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Study on Phenological Diversity of Chlorophycean Algae with its Role in Environment

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Abstract:
The River water algae can resist many environmental stresses. Usually they grow on water if the water is steady but the River water is also contaminated by series of natural reasons. Many genera can grow in the River water. The algae are identified by their shape, size, colour and morphological structure. The physiochemical status of the River water contributes to the phenology of Chlorophycean algae of the River Ganga in Kolkata. Maximum algal population was determined by testing the concentration of algae in the water of the Ganga River. Summer is the season when algal growths are seen at its peak but in the winter the concentration of those algal species are less. But the predominant two species are *Chlamydomonas* sp. and *Dunalliella*sp.
Key-words: Resist, Habitat, Terrestrial, Multicellular.

Introduction:

Algae are the diverse group of autotrophic organism, able to photosynthesis and having motile or non motile unicellular or multicellular forms. It is believed that although the chloroplasts have the single origin but all the algal groups are not originated from a single algal ancestor. Most algae have marine habitat but several algal species have terrestrial habitat as well. Most algae are found abundantly from desert sand to sea water to hot springs and glaciers of ice. They can be flagellated single celled organism or multicellular thallus type structure. The giant kelp of Eastern Pacific which is 60 meters long and deep dense forest like structure is also a type of algal growth itself. The aquatic ecosystems are also dependent on the algae. The primary producers of the ecosystem are algae. The fresh water fishes feed on algal food substances. So the fresh water food chains are highly dependent on algae. During stages of their lifecycle, fishes consume about 75% of algae. The BOD is often provided by the algal biomass of the water bodies. So algae are important to produce fishes in fisheries. The algae produce about 48% of oxygen of the world itself. The algal groups are producing single cell proteins (SCP) now days. The algal growth in the environment depends upon some conditions which are light, pH, temperature, hardness, salinity, phosphorus content, nitrate content and water current velocity for the growth of phytoplankton. Nutrients are the main factor for the growth of algal species. In the River like Ganga River the phosphorus content is predominantly found, which is certainly a trace element for the growth of algal species. Nitrogen is also found to be responsible for triggering a algal bloom. But this factor is more commonly studied in the case of salt sea water. The sources of water nutrients, important for algal growth are divided into two divisions by scientists. The first division is natural sources. And second division is artificial or man-made sources. Natural sources include the sources provided by nature as soil leach nutrients, atmospheric deposited nutrients and nutrients come with a certain water flow. The man-made sources are more complex and highly effective those may be manure, fertilizer, industrial effluents and human sewage. Among all the autotrophs algae secures its significant ranking by versatilities. It has excellent variation in structure. It possesses role in biodiversity and have wild variation of habitats. It is just not enough for algal qualities as there a lot of algal qualities. They have various thallus organizations. The periodic distribution is very hard for this organism which is referred to be phenology. Time to time the researchers has researched upon the algal diversity of Indian subcontinent. Systematic and classification of algae are overviewed by scientists on the basis of their morphology, cytology, biochemistry and recent aspects of biology. An attempt is made to focus on fresh water green algae or River water green algae. So the study is done on Ganga water algae of Kolkata.

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Fig 1: Algal bloom in the Ganga River.

Materials and methods:

Sample collection:

Samples of fresh water algae were collected from the different locations as Babughat, James PrincepGhat and many more Ghats, which are located on the Ganga River. The samples were taken to laboratory. They were washed in mild warm water and cold water. The samples are also preserved in 4% formaldehyde. Mounts of the samples were also prepared.

Detection of algal diversity:

Detection of algal diversity was done by microscopic analysis of the specimen. The structure of algal samples was studied under microscope. And the identification was done on basis on the phylogenetic tree and they are also noted.

Determination of concentration of algal cells:

The algal cell concentration was determined by the direct microscopic count methods. The concentrations were calculated per ml of water. And in every season the abundance of algal species are calculated.

Results:

The Chlorophyceae an algal flora that has found to be appearing in the Ganga water have studied along. It was found that the microbes isolated were coming from several groups, genera and orders. Orders are below.

Order	Genera
*Chlorococcales*sp.	*Pediastrum, Chlorella, Scenedesmus, Hydrodictium*
Volvocales sp.	*Clamydomons, Duralliceae, Pandoria, Eudorina*
Ulotrichales sp.	*Enteromorpha*
Cladophorales sp.	*Cladophora*
Chaetophorales sp.	*Stigeoclonium*
Conjugales sp.	*Spirogyra, Zygnema, Cosmarium, Closterium*

From this study the predominant genera are 15 different genera of algae among which mostly found are *Dunalliella*sp. and *Clamydomons*sp. Those two genera are found in high concentration in every season in Ganga River water. In the month of January to March a mass growth in the algal biomass is seen significantly rising. While in the month of May to July the growth faced a decrease. And in the month of December the decrease turn into the lowest growth condition of those algal species. The peak was found in January in the case of algal growth. The abundance chart of algae in the Ganga River water of Kolkata expresses the weather advantage influence on the algal growth. Due to the nutrient availability and excess sunlight the algal growth is found most abundantly in the Ganga River water. But the winter available with nutrients lacks the sunlight to cause the lowest algae found there. The monsoon season have a speciality the new fresh rain water is available in the season. That new fresh water mostly washout some algae and

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nutrients of the season. So the growth starts to decrease at this season. The population of *Chlorella* sp. was found significantly less across the whole year while other algal group's shows decrease and increase in the growth. We can see the serial decrease for almost every isolated algal group from January to December. That yearly change of algal growth is expressed by the study. The seasonal variations of those 15 algal species are included in the chat below.

Sl.	Algae	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1	*Pediastrum*sp.	++	+	+++	-	-	++	+	-	-	+	-	-
2	*Scenedesmus* sp.	-	+++	+	-	+	-	-	+	+	-	-	-
3	*Chlorella* sp.	++	+	-	+	-	-	+++	-	-	+	-	-
4	*Hydrodictium* sp.	-	++	+	-	++	+	-	-	-	-	-	-
5	*Clamydomons* sp.	+++	-	+	++	-	-	+	++	-	-	++	+
6	*Duralliceae* sp.	+++	+	+	-	+	+	-	-	-	++	+	+
7	*Pandoria* sp.	++	+++	+	-	+	+	+	+	-	-	-	-
8	*Eudorina* sp.	-	++	+++	++	-	-	-	-	+	-	-	-
9	*Enteromorpha* sp.	+	+++	++	+	-	-	+	-	+	-	++	-
10	*Cladophora* sp.	++	+++	-	++	-	+	-	-	+	-	-	-
11	*Stigeoclonium* sp.	+++	++	-	+	-	++	-	-	-	-	-	-
12	*Cosmarium* sp.	+	+++	++	-	+	-	+	-	-	+	-	-
13	*Spirogyra* sp.	++	+	+	-	+	-	-	+	-	-	-	-
14	*Zygnema* sp.	+++	++	-	+	-	-	+	-	+	-	-	-
15	*Closterium* sp.	+	++	+++	+	-	++	-	+	-	+	-	-

This study is also shown the algal population mostly flourishes in the late winter mainly in early January. And this growth starts to decrease in the late monsoon. So the perfect time for the algal management for water is late winter and early summer. The remediation can't be done in the summer as the growth of plankton is high which may lead to hazards for the treatment. The seasonal changes of this growth also show that the temperature also effect on the microbial population specially the algal population.

Discussion:

The Kolkata is one of the religious and ancient places of West Bengal. It is a tourist spot also. The Kalighat made it famous religiously. The British capital was the Kolkata due to the easy transportation by Ganga River. The Ganga River is also one of the important causes of the economical importance of the place. The Ganga River is also responsible for agricultural and human resources of the region. But the River water is affected by human activities and pollution. Xenobiotic compounds along with several chemicals and bio fertilizers are mixed with the River water from industrial and agricultural sites. This causes the algal bloom in water. The algae grow upon the water for various causes. And this study shows the algal groups isolated from Ganga water are *Chlorococcales* sp., *Volvocales* sp., *Ulotrichales* sp., *Conjugales*sp.,*Chaetophorales* sp., and *Cladophorales* sp.. While summer predominant are *Chlamydomonas*sp. and *Duralliceaae*sp. The most common algae in water are *Chlamydomonas*sp. *and Duralliceaae*sp. The plankton status of the water indicates the physiochemical status of water.

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Conclusion:

Algal diversity plays an important role in determining the quality of a water body. Here we have isolated Chlorophycean algae from the Ganga River. Algae forms may take over River and algal bloom highly interfere with the eco-system of River. Although it has an important role in food chain.Chlorophycean can tolerate high degree of pollution. It has been observed that quantity of algae vary season to season because of changes in temperature, pH and other physiological factors of water. In summer the concentration of Chlorophycean most and it gradually decreases up to winter when concentration of respective algal species are very loss. We can use these algae in agriculture field as nitrogen source and for waste water treatment also. It can help us more than its harm.

References:

1. Mohanty AK, Satpathy KK, Sahu G, Sasmal SK, Sahu BK, Panigrahy RC (2007) Red tide of Noctilucascintillans and its impact on the coastal water quality of the near–shore waters, off the Rushikulya River, Bay of Bengal. CurrSci 93:616–618.
2. Nagabhushanam AK (1967) On an unusually dense phytoplankton ‘bloom’ around Minicoy Island (Arabian Sea) and its effect on the local tuna fisheries. CurrSci 36:611–612.
3. Naik RK, Anil AC, Narale DD, Chitari RR, Kulkarni VV (2011a) Primary description of surface water phytoplankton pigment patterns in the Bay of Bengal. J Sea Res 65:435–441.
4. Naik RK, Hegde S, Anil AC (2011b) Dinoflagellate community structure from the stratified environment of the Bay of Bengal, with special emphasis on harmful algal bloom species. Environ Monit Assess 182:15–30.
5. Naik RK, Sarno D, Kooistra WHC, D’Costa PM, Anil AC, 2010. Skeletonema (Bacillariophyceae) in Indian waters: A reappraisal. Indian J Mar Sci 39(2):290–293.
6. Naqvi SWA, George MD, Narvekar PV, Jayakumar, DA, Shailaja MS, Sardesai S, Sarma VVSS, ShenoyDM, Naik H, Maheswaran PA, Krishnakumari K, Rajesh G, Sudhir AK, Binu MS (1998) Severe fish mortality associated with ‘red tide’ observed in the sea off Cochin. CurrSci 75:543–544.
7. Naqvi SWA, Jayakumar DA, Narvekar PV, Naik H, Sarma VVSS, D’Souza W, Joseph S, George MD (2000) Increased marine production of N2O due to intensifying anoxia on the Indian continental shelf. Nature 408:346–349.
8. Nayak BB, Karunasagar I (2000) Bacteriological and physico–chemical factors associated with Noctilucamilicans bloom along Mangalore, Southwest coast of Indian. Indian J Mar Sci 29:139–143.
9. O’Herald (2001) NIO discovers toxic algal off Goa. O’Herald Newspaper Goa, 29th October 2001 Padmakumar KB, Sanilkumar MG, Saramma AV (2007) A ‘Red tide’ caused by the diatom Coscinodiscus on the southwest coast of India. Harmful Algae News, An IOC Newsletter on toxic alage and algal blooms 35:14.
10. Padmakumar KB, Sanilkumar MG, Saramma AV, Sanjeevan VN, Menon NR (2008a) Microcystisaeruginosabloom on Southwest coast of India. Harmful Algae News, An IOC Newsletter on toxic alage and algal blooms 37:11–12.
11. Padmakumar KB, Sanilkumar MG, Saramma AV, Sanjeevan VN, Menon NR (2008b) “Green tide” of Noctilucamiliaris in the Northern Arabian Sea. Harmful Algae News, An IOC Newsletter on toxic alage and algal blooms 36:12.
12. Padmakumar KB, SreeRenjima G, Fanimol CL, Menon NR, Sanjeevan VN (2010a) Preponderance of heterotrophic Noctilucascintillans during a multi–species diatom bloom along the southwest coast of India. Int J OcOceanogr 4:5–63.
13. Padmakumar KB, Thomas LC, Salini TC, John E, Menon NR, Sanjeevan VN (2011) Monospecific bloom of noxious raphidophyteChattonella marina in the coastal waters ofSouth–West coast of India. Int J Biosci 1(1):57– 69.
14. Padmakumar NR, Smitha BR, Thomas LC, Fanimol CL, SreeRenjima G, Menon NR, Sanjeevan VN (2010b) Blooms of Trichodesmiumerythraeum in the South Eastern ArabianSea during the onset of 2009 Summer Monsoon. Ocean Sci J 45(3):51–157.
15. Smith, G.M. 1920. Phytoplankton of the Inland Lakes of Wisconsin part. I. Myxophyceae,

Phaeophyceae, Heterokontae and Chlorophyceae, Wisconsin Geological and Natural History Survey. Bull. 57 Sc. Ser. 12: 1-243.
16. Venkataraman, G. 1939. December. A systematic account of Some south Indian Diatoms, Proceeding of the Indian Academy of Sciences: Vol. X, No. 6: 293-368 pp.
17. Williamson, D. B. 1999. A proposed new desmids genus Cruiangulum and description of three new desmids species From rock pools in the Western C.
18. Whitton B A, 1969. Seasonal changes in the Phytoplankton of St. James Park lake, London, London Nat. 48: 14-39.