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Diversity of Algae Across the Renuka River of Sonbhadra District

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Abstract **- Sonbhadra district is the southern east part of Uttar Pradesh state of India. It contains various river and mountain ranges and prehistoric evidences. Most of the works have been done for higher plants and mineral study. In present work we were concern about the diversity of algae in Son and Renuka rivers as it flows and contain various types of pollutants and ashes. The major affect of water pollution is directly lead to diversity of algae and they cause water bloom. More nutrients lead to eutrophication that result into algal bloom formation. Algae are good indicators for water pollution. However, the study was resulted 14 algal species belongs to class Chlorophyceae, Cyanophyceae and Bacillariophyceae. It was found that the study was dominated by chlorophycean and Bacillariophycean member which indicate healthiness of the water. However the water was found fresh but still not potable.**

Key words. Cyanobacteria, diversity, Sonbhadra, River, Pollutants.

INTRODUCTION

Sonebhadra district is located in Uttar Pradesh at the bank of Renu and Sone river (Roy et. Al., 2022). The environment around nicely supports the Thermal and Hydroelectric (Hydel) Power Station. There are thirteen functioning units, all of which are coal-fired thermal power stations. The machinery for the most of the units is from Bharat Heavy Electricals Limited. Apart from the power plants, stone-crushing and transportation are major employment providers (Ahamad et al., 2020). Although power plants and stone crushing factories help in economy and development but on one hand they also give rise to pollution which has great impact on the environment, plants and animals (Raptis et. al., 20216).

Despite so many policies, pollution continues to occur. Here we are studying the effect of water pollution on algal diversity (Singh et. al., 2017). Because algae often grows in polluted water due to eutrophication which is enrichment of nutrient in any body. It is caused by air pollution, but it affects our water bodies too. Abundant nutrient enrichment resulted in an overgrowth of algae i.e. algal bloom (Gilbert 2017). There are many species of algae which form blooms. These are often harmful and contaminate water. Some species, such as the dinoflagellate *Alexandrium catenella* and the diatom *Pseudo-nitzschia australis,* produce potent toxins that are concentrated in fish or shellfish. Toxic effects can also be associated with inhalation of aerosolized toxins, or by swimming in toxin-contaminated water (Seeyave et. al., 2009).
Other species do not produce toxins but cause other harmful effects. For example, certain *Chaetoceros* diatom species have spines with serrated edges, which can lodge in fish gill tissues, causing irritation. Harmful algal bloom produces different toxins which cause effect on aquatic animal as well as people who depend upon it (Begum et. al., 2015). Fresh water species of *Anabaena, Aphanizomenon,* and *Nostoc sp. p*roduces Anatoxins, Saxitoxins which cuase repiratory problem and paralysis in fishes and animal who consume it (Carmichael 2001). Another fresh water species of *Cylindrospermopsis* produces cylindropsermposis and saxitoxin which cause kidney damage to aquatic animal as well as terrestrial which consume it (de costa et. al., 2013). *Lyngbya* sp. Produces Lyngbyatoxin causing dermatitis and gastro-intestinal effect Weirich et. al., 2014). A notorious species of Microcystis produces Microcystin a Hepatotoxin cause damage to kidney and reproductive system on related organisms. In this way we see that pollution causes algal bloom and it releases toxic materials which have harmful effects on the living beings (Mohan et. al., 2023). The presented work is focused on the diversity of algae and its identification.

MATERIAL AND METHOD

Study area and sampling

The study area was chosen at bank of Renuka and Son River from Obra to Chopan palces in Sonbhadra. The coordinates of are 24.42^0N 82.98^0E and 24.52^0 N 83.03^0 E of Obra and Chopan respectively. The collections of algae were done from Obra power plant to chopan at the bank of Renuka and Son River in collecting bottle. Visible samples and water sample were collected from

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various freshwater bodies by dipping sterilized sampling bottle to 0.5-1 ft. The collecting bottle were stored at low temperature in ice bags.

Identification of algae

The algal specimen were washed with water and prepare various slide for identification. No staining strain is used for original colour of algae. The identification was done visually using reference described by various scientists (Bold and Wynne 1978; Santhi et. al., 2013; Minhas et. al., 2023 and Silva 2008).

Slide preparation

Fresh samples from collection sites ware prepared on glass Borosil HNS 6304 slide and observed under the Olympus HNS 9027 binocular microscope. All the apparatus were cleaned before using. The light source were natural sunlight and most of the specimen were observed without staining. Only diatoms were satin with TMMEDIA Safranine staining solution.

RESULT

Description

Fig. 1. Algal image 1. Nostoc sp. 2. Anabaena sp. 3. Phormidium sp. 4. Oscillatoria sp. 5. Aphanothece sp. 6. Synedra sp.

Specimen 1 was collected at Chhath Ghat of obra were effluent of water treatment plant was connected. The specimen collected at surface water from the river. The specimen was found filamentous unbranched algae with uniseriate trichome. Heterocyst was found at apex of trochome mostly. The cells were found rounded or beaded structure. Most of the mucilaginous substances were found around the trichome. On comparative studies it shows resemblance with *Nostoc* species (Rajaniemi et. al., 2005). In specimen 2 Trichome was found uniseriate but devoid of mucilaginous sheath. The cells was found barrel shaped compare to Nostoc sp. Heterocyst were located between the trichome may be found as *Anabaena sp.* (Prasanna et. al., 2006)
Specimen 3 has The trichome was found uniseriate unbranched with conspicuous sheath similar to lyngbya but more like to *Oscillatoria*. The bulish green colour and collection of algae from water indicate its resemblance with *Phormidium* sp. (Stam and Holleman 1979). Specimen 4 were collected from the base of river attached to rock. The trichome was unbranched filamentous without sheath. The bright bulish green colore and floating behaviour identified as *Oscillatoria* sp. (Rani et. al., 2016). Specimen 5 collected from running water. They form mucilaginous mass. On observation cells were found unicellular structure with size 10 µm. Cells were embedded in mucilaginous mass certainly indicate *Aphanothece sp.* (Kant et. al., 2004).
Specimen 6 was found with rocks particles devoid of chlorophyll colour. They are sigmoid shape and eccentric raphe. They are solitary scattered during observation. It's a member of the *Synedra* genus (Venkatachalapthy and Karthikeyan 2013).

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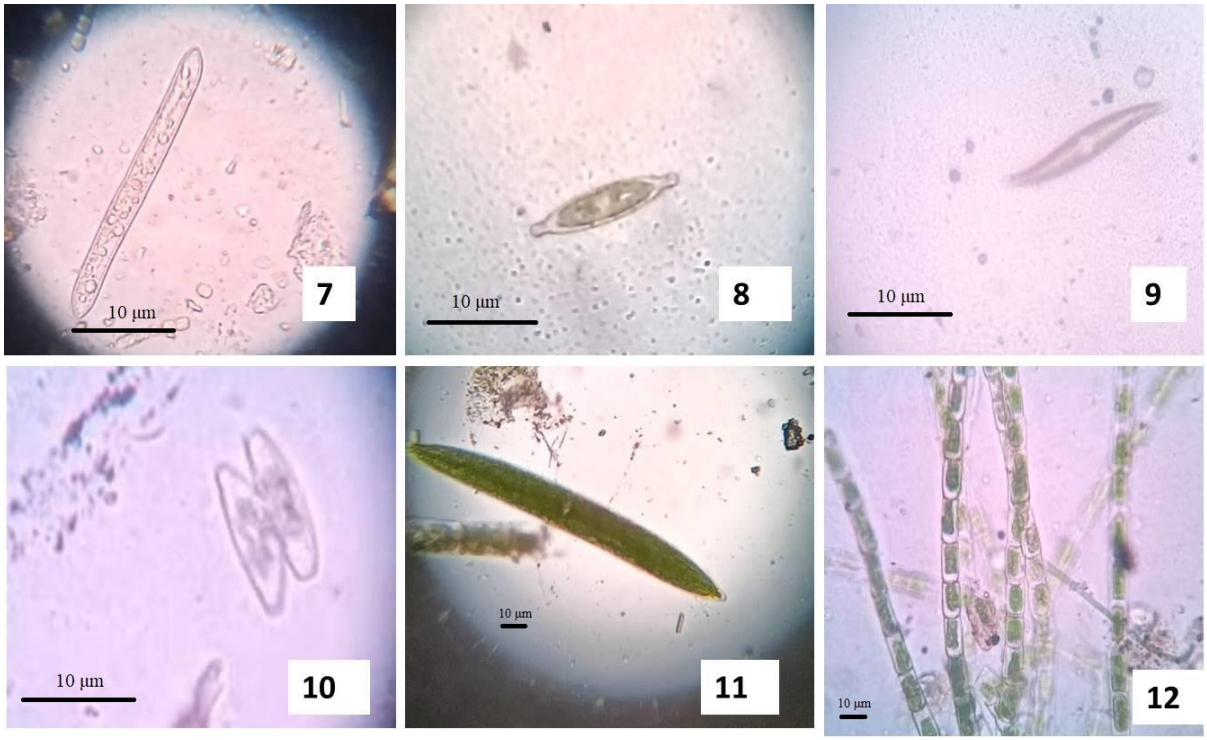

Fig. 2. Algal image 7. Nitzschioid sp. 8. Navicula sp. 9. Gyrosigma sp. 10. Cymbella sp. 11. Closterium sp. 12. Zygnema sp.

Specimen 7 was found with rocks particles devoid of chlorophyll colour. They are lanceolate shape and eccentric raphe. They are solitary scattered during observation. It's a member of the *Nitzschioid* genus (Trobajo et. al., 2013).

The specimen 8 was found boat shaped. It resemblance with pennate diatoms. Their cell structure becomes knob at end. It resemblance with *Navicula* species (El-Awamri 2007).
The specimen 9 was found transparent cell structure with marginal chloroplast. They are similar to made up of two halves which were sigmoid in outline. On morphological studies it indicate *Gyrosigma* sp. (Sterrenburg 1994).
Specimen 10 has Valves are dorsi-ventral with rounded, weakly protracted apices. The dorsal margin is moderately arched. The ventral margin is concave with a gibbous central valve. The axial area is narrow and located just ventral of the apical axis. The central area is asymmetric and rounded, about one-third to one-half the valve width. The raphe is lateral, becoming filiform toward the proximal and distal ends. It may be *Cymbella* sp. (Genkal et. al., 2020). This specimen 11 was found as elongated cell with tapering end at both side. Cells were conical shaped filled with dark coloured chloroplast like *Closterium* sp. (Kasai and Ichimura 1986). The specimen 12 was found as green algae characterized by its unbranched, cylindrical swollen cell and single net like chloroplast in *Zygnema* sp. (Stancheva et. al., 2012).

Fig 3. Algal image 12. Spirogyra sp. 14a and 14b. Oedogonium sp.

The specimen 13 was found with very conspicuous spirally arranged chloroplast as in Spirogyra. This belongs to chlorophyceae (Dawes 1965). This specimen 14 was found filamentous, unbranched and identified by cap and spore forming cells. Caps of cell were found very distinct as in Odeogonium (Mandal 2023).

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CONCLUSION

The water of Renuka and Son river was found to be fresh but not potable. However, there were various effluent of industires like stone cutting and thermal power plants were merge in these river. There were various ghats used for cloth washing also. However, the water of both river is uses for agriculture. Most of the ghats were famous for worship and ceremony. The present study was conducted to observe the diversity of algae. Most of the river portion was found running and sometime form small ditches and the other ways to flow. The river was full of sand particles and pebbles. Most of the algal communities occupies at the margin of the river.The growth of algae were descreate and not concentrated to form algal bloom. Most of the algae were belong to Chlorophyceae and some were identified as Cyanophyceae. Lot of Diatoms were identified and still they may be rich source of it. It will be topic of concern.

REFERENCES

[1] Ahamad, A., Raju, N. J., Madhav, S., & Khan, A. H. (2020). Trace elements contamination in groundwater and associated human health risk in the industrial region of southern Sonbhadra, Uttar Pradesh, India. *Environmental Geochemistry and Health*, *42*(10), 3373-3391.
[2] Begum, M., Sahu, B. K., Das, A. K., Vinithkumar, N. V., & Kirubagaran, R. (2015). Extensive Chaetoceros curvisetus bloom in relation to water quality in Port Blair Bay, Andaman Islands. *Environmental monitoring and assessment*, *187*, 1-14.
[3] Bold, H. C. and Wynne, M. J. (1978) Introduction to Algae; Structure and Reproduction, Prentice-Hall of India, New Delhi.
[4] Carmichael, W. W. (2001). Health effects of toxin-producing cyanobacteria:"The CyanoHABs". *Human and ecological risk assessment: An International Journal*, *7*(5), 1393-1407.
[5] da Costa, S. M., Ferrao-Filho, A. D. S., & Azevedo, S. M. (2013). Effects of saxitoxin-and non-saxitoxin-producing strains of the cyanobacterium Cylindrospermopsis raciborskii on the fitness of temperate and tropical cladocerans. *Harmful Algae*, *28*, 55-63.
[6] Dawes, C. J. (1965). An ultrastructure study of Spirogyra. *Journal of Phycology*, *1*(3), 121-127.
[7] El-Awamri, A. A. (2007). Morphology and Taxonomical studies of certain diatom species belonging to family naviculaceae. *Egyptian Journal of Phycology*, *8*(1), 67-80.
[8] Genkal, S. I., Scherbak, V. I., & Semenyuk, N. Y. (2020). Morphological variability of some species of the genus Cymbella (Bacillariophyta) from Reservoirs of the Dnieper Cascade (Ukraine). *International Journal on Algae*, *22*(2).
[9] Glibert, P. M. (2017). Eutrophication, harmful algae and biodiversity—Challenging paradigms in a world of complex nutrient changes. *Marine Pollution Bulletin*, *124*(2), 591-606.
[10] Kant, R., Tiwari, O. N., Tandon, R., & Tiwari, G. L. (2004). Morphology and taxonomy of cyanobacteria: I. The genus Aphanothece (Chroococcales). *Nat. J. Life Sciences*, *1*(1), 1-10.
[11] Kasai, F., & Ichimura, T. (1986). Morphological Variabilities of Three Closely Related Mating Groups of Closterium Ehrenbergii Meneghini (CHLOROPHYTA) 1. *Journal of phycology*, *22*(2), 158-168.
[12] Mandal, M. (2023). Notes On Oedogonium Circinatum Tiff.(Oedogoniaceae) From Indian Sundarban. *Bangladesh Journal of Plant Taxonomy*, *30*(2), 277-281.
[13] Minhas, L. A., Mumtaz, A. S., Kaleem, M., Waqar, R., & Annum, J. (2023). A Prospective Study on Morphological Identification and Characterization of Fresh water Green Algae Based on the Microscopic Technique in District Rawalpindi. *Pakistan Journal of Agricultural Research*, *36*(1).
[14] Mohan, R., Anjaly, M. A., Thomas, L. C., & Padmakumar, K. B. (2023). Occurrence and toxicity of cyanobacterium Microcystis aeruginosa in freshwater ecosystems of the Indian subcontinent: a review. *Energy, Ecology and Environment*, 1-12.
[15] Prasanna, R., Kumar, R., Sood, A., Prasanna, B. M., & Singh, P. K. (2006). Morphological, physiochemical and molecular characterization of Anabaena strains. *Microbiological research*, *161*(3), 187-202.
[16] Rajaniemi, P., Hrouzek, P., Kaštovska, K., Willame, R., Rantala, A., Hoffmann, L., & Sivonen, K. (2005). Phylogenetic and morphological evaluation of the genera Anabaena, Aphanizomenon, Trichormus and Nostoc (Nostocales, Cyanobacteria). *International journal of systematic and evolutionary microbiology*, *55*(1), 11-26.
[17] Rani, V. U., Perumal, U. E., & Palanivel, S. (2016). Morphology and taxonomy of Oscillatoria princeps Vaucher ex gomont (Oscillatoriales, Oscillatoriaceae). *Indian Journal of Education and Information Management*, *5*(1), 2277-5374.
[18] Raptis, C. E., van Vliet, M. T., & Pfister, S. (2016). Global thermal pollution of rivers from thermoelectric power plants. *Environmental Research Letters*, *11*(10), 104011.
[19] Roy, S., Pal, G., Singh, N., Maurya, S., Singh, S. K., Bhardwaj, D. R., & Behera, T. K. (2022). Study on socio-economic condition of Tribal farmers in Sonbhadra district of Uttar Pradesh. *Vegetable Science*, *49*(2), 233-240.
[20] Santhi, N., Pradeepa, C., Subashini, P., & Kalaiselvi, S. (2013). Automatic identification of algal community from microscopic images. *Bioinformatics and biology insights*, *7*, BBI-S12844.
[21] Seeyave, S., Probyn, T. A., Pitcher, G. C., Lucas, M. I., & Purdie, D. A. (2009). Nitrogen nutrition in assemblages dominated by Pseudo-nitzschia spp., Alexandrium catenella and Dinophysis acuminata off the west coast of South Africa. *Marine Ecology Progress Series*, *379*, 91-107.
[22] Silva, P. C. (2008). Historical review of attempts to decrease subjectivity in species identification, with particular regard to algae. *Protist*, *159*(1), 153-161.
[23] Singh, H., Singh, D., Singh, S. K., & Shukla, D. N. (2017). Assessment of river water quality and ecological diversity through multivariate statistical techniques, and earth observation dataset of rivers Ghaghara and Gandak, India. *International Journal of River Basin Management*, *15*(3), 347-360.
[24] Stam, W. T., & Holleman, H. C. (1979). Cultures of Phormidium, Plectonema, Lyngbya and Synechococcus (Cyanophyceae) under different conditions: their growth and morphological variability. *Acta botanica neerlandica*, *28*(1), 45-66.
[25] Stancheva, R., Sheath, R. G., & Hall, J. D. (2012). Systematics of the the genus Zygnema (Zygnematophyceae, Charophyta) from Californian watershed. *Journal of Phycology*, *48*(2), 409-422.
[26] Sterrenburg, F. A. S. (1994). Studies on the genera Gyrosigma and Pleurosigma (Bacillariophyceae). *Proceedings of the Academy of Natural Sciences of Philadelphia*, 217-236.
[27] Trobajo, R., Rovira, L., Ector, L., Wetzel, C. E., Kelly, M., & Mann, D. G. (2013). Morphology and identity of some ecologically important small Nitzschia species. *Diatom research*, *28*(1), 37-59.
[28] Venkatachalapathy, R., & Karthikeyan, P. (2013). Synedra species morphological observation at Bhavani region in Cauvery river, Tamil Nadu, India. *International Research Journal of Earth Sciences*, *1*(6), 1-5.
[29] Weirich, C. A., & Miller, T. R. (2014). Freshwater harmful algal blooms: toxins and children's health. *Current problems in pediatric and adolescent health care*, *44*(1), 2-24.