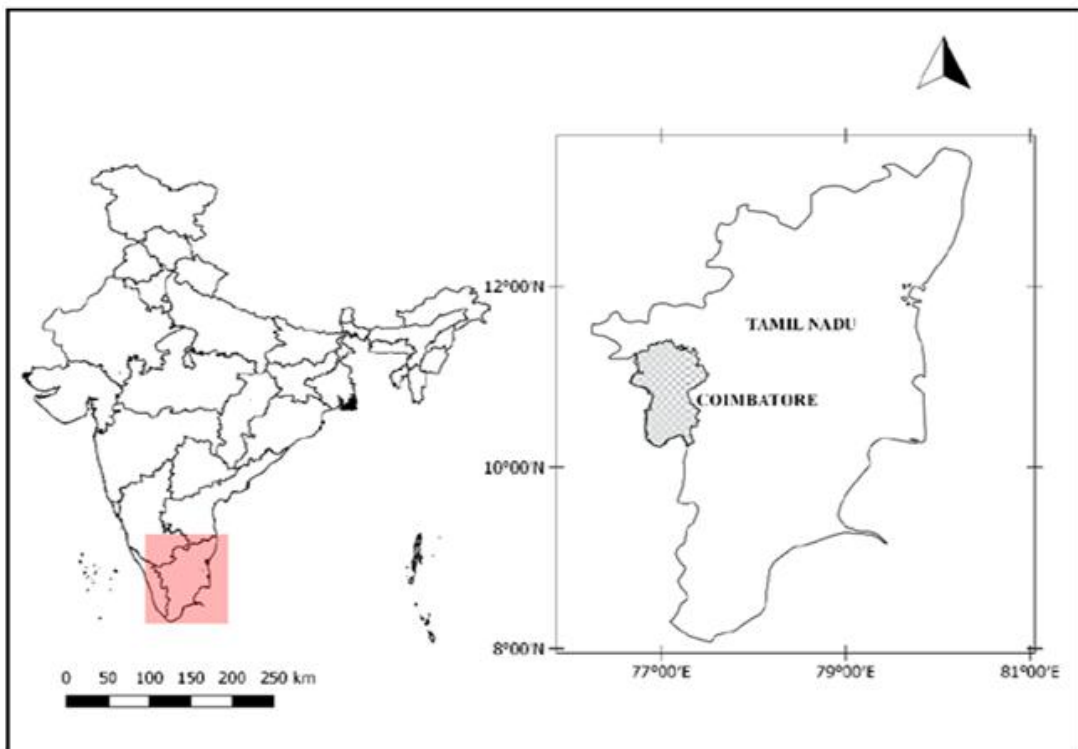
21]. The pond ecosystem has improved the groundwater level and nutrients. The manmade pond is consist of inlet and outlet of water entering pathway [22,23]. Ponds are constructed many steps and intervals to collect water and bathing purposes. It is one of the earliest methods of rainwater harvesting system. The harvested water is stored and maintained a long time, is used as many purposes such as holistic purposes (abishakam of god), agricultural purposes, livestock and restoration of groundwater. India's every town and villages have temples with include pond or ponds in external [24-28]. Sometimes a town or village created around the pond or near. The

Rajagoplaswamy temple pond is the largest one India build by Kulathunga chalan in 2000 century [27-30].

## MATERIALS AND METHODS

### Study Area

The Coimbatore (11.0168°N, 76.9558°E and 411 meters of MSL) is one of the important city of Tamil Nadu (Plate 1). Coimbatore was surrounded by the Western Ghats of Nilgiris, Annamalai, Munnar and Palghat. The Western Ghats is the biodiversity hotspots of Indian heritage by UNESCO. The ancient civilization



**Study Area: The Map of Coimbatore District**

**Plate 1.**

of Coimbatore under the Chola, Cheran, Nayakar, and Vijayanagara, Chola's create the many pond and lakes from the Noyyal rivers for recharging of groundwaters in the city. Singanallur pond, vallankulam, and Kumaraswamy lake are located in the main areas of the cities (Plate 2).

Coimbatore city area during the period of 2018 and 2019. Samples are randomly collected and using the small vials, container, spoon, knife used for the collection of epipellic algae, bulb attached pipette is used as a collection of desmids. The collected samples are observed in the laboratory of the Botany department at Vivekanandha College of arts and sciences for women (Autonomous),

One twenty-three sample were collected from different freshwater ponds in the



**Collection Sites of Algal sample**

**Plate 2.**

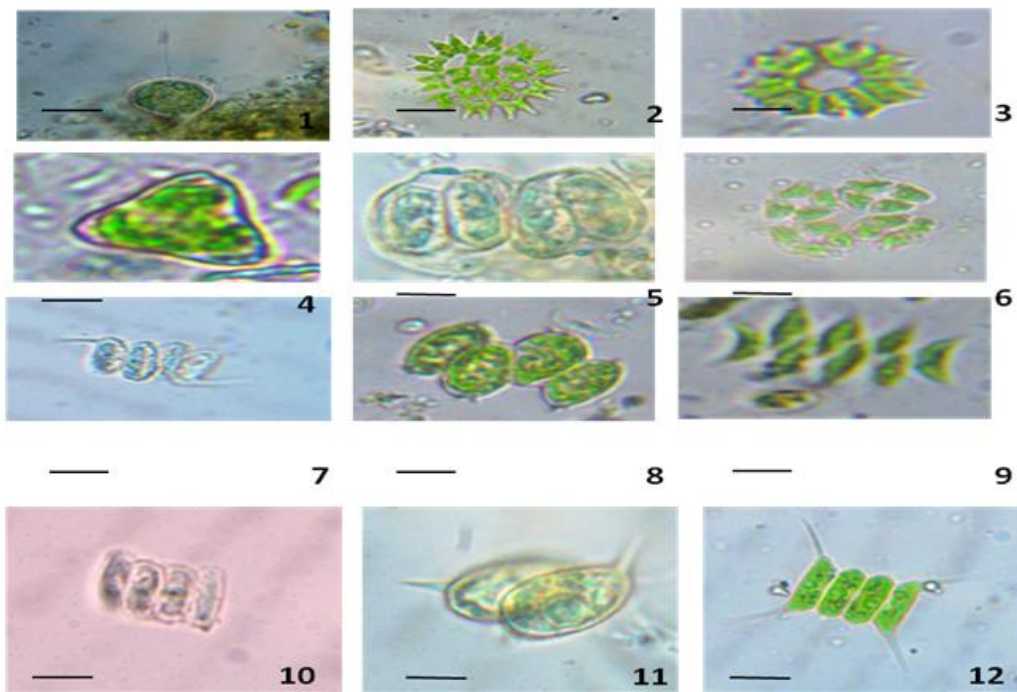
Tiruchengode. Algae are digital photographed using a Nikon microscope attached with Magnus pro camera. The arrangement of algae followed the classification of Fritsch, [31]. The algal samples are identified using standard monograph, manuals, books, and articles, etc. They are Volvocales [32], Cyanophyta [33], Systematic account on some south Indian Diatoms [34], Handbook of blue-green algae [35], Indian freshwater

microalgae [36], Freshwater Algal flora of Andaman and Nicobar Islands (Prasad and Srivastava, 1992), Manual of freshwater algae of Tamil Nadu [37], Manual of Freshwater algae (from Temple tanks of Kerala [38] and [39,40].

## RESULTS AND DISCUSSION

In the present study, the phytoplankton communities of algae are occurring in

### CHLOROPHYCEAE



1. *Golenkinia radiata* Chodat, 2. *Pediastrum duplex* Meyen, 3. *P. tetras* (Ehr) Ralfs var. *tetraodon* (Corda) Rabenh, 4. *Tetraedron hemisphaericum* Skuja, 5. *Oocystis solitaria* Witt, 6. *Dictyosphaerium reniforme* Bulnhein, 7. *Scenedesmus armatus* (Chodat) G.M. Smith var. *bicaudatus* (Guglielmetti) Chodat, 8. *S. denticulatus* Lagerh-, 9. *S. dimorphus* (Turp.) Kuetz, 10. *S. hystrix* Lagerheim, 11. *S. longus* Mayen var. *naegelii* (Breission) G.M. Smith, 12. *S. quadricauda* (Turp) Breb var. *longispina* (Chodat) G.M. Smith. Scale: 1cm=10µm

Plate 3.

Table 1. List of microalgal flora documented from Coimbatore City, Tamil Nadu, India

S. No.	Name of the organism	Singanallur Kulam Kumarasamy Lake Vallankulam					
		2018	2019	2018	2019	2018	2019
<b>CHLOROPHYCEAE</b>							
1.	<i>Golenkinia radiata</i> Chodat	-	+	-	-	-	-
2.	<i>Pediastrum duplex</i> Meyen	+	+		+		
3.	<i>P. tetras</i> (Ehr.) Ralfs var. <i>tetraodon</i> (Corda) Rabenh	-	-	+	-	+	-
4.	<i>Tetraedron hemisphaericum</i> Skuja	+	-	-	-	-	-
5.	<i>Oocystis solitaria</i> Witt	-	+	-	-	-	-
6.	<i>Dictyosphaerium reniforme</i> Bulnhein	+	+	-	-	-	-
7.	<i>Scenedesms armatus</i> (Chodat) G.M. Smith var. <i>bicaudatus</i> (Guglielmetti) Chodat	+	+	+	+	+	+
8.	<i>S. denticulatus</i> Lagerh	+	+	+	+	+	-
9.	<i>S. dimorphus</i> (Turp.) Kuetz	+	+	+	+	+	+
10.	<i>S. hystrix</i> Lagerheim	-	-	-	-	+	+
11.	<i>S. longus</i> Meyen var. <i>naegeli</i> (Brebisson) G.M Smith	-	+	-	+	-	+
12.	<i>S. quadricauda</i> (Turp.) Breb var. <i>longispina</i> (Chodat) G.M. Smith	-	-	+	+	-	-
13.	<i>S. quadricauda</i> var. <i>bicaudatus</i> Hansg	-	+	-	+	-	-
14.	<i>S. quadricauda</i> (Turp.) Breb. var. <i>quadrispina</i> (Chodat) G.M. Smith,	+	+	+	+	+	+
15.	<i>S. opoliensis</i> P. Righter.	+	+	+	+	+	+
16.	<i>Cladophora glomerata</i> (Linnaeus) Kutzing	-	-	-	+	-	-
17.	<i>Closterium moniliferum</i> Ralfs	-	+	-	-	-	-
18.	<i>Cosmarium cucurbitum</i> Brébisson ex Ralfs	-	+	-	+	-	+
19.	<i>C. granulatum</i> West	-	+	-	+	-	+
20.	<i>C. nymannianum</i> Grun ex Rabenh	-	+	-	+	-	+
21.	<i>Starastrum sunderbundense</i>	-	+	-	-	-	-
<b>BACILLARIOPHYCEAE</b>							
22.	<i>Cyclotella meneghiniana</i> Kutzing	+	+	+	+	+	+
23.	<i>Synedra ulna</i> (Nitzsch) Erenberg	+	+	+	+	+	+
<b>CYANOPHYCEAE</b>							
24.	<i>Aphanothece saxicola</i> Nag.	+	-	-	-	+	-
25.	<i>Nostoc muscorum</i> Ag. ex Born. et Flah	-	-	-	+	-	-

Note: Species present (+), Species absent (-)



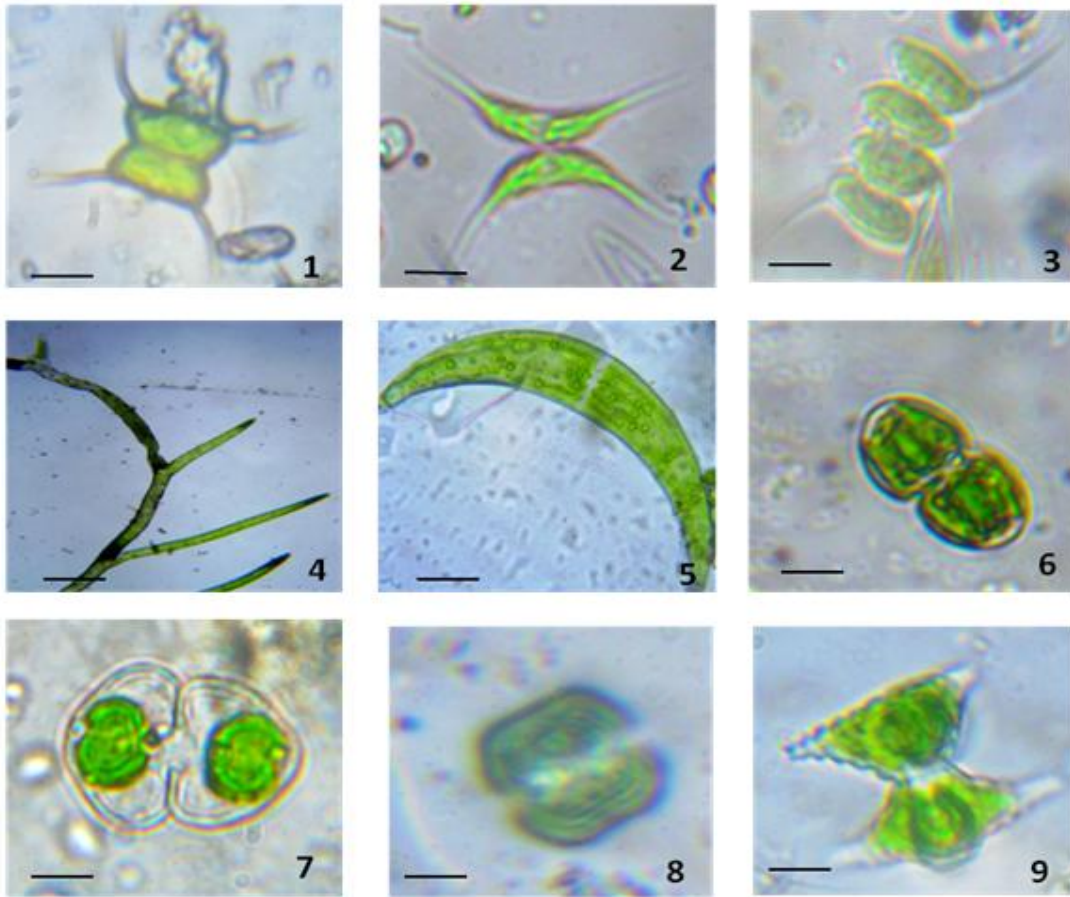


Figure: 1. *Scenedesmus quadricauda* var. *bicaudatus* Hansg, 2. *S. quadricauda* (Turp.) Breb. var. *quadrispina* (Chodat) G.M. Smith, 3. *S. opoliensis* P. Righter. 4. *Cladophora glomerata* (Linnaeus) Kutzling, 5. *Closterium moniliferum* Ralfs, 6. *Cosmarium cucurbitum* Brébisson ex Ralfs, 7. *C. granulatum* West, 8. *C. nymannianum* Grun ex Rabenh, 9. *Staurastrum sunderbundense* Turner. Scale: 1cm=10µm

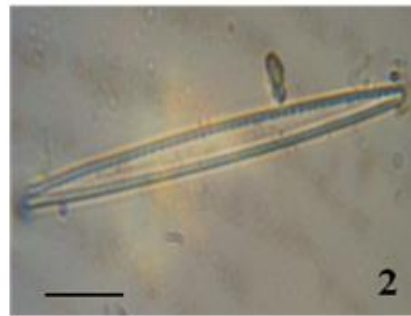
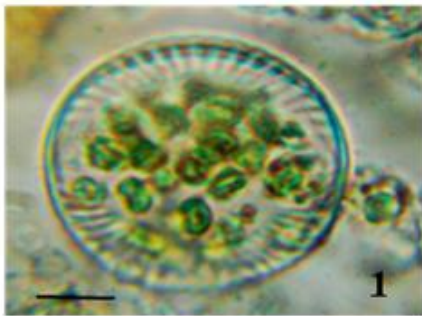
Singanallur Kulam, Kumarasamy Lake and Vallankulam of Coimbatore city in the year of 2018 and 2019 (Plates 3-4). *Scenedesmus armatus* (Chodat) G.M. Smith var. *bicaudatus* (Guglielmetti) Chodat, *S. dimorphus* (Turp.) Kurtz, *S. quadricauda* (Turp.) Breb. var. *quadrispina* (Chodat) G.M. Smith, *S. opoliensis* P. Righter of Chlorophyceae, *Cyclotella meneghiniana*

Kutzling *Synedra ulna* (Nitzsch) Erenberg of Bacillariophyceae are presented in three sites in 2018 and 2019 (Table 1) (Fig. 1). More dominant species of *Scenedesmus* of Chlorophyceae and two species of Bacillariophyceae, Baruah and Bhaswati Kakati 2012 also reported in Assam freshwater pond, Grish Kumar et al. 2014 discussed more dominant species

Chlorophyceae in temple ponds of Mahe, Pondicherry. Twenty-two species of Chlorophyceae and 16 species of Bacillariophyceae reported in the temple pond of Kanyakumari district [41]. Desingurajan et al. [42] discussed 59 species of Chlorophyceae and 14 species of

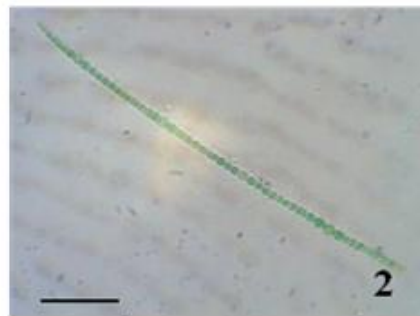
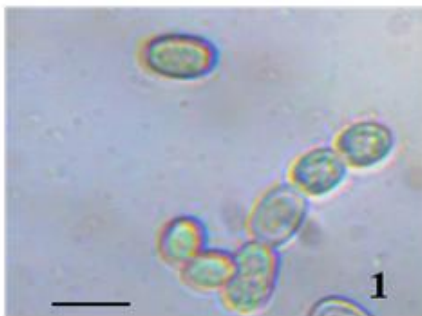
Bacillariophyceae are dominated in Karneshwarer temple pond of Chennai. Himangshu Sharma et al., [43] stated that Chlorophyceae and Bacillariophyceae were dominated in freshwater ponds of Southern Assam.

### BACILLARIOPHYCEAE



1. *Cyclotella meneghiniana* Kutzing, 2. *Synedra ulna* (Nitzsch) Erenberg

### CYANOPHYCEAE



1. *Aphanothece saxicola* Nag 2. *Nostoc muscorum* Ag. ex Born. et Flah

Scale: 1cm=10µm

Plate 4.

## CONCLUSIONS

The freshwater algal biodiversity survey represents the first comprehensive effort to document the algal community and to study the biodiversity status of the selected water bodies in the Coimbatore City, Tamil Nadu, India. Survey data to be listed in the Tamil Nadu Freshwater Algal Repository, which helps as a digital repository of photomicrographs of algae and geographical information of the localities. Moreover, from these studies we also record some microalgae belongs to Chlorophyceae and Bacillariophyceae members are notified economically and industrially highly valuable.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Ambili Nath, Neethu RV, Revathy JS. Diversity of plankton in a village pond at Dhanuvachapuram, Trivandrum. *International Journal of Innovative Research in Science, Engineering and Technology*. 2015;4(9):9189-9193.
2. Baruah PP, Bhaswati Kakati. Water quality and phytoplankton diversity of Gopeswar Temple Freshwater Pond in Assam (India). *Bangladesh J. Bot.* 2012;41(2):181-18.
3. Chinnasamy Muthukumar, Gangatharan Muralitharan, Ramasamy Vijayakumar, Annamalai Panneerselvam, Nooruddin Thajuddin. Cyanobacterial biodiversity from different freshwater ponds of Thanjavur, Tamil Nadu (India). *Acta Botanica Malacitana*. 2007;32:1-9.
4. Dhanya S, Smitha Sebastian, Ammini Joseph. A survey of algal blooms in the ponds of Pallippuram, Kerala, India. *International Journal of Environmental Sciences*. 2012;3(3):1185-1193.
5. Ebenezer Soh Kengne, Ives Magloire Kengne, Victor François Nguetsop, Ida Simo Foubi, Amougou Akoa, Linda Strande. Algal diversity and distribution in Waste Stabilization Ponds treating faecal sludge leachate from drying vegetated beds. *Int. J. Biol. Chem. Sci.* 2014;8(3):946-955.
6. Harsha TK, Pradeepkumar G, Girish Kumar E. Diversity of plan ktonic algae of selected freshwater ponds of Mahe, U T of Puducherry, India. *J. Algal Biomass Utiln.* 2017;8(3):50-55.
7. Janse van Vuuren S, Taylor J, Gerber A, van Ginkel C. Easy identification of the most common freshwater algae. A guide for the identification of microscopic algae in South African freshwaters; 2006. [ISBN 0-621-35471-6]
8. Jiji Joseph. Diversity and distribution of phytoplankton in an artificial pond. *Int. J. Adv. Res. Biol. Sci.* 2017;4(5):114-122.
9. Kateřina Skácelová, Miloš Barták, Pavel Coufalík, Daniel Nývlt, Kateřina Trnková. Biodiversity of freshwater algae and cyanobacteria on deglaciated northern part of James Ross Island, Antarctica. A preliminary study. *Czech Polar Reports*. 2013;3(2):93-106.
10. Kavitha A, Regini Balasingh GS, Raj ADS. Freshwater phytoplankton assemblages of two temple ponds of south Tamil Nadu. *Indian Hydrobiology*. 2005;8(1):61-65.
11. Köksal Pabuçcu, Rabia Gülecek, Cüneyt Nadir Solak. Seasonal variation of epipellic algal flora in gönyüzü pond (Eskisehir/Turkey).



- Asian Journal of Chemistry. 2011; 23(3):1387-1392.
12. Lakshpat Meena. Freshwater microalgal diversity–chlorococcales from Sawaimadhopur, Rajasthan, Indi. J. Algal Biomass Utln. 2017;8(3):50-55.
  13. Gaunker T, Vijaya Kerker. Studies on algal diversity in temple ponds from North Goa. Indian Hydrobiol. 2004;7(1-2):67-71.
  14. Girish Kumar E, Rekha C, Pradeep Kumar G, Sasikala K, Sivadasan KK. Diversity of Planktonic Algae of Selected Temple Ponds of Mahe (U.T. OF PUDUCHERRY), INDIA. 2014;1(3):2348-6058.
  15. Harikrishnan K, Abdul Azis PK. Primary production studies in a fresh water temple tank in Kerala. Ind. J. Environ. Ecoplan. 2000;3(1):127-130.
  16. Lubomira Burchardt, Beata Messyasz, Beata Mądrecka. Green algae population changes in fish ponds. Teka Kom. Ochr. Kszt. Środ. Przyr. 2006;3:30-34.
  17. Mishra S. Diversity of algal taxa in certain freshwater ponds of Khandwa (M.P.), India. Indian Hydrobiology. 2007;10(2):335-342.
  18. Neha Srivastava MR, Suseela, Kiran Toppo, Rubina Lawrence. Fresh water Algal diversity of Central India. International Journal of Research and Development in Pharmacy & Life Science. 2018;7(4):3039-3049.
  19. Prasad BN, Srivastava MN. Fresh water algal flora of Andaman and Nicobar Islands. Bishen Singh and Mahendra Pal Singh, Dehradun, India. 1992;1:1-369.
  20. Priyanka Sharma, Nilima Bhardwaj. Algal biodiversity in some water bodies of Kota, Rajasthan, India. International Research Journal of Biological Sciences. 2017;6(9):7-14.
  21. Rajagopal T, Thangamani A, Archunan G. Comparison of physico-chemical parameters and phytoplankton species diversity of two perennial ponds in Sattur area, Tamil Nadu. Journal of Environmental Biology. 2010;31(5):787-794.
  22. Todd Sink, Jessica Gwinn, Hannah Gerke, Mikayla House. Agri life extension solutions: Managing and controlling algae in ponds. Published By The Texas A&M Agrilife Extension Service. 2014;1-12.
  23. Xu Tao. Phytoplankton biodiversity survey and environmental evaluation in Jia Lize wetlands in Kunming City. Procedia Environmental Sciences. 2011;10:2336–2341.
  24. Sankaran B, Thiruneelagandan E. Microalgal diversity of Parthasarathy temple tank, Chennai, India. Int. J. Curr. Microbiol. App. Sci. 2015;4(4): 168-173.
  25. Smagula P, Jody Connor. Aquatic plants and algae of New Hampshire's lakes and ponds. The New Hampshire Department of Environmental Services, United States of America; 2007.
  26. Subha TS, Chandran S. Temple tanks their status and Algal biodiversity. Indian Hydrobiol. 2005;7:123-127.
  27. Suman Dhar, Kumar Nikhil. Algal biodiversity and quality of ponds water within the coal city Dhanbad. International Journal of Geology, Agriculture and Environmental Sciences. 2017;5(4).
  28. Tejaswini Gaunker, Vijaya Kerker. Studies on algal diversity in temple ponds from North Goa. Indian Hydrobiology. 2014;7(1-2):67-71.
  29. Tessy Paul P, Anu PK. Algal diversity of Guruvayur Temple Pond, Thrissur District, Kerala. IJALS. 2016;9(3):302-306.

30. Tharadevi CS, Santhakumari S. Nutrient dynamics in the sediments of two freshwater ponds of Kanyakumari district, Tamil Nadu. II Micronutrients. *Indian Hydrobiology*. 2005;8(1):41-48.
31. Fritsch FE. The structure and reproduction of algae. Cambridge at University Press. 1945;1-1962.
32. Iyengar MOP, Desikachary TV. Volvocales, Indian Council of Agricultural Research, New Delhi. 1981;1-532.
33. Desikachary TV. Cyanophyta, Indian Council of Agricultural Research, New Delhi. 1959;1-686.
34. Venkataraman G. December. A systematic account of some south Indian Diatoms, *Proceeding of the Indian Academy of Sciences*: 1939;X(6):293-368.
35. Anand N. Handbook of blue-green algae. Bishen Singh and Mahendra Pal Singh, Dehradun, India. 1989;1-79.
36. Anand N. Indian fresh water microalgae. Bishen Singh Mahendrapal Singh, 23-A, Cannought Place, Dehra Dun. 1998;94.
37. Mahendraperalum G, Anand N. Manual of fresh water algae of Tamilnadu. Bishen Singh Mahendrapal Singh, 23-A, Dehra Dun. 2008;1-124.
38. Arulmurugan P, Nagaraj S, Anand N. Manual of fresh water algae (from Temple Tanks of Kerala). Published by Gajendra Singh Gahlot for Bishen Singh Mahendra Pal Singh, 23-A, New Connaught Place, Dehra Dun, India. 2016;1-107.
39. Arulmurugan P, Nagaraj S, Anand N. Biodiversity of fresh water algae from temple tanks of Kerala. *Rec. Res. Sci. Tech*. 2010;2(6):58-71.
40. Arulmurugan P, Nagaraj S, Anand N. Biodiversity of fresh water algae from Guindy campus of Chennai, India. *Journal of Ecobiotechnology*. 2011;3(10):19-2.
41. Vijaya Rani B, Vasantha Kumari B, Regini Balasingh GS. Phytoplankton community, ecological status and bloom-forming algae of a temple pond in Kanyakumari District. *International Journal of Botany Studies*. 2016;1(6): 08-12.
42. Desingurajan P, Dhamatharan R, Sankaran B. Microalgal flora of Karaneeswarar Temple Pond, Saidapet, Chennai. *European Journal of Biomedical and Pharmaceutical Sciences*. 2018;5(9):507-519.
43. Himangshu Sharma, Debojit Das, Pampi Sharma, Jayasree Rout. A study on freshwater algal communities of pond ecosystems from southern Assam. *International Journal of Plant Research*; 2019.