JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

"SEASONAL VARIATIONS OF MICROALGAL DISTRIBUTION AND PHYSICO-CHEMICAL PARAMETERS OF PONDS IN PERINJANAM PANCHAYATH, THRISSUR DISTRICT, KERALA, INDIA"

[1]ALEENA.M. A AND [2]CHITRA G

[1] MSc Student

[2]Assistant professor

Department of Botany, Sree Narayana College Nattika, Thrissur, Kerala, India.

E-mail: AMA-aleenamaalee@gmail.com; CG-cprasadbalakrishnan@gmail.com

ABSTRACT

Microalgal dispersion and physico-chemical characteristics of two ponds in Perinjanam panchayath, Thrissur district, Kerala, were studied in different seasons. The samples were taken before the monsoon, during the monsoon, and after the monsoon. A total of 89 algal taxa were identified and they fall into 56 genera. Twenty-seven taxa belong to Bacillariophyceae, thirty to Cyanophyceae, seven Zygnematophyceae, four Chlorophyceae, four Trebouxiophyceae, four Xanthophyceae, three Coscinodiscophyceae, two Euglenophyceae, one Mediophyceae, and one Ulvophyceae. Temperature, pH, turbidity, total dissolved solids, conductivity, alkalinity, acidity, chloride, total hardness, calcium, magnesium and dissolved oxygen were among the physico-chemical characteristics studied. The major goal of this initiative was to learn more about freshwater algal dispersion and how to interpret water quality from it.

Index Terms -Bacillariophyceae, Cyanophyceae, Euglenophyceae, Zygnematophyceae, Coscinodiscophyceae, Water quality

INTRODUCTION

Freshwater is an extremely valuable natural resource. Freshwater ecosystems include ponds, rivers, streams, springs, bogs, and wetlands. The freshwater environment is made up of both living and non-living species that interact with one another. In comparison to the freshwater environment, the marine ecosystem covers the majority of the planet. Freshwater ecosystems are an important source of living organisms for a variety of reasons.

Ponds are significant biodiversity hotspots. They support more species and are home to more rare species than any other freshwater environment (Cereghino et al., 2008). Half of the photosynthetic biomass production on our planet occurs in water ecosystems. The primary categories of organisms engaged in biomass generation include phytoplankton. Autotrophic (self-feeding) organisms found in the ocean, sea, and freshwater ecosystems are known as phytoplankton. They keep the biotic and abiotic components of aquatic environment in a state of balance. These organisms are extremely varied, and the majority of them are tiny.

Microalgae are a diverse collection of prokaryotic and eukaryotic photosynthetic organisms that come in a variety of shapes and sizes, including individual cells, colonies, and extended filaments, and display a wide range of ecological diversity (Srivastava et al., 2018). Different forms of algae found in aquatic ecosystems include Bacillariophyceae or diatoms, Chlorophyceae or green algae, Rhodophyceae or red algae, Cyanobacteria or blue green algae, Euglenoids, Dinoflagellates, and Phaeophyceae or brown algae.

Temperature, pH, turbidity, total dissolved solids, conductivity, alkalinity, acidity, chloride, total hardness, calcium, magnesium, and dissolved oxygen all have an impact on the development and distribution of microalgal population. Microalgae are significant biological markers of an aquatic ecosystem because they are very sensitive to environmental changes. Freshwater ecosystems are now subjected to different forms of contamination, mostly as a result of human interference and industrialisation. As a result, monitoring physico-chemical parameters and the microalgal population provides a scientific method for assessing water quality and regulating freshwater bodies.

MATERIALS AND METHODS

Water samples were taken from two separate ponds in Perinjanam Panchayath, Thrissur district, Kerala, India, for the investigation of algal dispersion and water quality. The first pond chosen was Kottamkulam, which is located at 10°18'26"N and 76°9'4"E, and the second was Maniyankulam, which is located at 10°18'56"N and 76°8'51" E. (Figure -1). The samples were taken before, during, and after the monsoon seasons. For the study of physico-chemical parameters and the detection of algal dispersion, two litres of water samples were taken from each location in well-labelled and firmly sealed plastic bottles. The micro algae were gathered from the water's top and lower surfaces, as well as from submerged plant parts, floating plastic bottles, the stony substratum, and from other floating objects in the pond. Using a sterilised brush and scalpels, the microalgae were scraped out. A 4 % formaldehyde solution was used to preserve the collected samples. Water samples were collected for testing physico-chemical parameters and stored as soon as possible in the refrigerator to prevent changes in water properties.

Wet Mount Staining technique was used to determine the isolates' microscopic morphology. This was accomplished by picking up algal samples from temporarily preserved samples with a sterile micromanipulator, placing them on a clean glass slide with a drop of glycerin, and covering the preparation with clean cover slips. The slides were examined using microscope objectives of 10 x and 40 x. A Labomed digital microscope was used to photograph the taxa. Prescott (1962), Desikachery (1959 and 1987), Philipose (1967), William Barwell Turner (1978), Prasad and Srivastava (1992), Sharma and Khan (1980), Anand (1998), Jose (2013), Sarode and Kamat (2013) are all standard sources (1984) of technique involving wet mount staining.

Physico-chemical characteristics were examined in order to assess the water's quality. The chemical parameters include alkalinity, acidity, chloride, total hardness, calcium, magnesium, and dissolved oxygen, whereas the physical characteristics include temperature, colour, pH, turbidity, total dissolved solids, and conductivity. Using a thermometer, pH metre, and turbidity metre, physical characteristics including as temperature and turbidity were determined at the collecting location. Total dissolved solids, which is determined by a wet lab approach using a porcelain plate, is the total quantity of organic and inorganic compounds contained in water. The quantity of electrolytes dissolved in water is measured using a conductivity metre to determine its electrical conductivity. The presence of carbonates, bicarbonates, phosphates, borates, silicate, and other alkaline compounds indicates that the water is alkaline. Strong mineral acids, carbonic acids, acetic acids, and hydrolyzing salts like ferric and aluminium sulphates may all contribute to the acidity measurement. Acidimetric titration was used to determine the alkalinity and acidity of water. Chloride levels in the water are high due to the presence of industrial and sewage waste. The conventional Mohr's technique was used to determine the chloride concentration of the sample water. Water in nature becomes harder due to the presence of calcium and magnesium. The total hardness of water is the result of the combined action of calcium and magnesium hardness, as measured using complexometric titrations. Winkler's iodometric technique was used to calculate the quantity of dissolved oxygen in water.

Pond 1 –Kottamkulam, Perinjanam

Pond 2 – Maniyankulam, Perinjanam

Figure 1. Study area in the Perinjanam panchayath

RESULT

Algae are a varied collection of organisms that may be found in both fresh and salt water. The distribution, quantity, and diversity of algae in a freshwater environment are influenced by the physico-chemical characteristics of the water. A variety of algae species were found in the chosen ponds, with the diversity of these groupings varying depending on the physico-chemical characteristics of the pond water. During the pre-monsoon, monsoon, and post-monsoon seasons, 10 groups of algae species were found in the two ponds. Bacillariophyceae, Chlorophyceae, Coscinodiscophyceae, Cyanophyceae, Euglenophyceae, Mediophyceae, Trebouxiophyceae, Ulvophyceae, Xanthophyceae, and Zygnematophceae are among the families.

In pond 1, there were seventeen Cyanophyceae species, ten Bacillariophyceae species, seven Zygnematophyceae species, three Trebouxiophyceae species, two Coscinodiscophyceae species, and one each of Chlorophyceae, Mediophyceae, and Ulvophyceae species.Aphanotheca, Aphanocapsa, Calothrix, Dactylococcopsis, Merismopedia, Microcystis, and Nostoc were found in the pre-monsoon season, Calothrix, Dichothrix, Hyella, Microcystis, Synechococcus, Synechocystis, and Tolypothrix in the monsoon season, and Anabaenopsis and Fragilaria, Navicula, and Synedra from the Bacillariophyceae class were found during the pre-monsoon season, Navicula and Mastogloia during the monsoon season, and Achnanthes, Gomphonema, Nitzschia, and Pinnularia during the post-monsoon season.Closterium and Gonatozygon from the Zygnematophyceae class were found during the pre-monsoon season, Gonatozygon and Triploceras during the monsoon season, and Closterium, Cosmarium, Desmidium, and Micrasterias during the post-monsoon season. During the pre-monsoon and monsoon seasons, only Oocystidium ovalae and Rahidonema sp. were reported from the class Trebouxiophyceae; during the monsoon season, only Rahidonema sp. was recorded, and there were no representatives from the class Trebouxiophyceae during the post-monsoon season. Actinocyclus normanii and Melosira of the class Coscinodiscophyceae were found during the pre-monsoon and monsoon seasons, respectively. There were no members from the Coscinodiscophyceae class during the post-monsoon period.Kirchneriella elongata, a single species from the Chlorophyceae class, was found in both the pre-monsoon and post-monsoon seasons. A single Cyclotella sp. was found in the class Mediophyceae during the post-monsoon season, while a single species Ulothrix cylindrica was found in the class Ulvophyceae during the pre-monsoon season. (Table 1& Figure 2)

In pond 2, there were twenty Bacillariophyceae members, fourteen Cyanophyceae members, four Chlorophyceae members, four Xanthophyceae members, two Euglenophyceae members, and single Trebouxiophyceae, Mediophyceae, and Coscinodiscophyceae individuals. Achnanthes, Navicula, and Mastogloia were found in the pre-monsoon period; only Navicula sp. was found during the monsoon season; and majority of the species, including Achnanthes, Amphora, Cymbella, Diatoms, Diploneis, Fragilaria, Gomphonema, Mastogloia, Navicula, Pinnularia, and Thalassiothrix, were found during both the pre-monsoon and monsoon seasons, the species Navicula cuspidata was discovered. During the pre-monsoon season, Aphanocapsa, Aulosira, Rhabdoderma, Gleocapsa, and Stigonema were found in the Cyanophyceae class. During the monsoon season, Aphanocapsa, Aphanotheca, Nostoc, and Rhabdoderma were discovered, while during the post-monsoon season, Anabaena, Anabaenopsis, Aphanocapsa, Chroococcus, and Gleocapsa were discovered. During the pre-monsoon season, a single species of Chlorophyceae, Kirchneriella elongata, was discovered. During the monsoon season, Scenedesmus denticulatus was discovered. During the post-monsoon season, Schizochlamys and Treubaria were discovered. During the pre-monsoon season, Chlorellidiopsis and Ophiocytium were found in the Xanthophyceae class. During the pre-monsoon and monsoon seasons, Chlorellidiopsis separabilis was found, and Centritractus belanophorus was found during the post-monsoon season. During the post-monsoon season, a single species of Coscinodiscophyceae, Rhizosolenia alata, was discovered. During the post-monsoon season, just one species of Mediophyceae, Cyclotella striata, was found. During the post-monsoon season, Franceia ovalis from the class Trebouxiophyceae was discovered, while during the pre-monsoon season, Colacium and Trachelomonas from the class Euglenophyceae were discovered. (Table 2 & Figure 3)

Physico-chemical characteristics of pond water 1 indicated that the water's colour changed from green to dark green during the duration of the research. During the research period, the temperature of pond water 1 was recorded to be between 26 and 32 degrees Celsius, and the pH of the water was determined to be virtually neutral (6.9 -7.1). The electric conductivity of pond 1 was measured to be between 128.4 and 179.4 (s/cm). Turbidity levels vary from 2.0 to 6.2. (NTU). The total hardness was found to be 39.8 -72.8 (mg/l). Total dissolved solids (TDS) were measured in pond 1 and ranged from 128.4 to 179.4(s/cm). Turbidity levels varied from 2.0 to 6.2. (NTU). The total hardness was found to be 39.8 -72.8 (mg/l). The total dissolved solids (TDS) ranged from 72.8 to 98.7 (mg/L). Total dissolved solids (TDS) ranged from 72.8 to 98.7 mg/l. The total alkalinity and acidity were found to be 32.6–75 and 8-12.4 mg/l, respectively. The quantity of dissolved oxygen was found to be between 6.9 and 7.9. Cl, Ca, and Mg ions were found to be 8.4 – 15.1, 8.0 – 37.6, and 4.1 – 12.6 (mg/l) correspondingly. (Table 3)

In the instance of pond water 2, examination of physico-chemical characteristics indicated that the water's colour was dark green throughout the research. During the research period, the temperature of the pond water 2 was recorded to be between 26 and 32 degrees Celsius, and the pH of the water was determined to be virtually neutral (6.6 - 6.7). The electric conductivity of pond 2 was between 260.3 and 348.2 (s/cm), while the turbidity was between 2.0 and 5.3. (NTU). The total hardness was found to be between 84.6 and 123.2 mg/l, while the total dissolved solids (TDS) was found to be between 150 and 201 mg/l. Alkalinity and acidity were measured at 30.1–145 (mg/l) and 10–15 (mg/l), respectively. The quantity of dissolved oxygen varied between 3.2 and 5.8 parts per million. Cl, Ca, and Mg ions were found to be 17.3 – 69, 38.1 -72.1, and 6.8 – 18.8 (mg/l) correspondingly. (Table 4)

Statistical studies of hardness, temperature and pH revealed the algal diversity at a 5% level of significance (Table-5,6, &7)

LIST OF ALGAE IDENTIFIED FROM POND 1 (Table -1)

Sl. N0	Name of algal species	Pre monsoon	Monsoon	Post monsoon
	Class: Bacillariophyceae			
1	*Achnanthes elata* (Leuduger-Fortmorel) Gandhi			+
2	*Achnanthes minutissima* (Kutzing)			+

	Grun			
3	*Fragilaria leptostauron* (Ehrenberg) Hustedt	+		
4	*Gomphonema sumatrens* Fricke			+
5	*Navicula cari* (Ehrenberg) Indica Grandhi		+	
6	*Navicula reinhardtii* (Grunow)	+		
7	*Nitzschia sinuata* Var. tabellaria (Grunow)			+
8	*Mastogloia exigua* F.W. Lewis f. brevirostris Venkat		+	
9	*Pinnularia legumen* (Ehrenberg) V. florentna Grun Cleve			+
10	*Synedra Formosa*	+		
	Class: Chlorophyceae			
11	*Kirchneriella elongate* G. M. Smith	+		+
	Class: Coscinodiscophyceae			
12	*Actinocyclus normanii* (Gregory) Hustedt	+	+	
13	*Melosira granulata*	+		
	Class: Cyanophyceae			
14	*Anabaenopsis* sp.			+
15	*Aphanotheca nidulans* Var. endophytica West & West	+		
16	*Aphanocapsa littoralis* Hansg	+		
17	*Calothrix parietina* Thuret ex Bornet & Flahault		+	
18	*Calothrix stellaris* Bornet & Flahault	+		
19	*Chamaesiphon curvatus* Nordstedt			+

20	*Dactylococcopsis acicularis* Lemmermann	+		
21	*Dactylococcopsis smithii* Chodat & Chodat	+		
22	*Dichothix compacta* Bornet & Flahault		+	
23	*Hyella caespitosa* Bornet & Flahault		+	
24	*Merismopedia minima*	+		
25	*Microcystis aeruginosa* Kutzing emend. Elenkin	+	+	
26	*Microcystis flosaquae* (Wittrock) Kirchner		+	
27	*Nostoc calcicola* Brebisson ex Bornet & Flahault	+		
28	*Synechococcus elongatus* Nageli		+	
29	*Synechocystis pevalekii* Ercegovic		+	
30	*Tolypothrix foreanii* feremy		+	
	Class: Mediophyceae			
31	*Cyclotella* sp.			+
	Class: Trebouxiophyceae			
32	*Oocystidium ovale* Korshikov F. Hindak	+	+	
33	*Raphidonema* sp. Chodat		+	
34	*Raphidonema cryophilum* Chodat		+	
	Class: Ulvophyceae			
35	*Ulothrix cylindrica*	+		
	Class: Zygnematophyceae			
36	*Closterium idiosporum* West & G.S. West	+		
37	*Closterium* sp.			+

38	*Cosmarium rectisporum*			+
39	*Desmidium aptogonum* Brebisson ex Kutzing			+
40	*Gonatozygon aculeatum* W.N. Hastings	+	+	
41	*Micrasterias alata* Wallich			+
42	*Triploceras* sp.		+	

LIST OF ALGAE IDENTIFIED FROM POND 2 (Table -2)

Sl. No	**Name of algal species**	**Pre monsoon**	**Monsoo n**	**Post monsoon**
	Class: Bacillariophyceae			
1	*Achnanthes lanceolata* (Brebisson ex Kutzing) Grunow	+		
2	*Achnanthes minutissima* (Kutzing) Grunow			+
3	*Amphora ovalis* Kutzing V. gralilis (Ehrenberg) Cleve			+
4	*Cymbella turgidula* Grunow			+
5	*Diatoma* sp.			+
6	*Diploneis ovalis* (Hilse) Cleve V. Oblongella (Nag)			+
7	*Fragilaria construens* (Ehrenberg) Grunow. Ventr Grun			+
8	*Gomphonema vidarbhense* (Sarode & Kamat)			+
9	*Mastogloia exigua* Lewis. brevirostris. Venkat	+		
10	*Mastogloia* Sarmae & Kamat			+
11	*Navicula cari* (Ehrenberg).fa. Indica Grandti		+	
12	*Navicula cuspidata* Kuetz.Var. ambigua (Ehrenberg) Cleve	+	+	

13	*Navicula decussis* Ostrup		+	
14	*Navicula viridula* (Kuetzing) Ehrenberg		+	
15	*Navicula minima* (Grunow). ratomoldes Cleve			+
16	*Pinnularia braunii* (Grunow) Cleve. Var.amphiaphalae			+
17	*Pinnularia divergens* W. Smith			+
18	*Pinnularia finlandica* Cleve –Euler			+
19	*Pinnularia pseudoluculenta* Gandhi			+
20	*Thalassiothrix frauenfeldii* (Grunow)			+
	Class: Chlorophyceae			
21	*Kirchneriella elongate* G .M Smith	+		
22	*Scenedesmus denticulatus* Var. Australis		+	
23	*Schizochlamys compacta*			+
24	*Treubaria setigera* (W. Archer) G .M Smith			+
	Class: Coscinodiscophyceae			
25	*Rhizosolenia alata* Brightwell forma indica (peregathe) ostenfeld			+
	Class: Cyanophyceae			
26	*Anabaena sphaerica* (Bornet & Flahault) Var. allenuala Bharadwja			+
27	*Anabaenopsis* sp			+
28	*Aphanocapsa elachista* West & West			+
29	*Aphanocapsa endophytica* G. Smith	+		
30	*Aphanocapsa littoralis* Hansgirg		+	
31	*Aphanotheca saxicola* Negli f. nidulans		+	
32	*Aulosira aenigmatica*	+		
33	*Chroococcus tenax* (Kirchner)Hieronymus			+
34	*Gleocapsa rupestris* Kutzing			+

35	*Gleocapsa stegophila* (Kutzing) Rabenth	+		
36	*Nostoc punctiforme* Hariot		+	
37	*Rhabdoderma gorskii* Woloszynska	+		
38	*Rhabdoderma irregulare* (Naumann) Geitler	+		
39	*Stigonema dendroideum* fremy	+		
	Class: Euglenophyceae			
40	*Colacium arbuscula* F. Stein	+		
41	*Trachelomonas lacustris* Drezepolski	+		
	Class: Mediophyceae			
42	*Cyclotella striata* (Kuetz) Grun			+
	Class: Trebouxiophyceae			
43	*Franceia ovalis*			+
	Class: Xanthophyceae			
44	*Centritractus belanophorus* Lemmermann			+
45	*Chlorellidiopsis separabilis* Pascher	+	+	
46	*Ophiocytium cochleare* (Eichwald) A. Braun	+		
47	*Ophiocytium elongatum* (West &West) Var. major	+		

+: Presence of algae

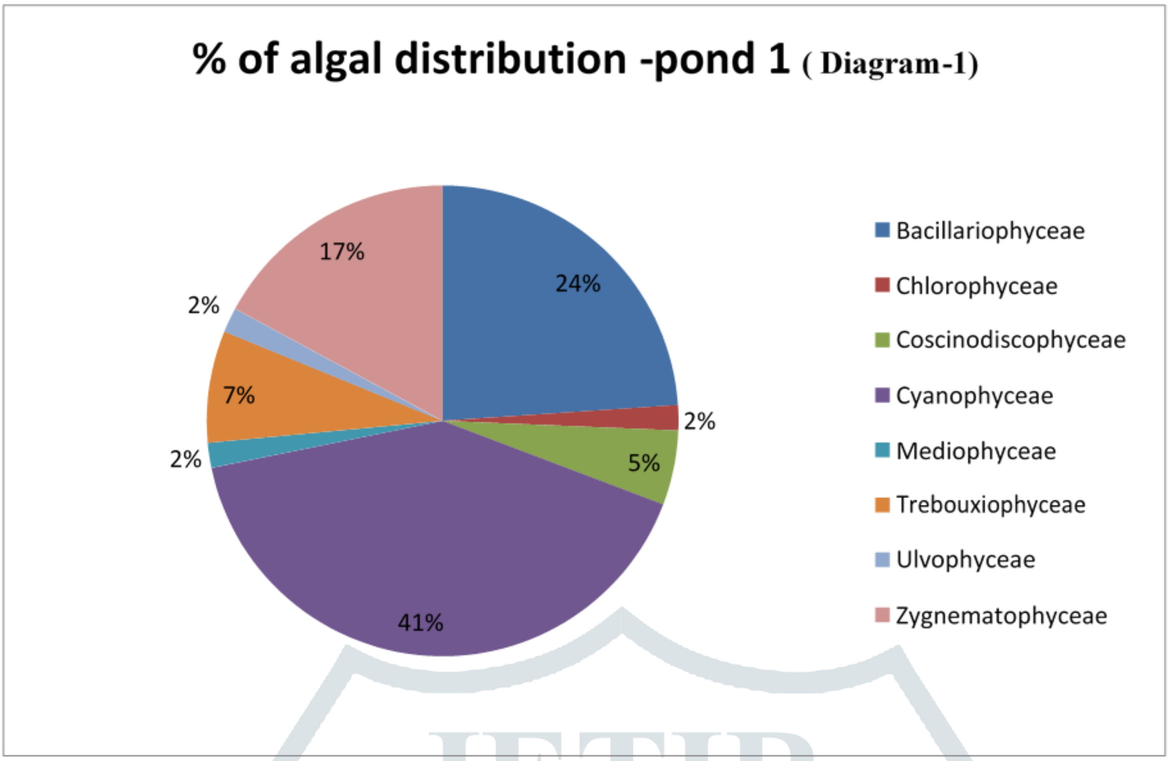

Figure 2. Algal distribution (%) at pond-1

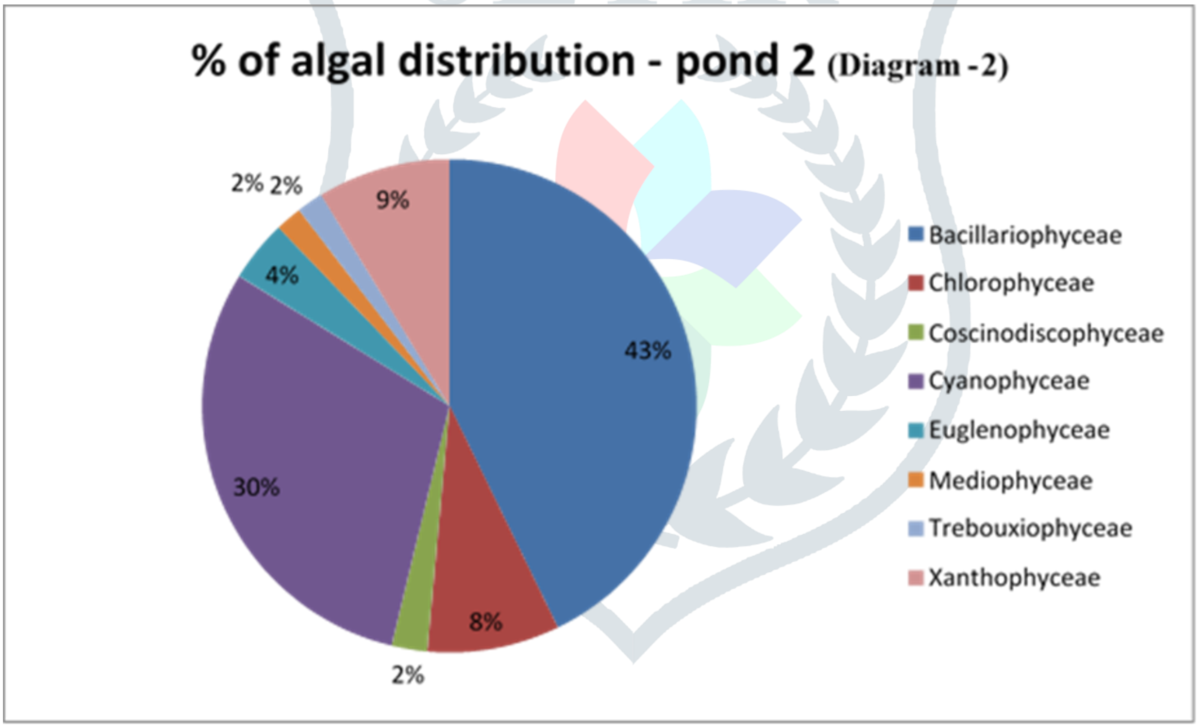

Figure 3. Algal distribution (%) at pond-2

PHYSICO-CHEMICAL PARAMETERS OF POND WATER-1 (Table-3)

Sl. No	**Water parameters (Unit)**	**Pre monsoon**	**Monsoon**	**Post monsoon**	**Permissible limit (BIS 1992)**
1	Temperature (ºC)	32	26	29	_
2	pH	6.9	7.1	6.9	6.5-8.5
3	Turbidity (NTU)	3.9	2.0	6.2	2.5

4	Total Dissolved Solids(mg/l)	72.8	77.9	98.7	500
5	Conductivity (µs /cm)	128.4	136.3	179.4	250
6	Alkalinity (mg/l)	32.6	50	75	200
7	Acidity (mg/l)	12.4	10	8	_
8	Chloride (as Cl] (mg/l)	15.1	15	8.4	250
9	Total Hardness [as CaCO3] (mg/l)	50.2	39.8	72.8	300
10	Calcium [as Ca] (mg/l)	37.6	8.0	22.4	75
11	Magnesium [as Mg] (mg/l)	12.6	4.8	4.1	50
12	Dissolved Oxygen (mg/l)	7.5	6.9	7.9	5

PHYSICO-CHEMICAL PARAMETERS OF POND WATER -2 (Table-4)

Sl. No	Water parameters (Unit)	Pre monsoon	Monsoon	Post Monsoon	Permissible limit (BIS,1992)
1	Temperature (ºC)	32	26	29	_
2	pH	6.6	6.6	6.7	6.5-8.5
3	Turbidity (NTU)	5.3	2.0	4.4	2.5
4	Total Dissolved Solids(mg/l)	150	201	182	500
5	Conductivity (µs /cm)	260.3	348.2	324.6	250
6	Alkalinity (mg/l)	30.1	66	145	200
7	Acidity (mg/l)	14.2	15	10	_
8	Chloride (as Cl] (mg/l)	50.6	69	17.3	250
9	Total Hardness [as CaCO3] (mg/l)	90.9	84.6	123.2	300
10	Calcium [as Ca] (mg/l)	72.1	51.7	38.1	75
11	Magnesium [as Mg] (mg/l)	18.8	8.5	6.8	50
12	Dissolved Oxygen (mg/l)	3.2	5.6	5.8	5

At a 5% level of significance, statistical analysis of hardness explains the relevance of the selected factors (**Table -5**).

	df	SS	MS	F	Significance
Regression	1	20.1643	20.1643	0.708541	0.447311
Residual	4	113.8357	28.45892		
Total	5	134			

At the 5% level, statistical examination of temperature with algal diversity shows that it is significant (**Table-6**).

	df	SS	MS	F	Significance
Regression	1	9	9	0.288	0.619962
Residual	4	125	31.25		
Total	5	134			

Statistical analysis of PH explains the diversity at a 5% level of significance **(Table-7**).

	df	SS	MS	F	Significance
Regression	1	1.8	1.8	0.054463	0.826928
Residual	4	132.2	33.05		
Total	5	134			

DISCUSSION

The aquatic habitat is impacted by a variety of environmental variables. Phytoplanktons, zooplanktons, macrophytes, and microinvertebrates are all part of the aquatic environment. Environmental variables have a significant impact on these freshwater ecosystems. Phytoplanktons are small free-floating algae colonies found in water bodies, and the variety of phytoplankton is directly connected to the productivity of an aquatic environment (Joseph Jiji, 2017). Due to variations in the physical and chemical composition of water, various species of planktons differ in different seasons. With seasonal changes, phytoplankton populations display a lot of diversity. As a result, the phytoplanktonic study is an extremely valuable instrument for assessing the quality and production of any form of water body. It also contributes to a better knowledge of lentic water bodies (Pawar et al., 2006). Many researchers, including Rameshkumar et al., (2019), Ansari and Singh (2017), Harsha et al., (2017), Gaunkar and Kerkar (2004), Dhar and Nikhil (2017) have studied the dispersion of algal populations in freshwater bodies.

The biological, chemical, and physical characteristics, as well as the dispersion of the algal population, are used to determine the quality of freshwater bodies. Bajpai Omesh et al., (2013), Bhakta and Adhikari (2012), Tessy and Sreekumar (2008), Gopinath and Ajith Kumar (2013), Ansari et al., (2015), Fikrat et al., (2014), Nasser et al., (2013). Bacillariophyceae, Chlorophyceae, Coscinodiscophyceae, Cyanophyceae, Euglenophyceae, Mediophyceae, Trebouxiophyceae, Ulvophyceae, Xanthophyceae, and Zygnematophyceae were found in the current study.

When compared to other groupings of algae, the algal species Cyanophyceae and Bacillariophyceae were prominent. These findings corroborated those of Harsha et al., (2017) and Hujare (2008), who found that Cyanophyceae, Chlorophyceae, and Bacillariophyceae are the most prevalent algae species in freshwater ponds.
The Cyanophyceae make up a significant portion of phytoplankton. The absorption of nutrients by blue-green algae is generally extremely effective even at low concentrations. It is highest during the summer and lowest during the rainy season, and these findings correlate with Hujare's findings (2008). Cyanobacteria, in particular, may be of most assistance in cleansing water of inorganic pollutants that have been entangled in it, as well as oxygenation and microbial profile features. The growth of cyanophyceae is aided by high conductivity, nitrite, phosphate, and sulphate levels in the water, which result in alkalinity and, in turn, encourage excessive blue-green algae growth (Srivastava et al., 2018).

According to Srivastava et al., Microcystis aeruginosa is the blue-green algae with the highest degree of civic pollution and may be regarded the best single indication of organic pollution in any water body. Microcystis aeruginosa was found in pond 1 throughout the pre-monsoon and monsoon seasons in this research. Several researchers, including Bajpai Omesh et al., (2013) and Dhanya et al., (2013), have documented the prevalence of Microcystis aeruginosa and the resulting water contamination (2012). In the research area, allergenic algae such as Anabaena, Microcystis aeruginosa, and Microcystis flosaquae were found. As a result, it has been advised that bathing and drinking water from a water source be avoided. Calothrix, Chroococcus, Aphanocapsa, Aphanotheca, Dactylococcopsis, Gleocapsa, Synechocystis, Microcystis, Synechococcus, Nostoc, and Tolypothrix are the additional Cyanopycean members discovered throughout the research. Barinova et al. (2011) found these species in the freshwater bodies of Algeti National Park, which is part of Georgia's protected areas system. Rai et al., (2010) found these species in East Nepal's freshwater bodies.

The supply of Bacillariophyceae is dominating during the post-monsoon period in this research. Munavar (1970) claimed that there is a steady supply of nitrate aided diatom development. According to Ansari et al., (2015), the presence of phosphate, silicate, nitrate, and overall hardness in water promotes Bacillariophyceae development. The pond water in this investigation is alkaline in nature. This agrees with the findings of Philipose (1960) and Hari Krishnan et al (1999). Diatoms like Fragilaria and Melosira thrive in contaminated water (Palmer, 1969), which is shown in the current study, since Fragilaria and Melosira were found in both ponds at various times of the year. The presence of Navicula sp., Nitzschia sp., Cyclotella sp., and Cymbella sp. at the research location indicates a high level of water contamination. Nandan and Aher's (2005) investigations in Maharashtra's Haranbaree Dam and Mosam River back up this claim (India). Diatoms like Fragilaria and Melosira thrive in contaminated water (Palmer, 1969), which is shown in the current study, with Fragilaria and Melosira found in both ponds at various times of the year. The presence of Navicula sp., Nitzschia sp., Cyclotella sp., and Cymbella sp. at the research location indicates indicative of water contamination. Nandan and Aher's (2005) research in Maharashtra's Haranbaree Dam and Mosam River backs up this claim (India). The number of diatoms is higher during the summer than during the monsoon season, according to Dhanam et al., (2016). Other diatom species found in the research region include Actinocyclus, Achnanthes, Amphora, Cymbella, Fragilaria, Mastogloia, Melosira, Navicula, Nitzchia, Pinnularia, Synendra, Oocystis, and Thalassiothrix. These findings matched those of Barinova et al., (2011), Bhakta et al., (2011), and Nasser (2013).

During the research period, chlorophyceae members were in short supply. Green algae development may have been aided by physico-chemical factors such as high pH, alkalinity, oxygen, total hardness, magnesium, total dissolved solids, and BOD. It's possible that the existence of chlorophyceae is related to high dissolved content. Turbidity is quite high in both ponds in this research, which has a negative impact on chlorophyceae development by absorbing sun radiation in the water's surface layer and so limiting photosynthesis. These findings matched those of Dhanam et al., (2016). The two ponds included Kirchneriella, Scenedesmus, and Oocystidium species. This is also in line with Hujare et al., (2008) and Harsha et al., (2009) research (2017). Tessy (2012) discovered Kirchneriella and Scenedesmus in Thrissur, Kerala's kole lands. Anila and Ajithkumar (2017) discovered chlorophyta sp. in Thiruvananthapuram's Museum Lake, as well as *Scenedesmus* sp.

Euglenoids were discovered in pond 2 during this investigation. Only two species, *Colacium arbuscula* and *Trachelomonas lacustris*, were found there. During the pre-monsoon season, Joseph Jiji et al., observed the highest population density of Euglenophyceae (2017). The abundance of Euglenophyceae was favoured by high CO2 and low DO (Hujare, 2008). This assertion is supported by the findings of this study since, in comparison to pond 1, pond 2 has a low amount of dissolved oxygen. The high temperature, chloride, total dissolved solids, and BOD all had a role in Euglenophyceae growth (Ansari et al., 2015). According to Pereira (1999), organic matter enrichment, medium to high conductivity (from 250-1900 scm), a pH of 6.0 to 7.5, and the presence of numerous inorganic ions favour the development of Euglenophyceae. This work is also relevant to the current investigation.

Closterium sp., Cosmarium, Desmidium, Micrasterias, Gonatozygon, and Triploceras sp. were among the seven Zygnematophyceae species discovered in pond 1 during this study. These species were discovered by Barinova et al. (2011 & 2014) in Georgia's Argavi River and Algeti National Park. Sankaran and Thiruneelagandan (2015) discovered Cosmarium sp in the Parthasarathy temple tank. Sreevastava et al., (2018) reported Cosmarium and Closterium sp. from their study on freshwater algal diversity in Central India. Nasser (2013) found Closterium, Cosmarium, Micrasteria, and Gonatozygon in the Chalakkudy river basin in Kerala, India. Desmids are found mostly in soft or slightly acidic water environments with abundant organic matter and low calcium levels (Prescott, 1982).

During the pre-monsoon season, Ulothrix cylindricum is the sole species from the Ulvophyceae class found in pond1. Ulothrix sp was discovered by Srivastava et al. (2018) and Agarwall (2018) in their study on algal diversity in freshwater ponds. Several Ulothrix species have been found in streams and waterfalls in India's Eastern and North-Eastern regions, according to Bhakta and Adhikary (2014). Ulothrix sp was found in the kole plains of Thrissur, according to Tessy (2012). The Xanthophyceae members in this study include Centritactus belanophorus, Chlorellidiopsis separabilis, Ophiocytium Cochleare, and Ophiocytium elongatum. Tessy (2012) reported Centritactus belanophorus and Ophiocytium sp. from the kole plains of Thrissur, Kerala. Fikrat (2010) identified many Xanthophyceae species in Iraq's Al-Hindiya barrage and Kitil city area.

Physico-chemical parameters are one of the most significant elements that might have an impact on the aquatic environment. Temperature is one of the variables that affects the growth activities and distribution of flora and animals in aquatic ecosystems, (Dwivedi and Pandey 2002, Singh and Mathur 2005).

The pH is an important feature for every aquatic environment since it controls how acidic or basic it is. Because of the presence of carbonates and bicarbonates, the majority of research concluded that water samples are somewhat alkaline (Tank and

Chippa 2013, Verma et al., 2012). At some point, a greater pH level can have an impact on aquatic life. BIS, on the other hand, recommends a range of 6.5-8.5. (1992). pH in pond 1 ranged from 6.9 to 7.1, whereas pH in pond 2 ranged from 6.6 to 6.7.

Total dissolved solids (TDS) include elements such as bicarbonate, sulphate, phosphate, nitrate, calcium, magnesium, sodium, and organic ions that are dissolved in water. It varied from 72.8-98.7 mg/l to 150-201 mg/l in the current research, with the lowest in pond 1 and the highest in pond 2.

The volume of oxygen present in a water body is referred to as dissolved oxygen (DO), which affects the health of the ecosystem. It is an essential water quality metric that is affected by the water's temperature, salinity, and pressure. The degree of water contamination is indicated by the DO level (Gopalkrushna, 2011). BIS recommends a DO of at least 5 mg/l (1992). In the current study, pond 2 had a minimum of 3.2–5.8 mg/l and a maximum of 6.9–7.9 mg/l, whereas pond 1 had a maximum of 6.9–7.9 mg/l. However, the dissolved oxygen in this investigation was shown to be higher than the necessary level in different seasons.

Turbidity is an optical characteristic that describes how light is scattered by the colloidal particles in water. A pond's turbidity is caused by phytoplankton, tiny creatures, mud, and other organic materials (Das and Srivastava 2003). The current investigation found that pond 2 had a minimum concentration of 2.0-5.3 NTU while pond 1 had a maximum concentration of 2.0-6.2 NTU.

The capacity to transfer electric current is measured by electric conductivity (EC). This is used to determine the amount of soluble ions in the soil. The proportion of ions such as chloride, sulphate, phosphate, bicarbonates, potassium, and magnesium, among others, affects conductivity (Francis et al., 2007). Cation exchange and primary production are affected by EC (Sonawane et al., 2011). The EC in this research varied from 128 to 179.4 s/cm in pond 1 and 260.3 to 384.2 s/cm in pond 2. The BIS recommends a minimum of 250 s/cm (1992).

Pond 2 has a high EC value when compared to pond 1. Higher EC values might be attributed to greater ionic component concentrations (Rai, 2008). The extent of salt in pond water samples is indicated by the EC (Joseph Jiji, 2017). Water's alkalinity refers to its ability to neutralise acid. Its high score implies that the aquatic environment is eutrophic (Kaur et al., 1999). It ranged from 32.6 to 75 mg/l in pond 1 and 30.1 to 145 mg/l in pond 2.
The presence of cations such as Ca^{+2}, Mg^{+2}, Fe^{+3}, and others causes higher hardness.

Water has the ability to precipitate soap by forming a combination with the calcium and magnesium in the water. Total Hardness should preferably vary from 0-30 (soft), 30-60 (moderate soft), 60-120 Total (moderate hard), 120-180 (hard), and higher than 180, according to APHA (2012) (very hard). During the post-monsoon season, pond 2 had a greater concentration of total hardness, according to the current study.

The quantity of calcium and magnesium hardness was highest in the summer and lowest in the wet season. Calcium hardness should ideally vary from 0-20 (soft), 20-40 (moderate soft), 40-80 (moderate hard), and 80-120 (very hard) according to APHA (2012) guidelines (hard). Calcium was found to be somewhat soft in pond 1 and moderately hard in pond 2. The greater concentration of magnesium ions was reported during the pre-monsoon season in the case of magnesium ions. Chloride is an essential characteristic to consider when evaluating water quality. According to Khare et al., (2007), a greater chloride content suggests a higher level of organic contamination. One of the most significant parameters in determining water quality is chloride. Chloride levels are highest in pond 2 in this research. A rise in chloride content is seen as a sign of eutrophication (Shradha et al., 2008). Eutrophication is defined as an increase in the concentration of chloride in a body of water (Shradha et al., 2008).

CONCLUSION

Eighty-nine algal species from fifty-six genera were collected and identified from the two ponds during the current investigation. Twenty-seven taxa were found to be Bacillariophyceae, thirty Cyanophyceae, seven Zygnematophyceae, four are Chlorophyceae, four Trebouxiophyceae, and four Xanthophyceae, three Coscinodiscophyceae, two Euglenophyceae, one Mediophyceae, and one Ulvophyceae. Cyanophycean members are more diversified than Bacillariophyceae members in the current research.

The physico-chemical factors were shown to be responsible for the varied group of phytoplanktons. Pollution-tolerant micro algae such as Closterium, Melosira, Navicula, and Scenedesmus are also indicators of enriched waters, indicating that the water has been contaminated. Melosira, Synedra, and Nitzchia have been identified as organic pollution markers (Nandan and Aher, 2005, Nasser ,2013). Anabaena and Microcystis, which are considered fresh water pollution algae (Palmer1969), were also discovered in the research region.

Temperature, pH, turbidity, total hardness, TDS, DO, Ca, Mg, Cl, conductivity, alkalinity, and acidity were all examined for water quality, and the results reveal that moderate contamination is present both the ponds. Turbidity, conductivity, DO, total hardness, and alkalinity were found to be greater than the acceptable level in different seasons in this study. As a result, changes in physico-chemical factors impacted phytoplankton development in an aquatic environment differently over different season.

The two ponds were also found to be on the edge of eutrophication and organic contamination, according to the research. Human actions such as the dumping of plastic bottles and other household garbage contaminate the water. Ponds are a significant source of drinking water and biological variety; therefore, their protection is critical, and now is the best moment to save the ponds under study.

ACKNOWLEDGEMENT

Authors are grateful to the Head of the Institution of Sree Narayana College, Nattika, Thrissur, Kerala for providing the facilities to carry out this work.

REFERENCES

1. Agarwal, Teena, (2018 b). Evaluation of the algal biodiversity of the Rurparael area of the Alwar District of Rajasthan. *Biodiversity International Journal*, 2(3), 306-308.
2. Anand, N. (1998). Indian freshwater microalgae. BishenSingh Mahendra Pal Singh, Dehradun. 94pp.
3. Anila, P. Ajayan, and K. G., Ajithkumar, (2017 c). The Influence on Environmental Parameters on Chlorophycean Abundance study from the Museum Lake in Thiruvananthapuram, Kerala, India.*Phykos*, 47(2), 117-128.
4. Ansari, Ekhalak, Gadhia, Mohini, and Ujjania, N.C. (2015). Phytoplankton Diversity and Water Quality Assessment of ONGC Pond, Hazira. *International Journal of Research in Environmental Science*, 1(1), 1-5.
5. Ansari, Shazia, and Singh, kumar, Santhosh, (2017). Limnological studies with reference to phytoplankton diversity in ponds of semi-arid zone of Western Uttar Pradesh. *Biological Forum –An International Journal*, 9(2), 129-147.
6. APHA (2012). Standard Methods for the Examination of Water and Waste water. 22ndedn.American *Public Health Association, Washington DC.*
7. Bajpai, Omesh, Mishra, Sujata, Mohan, Narendra, Mohan, Jintendra and Guptha, K. Rajan, (2013 b). Physico-Chemical Characteristics of Lakhna Devi Temple Water Tank, Lakhna, Bakewar, Etawah, U.P. with Reference to Cyanobacterial Diversity. *International Journal of Environment*, ISSN 2091-2854 pp.
8. Barinova, S., and Kukhaleishvili, L. (2014). Diversity and Ecology of Algae and Cyanobacteria in the Aragvi River, Georgia. The *Journal of Biodiversity Photon* 113, 305-308 pp.
9. Barinova, S., Kukhaleishvili, L., Nevo, E., and Janelidze, (2011). Diversity and Ecology of Algae in the Algeti National Park as a part of the Georgian System of Procted Areas. *Turk Bot*, 35, 7.
10. Bhakta, S., and Adhikary, S. P. (2012). Algal Diversity in Two Major Rivers of Eastern India and Physiological Assessment of Their Pollution. *The Ecosan,* 1, 01-04 pp.
11. Bhakta, S., Das, K.S., Nayak, M., Jena, J., Panda, P. K., and Sukla, L.B. (2011 a). Phyco Diversity Assessment of Bahuda River Mouth Areas of East coast of Odisha, India. *Recent Research in Science and Technology*, 2(4), 80-89 pp.
12. Bhakta, S.K., and Adhikary, S.P. (2014). Algal diversity in the Streams and Waterfalls of Eastern and North-Eastern region of India. *Nelumbo*, 56,291-341 pp.
13. BIS (1992). Indian standard Specification for Drinking water, IS: 10500, Bureau of Indian Standards, New

Delhi.29-774.

14. Cereghino, R., Biggs, J., Oertli, B., and Declerck, S. (2008). The Ecology of European Ponds: Defining the Characteristics of a Neglected Freshwater Habitat.*Hydrobiologia*, 597, 1-6.
15. Das, A.K., and Shrivastva, N.P. (2003). Ecology of Sarny Reservoir (M.P) in the Context of Fisheries. *Pollut Res* 22(4), 533–539.
16. Desikachery, T.V. (1959). 1sted.Cyanophyta, Indian Council of Agricultural Research, NewDelhi.I.C.A. R monographs of Algae-686 pp.
17. Desikachery, T.V. (1987). Atlas of Diatom.Vol.1-7. Madras Science Foundation.809 pp.
18. Dhanam, S, Sathya, A., and Elayaraj, B. (2016 a). Study of physico-chemical parameters and phytoplankton diversity of Outseri lake in Puducherry.World Science News, 54,153-164.
19. Dhanya, S., Sebastian, Smitha, and Ammini, (2012 b). A Survey of Algal Blooms in the Pond of Pallipuram, Kerala, India. International *Journal of Environmental Science*,3(3), 1185- 1193.
20. Dhar, Suman, and Kumar, Nikhil, (2017). Algal Biodiversity and Quality of Pond Water within the Coal City Dhanabad. *International Journal of Geology, Agriculture and Environmental Science*, 5 (4), 47-58.
21. Dwivedi, B.K., Pandey, G.C. (2002). Physico-Chemical Factors and Algal Diversity of Two Ponds Gurijakund and Maqubara Pond Faizabad.*Pollut Res*, 21,361–370.
22. Fikrat, Hassan, M., Salman, M.J., Asim, Al-Yassiry, and Thura, M.H. (2014). Ecological Observation on Phytoplankton Species Composition in Waste Water Treatment Plant Iraq. *International Journal of Advanced Research*, 2 (8), 344-356.
23. Fikrat, Hassen, M., William, Taylor, M.S., Mayson, and Hssen Al- Fatlawi, (2010). Phytoplankton composition of Euphrates River in Al-Hindiya barrage and Kifil City region of Iraq. *Journal of Environmental Biology*, 31, 343-350 pp.
24. Francis, A.F., Sikoki, D., and Ansa, E.J. (2007). Physico-chemical parameters of the Andoni River system-Niger Delta, Nigeria.J. Fish.Int., 2(1), 27-31.
25. Gaunker, T., And Kerkar, V. (2004). Studies on algal diversity in temple ponds from North Goa.*Indian Hydrobiology*, 7(1&2), 67-71.
26. Gopalkrushna, M.H. (2011). Determination of Physico-Chemical Parameters of Surface Water Samples in and Around Akot City. *Int. J.Res. Chem. Environ*, 1(2), 183-187.
27. Gopinath, Priya, T., and Ajith kumar, K.G. (2013 a). A Study on the Physico- Chemical Parameters and Diversity of Phytoplankton in Vellayani Lake, Thiruvananthapuram, Kerala, India. *Journal of Aquatic Biology and Fisheries*, 2, 489-492.
28. Harikrishnan, K., Sabu, G., Sanil, M. Paul, M. Satish. and Das, M.R. (1999). A Study on the Distribution and Ecology of Phytoplankton in the Kultanad Wetland Ecosystem, Kerala. *Pollut. Res*, 18, 261-269.
29. Harsha, T. K., Pradeep kumar, G., and Gireesh, kumar, E. (2017 b). Diversity of Planktonic Algae of Selected Freshwater Ponds of Mahe, UT of Puducherry, India. *J. Algal Biomass Utl*, 8(3), 50-55.
30. Hujare, M.S. (2008). Seasonal variations of phytoplankton in the freshwater tank of Talsande, Maharashtra. *Nature Environment and Pollution Technology* ,7, 2253-256 pp.
31. Jose John, Francis, M.S. (2013). An illustrated Algal flora of Kerala.Vol.1. Idukki District. 1sted.GreenCarmel Scientific Books, Thevara, Cochin, ISBN-978-81-8881.099- 4.281 pp.
32. Joseph, Jiji, (2017 a). Diversity and Distribution of Phytoplankton in an Artificial Pond.*Int.J. J-Adv.Res.Biol.Sci.*, 4 (5), 114-122.

33. Kaur, H., Bath, K. S, Mander, G.and Dhillon, S.S. (1999). Aquatic invertebrate diversity of Kanjali lake Punjab, India.J. *Environ.Ecoplan*, 2(1),37-41.
34. Khare, S.L., Paul, S.R. and Dubey, A. (2007): A study of water quality of Khomph – Niwau Lake at Chhatarpur, M.P. Nat. Env. And Poll. Tech., 6 (3): 539-540.
35. Munawar, M. (1970). Limnological Studies on Freshwater Ponds of Hyderabad - India. II. The biocenose — Distribution of Unicellular and Colonial Phytoplankton in Polluted and Unpolluted Environments. *Hydrobiologia*, 36 (1), 105–128.
36. Nandan, S.N., and Aher, N.H., (2005). Algal community used for assessment of water quality of Haranbaree dam and Mosam river of Maharashtra. *J. Environ. Biol*. 26, 223-227.
37. Nasser, Mohemmed, K. M. (2013). Ecology and biodiversity of Freshwater Microalgae in the Selected Areas of the Western Ghats. PhD Thesis submitted to Mahathma Gandhi University.
38. Palmer, C.M. (1969). Composite rating of algae tolerating organic pollution. *British Phycology Bulletin*, 5: 78-92.
39. Pawar, S.K., J.S., Pulle, and Shendge, K.M. (2006). The Study on Phytoplankton of Pethwadaj Dam, Taluka Kandhar, District-Nanded, Maharashtra. *J. Aqua. Biol*., 21, 1-6.
40. Pereira, M.J., 1999.Utilizacao de algas na avaliacao de contaminacao de aguas doces por metais. Dissertacao de Doutoramento.Universidade de Aveiro, Averio p.611.
41. Philipose, M.T., (1967). 1STed. Chlorococcales, published by T.S. Pruthi, under Secretory, Indian Council of Agricultural Research, New Delhi, 365pp.
42. Philpose, M.T. (1960). Freshwater phytoplankton of inland fisheries. Proc. Sym. Algology. ICAR, New Delhi.272-291pp.
43. Prasad, B. N., and Srivastava, M.N. (1992). Freshwater algal flora of Andaman & Nicobar Islands.Bishen Singh Mahendra Pal Singh, Dehradun.Vol.1.369 pp.
44. Prescott, G. W. 1982. Algae of the Western Great lakes Area. Otto Koeltz Science Publishers, Koenigstein, W-Germany.
45. Presscot, G.W. (1962). Algae of the Western Great Lakes Area.2nd ed. Brown.Co. Dubuque, low.997 pp.
46. Rai, P. K., Mishra, A., and Tripathi, B.D. (2010 a). Heavy metal and microbial pollution of the River Ganga: A case study of water quality at Varanasi. *Aquatic Ecosystem Health and Management*, 13(4), 352-361.
47. Rai, P.K. (2008). Heavy metal pollution in aquatic ecosystems and its phytoremediation using wetland plants: an ecosustainable approach. *International journal of phytoremediation*, 10(2), 133-160.
48. Ramesh, kumar, S., Radhakrishnan, Kalidoss, Aanand, S., and Rajaram, R. (2019). Influence of physico-chemical water qualityon aquatic macrophyte diversity in seasonal wetlands. *Applied Water Science*, 9(12), 2-8 pp.
49. Sankaran, B., and Thiruneelagandan, E. (2015). Microalgal Diversity of Parthasarathy Temple Tank, Chennai, India. *International Journal of Current Microbiology and Applied Science*, 4(4), 168-173.
50. Sarma, Y.S.R.K., and Khan, M. (1980). Algal taxonomy in India. Today and Tomorrow Book Agency, New Delhi, 153 pp.
51. Sarode, P.T., and Kamat, N.D. (1984). Freshwater diatoms of Maharashtra. 1sted.Saikripa Prakashan, Aurangabad.338 pp.
52. Shradha, Sharma, Dixit, Savita, Praveen, Jain, Shash, K., and Vishwakarma, Rakesh, (2008). The statistical evaluation of hydrological parameters of Narmada River water at Hoshangabad City, India. *Environmental monitoring and Assessment*, 143(1-3), 195-202.

53. Singh, R.P., Mathur, P. (2005). Investigation of Physico-Chemical Characteristics of Freshwater Reservoir of Ajmer City Rajasthan. *Indian J. Environ. Sci*, 19,179–186.
54. Sonawane, D.L. (2011). Physico-chemical profile of Sukhana River, in Aurangabad, (M.S.) India. *The Ecosan*, 5 (3 &4), 121-126.
55. Srivastava, Neha Susheela, M. R., Toppo, K., and Lawrence, R. (2018). Freshwater Algal Diversity of Central India.*Int.J.Res.Dev.pharm.L.Sci*.,7(4),3039-3049.
56. Tank, S.K., Chippa, R.C. (2013). Analysis of Water Quality of Halena Block in Bharatpur Area.*Int. J. Sci. Res.Publ.*, 3(3), 1–6.
57. Tessy, P. P., and Sreekumar, R. (2008 a). A Report on the Pollution Algae from the Thrissur Kole Wetlands (A part of Vembanad kole, Ramsar Site) Kerala. *Nature Environment and Pollution Technology*, 7(2), 311-314.
58. Tessy, P.P. (2012). Studies on the Algal flora of kole lands in Thrissur District, Kerala. PhD Thesis. Mahathma Gandhi University, Kottayam.
59. Verma, P., Chandawat, D., Gupta, U., and Solanki, H. (2012). Water Quality Analysis of an Organically Polluted Lake by Investigating Different Physical and Chemical Parameters.*Int.j.Res. Chem Environ*, 2(1), 105–111.
60. William Barwell Turner, 1978.The freshwater algae (Principally desmidiaceae) of East India.Kongal Srenska Velenskaps-Akademiens, Handlingar, Bandet 25. No.5.published by M/S Bishen Singh Mahendra Pal Singh, 23-A. New Connaught place, Dehradun, 178pp.

LEGENDS

Fig No. 1. Study sites

Fig No.2 Algal distribution (%) at Pond-1

Fig No.3 Algal distribution (%) at Pond-2

Table 1. List of algae identified from Pond 1

Table 2. List of algae identified from Pond 2

Table 3. Physico-chemical parameters of pond 1

Table 4. Physico-chemical parameters of pond 2

Table 5. Statistical analysis of hardness

Table 6. Statistical analysis of temperature

Table 7. Statistical analysis of pH