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CHLOROCOCCALES OF RIVER GANGA AND THEIR IMPACT ON WATER POLLUTION

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Abstract:

The present study deals with the investigation of chlorococcales in Ganga water between Bithoor (Kanpur Dehat) to Jajmau, Kanpur (U.P.). Herein qualitative and quantitative estimates of the algal compounds have been made on monthly basis and as many as 15 genera (Actinastrum, Chlorococcum, Golenkinia, Ankistrodesmus, Closteritun, Coelastrum Selenastrum, Senedesmus, Characium, Chlorella, Teraedon, Hydrodictyon, Closteriopsis, Crucigenia, and Oocystis,) spread over 46 species were recorded. Chlorococccals play an important role in determining water quality, odor, colour and pollution. There are many species which can tolerate high organic pollution. Their role as possible indicator of organic pollution has been discussed. The Compound Quotient value for Ganga water is high which points towards the fact that the water is eutrophic with organic pollution. Present study aims to find out a potential algal pollution index as an indicator of organic pollution and biomonitoring of polluted water. Organic pollution in water bodies is increasing day by day because of rapid industrialization, disposal of municipal, sewage and domestic wastes in water bodies. These pollutants bring about a change in physico-chemical characteristics as well as in biotic components of ecosystem. Different indices to evaluate the organic pollution of a water body on the basis of algal groups have been used.

KEYWORDS.

Allergenic, Chlorococcales, Eutrophication, Indicator, Pollution.

INTRODUCTION

Kanpur is situated at 26.58° N latitude and 8034°E longitude at an elevation of 110 meters from level on the Bank of river Ganga. The river receives domestic and industrial. wastes and the water shows high degree of pollution. Chlorococcales have been reported from different localities of Kanpur There are only a few studies in which algae has been exploited as the biological indicator of pollution, Fogg, 1960; 1961, 1969, Cholnoky, 1968, Prasad and Singh, 1982; Kant, 1979, Trivedi, (1986). Such studies show that there are plentiful algal species which can tolerate varying degrees of organic pollution and hence can be used as indicators of organic pollution. Chlorococcales have been reported from different localities of Kanpur by Nair, (1967); Panday, (1969); Bitta, (1968); Mohan; (1964); Shukla (1973); Shukla (1985); Tripathi. (1985); and Gupta and Shukla, (1988), Tripathi, 1991.

Present study aims to find out a potential algal pollution index as an indicator of organic pollution and biomonitoring of polluted water. Organic pollution in water bodies is increasing day by day because of

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rapid industrialization, disposal of municipal, sewage and domestic wastes in water bodies. These pollutants bring about a change in physico-chemical characteristics as well as in biotic components of ecosystem. Different indices to evaluate the organic pollution of a water body on the basis of algal groups have been used.

MATERIALS AND METHODS

Monthly water sampling was carried out in Ganga waters between Bithoor to Jajmau, Kanpur. One litre of water sample was filtered through a bolting silknet of 20 xxx. Plankton concentrate thus obtained was preserved in 5-6 per cent formalin and retained for two to three days. The concentrate was assayed for plankton quality using haemo-cytometer.

An exhaustive algal collection was also made and samples stored in specimen tubes during 2012-13. Camera lucida figures were prepared. On the basis of measurements algae were identified using standard texts. A modified compound quotient value (Nygaards 1976), was calculated.

$$CQ = \frac{BG + \text{Diatoms} + \text{Chloro} + \text{Euglenoids}}{\text{Desmids}}$$

The value obtained were grouped as :

CQ = < 2 = Oligotrophic nature
2-6 = weak Eutrophic, => 6 = Eutrophic.

Besides this Nygards algal indices (1949), Palmers algal pollution indices (1969) for genera and species have been used to find out the possibility of algae as indicators of pollution.

OBSERVATION AND DISCUSSION

During present investigation a total number of 46 species were observed from Ganga waters. It is interesting to note that Hydrodictyon, Scenedesmus and Chlorococcum were found to be dominant while Golenkinia, Tetraedon, Crucigenia and Characium were recorded as rare genera. (Table-1) Observation reveals that nine species namely Actinastrum hantzschii, Ankistrodesmus falcutus, Chlorella vulgaris, Pediastrum boryanum, Scenedesmus obliquus, S. quadricauda, S. dimorphus, S. acuminatus, and S. arcuatus are the most tolerant species of organic pollution and can be effectively utilized as indicators of varying degrees of organic pollution and as bio-monitor in pollution abatement studies (Table-3).

Observation shows that species of Hydrodictyon, Pediastrum, Scenedesmus, Actinasout, and Chlorella are representative species of odor (Table-2). Species of Actinastrum; Golenkinia Scenedesmus. Selenastrum and Tetraedon are representative species of sewage pollution (Palmer, 1969) which supports the presence of sewage waste in Ganga water at Kanpur. Compound Quotient value of Ganga water is suggestive of moderate eutrophication with organic pollution, Nygards (1949). Algal indices computed also suggest eutrophic nature of Ganga water. Application of Palmer's algal genus index for pollution is indicative of organic pollution. Species of Chlorococcum, Chlorella and Scenedesmus are representatives of allergenic algae (Table-4).

Conclusively it can be said that there are large number of species belonging to chlorococcales which can tolerate varying degrees of organic pollution and therefore can be successfully employed as indicators of Ganga water pollution. The observations show that pollution in Ganga water is gradually increasing after Bithoor to Jajmau, Kanpur.

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Table-1. ANNUAL PERCENTAGE OF OCCURRENCE OF CHLOROCOCCALES

Chlorococcales (Species)	Percentage of occurrence
<i>Actinasuum hantzschii</i>	83.33
<i>Actinastrum hantzschii</i> var <i>fluviatile</i>	33.33
<i>Alikistrodesmus falcatus</i>	75.00
<i>Ankistrodesmus convohaus</i>	41.66
<i>Closieriopsis longissima</i>	58.33
<i>Characium naegeli</i>	16.66
<i>Characium prigshemia</i>	08.33
<i>Characium ambiguum</i>	33.33
<i>Chlorella vaulgaris</i>	66.66
<i>Crucigenia tetrapedia</i>	41.66
<i>Chlorococcum infusionum</i>	75.00
<i>Chlorococcum humicola</i>	83.33
<i>Coelastrum cambricum</i>	58.33
<i>Coelastrum proboscidium</i>	33.33
<i>Coelastrum reticulatum</i>	50.00
<i>Coelastrum sphericum</i>	33.33
<i>Golenkinia radiata</i>	08.33
<i>Hydrodictyon reticulatum</i>	83.33
<i>Oocystis crassa</i>	33.33
<i>Oocystis solitaria</i>	33.33
<i>Oocystis ellipticum</i>	25.00
<i>Oocystis borgei</i>	25.00
<i>Pediastrum boryanum</i>	66.66
<i>Pediastrum simplex</i>	75.00
<i>Pediasinan tetras</i>	75.00
<i>Pediastrum duplex</i>	41.60
<i>Scenedesmus amatus</i>	83.33
<i>Scenedesmus bijuga</i>	75.00

Chlorococcales (Species)	Percentage of occurrence
<i>Scenedesmus dimorphus</i>	83.33
<i>Scenedesmus obliquus</i>	66.66
<i>Scenedesmus abundans</i>	25.00
<i>Scenedesmus acuminatus</i>	58.33
<i>Scenedesmus quadricauda</i>	83.33
<i>Scenedesmus quadricauda var longispina</i>	08.33
<i>Scenedesmus quadricauda var westii</i>	66.66
<i>Scenedesmus quadricauda var quadrispina</i>	25.00
<i>Scenedesmus quadricauda var bicaudatus</i>	33.33
<i>Scenedesmus quadricauda var maximus</i>	08.33
<i>Scenedesmus arcuatus</i>	08.33
<i>Scenedesmus prizmaticus</i>	16.66
<i>Scenedesmus acutiformis</i>	25.00
<i>Selenasuum bibrianum</i>	16.66
<i>Selenastrum gracilae</i>	53.30
<i>Selenastrum westii</i>	50.00
<i>Tanaedon minimum</i>	25.00
<i>Tetraedon muticum</i>	16.66

Table -1. LIST OF ODOR PRODUCING CHLOROCOCCALES

SI. No.	Species	Mode of Odor
1.	<i>Hydrodictyon reticulatum</i>	Septic
2.	<i>Pediastrum tetras</i>	Grassy
3.	<i>Scenedesmus abundans</i>	Grassy
4.	<i>Chlorella vulgaris</i>	Musty

Table -3. LIST OF MAJOR POLLUTION INDICATING SPECIES OF CHLOROCOCCALES RECORDED FROM RIVER GANGA

Sl. No.	Species
1.	<i>Actinastnun hantzschii</i>
2.	<i>Ankistrodesmus falcatus</i>
3.	<i>Chlorella vulgaris</i>
4.	<i>Pediastrum boryaman</i>
5.	<i>Scenedesmus obliquus</i>
6.	<i>Scenedesmus quadricauda</i>
7.	<i>Scenedesmus dimorphus</i>
8.	<i>Scenedesmus acuminatus</i>
9.	<i>Scenedesmus bijuga</i>
10.	<i>Scenedesmus arcuatus</i>
11.	<i>Scenedestnus prismaticus</i>
12.	<i>Scenedestnus abundans</i>

Table -4. LIST OF CHLOROCOCCALES RECORDED FROM RIVER GANGA AS OF ALLERGENIC SIGNIFICANCE

Sl. No.	Species
1.	<i>Chlorococcum humicola</i>
2.	<i>Chlorococcum ifusionum</i>
3.	<i>Chlorella vulgaris</i>
4.	<i>Scenedestnus acuminatus</i>
5.	<i>Scenedesmus dimorphus</i>
6.	<i>Scenedesmus obliquus</i>
7.	<i>Scenedesmus prismaticus</i>
8.	<i>Scenedesmus abundans</i>
9.	<i>Scenedesmus quadricauda</i>
10.	<i>Scenedesmus bijuga</i>
11.	<i>Scenedesmus arcuatus</i>

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