Correlation Studies on Physico-Chemical Parameter and Phytoplankton in Fresh Water Bodies of Mandya District

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Abstract

The periodicity of phytoplankton with reference to Physico-chemical and Biological parameters was undertaken from June 2014 to May 2015 in Guthal lake of Mandya. 18 Physicochemical parameter and four groups of planktonic population have been correlated. Chlorophyceae and Cyanophyaceae are controlled by total acidity and Cyanophyceae. Bacillariophyceae are dependent on Magnesium. Total dissolved solids, BOD and Phosphate has maximum role in controlling their growth. Euglenophyceae and Cyanophyceae are regulated by a wide variety of physico-chemical factors of total hardness, total solids, phosphate and BOD. The diversity of phytoplankton is important in understanding the distribution of planktonic algae in fresh water lake.

Keywords: Phytoplankton’s, Physico-Chemical Parameters, Correlation Matrix, Freshwater Lake

I. INTRODUCTION

Surface water pollution has become one of the major problems across the world. Water pollution affects on plants and organism in the water. This study is an interdisciplinary research designed to investigate all possible anthropogenic impact on the water quality. A large number publications have appeared an freshwater regarding its suitability for domestic as well as industrial purposes (Hosmani & Bharati 1980; 1987) depending upon the chemicals the pollutants that enter such water tend to increase (or) decrease the saturation effect. Barring the report of Hosmani & Vasanathkumar (1996). A large number of physic-chemical and Biological parameters such as temperature, pH, Nitrite, phosphate, turbidity, DO, BOD, COD, Bacillariophycea and Chlorophyceae growth will have a great influence over the quality of water (Naganandini & Hosmani 1998, Verma & Mohanty 1995). The present survey was undertaken with the objective of elucidating lake water and establishing interrelationship between various physico-chemical parameters its influence on phytoplanktons.

II. MATERIALS AND METHODS

Guthal lake situated in the southern part of Mandya district, Karnataka State, lies between 76° 50’ E longitude and 12° 30’ north latitude. It receives an average annual rainfall about 180 mm the catchment area about 60 acre, it has maximum depth of 7.0 mts when full with a minimum depth of 6 mts. Selected lake is the source of water for many of the application such as drinking, washing, irrigation, entertainment etc. The continued anthropogenic activity of the lake has not only caused the environment pollution of lake but also contribute rapid degradation of lake. The method for collection, preservation, identification and enumeration of phytoplankton and various methods adopted for adnalysis of physo-chemical parameters are described in detail Fritsch (1975), Golterman et.al. (1978), Hosmani & Bharathi (1980), Trivedy & Goel (1986), APHA (1995) and Hosmani & Vasanathkumar (1996). The sample collections were made from June 2014 to May 2015. All the data were subjected to pearsons correlation matrix Tiwari and Ali (1987).

III. RESULTS AND DISCUSSION

The annual periodicity Guthal Lake depicted in the figure-1, shows that Chlorophyceae constituted highest of 46.45% of the total phytoplankton population Bacillariophyceae followed by 30.76% Cyanophyceae 16.38% and Euglenophyceae lowest of 6.41%. The seasonal variation of 20 physico-chemical and four groups of phytoplankton were represented in table (1&2) and figure (2&3). The correlation matrix are presented in table -3. 26 species of phytoplankton have been recorded of which 12 species belong to Chlorophyceae four to Cyanophyceae, eight to Bacillariophyceae and two Euglenophyceae.
The maximum population density of Chlorophyceae was observed highest number during summer (17760 org/lt) Scenedesmus Quadricauda, Chlorella vulgaris, Euastrum luexemuelen, similarly reduced during winter and monsoon seasons (11340 and 6300 org/lt) Scenedesmus dimorphos, Scenedesmus armatus are poorly represented, Closterium lumula, Euastrum luexemuelen, ongonema compaclum were observed throughout the year of study. The maximum Bacillariophyceae are represented in higher during winter season Nitzschia obtuse, Coconies placenta appears in three seasons. The minimum density of Acanthes inflata was obtained in summer (840 org/lt). Singh (1960) & Munnavar (1970) on critical examination observed that water having high average concentration of free CO₂ have abundant Euglenophyceae. The present study Euglenophyceae were poorly represented probably due to low carbon dioxide in lake. Zafar (1967) attributed the occurrence of Euglenophyceae to be inversely related to Cyanophyceae. Cyanophyceae were also not presented in good number in the lake study, Oscillotoria, Arthospira prevailed throughout the year. A large number of physico-chemical and biological parameters like, temperature, pH, Nitrate, Phosphate, Turbidity, DO, BOD, COD and Bacillariophyceae growth will have a greater influence over the quality of water, similar observation were made by Naganandini & Hosmani (1998), Verma and Mohanty (1995). Over all investigation maximum development of phytoplankton was observed during winter (62120 org/lt) and minimum during monsoon (13020 org/lt). Kumar & Dutta (1991), Anjana, et, al.(1998) estimated that the intensity of phytoplankton has greater during summer, post monsoon and winter.

Significant correlation was established between physico-chemical parameters and phytoplankton. Chlorophyceae are controlled by total acidity. Bacillariophyceae are dependent on TDS, Phosphate and BOD. Similarly temperature, pH, DO, Magnesium, Nitrate and Nitrite have a significant role in controlling the population of Bacillariophyceae in this lake. Cyanophyceae had the lowest limits and it regulated by the total acidity and Chloride. Euglenophyceae except Euglena acus and lepocinclis ovum are controlled by wide variety of physico-chemical factors including total hardness, total dissolved solid, Phosphate and BOD. The amount of Phosphate and total dissolved solid were the most significant parameters in accelerating the growth of Bacillariophyceae. Total hardness, total dissolved solid and Phosphate are three significant parameters controlling growth of total plankton in this lake.

IV. CONCLUSION

Guthal lake of Mandya is less organically polluted, only Nitzschiapalea as an indicator with low sensitivity values. Among the four groups of organism Euglenophyceae and Cyanophyceae were more affected by the physico-chemical parameters. Acidity, TDS, BOD, Phosphate, total hardness, CO₂ Nitrate and total solids are controlling the growth of phytoplanktons. The study reveals that there is human disturbance in the lake in the form of entry of untreated sewage and needs to be treated before letting it into the lake. Phytoplanktons and Physico-chemical parameters important tool in detection of pollution.

ACKNOWLEDGEMENT

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Table1: Seasonal variation of Physico-chemical and Biological parameter in Guthal lake of Mandya District (All the parameters measured in mg/l except air temperature and water temperature)

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Parameter</th>
<th>Seasons</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Summer</td>
</tr>
<tr>
<td>1</td>
<td>Air Temperature</td>
<td>32.00</td>
</tr>
<tr>
<td>2</td>
<td>Water Temperature</td>
<td>32.00</td>
</tr>
<tr>
<td>3</td>
<td>pH</td>
<td>08.40</td>
</tr>
<tr>
<td>Sl. No.</td>
<td>Free Carbon Dioxide</td>
<td>Dissolved Oxygen</td>
</tr>
<tr>
<td>--------</td>
<td>---------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>1</td>
<td>33.00</td>
<td>11.00</td>
</tr>
<tr>
<td>2</td>
<td>03.65</td>
<td>5.27</td>
</tr>
<tr>
<td>3</td>
<td>00.00</td>
<td>0.00</td>
</tr>
<tr>
<td>4</td>
<td>350.0</td>
<td>225</td>
</tr>
<tr>
<td>5</td>
<td>01.50</td>
<td>1.40</td>
</tr>
<tr>
<td>6</td>
<td>196.0</td>
<td>236</td>
</tr>
<tr>
<td>7</td>
<td>53.70</td>
<td>51.2</td>
</tr>
<tr>
<td>8</td>
<td>1260</td>
<td>220.0</td>
</tr>
<tr>
<td>9</td>
<td>40.87</td>
<td>39.98</td>
</tr>
<tr>
<td>10</td>
<td>24.14</td>
<td>78.1</td>
</tr>
<tr>
<td>11</td>
<td>230.0</td>
<td>220.0</td>
</tr>
<tr>
<td>12</td>
<td>0.115</td>
<td>0.136</td>
</tr>
<tr>
<td>13</td>
<td>0.025</td>
<td>0.064</td>
</tr>
<tr>
<td>14</td>
<td>0.160</td>
<td>0.18</td>
</tr>
<tr>
<td>15</td>
<td>5.20</td>
<td>4.90</td>
</tr>
<tr>
<td>16</td>
<td>2.84</td>
<td>2.35</td>
</tr>
</tbody>
</table>

**Table - 2**

Phytoplankton Population (Mg/l) in Guthal lake

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Name of Group &amp; Species</th>
<th>Summer</th>
<th>Monsoon</th>
<th>Winter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorophyceae</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Scenedesmus quadricauda</td>
<td>1260</td>
<td>840</td>
<td>840</td>
</tr>
<tr>
<td>2</td>
<td>Scenedesmus dimorphus</td>
<td>840</td>
<td>420</td>
<td>420</td>
</tr>
<tr>
<td>3</td>
<td>Scenedesmus armatus</td>
<td>420</td>
<td>-</td>
<td>420</td>
</tr>
<tr>
<td>4</td>
<td>Pediastrum duplex</td>
<td>840</td>
<td>-</td>
<td>1680</td>
</tr>
<tr>
<td>5</td>
<td>Coelastrum cambricum</td>
<td>420</td>
<td>-</td>
<td>840</td>
</tr>
<tr>
<td>6</td>
<td>Chlorells vulgaris</td>
<td>2560</td>
<td>-</td>
<td>2100</td>
</tr>
<tr>
<td>7</td>
<td>Ankistrodesmus falcatus</td>
<td>840</td>
<td>-</td>
<td>420</td>
</tr>
<tr>
<td>8</td>
<td>Closterium lumula</td>
<td>840</td>
<td>2100</td>
<td>840</td>
</tr>
<tr>
<td>9</td>
<td>Euastrum luerschmuller</td>
<td>1680</td>
<td>1680</td>
<td>1260</td>
</tr>
<tr>
<td>10</td>
<td>Onchonema compaquill</td>
<td>420</td>
<td>420</td>
<td>840</td>
</tr>
<tr>
<td>11</td>
<td>Cosmarium maculatum</td>
<td>840</td>
<td>840</td>
<td>1260</td>
</tr>
<tr>
<td>12</td>
<td>Staruratus tetracerum</td>
<td>840</td>
<td>-</td>
<td>420</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>17760</td>
<td>6300</td>
<td>11340</td>
</tr>
</tbody>
</table>

| Cyanophyceae |                        |        |         |        |
| 13          | Anabaena Oscillatorides | 2520   | -       | 2100   |
| 14          | Spirulina Nordstedii    | 840    | -       | 420    |
| 15          | Oscillatoria Sublurvis  | 2520   | 840     | 1260   |
| 16          | Arthospira Lenneri      | 420    | -       | -      |
|         | Total                   | 6300   | 840     | 3780   |

| Bacillariophyceae |                        |        |         |        |
| 17          | Nitzschia Obstuse      | 2100   | 420     | 28980  |
| 18          | Navicula Rhomboid      | 1680   | 1260    | 1680   |
| 19          | Synedra Uina           | -      | -       | -      |
| 20          | Epithemia Lerex        | -      | -       | -      |
| 21          | Cymbella Leptocerus    | 2100   | 840     | 1260   |
| 22          | Pinnularia Smpteri     | 2160   | 1260    | 840    |
| 23          | Coconex Placentula     | 4200   | 2100    | 12600  |
| 24          | Acanthes Inflata       | 840    | -       | -      |
|         | Total                   | 12180  | 5880    | 46620  |

| Euglenophyceae |                        |        |         |        |
| 25          | Euglena Acus           | 1080   | -       | 420    |
| 26          | Lepocinclis Ovum       | 840    | -       | -      |
|         | Total                   | 2920   | -       | 420    |
|         | Total Phytoplankton    | 39160  | 13020   | 62120  |

Note: “-” indicates Absence

**Table – 3**

Correlation Coefficient (Phytoplanktons and Physico-Chemical parameters in Guthal lake)

<table>
<thead>
<tr>
<th>Physico-Chemical Characteristics</th>
<th>Phytoplankton Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Chloro-phyceae</td>
</tr>
<tr>
<td>Air Temperature</td>
<td>0.571</td>
</tr>
<tr>
<td>Water Temperature</td>
<td>0.292</td>
</tr>
<tr>
<td>pH</td>
<td>0.256</td>
</tr>
<tr>
<td>Free CO₂</td>
<td>0.559</td>
</tr>
</tbody>
</table>
Correlation Studies on Physico-Chemical Parameter and Phytoplankton in Fresh Water Bodies of Mandya District

**Table 1: Correlation Coefficients**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Summer</th>
<th>Monsoon</th>
<th>Winter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dissolved Oxygen</td>
<td>-0.741</td>
<td>-0.947</td>
<td>0.137</td>
</tr>
<tr>
<td>Total Alkalinity</td>
<td>0.628</td>
<td>0.886</td>
<td>-0.289</td>
</tr>
<tr>
<td>Total Acidity</td>
<td>-0.991*</td>
<td>-0.962*</td>
<td>-0.450</td>
</tr>
<tr>
<td>Total Hardness</td>
<td>-0.846</td>
<td>-0.563</td>
<td>-0.917</td>
</tr>
<tr>
<td>Calcium</td>
<td>0.069</td>
<td>0.461</td>
<td>-0.785</td>
</tr>
<tr>
<td>Magnesium</td>
<td>0.278</td>
<td>-0.128</td>
<td>0.950</td>
</tr>
<tr>
<td>Chlorides</td>
<td>-0.899</td>
<td>-0.999*</td>
<td>-0.144</td>
</tr>
<tr>
<td>Total Dissolved Solids</td>
<td>-0.785</td>
<td>-0.473</td>
<td>-0.954*</td>
</tr>
<tr>
<td>Phosphates</td>
<td>-0.563</td>
<td>-0.187</td>
<td>-1.000**</td>
</tr>
<tr>
<td>Nitrate</td>
<td>0.078</td>
<td>-0.326</td>
<td>0.868</td>
</tr>
<tr>
<td>Nitrite</td>
<td>-0.559</td>
<td>-0.843</td>
<td>370.00</td>
</tr>
<tr>
<td>COD</td>
<td>-0.046</td>
<td>356.0</td>
<td>-0.851</td>
</tr>
<tr>
<td>BOD</td>
<td>-0.829</td>
<td>-0.538</td>
<td>-0.929</td>
</tr>
</tbody>
</table>

**Significant at p< 0.01, *Significant at p< 0.5**

**Fig. 2: Seasonal variation of Physicochemical and Biological parameter**

**Fig. 3: The annual total Phytoplankton Population (Org/L) in Guthal Lake, Mandya.**
REFERENCE