*Plant Archives* Vol. 22, No. 1, 2022 pp. 126-129 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org
DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2022.v22.no1.021

# ALGAE AS BIOINDICATORS: A STUDY IN THE POND OF DISTRICT JALAUN, U.P. INDIA

**V.K. Yadav and Sonam Sharma***
Department of Botany, D.V. College, Orai.285001 (U.P.) India
Corresponding author Email*: sonamsharmadvc@gmail.com

(Date of Receiving : 08-10-2021; Date of Acceptance : 02-01-2022)

**ABSTRACT**

Algae are physiologically adapted, surviving at different level of organic pollution and recognized as well-known bio-indicator of the environment. Palmer Algal genus pollution index was employed to study the water quality of seven ponds. The total source was calculated to be showing the evidence of high organic pollution. Results showed that the total score of Palmer algal genus pollution index of pond 1, 2, 3, 4, 5, 6 and 7 were 29, 21, 23, 16, 18, 19 and 06 respectively showing a warning sign of the de-treating condition of water quality in all ponds except number 7. Measure needs are required to be forced in to reduce the rate of pollution of ponds arising from the human activities in the catchment of the pond.

***Keywords*** **:** Bio-indicator, Algae, Palmer pollution index, Ponds.

## Introduction

Water is the most important constituent of the life on earth. Every living individual has more than 75% of the water content, which shows its importance for life activities. A fundamental of earth is abundance of water which covers about 71% of its surface area with an average depth of 3000 meters. About 97.6% of the water existing on the earth distributed in oceans and of the 2.4% of fresh water. Only less than 1% is available for human consumption and other activities (Wetzel, 2001). Men utilize water available from sources like lakes, ponds, rivers, streams, ground water, bogs and brooks.

Ponds are historically and ecologically important ecosystem representing around 30% of the global surface area of standing water (Dowing *et al*., 2006, 2010). Ponds serve as a source of water for drinking, domestic, irrigation and industries. The services provided by the pond are ground water recharge, food alleviation, high local and regional aquatic biodiversity, culture, aesthetic and recreation (Cereghino, 2014; Takamura, 2012).

Palmer (1969) state that organic pollution tends to influence the algal flora rather than other physico-chemical factors. Algae are one of the most rapid bio-indicator of water quality changes due to their short life span quick response of pollutants and easy to determine their number (Paltkiaet *et al*., 1989). The algal composition not only demonstrate the certain situation of water but also the previous situation of the aquatic ecosystem (Chellappa *et al.,* 2009; Yusuf, 2020).

In the present study the water pollution index is used for the detection and evaluation of water pollution in the seven ponds of Jalaun district of Uttar Pradesh India as effort has been made before the studying of water quality of ponds.

## Material and Methods

The present study was undertaken in seven ponds of Jalaun district (U.P.) India (Table 1). The pond was selected on the base of magnitude of activities and disturbances. For the analysis of algal genera, the water samples were collected during March 2020 to February 2021. Pollution index used for this assay test based on algal genus for rating the water sample for high and low organic pollution (Palmer, 1969). The identification of algae was done on the basis of standard information available (Smith, 1950; Prescott, 1951; Randhawa, 1959; Sarode and Kamat, 1984).

**Table 1 :** Geographical location of ponds

| S.No. | Name of the Pond | Latitude | Longitude |
|---|---|---|---|
| 1 | Mahil Pond | 25.986 N | 79.449 E |
| 2 | Ram Kund | 25.992 N | 79.444 E |
| 3 | Madora Pond | 25.986 N | 79.448 E |
| 4 | Usargaon Pond | 26.038 N | 79.44 E |
| 5 | Sagar talab | 26.003 N | 79.159 E |
| 6 | Ajnari Pond | 25.982 N | 79.457 E |
| 7 | Industrial area Pond | 26.013 N | 79.507 E |

## Results

The pollution tolerance of 21 algal genus in the present study have seen arranged in decreasing order of emphasis from seven ponds (Table 2). Result envisaged that 13 algal genera show as *Chalamydomonas, Scanedesmus, Chlorella, Oscillotoria, Phormidium, Anacystis, Euglena, Navicula, Synendra, Melosira, Gomphonema* and *Cyclotella* with algal

pollution index in different ponds of which Chlorophyceae accounted 23%, Cyanophyceae 23%, Euglenophyceae 8% and Bacillariophyceae 46% (Table 3 and Fig. 1). The total score of algal genus pollution index of pond 1, 2, 3, 4, 5, 6 and 7 were 29, 21, 23, 16, 18, 19 and 06 respectively. Thus, it was observed that the higher score for Palmer index at pond 1, 2, 3 indicating high organic pollution while the total score of ponds 4, 5, 6 showed probable high organic pollution. However, pond 7 indicate lack of organic pollution.

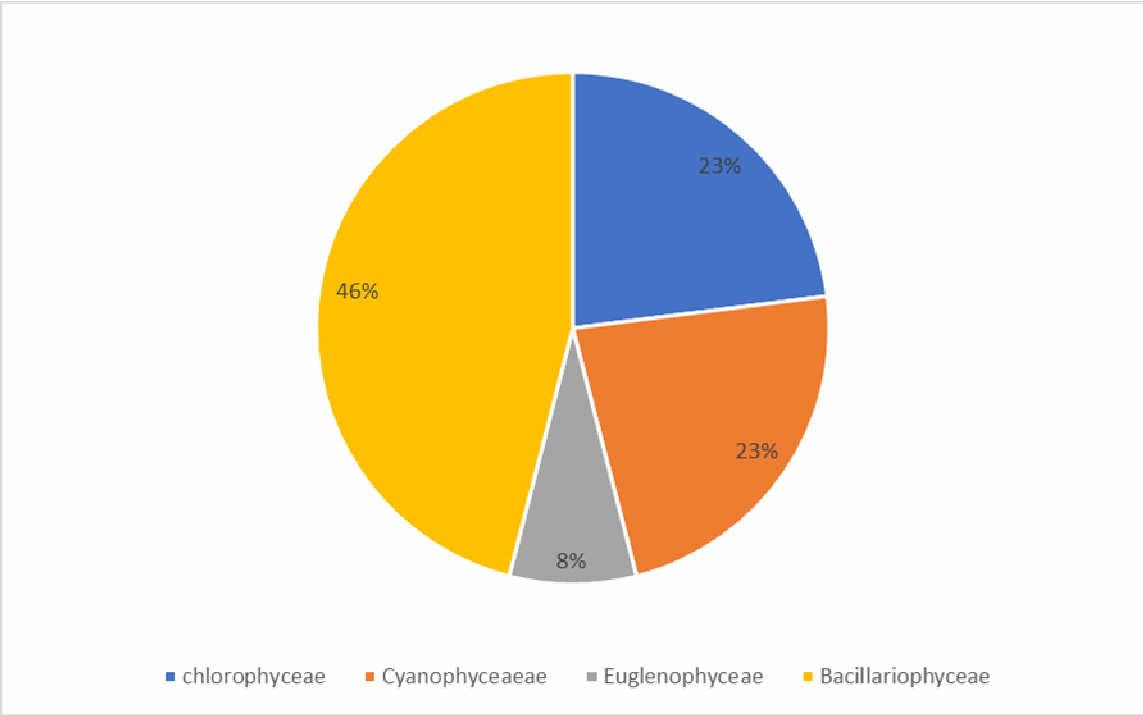


**Fig. 1 :** Different Class % of algal Pollution index during studies.

**Table 2 :** Pollution tolrent genera of algae from seven ponds of Jalaun district in order of decreasing emphsis(Palmer, 1969)

| S.No. | Genus | Group | No. of Authors | Total points | Ponds | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1 | ***Euglena*** | F | 97 | 172 | + | + | + | + | - | + | - |
| 2 | ***Oscillatoria*** | B | 93 | 161 | + | + | + | - | + | - | - |
| 3 | ***Chlamydomonas*** | F | 68 | 115 | - | + | + | - | - | + | - |
| 4 | ***Scanedesmus*** | G | 70 | 112 | + | - | - | + | - | + | - |
| 5 | ***Chlorella*** | G | 60 | 103 | + | + | - | + | + | - | + |
| 6 | ***Nitzchia*** | D | 58 | 98 | + | - | + | - | + | + | - |
| 7 | ***Navicula*** | D | 61 | 92 | + | - | + | + | + | - | - |
| 8 | ***Synendra*** | D | 44 | 58 | + | - | + | - | + | + | - |
| 9 | ***Phormidium*** | B | 37 | 52 | + | + | - | - | - | - | + |
| 10 | ***Melosira*** | D | 37 | 51 | - | + | - | - | + | - | - |
| 11 | ***Gomphonema*** | D | 35 | 48 | + | + | - | + | + | - | + |
| 12 | ***Cyclotella*** | D | 35 | 47 | + | - | + | - | - | + | + |
| 13 | ***Anacystis*** | B | 28 | 39 | + | + | - | - | - | - | - |
| 14 | ***Anabaena*** | B | 27 | 38 | + | - | + | + | - | + | - |
| 15 | ***Fragilaria*** | D | 24 | 33 | + | - | - | - | + | - | - |
| 16 | ***Ulothrix*** | G | 25 | 33 | + | + | + | + | - | - | - |
| 17 | ***Spirulina*** | B | 17 | 25 | + | - | - | + | - | - | + |
| 18 | ***Diatome*** | D | 19 | 22 | - | - | + | + | - | - | - |
| 19 | ***Asterionella*** | D | 14 | 17 | + | + | - | - | + | + | - |
| 20 | ***Cocconies*** | D | 14 | 17 | + | - | + | - | - | + | - |
| 21 | ***Tribonema*** | G | 10 | 16 | + | + | - | + | - | + | - |

Groups: B – bluegreen algae; D – diatom; F – flagellate: G – green;
Key: + = present; - = absent

**Table 3 :** Pollution index of algal genera accoding to Palmer (1969) from seven ponds of Jalun district.

| S.No. | Genus | Pollution index | Ponds | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1 | ***Chlamydomonas*** | 4 | 0 | 4 | 4 | 0 | 0 | 4 | 0 |
| 2 | ***Scanedesmus*** | 4 | 4 | 0 | 0 | 4 | 0 | 4 | 0 |
| 3 | ***Chlorella*** | 3 | 3 | 3 | 0 | 3 | 3 | 0 | 3 |
| | **CYANOPHYCEAE (23%)** | | | | | | | | |
| 4 | ***Oscillatoria*** | 5 | 5 | 5 | 5 | 0 | 5 | 0 | 0 |
| 5 | ***Phormidium*** | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 |
| 6 | ***Anacystis*** | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| | **EUGLENOPHYCEAE (08%)** | | | | | | | | |
| 7 | ***Euglena*** | 5 | 5 | 5 | 5 | 5 | 0 | 5 | 0 |
| | **BACILLARIOPHYCEAE (46%)** | | | | | | | | |
| 8 | ***Nitzia*** | 3 | 3 | 0 | 3 | 0 | 3 | 3 | 0 |
| 9 | ***Navicula*** | 3 | 3 | 0 | 3 | 3 | 3 | | 0 |
| 10 | ***Synendra*** | 2 | 2 | 0 | 2 | 0 | 2 | 2 | 0 |
| 11 | ***Melosira*** | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 |
| 12 | ***Gomphonema*** | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 |
| 13 | ***Cyclotella*** | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 |
| | ***TOTAL SCORE*** | | 29 | 21 | 23 | 16 | 18 | 19 | 6 |

## Discussion

Thirteen pollution tolerant algae were recorded in seven ponds during this period of the study. Occurrence of *Euglena* and *Oscillatoria* was found to be the most active participant which may be considered to be good indicator of highly pollution tolerant algae, reliable indicator of eutrophication (Patrick, 1965). The genera like *Euglena, Scenedesmus, Chlamydomonas, Chlorella, Phormidium, Nitzia, Occilotoria, Synendra, Gomphonema, Cylotella, Anabaena* were recorded and were found to be considered indicator of organic pollution in view of result of Palmer Pollution Index (Palmer, 1969). It has been observed that the presence of all algal genus pollution was found in pond 1, 2 and 3 showed that high organic pollution as recorded in various water bodies also (Begum *et al*., 2007; Roy, 2015; Ferdoushi, 2019; Mahadev *et al*., 2019). Similarly ponds 4, 5 and 6 showed evidence of high organic pollution supported by various worker (Bhuiyan and Khondker, 2017; Khan *et al*., 2019). Yusuf (2020) reported that the presence of organic pollution indicated *Clostridium, Navicula, Nitzia, Synendra, Chlamydomonas, Anacystis i*s a warning sign of the degenerating condition of water quality in Nasarwar reservoir and also found the contribution of each class of phytoplankton in term of composition was in order Bacillariophyceae > Chlorophyceae > Cyanophyceae > Euglenophyceae. The similar trends also found in the present study except Chlorophyceae and cyanophyceae showed similar contribution.

The present study has been made to determine the pollution status of different ponds which will be indicative of the pollutants entering the ponds. Such studies are recommended so that the pollution control measure can be adopted.

## Conclusion

The ponds are very useful and important ecosystem which harbour a vast majority of regional biodiversity which is declining due to anthropogenic drivers and climate change. There is urgent need of scientist and social workers to find out the measures to protect and conserve the ponds as they are economically important for human societies. Some of the suggested measure for pond conservation are educate the public regarding the services they provided to mankind for free of cost, cheque the nutrient and sewage input, Phytoremediation of nutrient and heavy metals, protect against the invasive vegetation and continuous monitoring of ponds.

## References


Begum, M.; Hossain, M.Y.; Wahab, M.A.; Ahmed, Z.F.; Alam, M.J. and Shah (2007). Effects of Iso-nutrient fertilization on plankton production in Earthen Ponds of Bangladesh. *Pakistan Journal of Biological Sciences,* 1221-1228.

Bhuiyan, M.A.H. and Khondker, M. (2017). Seasonal variation of water quality of Dharma Sagar of Comilia City. *Bangladesh J. Bot.* 46(3): 971-978.

Cereghino, R.; Boix, D.; Cauchie, H.M.; Martens, K. and Oertli, B. (2014). The ecological role of ponds in a changing world, *Hydrobiologia*, 723: 1-6.

Chellappa, N.T.; Camara, F.R.A. and Rocha, O. (2009). Phytoplankton community: indicator of water quality in the Armando Ribeiro Goncalaves Reservoir and Pataxo Channel, Rio Grande do Norte, Brazil, *Brazilian Journal of Biology–Revista Brasileira de biologia*, 69(2): 241-251.

Dowing, J.A. (2010). Emerging global role of small lakes and pond: little things mean a lot, *Limnetica*, 29: 9-24.

Dowing, J.A.; Praire, Y.T.; Cole, J.J.; Dwarte, C.M.; Tranvik, L.J.; Striege, R.G.; MC Dowell, W.M.; Kortlainen, P.; Caraco, N.F.; Melack, J.M. and Middleburg, J.J. (2006). The global abundance and size distribution of lakes, ponds and impoundments, *Limnology and Ocenography,* 51: 2388-2397.

Ferdoushi, Z.; Hossain, F.; Naher, M.J.; Hassan, O. and Arafat, Y. (2019). Limnmlogical study of Shuksagar Lake in Dinajpur District. *Bangladesh J. Fish*, 31(1): 101-109.

Khan, N.S. and Islam, S. (2019). State the Organic Pollution Level in Rain Fed Ponds, Noakhali, Bangladesh. *International Journal of Fisheries and Aquatic Studies,* 7(5): 438-441.

Mahadev, J.; Sugeetha, G.; Pankaja, N.S. and Shivkumar, K.V. (2019). Algal as indicator of water quality in fresh warer bodies of Mysore, Karnataka, India. *International Journal of Current Microbiology and Applied Sciences,* 8: 2319- 7706.

Palmer, C.M. (1969). Composite rating of algae tolerating organic pollution, *Journal of Phycology,* 5(1): 78-82.

Patrick, R. (1965). Algae as indicator of pollution: a biological problem in water pollution. 3rd seminar 1962. Rbot. A. Taft. Sanitary Engineering Center, *Publ. Hlth. Serv. Publs. Wash*., 223-232.

Prescoot, G.W. (1951). Algae of the Western great lakes area, Granbook. *Inst. Sci. Bull*., 31: 946.

Randhawa, M.S. (1959). Zygnemaceae. Indian Council of Agriculture Research, New Delhi. 1-478.

Roy, K.; Gupta, S. and Pandey, S.K. (2015). Checklist of commonly Available Phytoplankton and Zooplankton Genera og Urban and Rural Ponds of Rajpur, Chhattisgarh, India. *World Journal of Zoology,* 10(4): 351-357.

Sarode, P.T. and Kamat, N.D. (1984). Freshwater diatoms of Maharashtra, SaiKrupa Prakashan, Aurangabad.

Smith, G.M. (1950). The fresh water algae of United States. McGraw-Hill, London. 719.

Takamura, N. (2012). Status of biodiversity loss in lakes and ponds in Japan. In S. Nakano, T. Yahara & T. Nakahizerka (Eds.). The biodiversity observation network in the Asia-Pacific region: Towards future development and monitoring Tokyo: *Springer*, Pp. 133-148.

Wetzel, R.G. (2001). Limnology Lake and river ecosystems. 3rd ed. San Diego, CA: Academic Press.

Yusuf, Z.H. (2020). Phytoplankton as bioindicators of water quality in Nasarawa reservoir, Katsina State Nigeria. *Acta Limnologica Brasiliensia*, vol, 32: ISSN 2179-975X.