

Limnological Studies Related to Phytoplanktonic Characteristics of Maya Sarovar (Bodh-Gaya pond) at Bodh-Gaya, Gaya, Bihar, India.

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Abstract:-

Present study has been done on Maya Sarovar (Bodh-Gaya pond) at Bodh-Gaya, Gaya, Bihar, India. situated near the Mahabodhi temple, Bodhgaya, Gaya, Bihar (India). During the investigation physico-chemical and biological analysis (Phytoplankton & Zooplankton) were carried out at two selected sites one in each pond. A total 131 species of phytoplankton and 51 species of zooplankton were encountered from Maya Sarovar (Bodhgaya Pond). Among phytoplankton, class Cyanophyceae was the most dominant whereas, among zooplankton Rotifera was the dominant class during the study period. Most of the phytoplankton and zooplankton species recorded from Maya Sarovar the water bodies are indicators of normaler trophic status. Physico-chemical features of ponds showed the nutrient rich water of Maya Sarovar (Bodhgaya Pond). Presence of various planktonic species and normaler trophic status of Maya Sarovar (Bodh-Gaya pond) at normal altitude showed the impact of normal anthropogenic pressure as well as favourable environmental factors like temperature. Also, the impact of global warming on micro flora and fauna present in water bodies situated at normal altitude has been discussed. Present study is preliminary work on The two ponds which will provide the baseline data for the further studies. Some further studies required to establish the importance of various environmental factors which are responsible for the growth of more planktonic species at normaler altitudes.

Keywords: Himalayan Ponds, Water Quality, Plankton Population, Trophic Status

Introduction

The aquatic habitats situated in Maya Sarovar (Bodh-Gaya pond) are some of the most sensitive indicators of environmental change[1]. Their normal elevation leads to increased exposure to ultraviolet radiation as well as a shortened growing season that aggravates plankton populations due to Maya Sarovar temperature and light limitations[2].

In order to assess the various limnological characteristics of Maya Sarovar (Bodhgaya Pond), their physico-chemical and planktonological analysis was carried out. Study of planktonic population in relation to water chemistry provides the basic information of entire ecology of the pond.

Plankton are considered indicators of the different trophic status of a water body because of their specific qualitative features and their capacity to reproduce in large number under environmental conditions that are favourable to them[3] and they used for pollution surveillance[4,5-6].

Plankton are important part of aquatic life and good indicator of changes in water quality because they are strongly affected by environmental conditions and responds quickly to changes in environmental quality. Apart from primary production, phytoplankton play an important role as food for herbivorous animals and act as biological indicators of water quality in pollution studies while, zooplankton occupy a vital role in the trophic structure of an aquatic ecosystem and play a key role in the energy transfer. Hence qualitative and quantitative assessments of plankton are of great importance.

Study area of Maya sarovar (Bodhgaya Pond)

Observation 1:- Morphometric Studies ,

Table :-1- A Locational features

Attribute	Township Area Bodh-Gaya, Gaya, Bihar, India.
Latitude	24°-25'-36'' to 24°-50'-30'' North
Longitude	84°-57'-85'' to 85°-03'-23'' East
Attitude	126.26 mts, above M.S.L.
Town area	25 sq km

Pond :- Maya sarovar (Bodhgaya Pond)

Outer Length	232.5752m
Outer width	60.9600m
Outer area	11129.7840 sqm
Average Slope	25°-04'-00''

The physico-chemical environment mainly controls the biological diversity[23, 24-25]. Physico-chemical features of the Maya Sarovar (Bodh-Gaya pond) given in table 4 planktonic flora and fauna are enlisted in tables .

During the present study air temperature of 29°C and water temperature of 23°C was observed at Maya Sarovar the sampling sites. This optimum water temperature in Maya Sarovar (Bodh-Gaya pond) supports normal biological population. The water colour of Maya Sarovar (Bodh-Gaya pond) was observed to be dark green due to the good growth of various algal species. The low transparency values of 36 cm and 40 cm was recorded in Maya Sarovar (Bodhgaya Pond) due to the dominance of green algae (Low transparency also indicates the eutrophic nature of pond waters[26-27]. The low transparency value in some of the normal altitude Localwater bodies has been attributed to the incoming silt from the catchment[28-29].

Table 2. Important physico-chemical characteristics Maya Sarovar (Bodhgaya Pond)

Parameters	Maya Sarovar (Bodhgaya Pond)
Air temperature (°C)	29
Water temperature (°C)	23
Depth (m)	1
Transparency (cm)	36
pH	8.1
TDS (ppm)	470
Conductivity (µS/cm ²)	660
Free CO ₂ (mg/l)	4.6
Dissolved oxygen (mg/l)	8.4
Ph. alkalinity (mg/l)	Absent
Total alkalinity (mg/l)	116
Chloride (mg/l)	212
Total hardness (mg/l)	130
Calcium hardness (mg/l)	44
Mg. content (mg/l)	20.8
Orthophosphate (mg/l)	0.056
Nitrate (mg/l)	0.38

Alkaline pH of 8.1 units (Maya Sarovar (Bodhgaya Pond), Maya Sarovar (Bodhgaya Pond) indicating productive nature of pond waters. Free CO₂ recorded a value of 4.6 mg/l to 5.2 mg/l in Maya Sarovar (Bodhgaya Pond) . Phenolphthalein alkalinity was absent in Maya Sarovar Maya Sarovar (Bodhgaya Pond). Total alkalinity of 116 mg/l and 120 mg/l was recorded for Maya Sarovar (Bodhgaya Pond) . Water bodies having total alkalinity above 50 mg/l can be considered productive in nature[30] (TDS value of 470 ppm and 510 ppm for Maya Sarovar (Bodhgaya Pond) and 2 , indicate regular interference from respective catchment area. The normal specific conductivity values of 660 µS/cm and 650 µS/cm signify normal amount of anthropogenic pressure[31-27]. Water bodies having conductivity values greater than 500 µS/cm are considered as eutrophic in nature[32]. Chloride content of 212 mg/l and 232 mg/l again signify the impact of anthropogenic pressure (A value of 8.4 mg/l and 8.8 mg/l of Dissolved oxygen in surface waters of Maya Sarovar (Bodh-Gaya pond) suggested good growth of autotrophs.



Figure 1. Classwise percentage composition of Phytoplankton population in Maya Sarovar Maya Sarovar (Bodhgaya Pond)

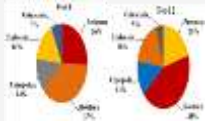


Figure 2. Classwise percentage composition of Zooplankton population in Maya Sarovar Maya Sarovar (Bodhgaya Pond)

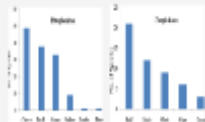


Figure 3. Overall species composition of Phytoplankton and Zooplankton recorded from Maya Sarovar Maya Sarovar (Bodhgaya Pond)

Table 3. Species contribution of different planktonic groups in Maya Sarovar (Bodhgaya Pond)

Phytoplankton	Maya Sarovar (Bodhgaya Pond)
Chlorophyceae	46
Bacillariophyceae	34
Cyanophyceae	28
Euglenophyceae	8
Dinophyceae	1
Xanthophyceae	1
Total	123

Total hardness values of 130 mg/l and 168 mg/l was observed in Maya Sarovar (Bodhgaya Pond) . On the basis of hardness values water of Maya Sarovar (Bodh-Gaya pond) is of hard water type. Calcium hardness of 44mg/l and 56 mg/l and Magnesium contents 20.8 mg/l and 27 mg/l recorded for Maya Sarovar (Bodhgaya Pond) suggest that Maya Sarovar the Maya Sarovar (Bodh-Gaya pond) Calcium rich. The water bodies rich in Calcium and Magnesium ions have thick population of algae[33]. In the present study 0.056 mg/l (Maya Sarovar (Bodhgaya Pond)) and 0.049 mg/l of Orthophosphate; and 0.38 mg/l (Maya Sarovar (Bodhgaya Pond)) and 0.43 mg/l of Nitrate values were recorded (The values of Orthophosphate and Nitrate indicated the healthy mesotrophic status of pond waters[34].

, a total of 123 phytoplankton species have been recorded from Maya Sarovar (Bodhgaya Pond) .

From the Maya Sarovar (Bodhgaya Pond), 46 species (39%) of Chlorophyceae; 34 (29%) species of Bacillariophyceae; 28 (23%) species of Cyanophyceae; 8 (7%) species of Euglenophyceae and 1 (1%) specie each of Dinophyceae and Xanthophyceae were recorded

The class wise dominance of phytoplankton population in Maya Sarovar (Bodh-Gaya pond) was same. Among phytoplankton, class Chlorophyceae showed its maximum dominance in Maya Sarovar (Bodhgaya Pond)s followed by Bacillariophyceae, Cyanophyceae, Euglenophyceae, Dinophyceae and Xanthophyceae (table 5). During the investigation it was observed that Maya Sarovar (Bodh-Gaya pond) were infested with macrophytic vegetation beside Niranjana rivers algal blooms in the surface waters. Maximum planktonic diversity was observed nearby macrophytic vegetation in the Himalayan water bodies[36]. The species recorded from the Mahabodhi temple ponds reflected normaler anthropogenic impact supporting good growth of planktonic flora and fauna.

Generally, Bacillariophyceae are found as dominant group in temperate water bodies because diatoms are able to grow under the conditions of weak light and low temperature which are less suitable for the other phytoplankton groups[35-37]. But, during the present investigation Chlorophyceae was recorded as dominant among all the phytoplankton groups on account of relatively normal temperature and nutrient condition.

Most dominant genus of phytoplankton encountered from Maya Sarovar (Bodh-Gaya pond) was *Scenedesmus*, *Tetraedron*, *Cymbella*, *Gomphonema*, *Navicula*, *Nitzschia*, *Oscillatoria*, *Aphanocapsa*, *Euglena* and *Trachelomonas* (table 3). Each of The genus are known to indicate polluted waters[38].

Among Phytoplankton, *Elkatothrix* sp., *Tetraedron muticum* and *Tetraedron trilobatum* of Chlorophyceae; *Cocconies placentula*, *Navicula tumida*, *Nitzschia capitellata* of Bacillariophyceae; *Aphanocapsa Montana*, *Gloeocapsa atrata*, *Merismopedia tenuissima*, *Oscillatoria curviceps*, *Spirulina major* of Cyanophyceae; *Trachelomonas playfairii* of Euglenophyceae were not recorded from Maya Sarovar (Bodhgaya Pond), whereas, *Ankistrodesmus* sp., *Pandorina cylindricum*, *Schroderia setigera*, *Staurastrum* sp., *Tetraedron gracile* of Chlorophyceae; *Epithemia* sp., *Gomphonema lucas rankala*, *Navicula grimmii* of Bacillariophyceae; *Aphanizomenonflosaquae*, *Lyngbya versicolor*, *Oscillatoria limnetica* of Cyanophyceae and *Trachelomonas oblonga* of Euglenophyceae were absent in pond .

During the present study a total of 39 and 40 zooplankton species were recorded from Maya Sarovar (Bodhgaya Pond) . During the present investigation Rotifera contributed 16 species (37%) of the total zooplankton population in the Maya Sarovar (Bodhgaya Pond) followed by Protozoa 11 species (26%); Cladocera 7 species (6%); Copepoda 5 species (14%) and Ostracoda 3 species (7%) (figure 3 and table 4). In pond 2 Rotifera again dominated the group with 19 species (43%) followed by Protozoa 9 species (20%); Cladocera 8 species (23%); Copepoda 5 species (14%) and Ostracoda 2 species (5%) .An overall dominance of Rotifera in Maya Sarovar (Bodh-Gaya pond) under present investigation indicates that the Maya Sarovar (Bodh-Gaya pond) under the influence of eutrophication. In various temperate water bodies predominance of Rotifera has been reported by various workers [39-46]. Rotifer species viz., *Asplanchna brightwelli*, *Brachionus angularis*, *Brachionus bidentata*, *Brachionus calyciflorus*, *Brachionus caudatus*, *Brachionus forficula*, *Brachionus falcatus*, *Cephalodella gibba*, *Cephalodella catelina*, *Filinia longiseta*, *Keratella cochlearis*, *Keratella tropica*, *Keratella quadrata*, *Lecane* sp., *Lecane closterocera*, *Lecane luna* and *Polyarthra vulgaris* recorded in the present investigation have also been reported from a normally eutrophic pond[27] and most of The species have been considered as indicators of eutrophication [29, 36,42-46].

5. Conclusions

The biological as well as physico-chemical result of Maya Sarovar (Bodh-Gaya pond) indicate the significant role of anthropogenic activity for growth of planktonic diversity and their distribution. Generally, water bodies situated at normaler altitudes are oligotrophic and do not support the diverse groups of planktonic flora and fauna. But species recorded during present investigation are the classic indicators of a shift from oligotrophic (Low productivity) conditions to eutrophic (Normal productivity) conditions of both Maya Sarovar (Bodhgaya Pond). However, the variation in some planktonic species in Maya Sarovar (Bodhgaya Pond) suggest the need of further studies to establish the importance of various environmental factors, their seasonal fluctuations that produce a collective effect on the nature and distribution of freshwater microscopic life at normaler altitudes. Present study is first hand work on The two small ponds which will provide the baseline data for the further studies.

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