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Algal Spectrum of a Wetland and its Correlation with the Physico-Chemical Parameters

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Abstract

Algal spectrum and physico-chemical factors of the water of the selected wetland pond was studied for two successive years. 49 different algal species belonging to 32 genera of arbitrarily considered dominant three classes namely, Cyanophyceae, Chlorophyceae and Bacillariophyceae were identified with other pollution tolerant and bioremediant algae. The spectrum was dominantly represented by the algae belonging to the class Chlorophyceae as compared to the other two classes Cyanophyceae and Bacillariophyceae. Correlation study made between algal spectrum and the physico-chemical factors revealed a significant positive correlation with transparency of water ($P < 0.05$) and existence of a significant negative correlation was individually found with its temperature, conductivity and total dissolved solids ($P > O.O5$) in case of class Bacillariophyceae only.

Keywords: Algal spectrum, physico-chemical factors, wetland, correlation.

Introduction

Algae is common and important inhabitant of aquatic ecosystems and it plays an important role as a primary producer. The physico-chemical characteristics of the water may have influence on the algal spectrum represented by certain algae due to its periodical addition at a particular time while elimination of the other species at the same time. Certain algae respond quickly to any change in the quality of water and assume the role like a "sensor " in evaluation of water pollution either by retarding and preventing algal growth while others stimulate growth resulting into their bloom. Although, some useful contributions on algal spectrum have been made by the earlier workers in India and abroad[1-7].

However, sporadic references are only available as regards to water bodies of Bihar[8-12]. The socio - economic life of the poor rural masses inhabiting around the wetland,are closely linked. It gains further importance that rain and flood water mixed agricultural runoff becomes confluent to most of these wetlands during monsoon period and gradual recession of water during post monsoon period leaves them as land locked water bodies. The present study was, therefore, conducted on algal spectrum found in one such wetland pond of Vaishali district in Bihar along with estimation of the physico–chemical factors of the supporting water.

Material and Methods

The oldest wetland pond of Vaishali district in Bihar, known even before to Buddha regime, was selected for the present study. Monthly water samples from four different corners were drawn from January 2009 to December 2010. Algae collected were preserved by adding Lugol's solution and later on, identified on the basis of works of Presscott and Scott[13], Desikacharya[14], Randhawa[15], Presscott[16], Suxena and Venkateswarlu[17]. Algae which appeared frequently in different samples were arbitrarily considered as dominant algae while these found sparsely, were not considered. Three such classes of dominant algae namely, Cyanophyceae, Chorophyceae and Bacillariophyceae were considered for the algal spectrum purpose.

The standard methods of APHA[18] were used for determination of different physico-chemical factors of the water such as, transparency, temperature, pH, Free carbon dioxide, dissolved oxygen, conductivity, total alkalinity, calcium, magnesium, calcium hardness, chloride, total hardness and total dissolved solids. Correlation studies between algal spectrum and estimated value of physico-chemical factors of the sample water were statistically calculated.

Results and Discussion

Figure indicates monthly average variation in algal spectrum belonging to only three dominant classes namely, Cyanophyceae, Chlorophyceae and Basillariophyceae. Class Cyanophyceae was represented by Anabaena variabilis Kuetz, A circinnalis Rabenh, Chroococcus limneticus Lemm., C. minor (Kuetz.) Naeg., Lyngbya limnetica Lemm., Merismopedia elegans A. braun, M. glauca (Ehr.) Naeg., Microcystis elabens, (Breb.) Kuetz. M. aeruginosa, Nostoc calcicola Breb., N.linckia (Roth.) B.&T. Oscillatoria limosa (Roth.) Ag., O. princeps Vaucher, Rivularia aquatic Dey Wilde, Spirulina major Kuetz., S. subsalsa Oersted.

Chlorophyceae class was represented by Ankistrodesums convolutes Cord., Actinastrum falcatus (Corda) Ralfs, Actnastrum sps., Chlorella conductrix (Brandt) beijerinck, C. vulgaris Beijerinck, Cladophora fracta (Dillw.) Kuetz., Closterium acerosum Ralfs, C. rostratum Ehrenb, Coelastrum microporum Naeg. Cosmarium angulosum Breb., C. contractum Kirchn., C. corruptum Turner, C. maculatum Turner, Desmidium aptogonum Breb., Hydrodictyon reticulatum (L.) Lagerh., Oocystis incrassate W. West, Pediastrum duplex Meyen, Scenedesmus acuminatus (Lagerh.) Chodat, S. bijugatus (Turpin) Kuetz., S. quadricauda (Turpin) Kuetz, S. elenastrum gracile Riensch., Spirogyra communis (Hass.) Kuetz, Tetraedron muticum (A. Braun) Hansgirg, Ulothrix variabillis Kuetz. Class Bacillariophyceae was comprised of Cymbella aspera (Ehr.) Cl., Fragilaria capucina Desm., Gomphonema acuminatum Ehr., Navicula cuspidate Kuetz, N. minuta (Cl.) Cl., Nitzschia amphibian v. acutiuscula (Grun.) Grun., N. palea (Kuetz.) W. Smith, Pinnularia divergens W. Smith, Synedra ulna (Nitz.) Ehr.

It is evident from the figure that altogether 49 species belonging to 32 genera under three arbitrarily considered dominant classes namely, Cyanophyceae, Chorophyceae and Bacillariophyceae constituted the algal spectrum found in the wetland water. Month wise spectrum analysis revealed that compared to the other two classes, chlorophyceae dominantly participate in the formation of algal spectrum with 24 species and 16 genra . It gains further support by the fact that both maximum and minimum number of algae counted month wise in the class chlorophyceae ranged between 4 to 13, as compared to the corresponding figure ranging from 3 to 8 in other two classes, Cyanophyceae and Bacillariophyceae.

Discussion: Like other aquatic ecosystems, a dynamic inter-action exist between the water and the living organisms inhabiting the wetland. As an important and common inhabitant of this water body, algae play an important role as primary producer in its community structure. Population of algae contributes to strike an ecological balance and any change in quality of water may affect the algal population by appearance or disappearance of certain algae at a given time. Earlier workers on algal spectrum analysis have reported class wise variation as regards to dominance of a particular class of algae over others. Predominance of chlorophyceae during certain periods of the year was observed by Vyas and Kumar, 1968[19]; Kant and Anand[20] ; Mesfin and Belay[21]. While Rao[22], Seenaya[23] , Munawar[24] observed dominace of the other class Cyanophyceae due to rise in its population during certain months and attributed the bloom in Cynophyceae to the high nitrate content. However, Sharma N.K. et. al.[25] explained the Cyanophycean bloom due to presence of Microcystis in the water. As compared to the other classes, dominance of Bacillarophyceae was observed by Kant and Kachroo[26] ; Rai and Kumar[27]; Grover et al[28] ; Verma and Munshi[29]; Kumar and Oommen[30] ; Fonge B.A. et. al.[31] ; Shivkumar N. et. al.[32] , etc.

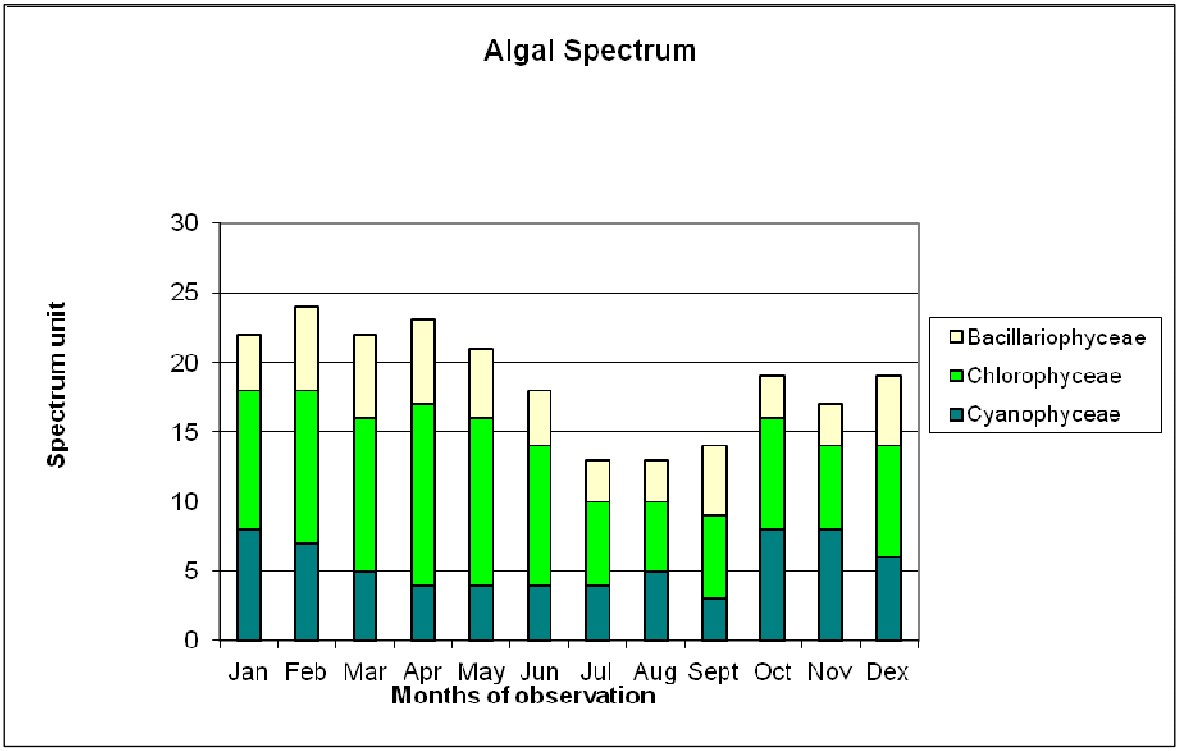

Figure-1
Month wise variation in Algal spectrum

Table–1
Correlation co -efficient values between physico-chemical parameters and algal spectrum

Algal Spectrum-→	Cyanophyceae	Chlorophyceae	Bacillariophyceae
Transparency	0.229	0.219	0.463*
Temperature	-0.311	-0.099	-0.461*
pH	-0.020	-0.058	-0.293
Dissolved Oxygen	0.379	-0.140	-0.148
Free Co2	0.092	-0.197	-0.195
Conductivity	-0.127	-0.127	-0.441*
Total alkalinity	-0.30	0.194	-0113
Calcium Hardness	0.010	0.035	-0.288
Chloride	-0.327	-0.060	-0.232
Total hardness	0.385	-0.135	0.241
Calcium	0.143	-0.093	0.105
Magnesium	0.387	-0.115	0235
TDS	-0.127	-0.217	-0.441*

In the present investigation class wise variation in algal spectrum with complete dominance of the class Chlorophyceae over other two classes namely, Cyanophyceae and Bacillariophyceae was observed in monthly and total counts. 24 species and 16 genera of algae belonging to this dominant class occupied a wider part of the total size of the spectrum and their dominance continued throughout in all the monthly counts where minimum and maximum contributing number of algae ranged between 4 to 13 and the corresponding number in Cyanophyceae and Bacillariophyceae always remained low ranging only between 3 to 8. The result thus showed conformity to the earlier results of Vyas and Kumar, 1968; Mesfin and Belay,1989 about dominance of class Chlorophyceae in the algal spectrum largely due to participation of more algae in the spectrum formation and rise in the population of possibly certain genera from the month of October to June when the water was relatively more transparent and available for deeper penetration of sun light for photosynthetic activity to augment their growth and development.

Amongst the above noted taxonomic entites, some of the algae were located from unpolluted and polluted sites of the pond and the collected genera tolerant to organic pollution were Oscillatoria, Scenedesmus, Chlorella, Spirulina, Anabaena. Some of the useful taxa invoved in bioremediation, such as, Anabaena, Chlorella, Fragilaria, Nostoc etc. were also found. Colouration causing algae, Spirogyra, Anabaena, Microcystis, etc were present in low to moderate numbers to play a significant role as primary producers.

It is evident from the table that differential feeble positive /negative correlation exists between certain physico-chemical factors of the wetland water and algal spectrum of the class Cyanophyceae and Chlorophyceae. Remarkably, a significant positive correlation with transparency of water ($P < 0.05$) and significant negative correlation exist individually between Temparature, Conductivity and Total dissolved solids and the algal spectrum only in the class Bacillariophyceae ($P > 0.05$).

Conclusion

Water of the Wetland pond appears to be very much conducive to the algal growth specially the algae belonging to the class Chlorophyceae followed by the other two classes Cyanophyceae and Bacillariophyceae. Algae belonging to the class Bacillariophyceae were very much sensitive to any change in the quality of supporting water and exhibited sharp and significant correlation with some of the physico-chemical factors such as transparency, temperature conductivity and total dissolved solid. All these parameters are influenced during rainy season. As this water body is an algal treasure including some useful algae, efforts should be made to protect this water body from degradation and eutrophication in the interest of poor rural fishing community inhabiting around in the district of Vaishali.

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