International Journal of Research and Review
Vol. 10; Issue: 9; September 2023
Website: www.ijrrjournal.com
Research Paper *E-ISSN: 2349-9788; P-ISSN: 2454-2237*

A Study on Diversity of Phytoplankton and Ecological Features of Temple Stream of Kasipatnam, Visakhapatnam (Dist), Andhra Pradesh, India

Padmaja Rani Ponnaganti[1], P. Rathna Kumar[2], Mohan Narasimha Rao Geddada[3]

[1,2,3]Department of Botany, Andhra University, Visakhapatnam-530003, India

Corresponding Author: Padmaja Rani Ponnaganti

DOI: https://doi.org/10.52403/ijrr.20230958

ABSTRACT

The present study was to enumeration details of the phytoplankton diversity and ecological features of Kasipatnam Temple Stream, Kasipatnam, Anathagiri Mandal, Visakhapatnam (Dist), Andhra Pradesh, India. During one year period on May 2020 to April 2021. Present observation of ecological features such as water temperature, weather temperature, rain fall, humidity and wind analyzed at Kasipatnam Temple Stream. The phytoplanktonic number decreased during monsoon season and increased very quickly during post-monsoon months. In monsoon season the phytoplankton communities value were low. Because high inflow of water in this season. Investigation of the Kasipatnam temple Stream revealed that the total number of 30 genera and 58 species belongs to four classes such as Chlorophyceae, Bacillariophyceae, Cyanophyceae and Euglenophyceae. Most number of the chlorophyceae classes have 15 genera and 28 species, Bacillariophyceae have 9 genera and 12 species, Cyanophyceae have 4 genera and 10 species and Euglenophyceae have 2 genera and 6 species. The present observation revealed that chlorophyceae species were dominant followed by Bacillariophyceae, Cyanophyceae and Euglenophyceae.

Keywords: Algal diversity, Ecological studies, Kasipatnam Stream,Vizinagaram District, Andhra Pradesh.

INTRODUCTION

Algae are simple aquatic plant like organisms that do not have true roots stems and leaves. Many are single celled so can only be seen using a microscopic while others grow in filamentous or mats filaments that are quite conspicuous. The main groups of algae found in streams are the green algae (Chlorophyta) red algae (Rhodophyta) blue green algae (Cyanophyta) and diatoms (Bacillariophyta). Green Slime and Brown scum on stream beds is usually regarded as an unattractive nuisance however, it is a vital part of stream ecosystem phytoplankton are primary producers and autotrophs organisms. They dependson light energy it converts into chemical energy which is then stored in organic compound similarly, estuaries ecosystem helps to produce high biomass of secondary consumers and give good support of fishery yields (Madhava Rao *et.al.*,2015) Pollution increasing in the world it leads to global warming. And the environment loses the renewable energy sources. So, our main aim to find sustain way on the development of renewable energy sources such as temperature, wind, water, rainfall and humidity. Renewable Sources to protect sustainable way to development of micro algae. (Paran Gani *et al*., 2019). An aquatic

ecosystem mainly depends on the rate of biomass production and diversity of phytoplankton (K. Rajalakshmi and M. Aruna 2019). The algal growth and community structures affected by many physical and chemical factors such as light, temperature, organic and inorganic compounds PH and seasonality in water (Jaffer *et. al.,* 2018). The factors changed the algal morphology. Some algal species have ability to face stress environment and some species are unable to adopt themselves in stress environment (Schlichting 1974). Different species grow at different temperature for example thermal blue green algae grow at 74 degrees centigrade (Brock *et al*., 1967). Green algae grow below 47°C. Diatoms can grow in temperature up to 60°C (Chang 1966.phytoplankton and some macrophytes have been used as a bioindicators of environmental conditions and indicators of water quality in aquatic ecosystems (Sign *et al.*,2013a; Thakur *et al.*, 2013; Singh *et al.,* 2013 BC). Phytoplankton have grown quickly and rapid response to environmental change (Sharmal *et al*.,2013; Jindal *et al*.,2013) the biodiversity is declining the aquatic environment than the terrestrial environments and this problem is particularly acute in streams and rivers (Johal and Rawal, 2005). Very few knowledge obtained from investigation in freshwater phytoplankton of coastal Andhra Pradesh (Munawar 1970, Kodarkar 1995, Jyoti and Narsimha Rao 2013 A&B, Bhanu Prakash *et al.*,2014, Jyotsna *et al.,* 2014, Setu Madhavarao et.al., 2015). The main object to study to evaluated object examine to diversity of phytoplankton and ecological features in temple stream of Kasipatnam.

MATERIALS AND METHODOLOGY

Study site:

The tree temple is said to the 400 years old. It is the temple of Lord Shiva known as Uma Rama Lingeswara temple. A Banyan tree covered the major part of the temple. So you must just assumed the age of this tree and the temple. This place is completely surrounded by tribal area. This village is called scenic mountain stream near Kasipatnam on the way to Araku from Visakhapatnam the latitude and longitude of Kasipatnam 18.093972°N and 83.1 359734°. 3 stations are selected in the same for collection of water samples.

Collection of Samples:

Environmental features of from May 2020 to April 2021. During this period transparent plastic bottles were used for the collection of algal samples. The samples were collected with 10 meters distance. The algal samples were put into the bottles with the help of forceps and spatula. The details of environmental features such as water temperature, weather temperature, rain fall, wind speed and humidity of the study area were analyzed as per standard methods. Water samples (one liter) were collected from the study area. The algal samples were preserved in 4% formalin and were brought to the laboratory then centrifuged at 1500-2000rpm for 10-12 minutes. Phytoplanktons were could be easily counted individually under compound binocular microscope 10X and 40X and phytoplankton were measured and multiplied with the dilution factor, using Sedgwik rafter cell APHA as was described by Welch (1948) Smith (1950) Trivedi and Goel (1986) Kodarkar *et.al* (1991) and Dhanapati (2000). The sample was placed on the clean slide. The material was spread with the help of needle on the slide and one drop of water was add on the material. Coverslip was placed on the material and gently pressed with the help of thumb to remove water droplets from the material. Then the phytoplanktons were identified with standered monographs and manuals (Fritsch, 1907; Desikachary,1959; Chapmann,1962; Edmondson,1963; Philipose, 1976; Prescott,1984; Anand, 1998.

RESULTS AND DISCUSSION

Ecological features of running stream water at Kasipatnam were collected for the one-year period from May 2020 to April 2021. Table 1 shows the environmental features

such as Water temperature, Weather temperature, Rainfall, Humidity and wind during the period of study. High water temperature and weather temperature recorded in the month of May (29.8°C) and (30.44°C). During the pre-monsoon period the environmental conditions of the weather temperature and light also increasing during this season as suggested by Kopoczynska (1980) and Dwivedi and Pandey, 2002. And low water temperature and weather temperature in the month of January (25.7°C) and(26.4°C) During the period of observation maximum rainfall was recorded in the month of October 82.5mn and minimum in the month of February 10.5 mn. An Ecological condition such as humidity was observed maximum and minimum from 90.6 to 59.99 percentage at study area. Wind speed of the running water stream at study area range from 11 to 2 km /h.

Table:1 Ecological Conditions of Water Stream at Kasipatnam Temple Stream

Month and Year	Water Temperature (C°)	Weather Temperature (C°)	Rainfall (mn)	Humidity (%)	Wind (Km/h)
May 2020	29.8	30.44	17.6	59.19	6
June	27.3	30.37	56.0	72.70	8
July	29.2	30.15	30.3	89.90	4
August	28.8	29.66	81.4	90.60	11
September	29.3	29.77	58.5	90.21	5
October	28.4	29.47	82.5	86.23	4
November	27.6	28.59	52.6	76.1	4
December	26.2	27.08	33.19	67.5	8
January 2021	25.7	26.40	11.1	76.3	9
February	26.7	26.84	10.5	77.7	3
March	27.8	28.21	13.0	69.3	2
April	29.0	29.80	26.2	71.4	3

Ecological conditions were measured and species were identification. The whole species belonging to four classes such as Chlorophyceae, Bacillariophyceae, Cyanophyceae and Euglenophyceae. Distribution of microalgae in 10 meters distance of sites of single station at Kasipatnam Temple Stream. 58 species of microalgae belonging to four classes were identified at study area of study period. The largest class was Chlorophyceae with 13 species, followed by Bacillariophyceae with 17 species, Cyanophyceae with 13 species and Euglenophyceae with 8 species. Investigation of algae the Chlorophyceae members were dominant at study area. Similar observations were made by earlier workers Ramesh and Aruna (2015) Madhava Rao D.S., and Mohan Narasimha Rao G. (2016). Shailaja and Aruna (2018), Rajyalakshmi and Aruna (2019). The class Chlorophyceae species such as *Oedogonium species, Microspora species, Spirogyra species, Ulothrix species* and *Zygnema species.* These all member of species wre more dominant at study area. The maximum Chlorophyceae numbers found in the month of November. The next dominant class was Bacillariophyceae in months of March and April. The most dominant *species* of Bacillariophyceae were *Navicula species, Pinnuaria species, Synder species, Amphora species* and *Aulocosera species*. The greater number of Cyanophyceae class *species Anabena specices, Nostoc species, Oscillatoria species* and *Spirulina species* were abundant in months of August and September. The class Euglenophyceae species less number found at study area. *Euglena species* and *Phacus species* were abundant in study period. The different species were observed in months of October, November and December.

Table:2 Phytoplaktons Abundance of Temple Stream of Kasipatnam during May 2020 - April 2021															
S. No	**Name of the class**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**Total**	**%**
1	Chlorophyceae	26	38	25	39	36	41	45	42	37	30	29	25	417	38.97
2	Bacillariophyceae	35	18	16	21	22	24	31	26	19	28	36	37	313	29.25
3	Cyanophyceae	14	23	20	32	34	28	25	19	19	18	12	13	257	24.01
4	Euglenophyceae	7	9	8	8	9	8	6	5	8	6	8	9	83	7.75

Table :3 Distribution of phytoplankton species of Kasipatnam Temple Stream of Kasipatnam, Visakhapatnam District. Andhra Pradesh, During 2020-2021.

S. No	Name of the Class	Name of the Species
1	Chlorophyceae	*Ankistodesmum falcatus*
2	Chlorophyceae	*Carteria globosa*
3	Chlorophyceae	*Chlorella pyrenoidosa* Chick
4	Chlorophyceae	*Cladophora cripspate* (Roth)Kutz
5	Chlorophyceae	*Closterium acutum*
6	Chlorophyceae	*C.gracile*
7	Chlorophyceae	*Euastrum bidentatum*
8	Chlorophyceae	*E.elegans*
9	Chlorophyceae	*Eudorina elegans*
10	Chlorophyceae	*Golenkinia radiate*
11	Chlorophyceae	*Hydrodictyon retioculatum*
12	Chlorophyceae	*Microspora amoena*
13	Chlorophyceae	*Oedogonium capilliforme*
14	Chlorophyceae	*O.princeps*
15	Chlorophyceae	*O.globosum*
16	Chlorophyceae	*Pandoria morum*
17	Chlorophyceae	*Spiryogyra species*
18	Chlorophyceae	*Ulothrix zonata*
19	Chlorophyceae	*U.variabills*
20	Chlorophyceae	*Zygnema species*
21	Bacillariophyceae	*Aulocosera granulate*
22	Bacillariophyceae	*Amphora ovalis* Kutz
23	Bacillariophyceae	*Cyclotella meneghiniana* Kutz
24	Bacillariophyceae	*C.autique*
25	Bacillariophyceae	*C.gromerata*
26	Bacillariophyceae	*Cymbella affinis*
27	Bacillariophyceae	*C.tumida*(Breb)Van.Heurck
28	Bacillariophyceae	*C.ventricosa* Var.arcuata
29	Bacillariophyceae	*C.formis* Kuetz
30	Bacillariophyceae	*C.turgida* (Grey)Cleve
31	Bacillariophyceae	*Fragellaria brebistriata*
32	Bacillariophyceae	*Navicula cuspidate*
33	Bacillariophyceae	*N.pupula*
34	Bacillariophyceae	*N.radiosa*
35	Bacillariophyceae	*Pinnularia viridis*
36	Bacillariophyceae	*P.gibba*
37	Bacillariophyceae	*Synedra ulna*
38	Bacillariophyceae	*S.acus*
39	Bacillariophyceae	*Skeletonema costatum*
40	Cyanophyceae	*Anabena backeiis*
41	Cyanophyceae	*A.constricta*
42	Cyanophyceae	*Chroococcus indicus*
43	Cyanophyceae	*C.minor* (Kutz)Nageli
44	Cyanophyceae	*Nostoc carenum*
45	Cyanophyceae	*N.commune*
46	Cyanophyceae	*Oscillatoria Formosa*
47	Cyanophyceae	*O.limosa*
48	Cyanophyceae	*O.subbrevis schmidle* F.Crassa
49	Cyanophyceae	*Rivularia curvat R.harmatitesa*
50	Cyanophyceae	*Spirulina ladyrinthiformis*
51	Cyanophyceae	*S.major* (kutz) Gomont
52	Euglenophyceae	*Euglena ehrenbergii*
53	Euglenophyceae	*E.virids* Her
54	Euglenophyceae	*Phacus acuminates*
55	Euglenophyceae	*P.orbicularis*
56	Euglenophyceae	*P.longicauda*
57	Euglenophyceae	*Trachelomonas hispida*
58	Euglenophyceae	*T.rugulosa*

Chlorophyceae


Ankistrodesmum falcatus


carteria globosa

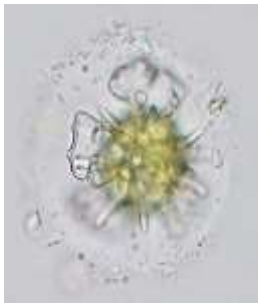

Cladophora cripspate


Euastrum bidentatum


Chlorella pyrenoidosa


Closterium acutum


C.gracile


Euastrum elegant


Eudorina elegans


Golenkiniaradiat


Hydrodictyon retioculatum


Microspora amoena


Oedogonium capilliforme


O.princeps


O.globosum


Pandoria morum


Spiryogyra species


Ulothrix variabills


Ulothrix zonata


Zygnema species

Bacillariophyceae


Aulocosera granulate


Amphora ovalis


Cyclotella meneghiniana


C. autique


C. gromerata


Cymbella affinis

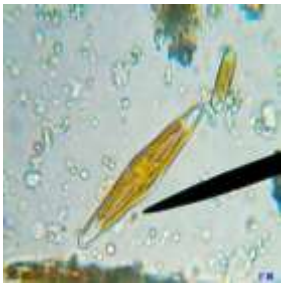

C. tumida


C. turgida


C. formis


C. ventricosa


Fragellaria brebistriata


Navicula cuspidate


N. pupula


N. radiosa


Pinnularia viridis


P. gibba


Synedra ulna


S.acus

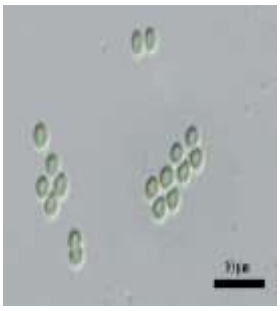

Skeletonema costatum

Cyanophyceae


Anabena constricta


Anabena backeiis


Chroococcus indicus

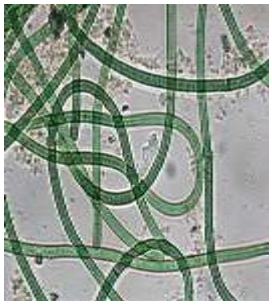

C. minor


Nostoc carenum

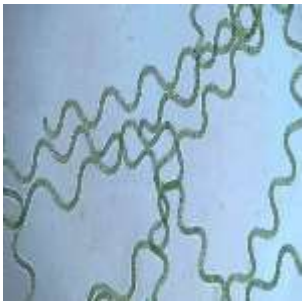

N. commune


Oscillatoria Formosa


O. limosa


O. subbrevis


Rivularia curvat

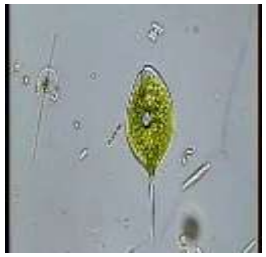

Spirulina ladyrinthiformis


S. major

Euglenophyceae


Euglena ehrenbergii


E. virids


Phacus acuminates


P. orbicularis


P. longicauda


Trachelomonas hispida


T. rugulos

Photographs of some phytoplankton observation in Kasipatnam temple stream

Declaration by Authors

Acknowledgement: The authors are thankful to the Head of Department of Botany, Andhra University, Visakhapatnam, the local people and who had helped me during the field studies at Kasipatnam stream. This work has been supported and providing necessary facilities for above research.

Source of Funding: None

Conflict of Interest: The authors declare no conflict of interest.

REFERENCES

1. Anand, N.1998 India Freshwater Microalgae Bishen Singh Mahendra Pal Singh, Dehra Dun. India.1-94.
2. APHA. 2012. Standard Methods for the Examination of water and Wastewater.22nd Ed. American Public Health Association (APHA), American Water Works Association (AWWA) &Water Environment Federation (WEF), Washington D.C., U.S.A.1175p
3. Bhanu Prakash, M., Jyothi, K. and Narasimha Rao, G.M., 2014. Seasonal variations of phytoplankton community structure in relation to physico- chemical factors in Lake kolleru, Andhra Pradesh, Ind. J. Algal Biopmass Utln. Vol-5(3)1-7.
4. Brock, T.D. 1967. A Life at high temperature, Science, 158:1012-1019.
5. Chang. T. 1966. A Preliminary report on the Diatoms of the hot spring of Taiwan. Taiwania, 12:47-64.
6. Chapman, 1962. The Algae, MacMillan & Co Ltd. London.
7. Desikachary, T.V. 1959. Cyanophyta, Indian Council of Agricultural Research, New Delhi. Pp. 1-686.
8. Dwivedi B.K. and G.C. Pandy 2002. Physico-Chemical Factors and Algal Diversity of two Ponds In faizabad, India Poll. Res. 21 (3): 361-370.
9. Edmondson, W.T., (1993): Freshwater Biology 2nded.Ohn Willey and Son, Inc. New York.
10. FrischF.E.1907. The sub-Arial and Freshwater algae flora of the topic Ann. Bot. 21, 235-275.
11. Izabela Michalak., Beta Messyaz. 2021 Concise Review of Cladophora Spp: Microalgae of Commercial Interest. *Journal of Applied Phycology* (2021). 33:133-166. Poland.
12. Jindal R, Thakur RK, Singh UB and Ahluwalia AS. 2013. Phytoplankton Dynamic and Species Diversity in a Shallow Eutrophic, Natural Mid- altitude Lake Himachal Pradesh (India): Role of Physico-Chemical factors, Che- Ecol. DOI: 10.1080/02757540. 2013.871267.
13. Johal MS and Rawal YK. 2005. Key to the Management of the Western. Himalayan Hill Streams in relation to Fish Species Richness and Diversity. Hydrobiology. 532(1-3): 225-232.
14. Jyothi, and Narasimha Rao G.M., 2013 A. Seasonal Distribution of Phytoplankton in Raiwada Reservoir, Visakhapatnam, Adhra Pradesh, India. Not. Sci. Biol.5 (3): 290-295.
15. Jyothi, and Narasimha Rao G.M., 2013 B. Diversity and Seasonal Variation of Phytoplankton in Physico- Chemical Parameters in Thatipudi Reservoir, Visakhapatnam, Andhra Pradesh, India. Seaweed Res. Utiln. 35(1&2): 211-219.
16. Jyotsna, N., Subba Rangaiah G and Narasimha Rao G.M., 2014. Seasonal Variation of Microalgae in relation to the Physico-Chemical Parameters of Karagam Lake, Srikakulam District, A.P. India. J Algal Biomass Utln. 2014, 5(4) : 68-73.
17. Kodarkar MS.,1995. Conservation of lakes, India Association of Aquatic Biologists (IAAB) Hyderabad Publication 3;1-82.
18. Kopoczynska E.E 1980. Seasonal Variation in Phytoplankton in the Grand River Mouth Area of Lakes Michigan. Pol. Arch. Hydrobio.27 (1) : 95-123.
19. Munawar M. 1970 Limnological studies on freshwater ponds of Hyderabad, India. The Biosense distribution of unicellular and colonial Phytoplankton in polluted and unpolluted environments, Hydrobiology. 36(1):105-138.
20. Madhava Rao, D.S., Jyothi Kaparapu and Mohan Narasimha Rao, G.M.,2015. Micro Algal population in Mangrove Habitats of the Visakhapatnam, East Coast of India. *Journal of Algal Biomass Utiln*. 6(2):5-10.
21. Madhava Rao, D.S.,Narasimha Rao,G.M.,2016. Seasonal Abundance of Phytoplankton in Relation to Physico-Chemical features of Venkammacheruvu Veeraghattam, Srikakulam (Dist), A.P.,

India. IOSR-JPBS, Vol (11), Issue 4 pp 91-98.
22. Messyaz B, Pikoz M, Schroeder G, Leska B, Fabrewska J (2015a). Identification and Ecology of Macroalgae Specices Existing in Poland. In: Kim SK, Chonjnackak (eds) Marian algae extracts: Processes, Products and applications. Wiley-VCH, Weinheim, pp15-40 Poland.
23. Mehwish Jaffer, Atiq Ur Rehman and ShahzaGauhar (2018). Study of Diversity of Fresh Water Algae in some Areas of Lahore City, Punjab State, India. Vol. 08 pp 61-79. NewDelhi.
24. Neha Srivastava (2018). Fresh Water Algal Diversity of Central India. *International Journal of Research and Development in Pharmacy and Life Science*. 7 (4) 3039-3049.
25. Paran Gani, Norshuhalia Mohamed Sunar, Hazel Monica Matias-Peralental Factors Effect on the Growth of Microalgae. Journal of Applied Chemistry and Natural *Resources*, Vol. No.2 (2019) p. 1-5.e- ISSN 2672-7358 Malaysia.
26. Philipose, M. T. 1960., Proe. Sym. Algology, ICAR., 272-291.Philipose, M.T.1967. Chlorococcales ICAR New Delhi pp 356.
27. Prescott, G.W. 1984.The Algae: A Review, Koenigstein, Otto Koeltz Science Publishers, 436P.
28. Ramesh, B and Aruna M. (2015). Diversity of Fresh water Algae in Triveni sangamam of Nizamabad District, Telangana State. *India European Journal of Botany Plant Sciences and Phytology*. Vol. 2, No. 4, pp31-37.
29. Rajyalaxmi R. Aruna M. (2019). "Distributional Status of the Diversity of Phytoplankton Population in Freshwater Lake," International *Journal of Scientific Research in Science and Technology (IJSRST*), Nizamabad, Telangana, India. Vol 6 Issue 1, pp 227-234.
30. Schlichling, H.E. 1974. Survival of some Fresh water algae under extreme environmental conditions. Trens, Amer. Micros. Soc., 93: 610-613.
31. Shailaja, A. and Aruna, M. (2016). Diversity of Phytoplankton in Agraharam Lake of Karimnagar District, Telengana State, India.
32. Sharma C, Jindal R, Singh UB, Ahluwalia AS and Thakur RK. 2013. Population Dynamics and Species Diversity of Plankton in relation to Hydrobiological Characteristics of River Sutlej, Punjab, India. Ecol Environ Conserv., 19 (3) : 717-724.
33. Singh UB, Ahluwalia AS, Sharma C, Jindal R and Thakur RK. 2013a. Planktonic indicators: a promising tool of monitoring water quality (early-warning signals). Ecol Environ Conserv., 19(3): 793-800.
34. Singh UB, Ahluwalia AS, Jindal R and Sharma C, 2013 b. Water quality Assessment of some Freshwater bodies supporting Vegetation in and around Chandighar (India). Using multivariate Statistical Methods. Water Qual. Expo. Health. 5(3): 149-161.
35. Thakur RK, Jindal R, Singh UB and Ahluwalia AS. 2013. Plnkton Diversity and Water Quality Assessment of Three Fresh Water Lakes of Mandi (Himachal Pradesh, India) with special reference to Planktonic Indicators. Environ Monit Asses., 185(10): 8355-8373.

How to cite this article: Padmaja Rani Ponnaganti, P. Rathna Kumar, Mohan Narasimha Rao Geddada. A study on diversity of phytoplankton and ecological features of temple stream of Kasipatnam, Visakhapatnam (Dist), Andhra Pradesh, India. *International Journal of Research and Review*. 2023; 10(9): 560-568. DOI: *10.52403/ijrr.20230958*

******