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Effect of Brick Kiln Industries on the Community Composition of Plankton in the Lentic Systems of Cachar District in Assam, Northeast India

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Abstract: Plankton composition and abundance in aquatic systems is determined and regulated naturally by the prevailing environmental conditions, and are expected to be at equilibrium. However, human induced environmental factors such as land use change putatively disturb such equilibrium leading to change in the composition, abundance and dominance patterns. Therefore, it is important to study how planktonic communities are affected by the change in the aquatic environmental parameters. In the present study, we studied the community composition of plankton in the aquatic bodies formed in agricultural lands as a result of excavation of soil for brick making. We also characterized the aquatic environment through analysis of water properties of selected aquatic bodies. We recorded a total of 48 genera of phytoplankton and 27 genera of zooplankton communities. Amongst phytoplankton, Bacillariophyceae was the most dominant class with 20 numbers of genera, followed by Chlorophyceae (11) and Cyanophyceae (10). Amongst zooplankton, Cladocera was the most dominant group representing 11 genera, followed by Rotifera (6) and Protozoa (5). The present study showed that water properties of the aquatic bodies near brick kiln industry are characterized by typical conditions such as shallow systems with increased water temperature accompanied by lower pH, and available form of nutrients like NO_3-N and PO_4-P that plausibly lead to dominance of few planktonic organisms. The CCA result confirms that plankton communities respond differentially to the aquatic parameters indicating their adaptive capacity to persist in an altered environmental condition. We conclude that the human-induced degraded land modulates the water quality which in turn regulates the community composition and diversity of plankton.
Keywords: Lentic system, anthropogenic factor, water properties

I. INTRODUCTION

Phytoplankton communities are important in environmental impact studies because of their extreme sensitivity to changed conditions (Ingole *et al.* 2010, Zębek 2004). Phytoplankton play an important role in the biosynthesis of organic matter in aquatic body, which directly or indirectly serve all the organisms of a water body as food (Anjana *et al.* 1998). Moreover, number and species composition of phytoplankton serves to determine the quality of a water body (Bahura 1991). Likewise, zooplankton are microscopic, free floating organisms, occupying a middle position between the autotrophs and other heterotrophs in aquatic ecosystems (Ghosh and Biswas 2015). They are used as bioindicators in biomonitoring studies (Sladecek 1983) and have significant potential for assessing aquatic ecosystem health (Wu. Xia *et al*. 2014).

In nature, the composition and abundance of planktonic communities are mainly regulated through environmental variations in the aquatic systems (Okogwu 2010, Quiroga *et al.* 2013). They are expected to be in equilibrium with the environmental conditions (Petersen 1975, Soares *et al*. 2009). However, anthropogenic disturbances leading to degradation of natural habitats and change in land use have profound impacts on planktonic composition and abundance (Schindler 2001, Buzancic *et al*. 2016).

Brick kiln industries play a major role in unorganized sector of the economy in India, and are restricted mostly to rural and semi-urban areas. These industries profoundly affect the surrounding environment by conversion of wetlands and agricultural lands into degraded wasteland. Several studies have been undertaken on the ecological and environmental impacts of brick industry on soil quality, crop and fruit production, vegetation composition, air pollution, and human health (Naqvi 2004; Vives *et al.* 2007; World Bank 2007; Avitia 2012; Saha and Hosain 2016. However, their impact on the aquatic bodies, particularly the plankton communities have been less studied. Therefore, the present study was undertaken to study the planktonic composition in aquatic bodies near brick kiln industries, and to understand the species response to various water parameters.

We expected that owing to change in water properties, there would be a few typical planktonic organisms that can dominate under that habitat condition.

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II. METHODOLOGY

A. Study Area

The present study was conducted in brick kiln industry located in the Cachar district of Barak Valley, Assam (Fig. 1). For the present study we selected two sampling stations located within a geographical extent of 60 km^2, which were situated nearby brick kiln industry.

B. Water sampling And Analysis

Sampling of water was done at monthly interval from December 2013 to November 2014 from the selected stations. Air and water temperatures were measured in situ with the help of a mercury bulb thermometer (0-100°C). Samples for dissolved oxygen (DO) were collected directly in BOD bottles and were fixed in the field using alkaline iodide and manganous sulphate. For analyzing other chemical parameters, water samples were taken in PVC bottles and were brought to laboratory. pH and conductivity of the water samples were recorded using pH meter (make: Systronics; model: 103621) and conductivity meter (make: Systronics; model: 308 respectively. Other parameters like dissolved oxygen (DO), biological oxygen demand (BOD), free carbon dioxide (CO_2), nitrate-N (NO_3-N), and phosphate-P (PO_4-P) were estimated following Trivedy and Goel (1984) and APHA (2012).

C. Qualitative and Quantitative Analyses of Plankton

Sampling of plankton samples were done at monthly interval from December 2013 to November 2014 from the selected stations. For this 30 litres of water sample were collected from different areas of each sampling stations and passed through fine mesh (40 µm) plankton net. The water samples after passing through the plankton net were collected and preserved in glass vials using 2ml formalin (4%) which were later on brought to the laboratory. In the laboratory, further concentration of the plankton samples were done by centrifugation at 2000 rpm for 10 minutes which resulted in the settling down of the plankton samples at the bottom of the centrifuge tube. These samples were collected in a separate vial after decanting the supernatant from the centrifuge tube. The volume of the concentrated plankton sample was adjusted to 10 ml by adding distilled water. This was followed by standardization of the plankton sample by finding out the volume of one drop of the concentrated plankton sample. Identification of phytoplankton and zooplankton was done by taking one drop of the concentrated plankton sample on a glass slide and looking through binocular microscope (make: Magnus; model: MLX-i Plus). Likewise a total of 10 drops were considered for the qualitative and quantitative estimations of the phytoplankton and zooplankton taxa from each sampling station after every sample collections. Microscopic identification of phytoplankton and zooplankton was done at 10X and 40X magnifications and were identified up to the genera level.

Identification of phytoplankton was performed using standard keys and monographs of Needham & Needham (1972), Tumer (1978), Biswas and Kalipoda (1980), Pentecost (1984), Anand (1989 and 1998), Edmonson (1992); Tripathi and Pandey (1995), Desikachary (1959) Prasad and Singh (1996), Dutta (2007). Identification of zooplankton was performed using standard keys and monographs of Ward and Whipple (1959), Needham & Needham (1972), Tonapi (1980), Battish (1992), Edmonson (1992), Shiel (1995) and Dutta (2011).

Quantification of the plankton sample was done using Lackey's drop method (Lackey, 1938). The number of phytoplankton and zooplankton present in a litre of water sample has been determined by the using the following formula:

Number of individuals of phytoplankton/zooplankton per litre = $\frac{N1 X V1}{N2 X V2}$

Where,

N_1=Number of phytoplankton/zooplankton per drop

V_1=Volume of concentrated sample (ml)

N_2=Volume of one drop of the sample (ml)

V_2=Volume of the original sample collected (L)

D. Statistical Analysis

Univariate and multivariate statistical analyses were done using PAST software (ver. 3.14) (Hammer *et al*. 2011). Principle Component analysis (PCA) for water parameter was done using SPSS software version 20. Canonical Correspondence Analysis (CCA) was done to determine the relationship between plankton communities and the existing water parameter using CANOCO software (version 4.5, Trial version) (Ter Braak 2002).

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III. RESULTS

Table 1 shows the water quality parameter of the aquatic bodies near the brick kiln area. It shows that the aquatic bodies are shallow systems with low water pH and high water temperature. Principal component analyses (PCA) of water properties in aquatic bodies near the brick kiln area rendered five significant PCs with Eigen Values greater than 1 that explained 80% of the total variance of the dataset in the aquatic bodies near the brick kiln area (Table 3). PC1 contributed 24.94% of the total variance and showed high positive loadings for pH, total alkalinity (TA) and total hardness (TH) and negative loading for Phosphate-P (PO_4-P). PC2 explained 16.12% of the total variance with high positive loadings for water temperature (WT) and water depth (WD). PC3 explained 14.66% of the total variance with high positive loadings for biological oxygen demand (BOD) and free carbon dioxide (CO_2). PC4 explained 13.39% of the total variance with high negative loading for nitrate-N (NO_3-N). PC5 explained 10.95% of the total variance with high positive loading for electrical conductivity (EC).

In the present study, we enumerated a total of 48 genera of phytoplankton belonging to seven different classes and 27 genera of zooplankton belonging to five different groups (Table 2). Amongst phytoplankton communities, generic richness of Bacillariophyceae was the highest (20) followed by Chlorophyceae (11) and Cyanophyceae (10) (Table 2). Amongst zooplankton, generic richness of Cladocera was the highest (11), followed by Rotifera (6) and Protozoa (5) (Table 2).Class representation of phytoplankton communities in aquatic bodies near the brick kiln area (Fig. 2A) shows that the dominant phytoplankton class is Bacillariophyceae followed by Chlorophyceae and Cyanophyceae. Group representation of zooplankton communities in aquatic bodies near the brick kiln area (Fig. 2B) shows that the dominant zooplankton group is Cladocera followed by Rotifera and Protozoa.

When CCA ordination plotting was done for phytoplankton class the result revealed that Chlorophyceae and Dinophyceae were more associated with WD, CO_2 and PO4-P. Cyanophyceae was associated with TA and Zygnematophyceae with water pH while, Chrysophyceae was more associated with NO_3-N. Bacillariophyceae and Euglenophyceae were slightly affected by WT (Fig. 3A). Again, CCA for zooplankton group revealed that Rotifera and Cladocera were associated with PO_4-P whereas Copepod was associated with WT, EC and WD. Protozoa is slightly associated with BOD and CO_2. Ostracoda is associated with DO, TH, TA, pH and NO_3-N (Fig. 3B).

IV. DISCUSSION

The study showed that the habitat of the planktonic communities in the aquatic bodies near the brick kiln industry is mainly characterized by variations in pH, TA, TH, PO_4-P, WT, WD, BOD, CO_2, NO_3-N and EC in the aquatic bodies. These parameters collectively contribute to 80% of the variance in the data set (Tables 1 and 3).

Greater generic richness of Bacillariophyceae followed by Chlorophyceae and Cyanophyceae amongst the phytoplankton class (Table 2) indicates the existence of favorable environmental condition for these genera of phytoplankton in water bodies near brick kiln area. It may be mentioned here that high water temperature favour growth of diatoms (Bacillariophyceae) (Karsten *et al.* 2006). Besides, most of the species under Bacillariophyceae have the ability to multiply by cell division and increase in number, (Veronica *et al*. 2014). Total hardness in the form of calcium carbonates/bicarbonates also promotes the growth of Bacillariophyceae (Pattrick 1977). Lower genera of phytoplankton under Chlorophyceae was perhaps due to less availability of nutrients (Mustapha 2009) indicating poor habitat conditions for this class in aquatic bodies near brick kiln industries. Our analyses of the data on water properties and community composition of phytoplankton in aquatic bodies near brick kiln industries through the CCA ordination plots (Fig. 3A) revealed that in aquatic bodies near brick kiln industries the dominance of Bacillariophyceae (Fig. 2A) is not much significantly related with the analyzed water properties which indicates that it might be related with some other parameter of water like silica content of the aquatic bodies for its dominant status, because most of the diatoms required silicon for cell wall formation (Hildebrand *et al*.1998, 2000) (Fig. 3A). Chlorophyceae (Fig. 2A) was more affected by WD, CO_2, and PO_4-P (Fig. 3A). Cyanophyceae (Fig. 2A) was affected by TA and water pH (Fig. 3A).

Similarly greater generic richness of cladocerans followed by rotifers and protozoans indicates the capacity of these genera of zooplankton to tolerate harsh environmental condition in water bodies near the brick kiln industries. The dominance of cladocerans in such water bodies indicates sufficient food availability in that habitat condition as they feed on algae and also on some small sized rotifers and copepod nauplii (Dodson *et al.* 2009). They compete with the rotifers for similar type of food resources and thus large cladocerans limits the growth of rotifers and so competitively they become the most dominant (Herzig 1987, Gilbert 1988) even in aquatic bodies near brick kiln industries. Dominance of Cladocera in the selected water bodies (Fig. 2B) indicates the presence of both the organic and inorganic matters together with phytoplankton and bacteria which all together constituted the food for the cladocerans (Wetzel 2001). Rotifera, the second dominant group of zooplankton indicate the presence of nutrients loading

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(Mulani *et al.* 2009; Ezz *et al*. 2014) in the form of organic matters within the system. This might also be attributed to the direct flow due to different anthropogenic activities in the riparian area of the aquatic bodies like grazing by cattle, sometimes fishing, washing utensils and cloths, and taking bath by the labors working in the brick kiln industries (Personal observation). Abundance of Protozoa, the third dominant zooplankton group, indicates greater decomposition of organic matters in such aquatic bodies which facilitates greater accumulation of bacterial population upon which the protozoans feed.
Analyses of the data on water properties and community composition of zooplankton through the CCA ordination plot (Fig. 3B) revealed that in aquatic bodies near brick kiln industries the dominance of Cladocera and Rotifera (Fig. 2B) was related with available phosphorous (Fig. 3B). On the other hand, the dominance of Protozoa (Fig. 2B) was related with high BOD and CO_2 in aquatic bodies near brick kiln industries (Fig. 3B).

V. CONCLUSION

The study showed that environmental variables play an important role in influencing the plankton community in any aquatic bodies. The plankton communities respond to particular water parameter depending on their capability to cope with the existing environmental condition under that habitat condition. The present study also showed that the water properties in aquatic bodies near brick kiln industry are characterized by certain typical conditions particularly due to its surrounding land use type which facilitated few planktonic organisms to dominate under that habitat condition.

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REFERENCES

[1] Anand, N. 1989). Handbook of blue-green algae (of rice fields of South India). Bishen Singh Mahendra Pal Singh.
[2] Anand, N. (1998). Indian freshwater microalgae. Bishen Singh Mahendra Pal Singh.
[3] Anjana S, Gujarathi S, Kanhere, R. R.(1998). Seasonal dynamics of phytoplankton population in relation to abiotic factors of a fresh water pond at Barwani (M.P). Poll Res 17:133-136.
[4] Avitia, A. Y. C., & De la Mora Covarrubias, A. (2012). Environmental assessment of brick kilns in Chihuahua State, Mexico, using digital cartography. In The Functioning of Ecosystems.pp.271-282.
[5] APHA: (2012). Standard Methods for examination of water and wastewater. 22nd Edn., APHA, AWWA, WPCF, Washington DC, USA.
[6] Bahura, C.K.(1991). Diurnal Cycle of Certain Abiotic Parameters of a Fresh Water Lake the Ganjer lake (Bikaner) in the Thar desert of India , J. Aqua Biol. 16 (12):45-48.
[7] Battish. S.k. (1992). Fresh water zooplanktons of India. Mohan Primlaini, New Delhi.
[8] Biswas and Kalipoda (1980).Common fresh and brackish water algal flora of India and Burma. International Book Distributers, Dehradun. 105pp .
[9] Buzancic, M., Gladan, Ž. N., Marasović, I., Kušpilić, G., & Grbec, B. (2016). Eutrophication influence on phytoplankton community composition in three bays on the eastern Adriatic coast. Oceanologia, 58(4), 302-316.
[10] de Vives, A. E. S., Moreira, S., Brienza, S. M. B., Medeiros, J. G. S., Tomazello Filho, M., Zucchi, O. L. A. D., ... & Barroso, R. C. (2007). Species arboreal as a bioindicator of the environmental pollution: Analysis by SR-TXRF. Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment, 579(1), 494-498.
[11] Desikachary, T.V.(1959). Cyanophyta. Indian council of Agricultural Research, New Delhi, 686 pp.
[12] Dodson, S. L., Cáceres, C. E., & Rogers, D. C. (2009). Cladocera and other Branchiopoda. In Ecology and Classification of North American Freshwater Invertebrates (Third Edition) (pp. 773-827).
[13] Dutta, N. K. (2007).Phytoplankton: A Practical Approach. Kasturi publication,Guwahati.503pp.
[14] Dutta Naren Kr. (2011). Zooplankton EBH publishers (India) 1-586 pp.
[15] Edmondson, W.T (1992). Fresh water Biology (Ward & Whipple). International Books & Periodicals Supply Service, 2nd ed
[16] Ezz, S. M. A., Aziz, N. E. A., Zaid, M. M. A., El Raey, M., & Abo-Taleb, H. A. (2014). Environmental assessment of El-Mex Bay, Southeastern Mediterranean by using Rotifera as a plankton bio-indicator. The Egyptian Journal of Aquatic Research, 40(1), 43-57.
[17] Ghosh, D., & Biswas, J. K. (2015). Macroinvertebrate diversity indices : A quantitative bioassessment of ecological health status of an oxbow lake in Eastern India, 3(2), 78–90.
[18] Gilbert, J. J. (1988). Suppression of rotifer populations by Daphnia: a review of the evidence, the mechanisms, and the effects on zooplankton community structure. Limnology and Oceanography, 33(6), 1286-1303.
[19] Hammer, Ø. (2011). Past: Paleontological Statistics, version 3.14: Reference Manual. Natural History Museum, University of Oslo, Norway, 220p.
[20] Herzig, A. (1987). The analysis of planktonic rotifer populations: A plea for long-term investigations. Hydrobiologia, 147(1), 163-180.
[21] Hildebrand, M., Dahlin, K., & Volcani, B. E. (1998). Characterization of a silicon transporter gene family in Cylindrotheca fusiformis: sequences, expression analysis, and identification of homologs in other diatoms. Molecular and General Genetics MGG, 260(5), 480-486.
[22] Hildebrand, M. (2000). Silicic acid transport and its control during cell wall silicification in diatoms. Biomineralization from biology to biotechnology and medical application, 171-188.

©IJRASET (UGC Approved Journal): All Rights are Reserved

[23] Ingole, S. B., Naik, S. R., Kadam, G. (2010). Study of phytoplankton of freshwater reservoir at majalgaon on sindphana river district beed (M.S). International Res J 1(13):87-88.
[24] Karsten, U., Schumann, R., Rothe, S., Jung, I., & Medlin, L. (2006). Temperature and light requirements for growth of two diatom species (Bacillariophyceae) isolated from an Arctic macroalga. Polar Biology, 29(6), 476-486.
[25] Lackey, J. B. (1938).The flora and fauna of surface waters polluted bv acid mine drainage. Publ. Health Rep. 53: 1499-1507.
[26] Mulani, S. K., Mule, M. B., & Patil, S. U. (2009). Studies on water quality and zooplankton community of the Panchganga river in Kolhapur city.
[27] Mustapha, M.K. (2009). Phytoplankton assemblage of a small, shallow tropical African resevior, Department of Zoology, University of Ilorin, Ilorin.Rev. Biol. Trap. 57 (4): 1009-1025.
[28] Naqvi, S.A.M.H.,(2004). Diseases of fruits and vegetables, Dordrecht: Kluwer Academic Publishers) 1, 575–579.
[29] Needham, James G., and Needham, Paul R. (1972). A Guide to the Study of Freshwater Biology. 5th Edition. Holden-Day Inc. San Francisco, Callifornia. 108pp.
[30] Okogwu, O. (2010). Seasonal variations of species composition and abundance of zooplankton in Ehoma Lake, a floodplain lake in Nigeria. Revista de biología tropical, 58(1), 171-182.
[31] Patrick, R. (1977). Ecology of freshwater diatoms and diatom communities. The biology of diatoms, 13, 284-332.
[32] Pentecost, A. (1984). Introduction to Freshwater Algae. Richmond Publishing Corporation, England. 247 pp
[33] Petersen, R. (1975). The paradox of the plankton: an equilibrium hypothesis. The American Naturalist, 109 (965), 35-49.
[34] Prasad, Braj Nandan and Singh, Yashpal (1996). Algal Indicators of Water Pollution. Bishen Singh Mahaendra Pal Singh, Dehra Dun, India. 440pp .
[35] Quiroga, M. V., Unrein, F., González Garraza, G., Küppers, G., Lombardo, R., Marinone, M. C., ... & Mataloni, G. (2013). The plankton communities from peat bog pools: structure, temporal variation and environmental factors. Journal of Plankton Research, 35(6), 1234-1253.
[36] Saha, C. K., & Hosain, J. (2016). Impact of brick kilning industry in peri-urban Bangladesh. International Journal of Environmental Studies, 73(4), 491-501.
[37] Schindler, D. W. (2001). The cumulative effects of climate warming and other human stresses on Canadian freshwaters in the new millennium. Canadian Journal of Fisheries and Aquatic Sciences, 58(1), 18-29.
[38] Sladecek, V. (1983). Rotifers as indicators of water quality. Hydrobologia, 100: 169 – 201.
[39] Shiel, R. J. (1995). A guide to identification of rotifers, cladocerans and copepods from Australian inland waters (No. 3). Canberra: Co-operative Research Centre for Freshwater Ecology.
[40] Soares, M. C. S., Vidal, L. O., Roland, F., & Huszar, V. L. (2009). Cyanobacterial equilibrium phases in a small tropical impoundment. Journal of Plankton Research, 31(11), 1331-1338.
[41] Ter Braak, C. J., & Smilauer, P. (2002). CANOCO reference manual and CanoDraw for Windows user's guide: software for canonical community ordination (version 4.5).
[42] Tonapi, G.T.(1980). Freshwater animals of India. Oxford and IBH Publishing Co. New Delhi.110001.
[43] Tripathi,A.K and Pandey, S.N. (1995). Water pollution. Ashish Publishing House, New Delhi. 326 pp.
[44] Trivedy R.K. and Goel P.K. (1984): In: Chemical and biological methods for water pollution studies. Published by Environmental Publication, Karad, Maharashtra (India)
[45] Tumer,W.B (1978).The freshwater algae (Prinpipally Desmidiceae)of East India. M/S Bishen,Mahenra Palsingh 23-A,New Connaught place Dehradun.
[46] Veronica,Evi., Amin, Setyo. Leksono.,Soemarno., Diana, Arfiati. (2014). Effect Of Water Quality On Phytoplankton Abundance In Hampalam River And Fish Pond Of Batanjung Village.IOSR Journal Of Environmental Science, Toxicology And Food Technology.8(1)15-21.
[47] Ward, H.B. & Whipple, G.C. (1959). Freshwater Biology. (2nd edition). Jhon Willey and Sons. Inc. New York, London.1248pp.
[48] Wetzel, R. G. (1969). Excretion of dissolved organic compounds by aquatic macrophytes. Bioscience 19:539-540.
[49] World Bank, (2007).Small study on air quality of impacts of the North Dhaka brickfield cluster by modeling of emissions and suggestions for mitigation measures including financing models. Consultant report prepare by Bangladesh University of Engineering and Technology for the World Bank, Washington, DC.
[50] Wu, Y., Xia, L., Yu, Z., Shabbir, S., & Kerr, P. G. (2014). In situ bioremediation of surface waters by periphytons. Bioresource technology, 151, 367-372.
[51] Zębek, E. (2004). Species biodiversity of net phytoplankton as an indicator of trophic changes in the urban lake Jeziorak Mały.Teka Kom Ochr Kszt Środ Przyr 1:316-321

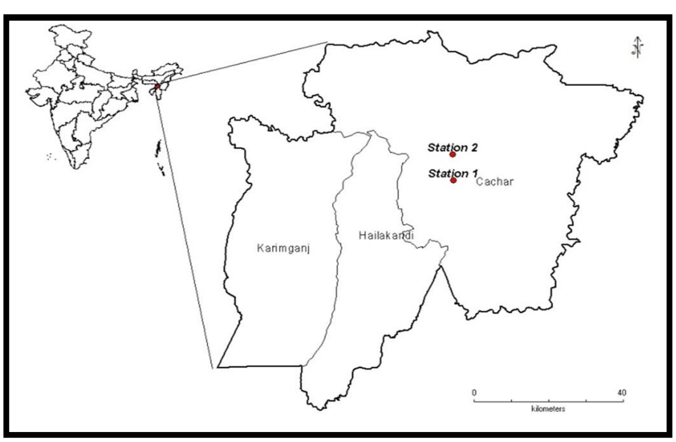

Fig. 1 Map of the study area and sampling stations

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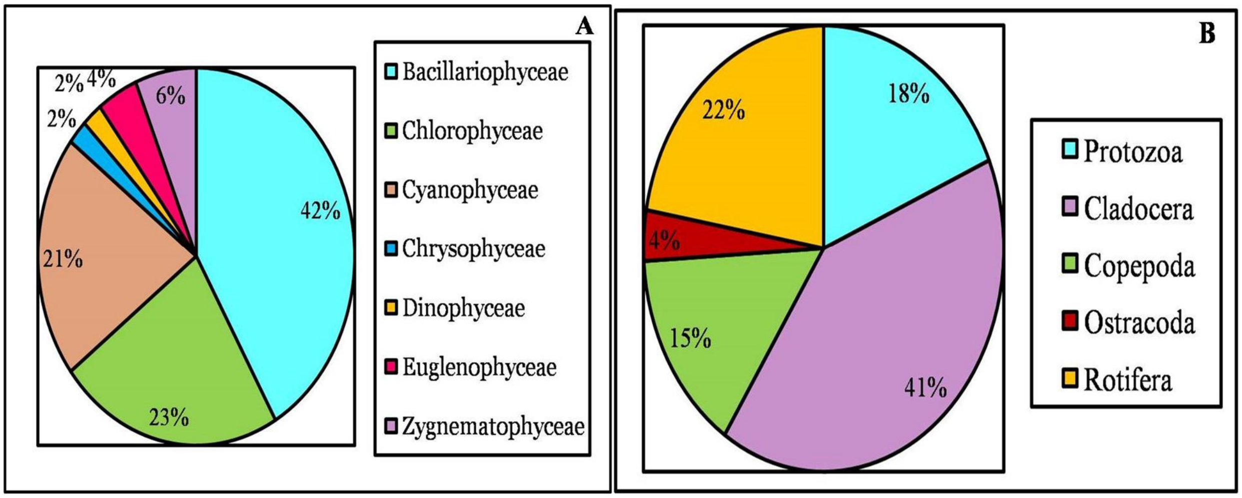

Fig. 2 Class representation of phytoplankton communities (A) and group representation of zooplankton communities (B) in aquatic bodies near the brick kiln area

Table 1. Physico-chemical properties of water in aquatic bodies near the brick kiln area

Parameter	Mean ± SD	Range	
		Minimum	Maximum
Air temperature (°C)	29.07 ±5.13	22.50	38.08
Water temperature (°C)	29.08 ±4.51	22.33	37.67
Sediment Temperature (°C)	27.80±4.99	22.68	34.92
Transparency (m)	Turbid	-	-
Water depth (m)	0.59±0.26	0.32	1.04
pH	5.65±0.66	4.57	6.37
Electrical conductivity (µS)	92.80±48.29	32.13	190.75
Total alkalinity (mgl^{-1})	18.50±9.06	5.00	32.00
Dissolved oxygen (mgl^{-1})	7.09±1.31	4.31	8.99
Biological oxygen demand	3.69±1.70	0.94	4.50
Free carbon dioxide (mgl^{-1})	14.71 ± 9.16	2.66	32.44
Total hardness (mgl^{-1})	61.10±33.38	23.17	106.00
Nitrate-N (mgl^{-1})	2.71±1.95	0.32	6.51
Phosphate –P (mgl^{-1})	0.07±0.06	0.01	0.23

Mean±SD; n=24

Table 2. List of plankton found in aquatic bodies near the brick kiln area

Phytoplankton (Total genera=48)	Class	Genera
	Bacillariophyceae	Achnanthes spp., Amphora spp., Aulacoseira sp. Cyclotella spp., Cymbella sp., Diatoma spp., Enotia spp., Epithemia spp, Fragilaria sp., Frustulia spp., Gomphonema spp., Gyrosigma sp. Melosira spp., Meridion spp., Navicula spp., Nitzschia spp., Pinnularia spp., Surirella spp, Synedra spp, Tabellaria spp
	Total genera	20
	Chlorophyceae	Ankistrodesmus spp, Chlorella spp., Chlamydomonas sp., Docidium sp., Microspora sp., Oedogonium sp., Oocystis sp., Pediastrum spp., Spirogyra spp. , Staurastrum spp., Tetraedron spp.
	Total genera	11

	Cyanophyceae	Anabaena sp., Anacystis sp., Nostoc sp., Oscilatoria spp., Lyngbya sp., Hydrodictyon sp., Synechococcus sp., Microcystis spp., Merismopedia spp, Spirulina sp., Cryptomonas sp.
	Total genera	10
	Chrysophyceae	Cryptomonas sp.
	Total genera	1
	Dinophyceae	Peridinium sp.
	Total genera	1
	Euglenophyceae	Euglena spp., Trachelomonas spp.
	Total genera	2
	Zygnematophyceae	Pleurotaenium sp., Desmidium spp., Zygnema sp
	Total genera	3
Zooplankton (Total genera=27)	Group	Genera
	Protozoa	Arcella sp., Difflugia spp., Centropyxis spp., Trinema spp., Euglypha sp.
	Total genera	5
	Cladocera	Alona sp., Alonella sp., Bosmina spp., Diaphanosoma sp. , Ceriodaphnia sp., Simocephalous sp., Nauplius larva, Macrothrix sp., Chydorus spp., Diaptomus spp., Moina sp.
	Total genera	11
	Copepoda	Cyclops spp., Copepod nauplii, Calanus sp., Bryocamptus sp.
	Total genera	4
	Ostracoda	Cypris sp.
	Total genera	1
	Rotifera	Lacane spp., Monostyla sp., Asplanchna spp., Brachionus spp., Plationus sp., Filinia sp.
	Total genera	6

Table 3. Principal component analyses showing rotated component matrix for physico-chemical properties of waterIn aquatic bodies near the brick kiln area

Rotated component matrix		PC1	PC2	PC3	PC4	PC5
Loading score	Water temperature	0.05	0.84	0.13	0.37	0.15
	Water depth	-0.03	0.84	0.03	-0.09	-0.05
	pH	0.70	-0.28	0.12	-0.14	-0.11
	Electrical conductivity	-0.26	0.10	-0.07	-0.19	0.87
	Total alkalinity	0.78	0.28	0.15	-0.09	-0.12
	Dissolved oxygen	0.62	-0.12	0.00	0.36	0.55
	Biological oxygen demand	0.03	0.21	0.92	-0.09	-0.10
	Free carbon dioxide	0.05	-0.11	0.82	0.46	0.04
	Total hardness	0.79	0.24	-0.05	0.18	-0.24
	Nitrate-N	0.18	-0.15	-0.13	-0.91	0.14
	Phosphate-P	-0.76	0.18	0.10	0.23	-0.10
Eigen value		2.74	1.77	1.61	1.47	1.20
% of Variance		24.94	16.12	14.66	13.39	10.95
Cumulative %		24.94	41.05	55.71	69.10	80.06

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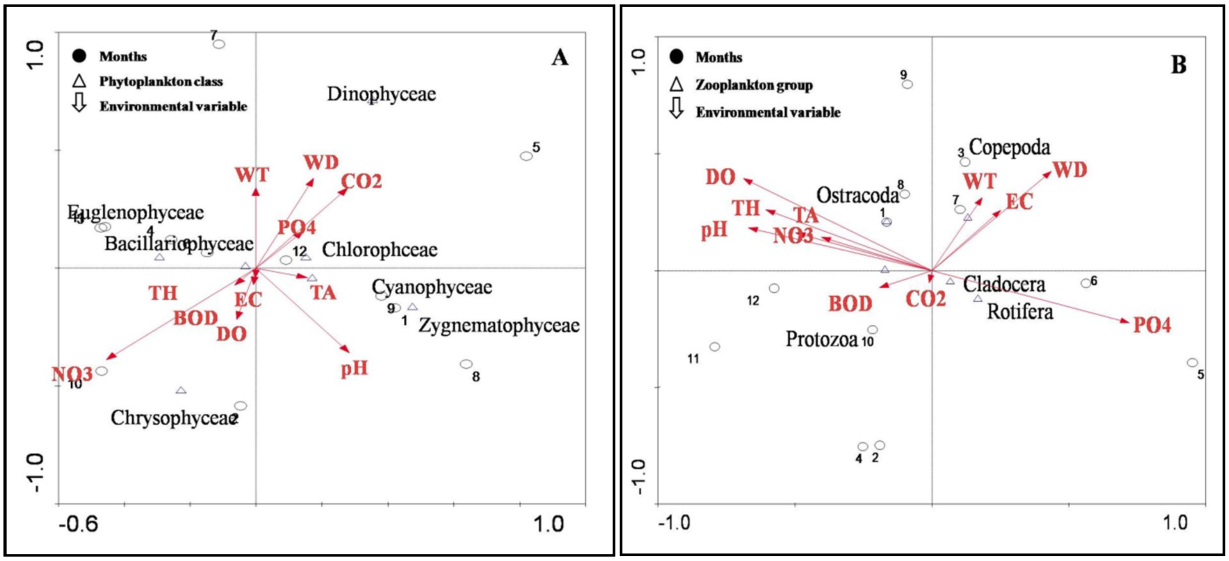
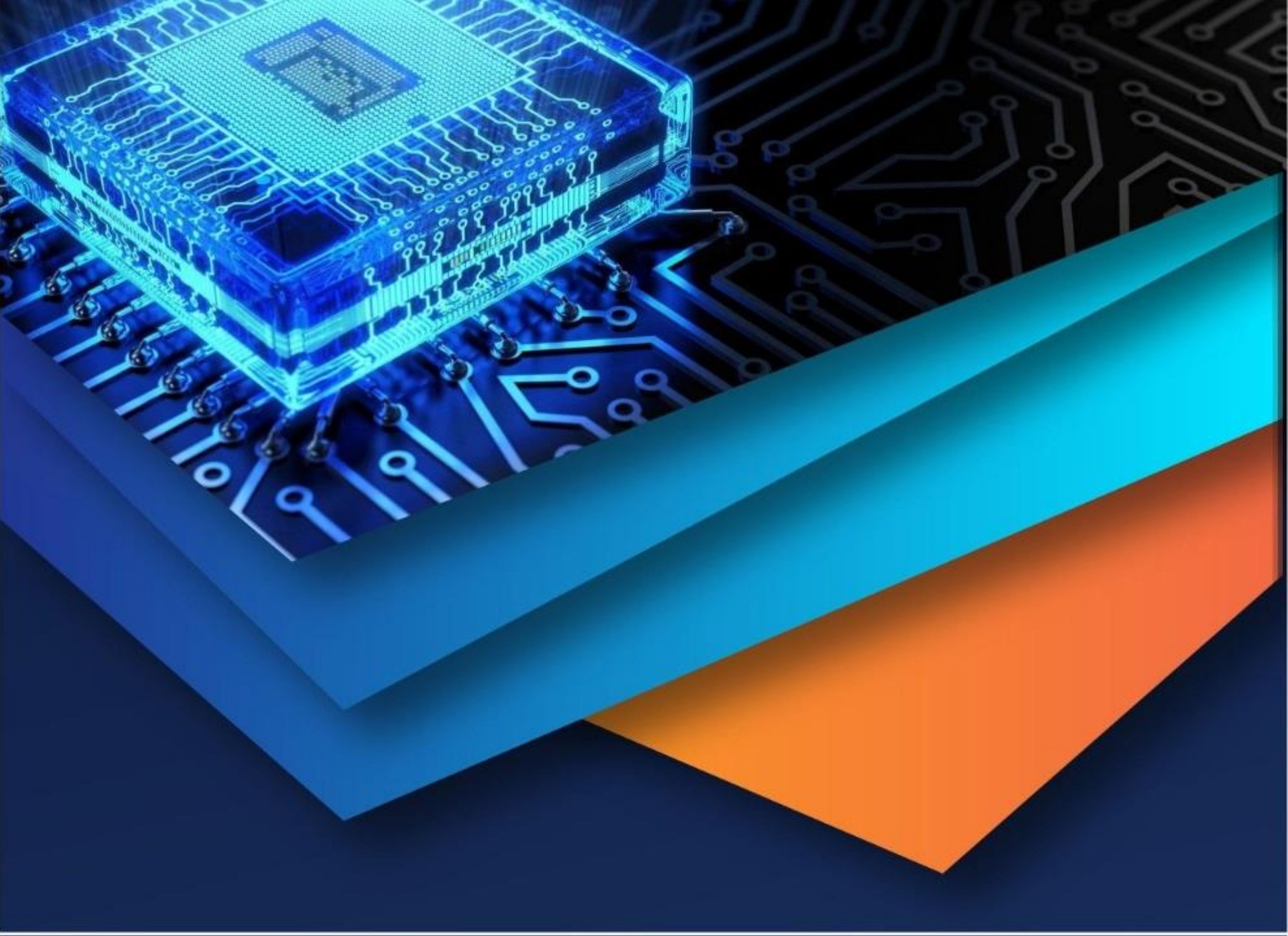


Fig. 3 Canonical correspondence analysis (CCA) based on environmental variables with phytoplankton (A) and zooplankton (B) communities in aquatic bodies near the brick kiln area.

WT- Water temperature; WD-Water depth; EC-Electrical conductivity; DO- Dissolved oxygen; BOD- Biological oxygen demand; TA-Total alkalinity; TH-Total hardness; CO_2-Free carbon dioxide; NO_3-N-Available nitrogen; PO_4-Available phosphorous



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