“Ecobiodiversity studies of Algae of Bindusara Reservoir in Beed district of Maharashtra”

Report of Minor Research project Submitted to

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By

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DECLARATION

I hereby declare that the Minor Research Project entitled,“**Ecobiodiversity studies of Algae of Bindusara Reservoir in Beed district of Maharashtra**” is an original work carried out by me at Department of Botany, Mrs. K.S.K. College, Beed.

Place- BEED

Date- 18/01/2021

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INTRODUCTION

Algae are the most widespread and abundant photosynthetic life in aquatic as well as terrestrial ecosystem. It is a diverse group of plant kingdom, comprising large heterogeneous assemblage of autotrophs. As water is life supporting system each type of water body has their own communities. Fresh water bodies are the habitats where algae grows abundantly and found in diverse form. Rivers, streams, pools, puddles, ponds, lakes and dams are the different types of fresh water habitats. They have their own specific flora and fauna. It is an established fact that, algae with the help of pigment complex and in the presence of carbon dioxide and water converts effectively solar energy into biochemical energy. Algae constitute the main autotrophic component of the aquatic ecosystem. They are the chief primary producers and form the base of food chain, on which the entire dynamics of aquatic ecosystems is depend. Algae gain its importance in the modern time not only as alternative potential source of protein for the hungry man but also as the primary source of food for aquatic animals. Algae constitute about 40% of the total carbon fixed annually on this planet and thus is an important component of ecosystem.

In the recent era great advances have been made in the investigation of fresh water algae in many parts of the world and particular attention has been paid to their biology and ecology. Survey of literature revels that, studies on algal biodiversity in abroad and in India have been done extensively. In Maharashtra several workers have paid their attention on diversity of algae. Marathwada is a one of the important geographical region of Maharashtra where large number of fresh water bodies are present. Review of literature reveals that the algal biodiversity in Marathwada is still in infacy (Sarode and Kamat, 1979, 1980, 1981 and 1983; Ashtekar, 1980; Kamble, 2008 and Andhale, 2008, Talekar 2009, Yadav 2010). Beed district of Marathwada region is rich in large number of fresh water bodies. So far, this area has not been explored as its biotic diversity of algae is concerned. Therefore to fulfil this lacuna, it has been decided to work on Ecobiodiversity studies of algae of Bendusara reservoir in Beed district of Maharashtra.

OBJECTIVES OF INVESTIGATION

i) To explore the algal flora from Bendusara reservoir of Beed.

ii) To find out Class wise Composition algal taxa.

iii) To study physico- chemical parameters of water of reservoir for assessment the water quality.

iv) To find out correlation among algal flora and physico- chemical parameters.

v) To study the water quality.

vi) To study the seasonal variation.

REVIEW OF LITERATURE

All over the world extensive and appreciable work have been carried out by the researchers on algal biodiversity of fresh water bodies.A brief account of algal biodiversity study in abroad, India and Maharashtra is given below.

Paranekar (1935) reported two Charophytes from Kolhapur. Gonzalves and Joshi (1943) studied fresh water algae in some rain water pools near Boriwali and rain water puddles near Joshiwari at Bombay. They also observed seasonal succession of algae in the tank of Bandra. Chacko and Ganapati (1952) worked on hydrobiology of the Saruli river, Madurai distict, Tamilnadu. They reported fairly good flora and fauna. Singh (1953) studied algal composition of water blooms and reported *Microcystis aeruginosa* as a indicator of water pollution. Chacko and George (1953) presented an account of the flora and fauna of the

Veeranam tank, south Arcot district Madras. Kamat (1962) reported 126 taxa of Chlorophyceae form Ahmedabad. Saxena and Venkateswarlu (1968) studied desmids of Dharamsagar lake Warangal (A.P) and reported 53 taxa. Munawar (1972) Studied ecological distribution of Euglenoides in ceartin polluted and unpolluted environment at Hyderabad.

Anand (1975) presented a check list of planktonic algae form Mansar lake Jammu. He reported 25 taxa. Nasar and Datta (1976) studied algal flora of ponds of Bhaglapur, Bihar and reported 33 taxa of algae. Rai and Kumar (1976) studied pollution tolerant algae form effluent of fertilizer factory at Varanasi. Rai (1978) conducted ecological studies of alga flora of Ganga river of Varanasi.

Aykuyla (1978) presented quantitative study of the phytoplankton of the river Avon and reported 233 taxa of algae. Ashtekar and Kamat (1978) extensively worked on Oedogoniaceae and Zygnemataceae of Aurangabad district of Marathwada region. Freitsa and Kamat (1979) observed Desmids of Nagpur. Gunale and Balakrishnan (1979) showed *Schizomeris leibleini* is an indicator of eutruphication while studying pollution indicator algae of Mula – Mutha river , Poona. Sarode and Kamat (1979) extensively studied the Diatoms of Marathwada. Pandey and pandey (1980) surveyed Baghla and Mc Pherson lakes form Allahabad and found 80 forms of desmids. Ashtekar (1980) systematically studied algal biodiversity of Aurangabad district and recorded 617 algal taxa.

Gunale and Balkrishanan (1981) have used algae as biomonitors of eutrophication in the study of Pavana, Mula, Mutha rivers at Pune city. Barahate and Tarar (1981) studied algal flora of Tapti river flowing through Bhusawal and reported 41 algal taxa. Pingale (1981) studied on ecology of algae of Pam river in Poona and assessed the organic pollution of river by using Palmers Index of pollution. Jagdale *et. al.,* (1984) studied the pollution of Godavari river water at Nanded. Mahajan and Mahajan (1988) studied the algal communities in Velhala lake near Bhusawal and used algae as indicators of organic pollution. Ningangoudar and Hegde (1990) studied occurrence of phytoplankton in a lake Dharwad, Karnataka. They reported 37 algal taxa. Senger *et. al.,* (1990) studied algae with reference to water purification. Jose and Patel (1992) gave a systematic account of Chlorococcales new to Kerala. Nandan (1993) found blooms of *Microcystis aeruginosa*, *Microcysits elognata* and *Anabaena reciborskii* in river

Vishwamitri Baroda, Gujarat. Iqbal (1993) studied some desmids of Jaipur, Rajasthan and reported 22 taxa. Nandan (1993) reported 30 species belonging to four groups of algae from fish pond in Dhule. Nandan and Ansari (1999) carried out ecological study of algae form Mausam river flowing through Malegaon city. They reported 37 pollution tolerant genera and 27 species. More and Nandan (2000) recorded 4 groups of algae form 3 stations of Panzara river. Waghodekar and Jawale (2001) reported eight taxa of Euglenophyceae form Yawal and Raver talukas of Jalgaon district. Jain (2002) extensively carried out ecological studies of algae form Sonvad and Devbhane Dam of Dhule district and reported total 306 algal taxa. Eswari (2002) did hydrobiological studies of Red hills reservoir North Chennai, Tamil Nadu and classified reservoirs to be mesotrophic.

Misra and Srivastav (2003) studied some desmids form Bahraich, Sarswasti and Gonda districts of U.P and recorded 38 desmidain taxa. Mini *et. al.,* (2003) worked on hydrobiological studies of Vamanapuram river, Thirvananathapuram (kerala). Somani *et. al.,* (2003) specifically studied the dynamics of Chlorophyceae in phytoplankton of lake Masanda, Thane. They found *Pediastrum* and *Scenedesmus* as the consistent genera contributing to the peak of Chlorophyceae. Nandan and Mahajan (2003) have studied diversity of Cyanobacteria in polluted lakes of Jalgaon district of North Maharashtra. More and Nandan (2003) evaluated Panzara Dam water for hydrobiological study of algae and recorded 12 species of pollution tolerant genera.Kumawat and Jawale (2003a & b) studied genus *Tetraedron* form some fish ponds at Anjale. Dist. Jalgaon. They reported 20 taxa belonging to this genus. They also reported 65 members of phytoplankton form the same area. Sirsat *et. al.,* (2004) studied phytoplankton of fresh water pond at Dharamapuri, Beed. Their study revealed that the biota such as *Microcystis, Nostoc, Lyngbya* and *oscillatoria* produce biotoxins. Kumawat and Jawale (2004 a & b) researched the ecology of fish pond at Anjale, Jalgaon district with special emphasis on euglenoids and genera *Schroderia*.

Patel and Bhadane (2004) gave comparative account of plankton diversity form Tadya pond of Amalner district Jalgaon. They found higher density of phytoplankton community including species of *Oedogonium, Volvox, Anabaena* and *Microcystis.* Peramalsamy and Thangamani (2004) studied species diversity of phytoplankton richness and evenness and also pollution indicators form Marulathu pond, kalapperumalpatti (T.N). Jawale and Dhande (2005) reported

10 taxa of *Oedogonium* form Hartala lake of Jalgaon district.. Dhande and Jawale (2006) reported 27 taxa of *Oedogonium* during the extensive study of algal flora of Hartala lake form district Jalgaon. Khapekar and Deshpande (2007) studied the phytoplankton composition and assessed the pollution status of Naik lake, Nagpur. Dhande *et. al.,* (2007) recorded 6 species of *Spirogyra* for the first time form Maharashtra and two species collected for the first time form India, while *Spirogyra patelii* sp. NOU is new to science.

Nandan *et. al.,* (2007) recorded 322 algal forms form Hartala lake of river Tapti. In their study genera *Tetraedron, Oocystis, Scenedesmus, Spirogyra, Closetrium* and *Cosmarium* were most frequently observed. Yadav and Ashtekar (2007) reported Desmids form Bindusara dam Beed. They found the desmids are present in large number and encountered desmids includes *Cosmarium, Closterium, Euastrum* and *Staurastrum* Mager *et. al.,* (2007) observed algal flora of kasura reservoir of Jalna district. They found 53 species belonged to 28 genera. Senthikumar and Sivkumar (2007) conducted studies on the phytoplankton periodicity and abundance in relation to water quality at Veeranam lake (T.N). They reported total 160 taxa of algae among which Bacillariophyceae was dominant. Verma (2008) extensively studied macrophytes and algae of Narmada river at Maheshwar in Madhya Pradesh. He systematically enumerated the variations in physicochemical parameters and seasonal variations in algae. He also studied role of algae as indicator of water quality. Kamble (2008) systematically studied algal biodiversity and seasonal variation of selected water bodies of Marathwada region and recorded 57 taxa, of which 30 species under 11 genra belonged to Cyanophyceae, 23 species under 15 genera belonged to Chlorophyceae and 4 species under 4 genera belonged to Bacillariophyaceae. Further he studied biochemical analysis, antimicrobial activity of algae and effect of algal extracts on seed germination.

Magar (2008) reported 364 algal taxa which mainly belongs to Chlorphyceae, Cyanophyceae , Bacillariophyceae and Eugleonophyceae form Grina reservoir of Nasik district. Andhale (2008) recorded 215 species of algae from Jayakwadi reservoir of Paithan Tahsil in Aurangabad District.

METHODOLOGY

1) General geography and climatology:

The exact geographical location of Beed district is at 16.65^{o}N 74.13^{o}E. it has a mean elevation of 530 meters (1738 feet). Beed district is located on the Deccan plateau. In the district, the main rivers are Manjara, Bendusara and Sindfana. The Balaghat range is close by. The soil of the area is rough and rocky largely consisting of basalt. Thin deposits of fertile black soil are found in the northern part and in the south at the western bank of Bendusara. The district experiences semi-arid, warm and dry climate, summers are lengthy, extending from the middle of February to June. Average temperature in summer vary between 31^{o}C to 40^{o}C. Winters are short with temperature between 12^{o}C to 20^{o}C. Rains are inadequate and take place only during the monsoon from mid June to September. The average annual rainfall is 666mm.

2) Study area:

The present investigation was carried out on Ecobiodiversity studies of algae of Bindusara reservoir in Beed district of Maharashtra. Bendusara. reservoir is one of the important reservoir located near village pali and 10 km away from beed city. This reservoir was constructed on Bindusara river in 1955. It having water storage capacity 7.106 million cubic meters. The Geographical location of bindusara reservoir at the longitude of 75^0 72' and latitude of 18^0 90' . In order to study the algal Ecobiodiversity studies of algae of Bindusara reservoir in Beed district of Maharashtra area, 3 sites were selected for the collection of algal samples and water samples. These sites are:

1) **S_1** – Central outlet

2) **S_2** – Road site

3) **S_3** –Shantivan

3) Field Work:

Algal samples were collected at monthly intervals from three selected sites during June 2013 to May 2015. Acid washed collection bottles were used for the collection of algal samples. Floating, Planktonic, submerged and attached epiphytic algal samples were collected separately in collection bottles. Plankton net was used to collect Planktonic algae. After collection, algal samples were brought immediately to the Laboratory. The algal samples were preserved in 4% formalin for further taxonomic investigations.

Water samples were collected at about one feet depth below surface from all three sides. The collection was done during morning hours i.e. 8:00 to 10:00 am at seasonal intervals. The water samples were collected in acid washed plastic cans of five liters capacity. Air temperature and water temperature were recorded by using centigrade mercury thermometer at the time of sampling. For the estimate of dissolve oxygen separate samples were collected in 250 ml BOD Glass bottle . The samples were fixed with chemicals on the spot. The bottles were stored in ice-bags to maintain temperature.

4) Laboratory work:

a) Biodiversity study:

The biodiversity studied for qualitative analysis of algae. The fresh as well as preserved algal forms were observed under microscope and identified. Micrometry is an important and essential element in the taxonomical studies. The measurements with the ocular and stage micrometer were recorded. They were then used for identification of different taxa. Microphographs were taken and presented in taxonomic description of algae. Identification of algal taxa was performed by referring to the standard literature on algae (Smith 1950, Prescott 1951, Desikachary 1959, Randhawa 1959, Pal *et. al.,* 1962, Ramanathan 1962, Krieger and Gerloff 1965, Philipose 1967, Gonzalves 1981, Inyengar and Desikachary 1981, Sarode and Kamat 1984).

Taxonomic account of all identified algal taxa were made for the five groups of algae viz.

i) Chlorophyceae

ii) Charophyceae

iii) Euglenophyceae

iv) Bacillariophyceae

v) Cyanophyceae

b) Physico-chemical analysis of water :

The Physico-chemical analysis of water samples was carried out by the standards methods of APHA (1975) and Trivedy and Goel (1984) in present investigation ten parameters were selected for analysis viz. Air temperature , water temperature, dissolve oxygen, phospharous, carbonate, calcium, magnecium, chloride **.**

TAXONOMIC DISCRIPTION

CHLOROPHYTA

1) *Gloeocystis ampla* (Kuetzing) Lagerheim

Prescott 1951, p – 84, pl – 3, Fig. – 17.

Cells in a colony of 2 – 8, ovoid or oblong, enclosed in a copious, unlamellated, gelatinous envelopes; sheaths of each cell or group of cells not confluent but distinct; cells 9 – 11 μ in diameter, 10 – 14 μ long.

2) *Gloeocystis gigas* (Kuetzing) Lagerheim

Prescott 1951, p –84, pl – 3, Fig. – 16.

Cells solitary or in a colony of 4 – 8, spherical, enclosed in copious, gelatinous, lamellate envelopes; cells with brownish green contents, 9 – 12 μ in diameter.

3) *Gloeocystis major* Gerneck ex Lemmermann

Prescott 1951, p – 84, pl – 52, Fig. – 10.

Cells ovoid, in colonies of 4 – 8, enclosed by a wide, lamellate sheath in which groups of individuals are surrounded by concentric layers, chloroplast massive completely covering the wall; cells 17 – 19 μ in diameter, 21 – 23 μ long.

4) *Tetrospora cylindrical* (Wahl.) C.A. Agardh

Prescott 1951, p – 88, pl – 5, Fig. – 1, 2.

Thallus macroscopic, attached, irregularly lobed cylinder of firm mucilage, narrowed at the point of attachment; cells spherical to nearly spherical, scattered, 14 – 17 μ in diameter.

5) *Tetrospora lamellosa* Prescott.

Prescott 1951, p – 88, pl – 5, Fig. – 6.

Thallus irregularly lobed and saccate, free floating, cells spherical, in 2's with thick walls and gelatinous, lamellate sheaths which are distinct and not connunuent with the colonial mucilage, pseudocina very fine and 20 – 30 times the diameter of the cell in length chloroplast a dense. Parietal plate converting almost the entire wall, cells 9 – 10.5 μ in diameter.

6) *Ulothrix aequalis* Kuetcing

Prescott 1951, p – 96, pl – 6, Fig. – 1.

Filaments very long; cells cylindrical, as long as broad, rarely shorter, 13 – 15.5 μ in diameter, 18 – 30 μ long without constrictions at the cross walls; chloroplast parietal, girdle shaped, with 2 – 4 pyrenoids.

7) *Ulothrix zonata* (Weber and Mohr) Kuetizing

Prescott 1951, p – 97, pl – 6, Fig. – 14.

Filaments attached, usually long and stout, variable in diameter in the some plant mass, cells shorter, or elongate cylindric, sometimes slightly swollen with constrictions at the cross walls. Cell walls thick, especially near the base to the filament, chloroplast a complete circular band in the base of the midregion of the cell, with several pyrenoids. Cells 20 – 45 μ in diameter, 21 – 60 μ long.

8) *Stigeoclonium lubricum* (Dilliw.) Kuetzing.

Prescott 1951, p – 115, pl – 10, Fig. – 1, 2.

Filaments elongate and robust; axile cells barrel shaped; branches opposite or alternate, mostly short pointed; cells of the branches narrower than those of the main filaments; cells of the main filaments 17 μ in diameter, 12 – 30 μ long; cells of the branches 6 – 7 μ in diameter

9) *Stigeoclonium pachydermum* Prescott.

Prescott 1951, p – 116, pl – 12, Fig. – 1 – 4, 9, 10.

Filaments much branched erect, with numerous basal, downward, projecting rhizoidal branches; branches in the upper portion irregularly disposed and extremely varied in form mostly alternate but with one branch arising immediately above another on the opposite side of the filament or in a blunt at right angles to it; branches often developing, downward projecting branches developing form the upper part of the main axis; branches tapering to a blunt point and frequently ending in somewhat enlarged quadrangular globose sporangial cells, which may be intercalary near the ends of short branches also. Cells in the main axis 19.5 – 21 μ in diameter, in the branches 15 – 16 μ in diameter, cylindrical and several times longer thin wide, short and barrel shaped in the same filament. Walls of the cells in the main axis 3 – 4 μ thick.

1O) ***Trochiscia obtusa* (Reinsch) Hansgirg**

Prescott 1951, p – 239, pl – 52, Fig. – 8.

Cells spherical, the wall thick, with concentric series of ridges or law, parallel protuberanes; 34 – 37 µ in diameter.

11) ***Trochiscia aspera* (Reinsch) Hansgirg**

Prescott 1951, p – 239, pl – 53, Fig – 17.

Cells free floating globose, the wall moderately thick decorated with evenly distributed, wartlike projections, chloroplast several, disc shaped; cells (13) – 18 – 29.5 µ in diameter.

12) ***Pediastrum boryanum* (Turp.) Meneghini.**

Prescott 1951, P – 222, pl – 47, Fig – 9, Pl – 48, Fig. 1, 3.

Colonies entire; cells 5 – 6 sided with granular walls; peripheral cells with outer margins extended into 2 blunt tipped process; cells 14 µ in diameter; processes 21 µ long; 32 – 36 celled colonies 85 – 90 µ in diameter.

13) ***Pediastrum duplex* Meyen**

Prescott 1951, P – 223, pl – 48, Fig – 4.

Colony 8 – 128 celled, the walls smooth, with lens shaped spaces between the inner cells, which are quadrate, the outer margin concave; peripheral cells quadrate, the outer margin extended into 2 tapering, blunt tipped processes, distanced between processes of one cell about one half the distance between processes of adjacent cells; cells 15.6 μ in diameter; 36 – celled colony 105 μ in diameter.

14) *Pediastruim muticum* Kuetzing

Prescott 1951, P – 225, pl – 49, Fig – 8.

Colony perforate, with 6 – 64 smooth walled cells; inner cells 5 or 6 sided; peripheral cell with emarginated outer walls and 2 broadly rounded lobes, which are further apart than the lobes of adjacent cells; cells 2 μ in diameter

15) *Pediastrum simplex* (Meyen) Lemmermann

Prescott 1951, P – 227, pl – 50, Fig – 2.

Colonies entire, circular, consisting of 8 – 16 cells; inner cells 5 or 6 sided; outer sides of peripheral cells extended to form a single tapering horn-like process with concave margins; cells usually without intercellular spaces; cell wall smooth; cells 12 – 18 μ in diameter.

16) *Pediastrum tetras* (Ehrenb.) Ralfs.

Prescott 1951, P – 227, pl –50, Fig – 3, 6.

Colonies entire, 4 – 8 celled; inner cells with 4 – 6 straight sides but with one margin deeply incised; peripheral cells crenate with a deep incision in the outer free margin, their lateral margins adjoined along 2/3 of their length; cells 8 – 12 (16) μ in diameter

17) ***Hydrodictyon reticulatum* (L.) Lagerheim**

Prescott 1951, P – 219, pl – 47, Fig – 1.

Thallus macroscopic, consisting of cylindrical cells, adjoined at their ends to form a cylindrical net with five or six sided mesh; chloroplast at first parietal plate with a single pyrenoid, later becoming a reticulum covering the entire cell with many pyrenoids; cells upto 200 μ in diameter, much as 1 cm long.

18) ***Chlorella vulgaris* Beyerink**

Prescott 1951, P – 237, p – 53, Fig – 13.

Cells spherical, scattered among other or sometimes occurring in almost pure growths; chloroplast a parietal cup. Sometimes without a pyrenoid; cells 5 – 8.5 (10) μ in diameter.

19) ***Oocystis borgei* Snow**

Prescott 1951, P – 243, pl – 51, Fig – 10.

Colonies consisting of 8 cells; cells broadly ellipsoid, with rounded ends, poles not thickened; cells (9)-12-13 μ in diameter, (9)-10-19 μ long; chloroplast one, parietal, with a pyrenoid.

20) ***Oocystis crassa* Wiltrock.**

Philipose 1967, p. 181, F – 91; Prescott 1951, P – 243, pl – 51, Fig – 9.

Colonies consisting of 2 – 8 cells, ellipsoid, poles broadly rounded, furnished with a nodular thickening; chloroplasts 4 – 10, parietal, fairly large, each with a pyrenoid; cells 10 – 20 μ in diameter, 14 – 26 μ long.

21) *Oocystis pyriformis* Prescott.

Prescott 1951, P – 246, pl – 54, Fig – 8, 9.

Colonies consisting of 2 – 4, broadly pyriform ovoid cells, with a prominent apiculation at one pole, other end broadly rounded, chloroplast massive, parietal with a pyrenoid; cells 14 – 16 μ in diameter, 48.8 μ long.

22) *Ankistrodesmus falcatus* (Corda) Ralfs

Prescott 1951, P – 253, pl – 56, Fig – 5, 6.

Cells needle-like to somewhat spindle shaped, with the ends tapering to acute apices, usually in clusters of 2 – 4, not enclosed in a colonial sheath; chloroplast one, parietal, without pyrenoid; cells 2 – 6 μ in diameter, 25 – 100 μ long.

23) *Ankistrodesmus falcatus* (Corda) Ralfs *V. acicularis* (Braun) West

Prescott 1951, P – 253, pl – 56, Fig – 16.

Cells solitary and almost straight, the outer wall slightly curved in the median portion, extended into long, finely drawn out apices; chloroplast extending over 2/3 of the cell wall; cells 2.5 μ in diameter, 36 – 65 μ long.

24) ***Ankistrodesmus falcatus*** **(Corda) Rafs *V. mirabilis* (West et West) West**

Prescott 1951, P – 253, pl – 56, Fig – 10.

Cells sigmoid or lunate, apices gradually tapering to fine points; cells solitary, 2-3 μ in diameter, 150 μ long.

25) ***Selenastrum westii*** **G.M. Smith.**

Prescott 1951, p – 257, pl – 57, Fig – 10.

Cells 2 – 8, lunate or arcuate, arranged with their convex walls opposed; chloroplast parietal, along the convex wall; with a pyrenoid; cells 15 – 2.5 μ in diameter; 15 – 18 μ between apics.

26) ***Coelastrum microporum*** **Naegeli**

Prescott 1951, P – 230, pl – 53, Fig – 3.

Coenobium spherical, composed of 8-64 sheathed globose cells (sometimes ovoid with narrow end outwardly directed), cells interconnected by very short, scarcely discernible gelatinous processes, Leaving small intercellular space, cells 8-20 μ diameter including the sheath.

27) ***Coelastrum sphaericum*** **Naegeli**

Prescott 1951, P-231, P1-53, Fig – 7.

Coenobium ovoid composed of conical cells, the narrow end directed outward, adjoined without processes along the lower lateral walls forming interstices which are equal to or greater than the diameter of the cells, cells up to 25 μ in diameter.

28) *Scenedesmus armatus* (Chodat) G.M. Smith

Smith 1916, P.460, Pl.28, F.53, Pl.29 F.90-93: Philipose 1967, P.261, F.171, Prescott 1951, P.276, Pl.62, F.13,14.

Colonies consisting of 4 cells terminal cells with a sinole long spine form each pole; internal cells with a median, lateral, longitudinal rib; cells oblong ellipsoid, arranged in a linear series, cells 6-8 μ in diameter 9-15 μ long.

Habitat – S_3

29) *Scenedesmus armatus* Var *major* G.M. Simth

Prescott 1951, P.276, Pl.62, F.15, Pl.63, F.23.

Colonies consisting of 4 cells; arranged in a partially alternating series; cells oblong ellipsoid, with broadly rounded ends, terminal cells with a sinole long, usually curved or unevently bent spine at each pole, inner cells with median incomplete longitudinal ridge: cells 3-5.5 μ in diameter 9-12 μ long.

30) *Scenedesmus bijugatus* (Turpin) Kuetzing.

Philipose 1967, P.252, F.164, c,e,f.

Colonies consisting of 4-8 cells, arranged in a single linear series; cells oblong with broadly rounded ends, 3-6 μ in diameter 7-16.5 μ long.

31) *Scenedesmus dimorphus* (Turpin) Kuetzing

Philipose 1967, P. 249, 250, F, 160, c: Prescott 1951, P.277, 278, Pl.63, F. 8,9; Smith 1916, P. 434, Pl.32, F185-189,

Colonies consisting of 4-8 cells: arranged in a linear to suralternating series; outer cells of the colony more or less lunate, strongly curved with acute apices, the inner cells with straight, sharp apices cells 3-6 μ diameter 16-22 μ long.

32) *Scenedesmus dimorphus* (Turpin) Kuetzing *F. tortus* smith.

Philipose 1967, P. 251, F, 160d.

Colonies consisting of 4-cells, arranged in a single series, the outer cells of the colony lunate, strongly curved, inner cells tapering at both the ends; cells 3-3.7 μ in diameter, 17-18 μ long.

33) *Scenedesmus longus* Meyen var. *dispar* (Breb.) Smith.

Philipose 1967, P. 275, F, 180 F.G.

Colonies consisting of 4 cells, outer cells with oblique spine form each pole, inner cells with a single, short spine from one pole only, cells 3-7.2 μ diameter 8.2-17 μ long.

34) *Scenedesmus opoliensis* P. Richter

Prescott 1951, P. 279, Pl, 63 F. 18

Colonies consisting of 4 cells arranged in a single series; cells noviculoid, free walls of outer cells slightly convex, the lateral adjoined walls in contact along 1/3 – 2/3 of their length, apices of outer cells with 2 long spines at one pole only, cells 6-8 µ in diameter 14-26 µ long.

35) *Scenedesmus quadricauda* (Turpin) de Brebisson *V. longispina* (Chadal) G.M. Smith.

Philipose 1967, P. 285, F. 1876, C, Prescott, 1951, P. 280, Pl, 63, F. 22, Smith 1916, P. 480, Pl. 31, F. 159-161, 1920, P.159, Pl. 40, F. 12-14.

Colonies consisting of 4 cells arranged in a linear series, cells cylindrical, spines as long as to the length of the cells; cells 3.5-5 µ in diameter 8-11 µ long, spines 7.5-10 µ long.

36) *Scenedesmus acutiformis* Schroeder

Philipose 1951, P. 275, Pl. 62, F. 6,7

Colonies consisting of 4 cells; arranged in a single series; cells fusiform, elliptic, with sharply pointed poles; inner cells with a single facial longitudinal ridge; outer cells with 2-4 longitudinal ridges?; Cells 7-8 µ in diameter 16-22.5 µ long.

37) *Mougeotia jogensis* Iyengar

Randhawa 1959, P-130, Fiq-22.

Vegetative cells 22.1x207.1 µ in with a pectic sheath 6-7 µ in thickness; chloroplast plate-like with 4-8 pyrenoids in the greatly enlarged conjugating tubes and finally cut off form the adjoining gametangia by lamellate thickenings of the sporangium wall; zygospores globose

38) *Mougeotia viridis* (Kuetzing) Wittrock

Randhawa 1959, P-158, Fiq 83 a-b.

Vegetative cells 6-9 µ chloroplast occupying most of the cell with 2-6 pyreioids in a single row. Conjugation scalariform, sporangia dividing both garnetangia; zygospores quadrate with concave sides and retuse angles 22-30x22-31 µ; spore wall smooth colour less; aplanospores oblique ellipsoid, 14-16x21-36 µ.

39) *Spirogyra aequinoctialis* G.S. West

Prescott 1951, P-311, Pl. 72, F. 3,4, Randhawa 1959, P. 387.

Vegetative cells 23-29 µ in diameter, 150 µ long. with plane end walls; chlorosplasts 3, making 1 to 1 ½ turns; conjugation scalariform, conjugation tube formed by both gametangia; fertile cells symmetrically inflated, zygospores elonged ellipsoid to ovate (40)-41-50 µ in diameter, (52) 72-77 µ long; medium spore wall with deep pits.

40) *Spirogyra biformis* Jao.

Randhawa 1959, P. 317. F, 293.

Vegetative cells 37.6-39.4 µ in diameter, 52.6-135.3 µ long, with plane and walls; chloroplast 2, making 2.5-3 turns; conjugation scalariform, conjugation tube formed by both gametangia; fertile cells cylindric, zygospores ellipsoid with rounded ends, 37.6-38.5 µ in diameter 56.4-71.4 long, median spore wall yellow smooth.

41) ***Spirogyra subsalsa*** **Kuetzing**

Prescott 1951, P. 321. Pl. 73, F. 1-3.

Vegetative cells 26-28 µ in diameter (35)-148 µ long, with plane end wall, chloroplast 2,? Making 1 ½ -3 turns; conjugation scalariform, conjugation tubes formed by both the gametangia; fertile cells swollen zygospores ellipsoid (18) 33-35 µ in diameter (30)-55-59 µ long, median spore wall smooth, brown, reticulate.

42) ***Zygnema melanosporum*** **Lagerheim**

Randhawa 1959, P. 246. Fig 203.

Vegetative cells 25.2x52.1 µ, Conjugation scalariform; zygospore in one of the gametangia, zygospores ovoid to cylindric ovoid, 23-30x28-36 µ median spore wall dark blue finely punctate.

43) ***Zygnema mucigenum*** **Randhawa**

Randhawa 1959, P. 243. Fig 196 a-d.

Vegetative cells 14x47.4 µ each with two or less globose chloroplasts. Conjugation both lateral and scalarifom, but former mode of conjugation is very common. The zygospore are dark bluish green in colour, oval in shape, 15.8 µ broad and 30 µ long. There are 5-6 rows of pits.

45) *Euastrum irregulare* Gonzalves et Gangla

Gonzalves and Gangla 1947, P. 9, F. 1-4.

Cells usually 1 ½ times longer than broad 39-40.5 µ long isthus (12-) 4-14.2 µ broad deeply contracted. Sinus narrowly linear, open, dilated at the pex; semicells pyramidate 5 lobed, polar lobe rounded with no median incision the lower lateral lobes rounded and unequal much larger than the upper ends semi cells in the center with large granute protuberance and with smaller granute protuberances within each of the lateral lobes and within the polar lobes, semi-cells in lateral view somewhat rectangular with a protuberance on each side near the base with as apical granule, elliptic in vertical view with rounded poles and with three large rounded protuberances on each side cell wall irregularly qrandulate, granules especially prominent on all the rounded angles, chloroplast solitary in each semi cells with a single central pyrenoid.

46) *Euastrum spinulosum* Delp.

Scott and Prescott 1961, P. 40. Pl. 10, F. 3, Krienger 1957, P. 633, Pl. 93, F. 1-3.

Cells longer than broad deeply constricted, 46.9-53 µ in diameter 60-63 µ long, isthmus 11.6 µ wide, sinus linear, open, dilated at apex, semicells circular, with three crenulations on each side; semicells oval in lateral view, elliptic in top view; cell wall spinulose, with a ring of central granule protuberances; chloroplast solitary with a central pyrenoid.

47) ***Cosmarium contractum* Kirchner**

West and West 1905, P. 170. Pl. 61, F. 23-25.

Cells longer than broad, deeply constricted, sinus narrow towards the apex widening outwards; semicells broad elliptic, apex usually somewhat flattened circular in side view elliptic in ventricle view; cells 22.8-23 µ broad, 33.9-34 µ long, isthmus 6.5-6.8 µ broad; cell wall smooth. Colourless, chloroplast exile, with a pyrenoid in each semicells.

48) ***Cosmarium libogense* West et West *V. inevolutam* West and West**

Krieger and Gerloff 1965, P. 151. Pl. 32, F. 4.

Cells longer than broad deeply constricted, sinus linear, narrow dilated at the apex, outer extremity open; semicells pyramidate truncate, flattened, side convex, side view of semicells semicircular, vertical view elliptic, with slight tumids cells (29.1-) 32.5-37.6 µ broad, 34.1-45.1 µ long istimus 8.8-11 µ broad cell wall strongly and densely punctuate.

49) ***Cosmarium margaritatum* (Lund). Roy et Bisset *F. minor* (Boldt) West et West.**

Croasdale 1956, P. 41. Pl. 16, F. 11.

Cells large, longer than broad, up to 1 ¼ times as long as broad, deeply constricted, sinus linear, narrow open semicells subrectangular, side view subcircular, in vertical view oblong elliptic cells (46-) 53-55 µ broad (58) 63-65 µ long, isthmus 15-16 µ broad; cell wall granulate, each granule surrounded by hexagonally arranged small 6 punctae; chloroplasts with 2 pyrenoids in each semicells.

50) ***Cosmarium obtusatum* Schmidte**

Taktetoshi Hinode 1962, P. 33. F. 73.

Cells 60.7 µ long;31.6 µ m broad, isthmus 14.2 µ m wide.

51) ***Cosmarium subcostatum* Nordst.**

Hinode 1962, P. 34. F. 78.

Cells 19.8 µ m long, 12.2. µ m broad, isthmus 3.8 µ m wide.

52) ***Cosmarium speiosum* Lund V. *Simplex*. Nordstedt.**

Hirano 1957, P. 122. Pl. 19, F. 6.

Cells longer than broad, up to 1 ¾ times as long broad, deeply constricted, sinus linear, narrow semicells subrectuangular, with 20-22 undulations, side view of semicells subrectangular; cells 28.8-29.2 µ broad; 47.4-47.6 µ long, isthmus 17.2-17.5 µ broad cells wall smooth chloroplast axile, with a pyrenoid in each semicells.

53) ***Cosmarium bioculatum* Breb**

Gunnar Nygaard, P. 216. F. 260.

Cells closed linear their semi cells are ellipsoid with more or less flattened apices. 15.2 µ m length 12.9 µ m breadth, isthumas 3.05 µ m.

54) *Cosmarium subtumidum* Nordstedt *V. minutum* (Krieger) Krieger et Gerloff.

Krieger and Gerloff 1965, P. 164. Pl. 34, F. 4.

Cells slightly longer than broad or a long as broad deeply constricted, sins linear semicells pyramidate semicircular, lateral view of semicells nearly circular, cells 20-21 µ broad, 23-23.5 µ long isthmus 6-7 µ broad, cells wall smooth chloroplast one axile, with a pyrenoid in each semicells.

55) *Desmidium pseudostreptonema* West at West

Hirano 1960, P. 397, Pl. 53, F. 2.

Filaments straight or curved; cells broader than long moderately constricted, 32-35.2 µ broad, 16-19.5 µ long, isthmus 18.8 -26 µ broad, sinus narrowly linear, acutely rounded at the apex, open towards the extremity; semi-cells narrowly and transversely oblong, lateral angles perfectly rounded, apex straight, small, longer than broad, cells with convex and straight processes; semicells in side view transversely rectangular, lateral sides convex in vertical view triangular, lateral side concave, angles rounded.

CHAROPHYCEAE

1) *Nitella tenuissima* (Desv.) Kuetzing

Prescott 1951, P-33, P1-80, Figs. 1-7.

Plants small tufted 2-8 cm high with several branches arising from a single basal node; stem very selender, branching whorls of 6 branchlets which are short, densely crowded and form golomerules, giving a distinct beaded appearance to the plant; the branchlets forking 3-4 times, ending in 2-celled rays; sex organs monoecious, the oogonia spherical or broadly elliptic, about 260 µ (0.26mm) in diameter, 400 µ (0.4mm) long invested by corticating cells that show 9 turns; antherida about 0.175 mm in diameter.

2) *Chara excelsa* Allen

Prescott 1951, p-338, p1-81, Figs. 7-10

Plants coarse and brittle, encrusted with lime 6-14 cm high; stem bearing 7-8 leaves and a double whorl of stipulodes of which the upper row is longer than the lower; cortication of the intermode diplostichous the primary cortical cells larger and more prominent then the secondary laterals; 2-3 cells at the tip of the leaves uncorticated; sex organs monoecious, produced on the same node; oogonia 0.8 – 1.5 mm long investing cells showing 7-10 turns; bracts subtending the ogonium longer then the fruit; antheridia 0.32-0.35mm in diameter.

BACILLARIOPHYTA

CLASS – *BACILLARIOPHYCEAE*

1) *Fragilaria brevistriata* Grun v *vidarbhensis* v. nov.

Prescott 195 , p – 26, p1 – 01, fig 18

Frustules linear, loosely attached together to from short chains in girdle view; Values 19.7 23 µ long 3.5 – 4.8 µ broad liner lanceolate. Strongly tumid in the middle and slightly inflated towards the ends with some what acutely rounded ends; pseudoraphe broad in the middle, linear lanceolate striae 11-13 in 10 µ thick .

2) ***Fragilaria construens* (Eer.) Grn. V. *venter* Grun f *pusilla* Grn.**

Preacott 1951, P – 26, P1-1, Fig-20.

Frustules linear, attached together to form short chains; Values 12-15 µ long 2.8 µ broad. Linear lanceolate, gradually tapering towards the end; ends some what broadly rounded; pseudoraphe narrow, linear; central area not formed; striae 14-16 in 10µ strong

3) ***Gyrosigma khandeshensis* sp. nov.**

Perscott 1951 , p – 67, p1 – 7, fig-154.

Frustules free floating, Solitary; values 91.7-97.5 µ long 13.6 – 16 µ broad, slightly sigmoid, linear loanceolate with broadly rounded ends; raphe central slightly sigmoid, axial area narrow; centre area small and elliptical; transverse streae 22-24 in 10 µ. slightly radial , fine but distinct; longitudinal striae 18-20 in 10 µ fine

4) ***Navicula cuspidata* kuet f. *brevirostrata* Gandhi**

Prescott 1951, p-107, p1-12, fig – 259

Values 55- 8 – 65.5µ long, 17 – 27µ broad , elliptic lanceolate with constricted shortly rostrate, subtruncate ends; raphe thin and straight with central pores hook like; axial area very naroow, linear; central area very small; transverse striae 14-16 in 10 µ longitudinal striae 24-26 in 10µ fine.

5) ***Navicala cuspidata* kuetz . v. *ambigua* (Ehr). Cleve**

Prescott 1951, p- 108, p1- 12 fig-261

Values 56.7 – 125µ ling, 15.5 - 28µ broad, narrowly rhombic lanceolate with constricted produced, capitate end craticular plates some times present; raphe thin and straight with central pores hook like; axial area very narrow. Linear; central area very small; transverse striae 18 – 20 in 10µ longitudinal straae 20-22 in 10µ fine.

6) ***Pinularia aestuarii* cleve v. *interrupta*. (Hustedt)**

Prescott 1951, P – 134, P1 – 15 fig-344.

Values 62–82µ long, 9.5-11µ broad, linear with broadly subeuneate ends; raphe thick, complex, with large central pores, unilaterally bent and semi – circular terminal fissures; axial area ¼ the breadth of the valve. Striae 9-10 in 10 µ radial in the middle and convergent at the ends.

7) ***Cymbella aspera* (Ehr.) Cleve**

Prescott 195, P – 167 , P1 – 19, Fig-442.

Values 98 – 160µ long 22 – 23µ broad. Asymmetrical. with strongly convex dorsal and straight or slightly convex ventral side; ends obtuesly rounded; raphe think arcuate, slighty excentric with large, ventrally bent central pores and dorsally directed terminal fissures; axial area moderate, linnar; central marking on the dorsal side; striae 8-10 in 10µ radial and coarsely punctuate.

8) ***Cymbella bengalensis Grun.***

Prescott 1951, P – 167, P1 – 19 , Fig-444.

Values 75 – 110μ long, 20.5 – 24.5μ broad. Asymmetrical, dorsal side strongly convex and ventral side slightly convex with slightly constricted broadly rounded ends, raphe thick with prominent central pores and dorsally directed terminal fissures; axial area moderate central area slightly formed with an fisolated stigma us the central side; striae 8-10 in 10μ radial and coarsely punctuate.

9) ***Nitzschia closterium* W . smith**

Prescott 1951, P – 215 , P1 – 25, fig-584.

Valves 52-75 μ long, 3.5 – 4.5 μ board, mediunly spindle shaped with long attenuated ends, retracted in opposite directions; feebly silicified, keel panctae 18 – 22 in 10 μ small; striae in distinct

10) ***Nitzschia obtusa* W. smith v *scalpelliformis* Grun.**

Prescott 1951 , P – 222 P1 – 26, fig 609

Values 79 -129μ long, 5.5 – 7.5μ broad, linear very slightly sigmoid with obliquely wedge shaped acutely rounded ends; keel punctae 7-8 in 10μ large, rounded; strae 30 – 32 in 10μ very fine.

11) ***Nitzschia palea*** **(kuetz) W. smith**

Prescott 1951 , P – 222, P1 – 26, fig-612

Values 22 -25.5µ long, 3.5 – 4.5µ broad, linear sublanceolate with narrowed, constricted feebly capitate ends; keel excentric , keel puncatae 10 -12 in 10µ; striae about 35 in 10µ fine and almost indistince

12) ***Surirella ovata*** **kuetz**

Prescott 1951 , P – 232, P1 – 28, fig-649.

Values 27 -63.5 µ long, 19.5 – 33.4µ broad, heteropolar broadly ovate to ovate lanceolate with some what narrower base; pseudoraphe narrow , linear; marginal folds scarcely developed; costae 35 – 60 in 100µ thick, rib like, alternating with 2 -5 striae; striae, 16 – 20 in 10µ, very distinct and coarse

EUGLENOPHYTA

1) ***Euglena acus*** **Ehrenberg**

Prescott 1951, p-390, p1-85, fig. 28

Cells very slightly metabolic, elongate spindle-shaped, produced posteriorly into a long, fine tapering point, narrowed and truncate at the anterior end; membrane indistinctly spirally striated; chloroplasts numerous, disk-like; parmylon bodies 2 to several long rods; 10-14µ in diameter, 140 – 180 µ long.

2) ***Euglena convoluta*** **Korshikov**

Prescott 1951, P – 391, p1-86, Figs 7-9, 14

Cells slightly metabolic, elongate-fusiform and spirally twisted or curved, seldom straight, elliptic in cross section rather abruptly narrowed interiorly and truncate posteriorly, narrowing more gradually to form a long tail –piece. Membrane finely and spirally striate. Flagellum short about one-sixth the length of the cell. Paramylon bodies of two sorts; 6-8 large, concave or through-shaped plates laterally arranged, parallel with the long axis, with the pellicle slightly undulate over them; and numerous small disc –like rings irregularly scattered throughout the cell. Chloroplasts numerous ovoid disc, evenly distributed throughout the cell; pyrenoids lacking; eye spot elliptic, composed of irregularly arranged crimson granduales. Cell 120-145µ long. 10-12µ in diameter; large paramylon bodies 10 µ long small paramylon grains 5 µ wide, 7 µ long.

3) ***Euglena deses*** **Ehrenberg**

Prescott 1951, P-392, Pl-85, Fig-20.

Cells highly metabolic, twisting and turning continuously; elongate-fusiform or subcylindric, posteriorly tapering rather abruptly to a short blunt tip; membrane finely striated; chloroplasts numberous disc-like; paramylon bodies several to many rods of various length; cell 18-20 (24) µ in diameter, 65-125 (200) µ long.

4) ***Euglena proxima* Dangeard**

Prescott 1951, P-394, P1-85, Fig. 25**.**

Cells metabolic, fusiform, narrowed posteriorly to blunt tip; periplast spirally striated; chloroplast numberous, irregularly shaped discs; paramylon bodies numberous small rods scattered throughout the cell; cells 14.5-19-(21) µ in diameter, (50)-70-85(95) µ long.

5) ***Phacus angulatus* ponchmann**

Pochmann 1942, P-171, Fig. 70 a-c**.**

Cells nearly triangular, posterior end inflated, inclined, anterior end gradually attemiated; periplast longitudinally striated; chromatophores many, rounded, discoid; parmaylon bodies 2-4 disc like cells 24-26 µ broad, 30-36 µ long.

6) ***Phacus birgei* prescott**

Prescott 1951, p-398, P1-87, Fig. 11**.**

Cell broadly ovoid, produced posteriorly to form a long tapering caudus which is oblique to the longitudinal axis of the cell, broadly rounded anteriorly; flagellum as long as the cell; periplast very finely striated; margins of the cell sharply notched with 4 small indentations on either side; paramylon bodies one large and numberous small circular plates; chloroplasts many ovoid discs; pigment-spot; cell 50-60 µ in diameter, 70-80 µ long.

7) ***Phacus meson* Hubner P.**

Hubner 1955, P-195, Fig. Abb, 103**.**

Cell 102 µ long, 22.9 µ broad, centrally globularing forming, paramylum, chromatophores arranged in plates and many, anterior end broad, large elliptical and posterior end having long sharp tail.

8) ***Phacus* sp.**

Cells broad, ovoid, narrowed in the posterior part, posterior part ending into short, straight tail, chromatophores numberous discoid, paramylon bodies 3 disc-like, cells 20-22 µ long, 19 µ broad

9) ***Trachelomonas intermedia* Dangeard**

Prescott 1951, P-415, P1-83, Fig-10.

Test subspherical to oval, slightly narrowed anteriorly; wall finely punctuate, brown; flagellum aperture with a thickening but without a distinct collar; test 18 µ in diameter, 25 µ long.

10) ***Trachelomonas oblonga* Lemmermann**

Huber Pestalozzi 1955, p.278, P1-61, Fig. 459

Test ellipsoid-oblong; wall smooth; yellow-brown; flagellum aperture surrounded by a thickening of the collar, collar long, inside the test; test 22-26 µ in diameter, 25-26 µ long.

CYANOPHYTA

1) ***Microcystis aeruginosa* Kuetzing**

Desikachary, 1959, P. 93, Pl – 17, Fias – 1,2,6, and pl – 18, Fig – 10.

Colonies when young round or slightly longer than broad, solid, when old becoming clathrate, with distinct hyaline colonial mucilage; cells 3 – 7 μ in diam, spherical, generally with gas vacuoles

2) ***Microcystis robusta* (Clark) Nygaard**

Desikachary, 1959, p – 85, pl – 17, Figs – 7 – 10.

Colonies at first round, later irregularly elongate and clathrate; sheath distinct, later gelatinising; cells 6 – 9 μ diam, spherical, without gas-vacuoles.

3) ***Chroococcus minor* (kuetzing) Nag.**

Desikachary, 1959, p – 105, pl – 24, Fig – 1.

Thallus slimy-gelatinuous, dirty blue green, or olive green; cells spherical, 3 – 4 μ in diam, singly or in pairs, seldom 4 or 8; sheath colorless, very thin, hardly visible.

4) ***Chroocococcus turgidus* (kuetzing) Nag.**

Desikachary 1959, p – 101, pl – 26, Fig – 6.

Cells spherical or ellipsoidal single, or in groups of mostly 2 – 4, very seldom many, blue green, olive green or yellowish, without sheath 8 – 32 μ, with sheath 13 – 25 μ diam, rarely 40 μ; sheath colorless, not distinctly lamellated

5) *Gloeocapsa gelatinosa* kuetzing.

Desikachary 1959, p – 114, pl – 27, Fig – 6.

Cells without sheath about 2.5 μ and with sheath 6.2 – 10 μ diam, blue green; colonies about 25 μ diam; sheath colorless, seemingly thin, when old lamellated.

6) *Gloeocapsa rupestris* kuetzing

Desikachary 1959, p – 117,

Thallus brownish crustaceous; cells without sheath 6 – 9 (-11) μ in diam, blue – green; sheath yellow to brown, outer daughter colonies often pale yellow to nearly colorless, very distinctly lamellated; colonies 15 – 75 μ diam, spores with firm thin blackish brown wall more or less 15 μ diam.

7) *Gloeothece palea* (kuetz.) Rabenh.

Desikachary 1959, p – 127,

Thallus mucilaginous mostly blue – green; cells long cylindrical without envelope 2.5 – 4.5 μ broad, 1½ - 3 times as long as broad, with envelope 8 – 12 μ broad, blue – green or nearly colorless; individual mucilaginous envelopes colorless or partly colored yellowish, not lamellated, mannocytes present.

8) ***Gloeothece samoensis* Wille**

Desikachary 1959, p – 128, pl – 23, Fig – 3.

Cells ellipsoidal, without sheath 4 – 5 μ broad, 8 μ long, cells yellowish or bluish green in round colonies, often many uniting, mostly 2 – 4 in a common envelope, envelope colorless, unlamellated.

9) ***Aphanocapsa banaresensis* Bharadwaja**

Desikachary 1959, p – 133, pl – 22, Fig – 8.

Plant mass soft, spherical, hollow, irregularly hyaline or cream colored, up to 1.5 μ in diam, cells oval or almost spherical 4 – 6.2 μ in diam; sheath thick, unstratified, hyaline, closely adpressed to the cells, up to 1 μ thick.

10) ***Aphanothece nidulans* Richter, p.**

Desikachary 1959, p – 138, pl – 22, Fig – 1.

Thallus irregularly expanded, often found between other algae, plankton forms more or less round; cells cylindrical, straight or slightly bent, 1 – 1.5 μ broad, up to 3.5 μ long, blue – green, most densely arranged; mucilage sheath mostly diffluent, colorless or yellow to brownish yellow.

11) ***Merismopedia glauca* (Ehrenb.) Nag.**

Desikachary 1959, p – 155, pl – 29, Fig. – 5.

Colonies mostly small with 16 – 64 cells, rarely more, 45 – 150 μ diam., cells oval or spherical, closely arranged, 3 – 6 μ broad, pale blue – green.

12) *Merismopedia punctata* Meyen

Desikachary 1959, p – 155, pl – 23, Fig – 5 & Pl – 29, Fig. 6.

Colonies small, 4 – 64 cells, about 60 μ broad; cells not closely packed spherical or ovoid 2.5 – 3.5 μ broad, pale blue – green.

13) *Merismopedia tenussima* Lemm.

Desikachary 1959, p – 154, pl – 29, Fig – 7 & Pl – 30, Fig. 8, 9.

Cells pale blue – green closely packed in colonies of 16 – 100 cells, subspherical, 1.3 – 2 μ broad, sometimes individual cells with distinct mucilaginous envelopes.

14) *Johannesbaptistia pellucid* (Dickie) Taylor et Drouet

Desikachary 1959, p – 165, pl – 32 Figs. 14 – 19.

Filaments blue green or olivaceous, straight or curved, about 2.5 mm long (-3) 7.9 – 10.8 (-20) μ broad; cells discoid or sphaerico discoid, rounded at the apices of the filaments, arranged in a single series, in a cylindrical hyaline mucilage, cells 3.9 – 5.2 μ broad and 2.6 – 3.9 μ long; mucilage homogenous, sheath round the cell visible after division, firm or diffluent; contents blue green, olivaceous, homogenous or granular.

15) ***Myxosarcina burmensis*** **skuja**

Desikachary 1959, p – 178, pl – 32, Figs – 20 – 22.

Plants aquatic, minute, microscopic, rounded, sarcinoid; cells more or less, angular or with rounded corners, often arranged in transverse and vertical series, 2 – 3 μ diam, pale blue green or olivaceous, homogenous or finely granular; individual sheaths thin, mucilaginous, hyaline; young colonies of 4 cells, about 30 μ diam, propagation by the dividion of the colony into two parts.

16) ***Myxosarcina spectabilis*** **Geitler**

Desikachary 1959, p – 178, pl – 30, Figs – 1 – 5 & pl. 31. Figs. 17 – 22.

Cells in three dimensional colonies 6.5 – 10 μ broad; colonial sheath thin, distinct, hyaline, individual sheaths occasionally present, thin and hyaline; cell contents blue – green; endospores.

17) ***Arthrospira platensis*** **(Nordst) Gomont.**

Desikachary 1959, p – 190, pl – 35, Fig – 2.

Thallus blue green; trichomes slightly constricted at the cross walls, 6 – 8 μ broad, not attenuated at the ends or only a little attenuated, more or less regularly spirally coiled; spirals 26 – 36 μ broad, distances between the spirals 43 – 57 μ; cells nearly as long as broad, or shorter than broad, 2 – 6 μ long, cross walls granulated; end cells broadly rounded.

18) *Spirulina gigantea* Schmidle

Desikachary 1959, P – 197, Pl – 36, Fig – 12, 14 – 17.

Trichome 3 – 4 μ broad, deep blue green, regularly coiled, at the end conical attenuated, Spirals 11 – 16 μ broad.

19) *Spirulina laxissima* West, G.S.

Desikachary 1959, p – 196, pl – 36, Fig – 5.

Trichome 0.7 – 0.8 μ broad, blue green, spirals very loose, but regular, 4.5 – 5.3 μ broad; 17 – 22 μ distant form each other, end cells rounded, obtuse.

20) *Spirulina meneghiniana* zanard. Ex Gomont.

Desikachary 1959, p – 195, pl – 36, Fig – 8.

Trichome 1.2 – 1.8 μ broad, flexible, irregularly spiral coiled, bright blue green, forming a thick blue green thallus; spirals 3.2 – 5 μ broad and 3 – 5 μ distant form each other.

21) *Oscillatria obscura* Bruhl et Biswas

Desikachary 1959 , p – 207.

Trichome about 4 μ broad, attenuated at the apex, rounded, slight bent or nearly straight, blue – green not constricted at the cross – walls; cells about 1/5 as long as broad or shorter, cross – walls granulated .

22) ***Oscillatoria acuta* Bruhl et Biswas, Orth mut Geitler**

Desikachary 1959, p-240, p1 – 39 , figs- 5,8

Trichomes either solitary or a number of them parallel to each other aggregated into bundles of moderate size, hardy, brittle, not constricted at the cross – walls, 4-6 µ thick , 70 – 400 µ long, usually quite straight narrow or acuminate towards the subobtuse non-capitate non-calyptrate apex which may be straight but is more often rather abruptly bent aside; cells 3-4 µ long, contents bluish green finely granular sometimes with some larger granules close to the surface .

23) ***Oscillatoria chlorina* Kuetzing ex Gomont.**

Deshikachary 1959, P – 215 , P1 – 40 , fig – 4**.**

Thallus very thin, yellowish green; trichome straight or curved unconstricted or Slightly constricted at the cross – walls; 3.5 – 4 µ broad sometimes up to 6 µ broad gas – vacuoles absent; cells some what longer or shorter then broad 3.7 – 8 µ long ,cross – walls not granulated ; calyptra absent.

24) ***Oscillatoria ornata* Kuetzing ex Gomont.**

Desikachary 1959, P -206, P1 – 37 fig 12 & P1 – 40, fig -3**.**

Thallus dark blue – green; trichome spirally coiled at the ends, constricted at the cross – walls 9 – 11 µ broad, dull blue – green cells ½ - 1/6 as long as broad 2-5 µ long; cross – walls granulated; apices slightly attenuated; and cells rounded, not capitate, without thickened membrane.

25) ***Oscillatoria subbrevis*** **schmidle**

Desikachary 1959 , P1 – 37,fig 2 & P1 – 40 , fig -1**.**

Trichome single, 5-6 µ broad nearly straight not attenuated at the apices; cells 1-2 µ long not granulated at the cross – walls ; end rounded calyptra absent.

26) ***Phormidium abronema*** **Skuja**

Desikachary 1959 . P – 257**.**

Thallus coriaceous lamellated rarely mucose flocculose olivaceous blackish green to light bluish; filaments flexuous more or less loosely spirally coiled 4-7 µ broad sheath moderately thick hyaline muciaginous commonly diffluent; trichome 3-4 .5 µ broad ends briefly attenuated distinctly constricted at the cross – walls cells cylindrical barrel – shaped ¾ - 2 times as long as broad septa not granulated end cell more or less rounded conical.

27) ***Phormidium ambiguum*** **Gomont**

Desikachary 1959 , P – 266 , P1 44 fig – 6,& P1 – 45, fig – 5 -8

Trichome slightly constricted at the cross – walls, at the ends not attenuated, not capitate, 4.3 – 5 µ broad blue – green; sheath thin cells short than broad 1.4 - 2.1 µ long granulated at the cross – walls, end cell rounded calyptra absent

28) ***Phormidium molle*** **(kuetz.) Gomont.**

Desikachary 1959 P – 255 , P1 – 59 , fig – 8**.**

Thallus mucilaginous thin trichome straight or nearly straight 2.7 – 3.3 µ broad, cells quadrate, cylindrical, cell 3-7 – 8 µ long, end cell rounded calyptra absent.

29) ***Phormidium mucosum*** **Gardner**

Desikachary 1959 , P- 265, P1 – 43, fig – 6, 7**.**

Filaments 7.2 – 7.8 µ broad long straight or curved; trichome 2.5 – 3.4 µ broad no constricted at the cross – walls ends; sheath apparently thick more or less gelatinous colorless unlamellated; cells 2 – 2 1/3 times as long as broad pale blue – green end cell rounded .

30) ***Phormidium rubroterricola*** **Gardner**

Desikachary 1959, P – 261, P1 – 43, fig – 3**.**

Trichome 2.2 – 2.4 µ broad not constricted at the cross-walls with straight ends; cells quadrate or some what longer or shorter; end-cells obtuseconical ; sheath distinct not diffluent.

31) ***Phormidium stagnina*** **Rao, C.B**

Desikachary 1959, P – 265, P1 – 45 figs 16 – 18**.**

Thallus soft blue – green and membranous filaments 12-8-14.4 µ broad trichome blue – green interwoven and not attenuating, 8-9.6 µ broad; sheath hyaline unstained by chlor- zinc- iodide thick firm, sometimes diffluent; cells small without constrictions at the joints 1.3 – 2 µ long; end cell broadly rounded with a prominent calyptra.

32) ***Lyngbya aestuarii* Liebm ex Gomont**

Desikachary 1959 , P – 305 , P1 52 , fig – 8**.**

Filaments single, nearly straight sheath at first thin later thick yellow brown lamellated cells 8-18 µ broad , 2.7 – 4.7 µ long not constricted at the cross-walls, cross-walls often granulated end cells flat with thickened membrane, slightly attenuated.

33) ***Lyngbya ceylanica* wille**

Desikachary 1959 , P1 – 54, fig -4**.**

Thallus olive-green, violet or red; filaments 10-14 µ broad straight; sheath thin, colourless, when older often red, not colored violet by chlor – zinc – iodide; trichome blue – green or violet , unconstricted at the cross – walls not attenuated at the ends; 8 – 12 µ broad cross – walls not granulated; cells quadrate to ½ or 1/3 as long not as broad; end cell rounded without calyptra.

34) ***Lyngbya majuscula* Harvey at Gomont**

Desikachary 1959, P1 – 313 , P1 – 48, fig -7**.**

Thallus expanded , upto 3 cm long filaments very long , curved or seldom only slightly coiled; sheath colourless, trichome 16 – 60 µ (or 80 µ) broad mostly 20-40 µ broad cells very short 1/6 – 1/5 times as long as broad, 24 long end cells rounded calyptra absent.

35) *Lyngbya subconfervoides* Borge

Desikachary 1959, P – 321**.**

Thallus thin woolly, dull blue filaments long straight 21-30 µ broad, sheath colourless 3 µ thick when old indistinctly lamellated trichome not constricted at the cross – walls, cross – walls; not granulated blue green 18-27 µ broad not granulated not attenuated at the ends; cells ½ - 1/3 as long a broad; end cell rounded without calyptra.

36) *Plectonema gracillimum* (Zopt) Hansgirg.

Desikachary 1959 , P – 441**.**

Thallus thin membranous often later expanded pale blue, yellowish or grey – green, mostly slimy; filaments 2 -4 µ broad ; false branches single or geminate; cell 1-3 times longer then broad, dull blue – green, nearly colourless; sheath thin mostly colourless.

37) *Pectonema nostocorum* Bornet ex Gomont.

Desikachary 1959 , P – 439 , P1 – 83 , fig – 7**.**

Filaments nearly straight or flexuous; false branches sparse, single or geminate; sheath thin colourless, not coloured by chlro-zinc-iodide; cells cylindrical, sometimes constricted at the cross – walls, septa not granulated (0.7) 1-1.5 µ broad and 2-2.5 µ long pale blue – green end cell rounded.

38) ***Plectonema radiosum* (Schiederm.) Gomont.**

Desikachary 1959 , P – 437 , P1 – 83 figs – 6, 8**.**

Filaments irregularly curved , more or less radially arranged in a thallus, thallus caespitose cushion – like, rounded or spherical, about ½ cm long, dull – green or reddish brown; richly false single or geminate; sheath in the lower part of the filament, thick, lamellated outside uneven golden yellow in the upper part thin, hyaline, coloured blue by chlro – zinc – iodide; cells mostly only in the upper parts of trichome distinctly constricted at the cross – walls , 11 – 22 µ broad, 3 – 10 µ long blue – green cross – walls seldom granulated end cell rounded .

39) ***Calothrix brevissima* West , G.S**

Desikachary 1959 , P – 543 , P1 – 144, fig – 2**.**

Filaments epiphytic , many together very short 53 – 94 µ long , 5 – 7 µ broad sheath firm close to the trichome, thin, nearly, cylindrical colourless; trichomes very short, 30 – 62 µ long, heterocysts basal single, rounded hemispherical or subsperical.

40) ***Calothrix breviarticulata* W.et G.S West.**

Desikachary 1959 , P – 537 P1 – 110 fig – 9

Filaments single or many together at the base 15 – 16 µ broad in the middle 11.5 – 12.5 µ broad up to 380 as long gradually attenuated at the apex; sheath thick lamellated blackish brown; trichome at the base 8.5 µ broad in the middle 5.5-7.5 µ broad constricted at septa; cells very short, discoid ¼ - ½ times as broad pale blue – green ; heterocysts basal single hemisplaerical.

41) ***Calothrix fusca*** **(kuetz.) Bornet et flahault.**

Desikachary 1959 P – 527, P1 – 107, fig – 10**.**

Filaments single seldom gregarious in the gelatinous thallus of other algae 200 – 300 µ high 10 -12 µ broad bent at the base and inflated up to 15 µ broad at the base; sheath broad colourless at the apices diffluent; trichome 7-8 µ broad ending in long thin hair ; cells often discoid shorter then broad ; heterocysts basal hemispherical single or double, smaller than the basal cell of the trichome.

42) ***Calothrix geitonos*** **skuja**

Desikachary 1959 , P – 537, P1 – 109 figs 6 -12**.**

Filaments erect or flexuous, about 1 mm long sheath colourless sometimes mucilaginous, about 3 µ thick, cells at the base 7-8 µ broad , 1½ times as long as broad distinctly constricted cylindrical at the cross – walls, heterocysts 1 – 3 basal, rounded. cylindrical , barrel – shaped , 8 – 9.5 µ broad, and 7 – 19 µ long hemispherical.

EXPERMENTAL RESULTS

Table.01 Algal texa encountered form Bindusara Reservoir.

Sr. No.	Name of Algae	S_1	S_2	S_3
I	**CHLOROPHYCEAE**			
1)	*Gloeocystis ampla* (Kuetzing) Lagerheim	+	+	+
2)	*Gloeocystis gigas* (Kuetz.) Lagerheim	-	+	-
3)	*Gloeocystis major* Gerneck et lemmermann	-	+	+
4)	*Tetraspora lamellosa* Preseott	+	-	-
5)	*Tetraspora cylindrica* (Wahl) C. A. Agardh	+	-	-
6)	*Ulothrix aequalis* kuetzing	-	+	+
7)	*Ulothirx zonata* (Weber and Mohr.) Kuetzing	-	-	+
8)	*Stigeoclonium pachydermum* Prescott.	-	+	-
9)	*Stigeoclonium lubricum* (Dillw.) Kuetzing	+	-	-
10)	*Trochiscia aspera* (Reinsch) Hansgirg.	-	+	-
11)	*Trochiscia obtusa (Reinsn) Hansgirg*	-	+	-
12)	*Pediastrum boryanum* (Trup.) Meheghini	+	-	+
13)	*Pediastrum duplex* Meyen	-	-	+
14)	*Pediastrum muticum* Kuetzing	+	+	-
15)	*Pediastrum simplex* (Meyen) Lemmermann	-	+	-
16)	*Pediastrum tetras* (Ehrenb.) Ralfs	-	+	-
17)	*Hydrodictoyon reticulatum* (L.) Lagerheim	+	-	+
18)	*Chloeralla valgaris* Beyerink	-	+	-
19)	*Oocystis borgei* Snow	+	+	-

20)	*Oocystis crassa* Wittrock	-	+	-
21)	*Oocystis pyriformis* Prescott	-	+	-
22)	*Ankistrodesmus falcatus* (Corda) Ralfs	+	-	+
23)	*Ankistrodesmus falcatus* (Corda) Ralfs. *vacicularis* (Bruan) West.	-	+	-
24)	*Ankistrodesmus falcatus* (Corda) Ralfs. *V. mirabills* (west ad West)	+	-	-
25)	*Selenastrum westii G.M. Smith*	+	-	+
26)	*Coleastrum microporum* Naegeli	+	+	-
27)	*Coleastrum sphearicum* Naegeli	+	+	+
28)	*Scenedesmus armatus* (Chod.) G.M. Smith	-	-	+
29)	*Scenedesmus armatus V. major* G.M. Smith	+	-	-
30)	*Scenedesmus bijugatus* (Trup.) Kuetzing	-	-	+
31)	*Scenedesmus dimorphus* (Trup.) Kuetz.	+	-	-
32)	*Scenedesmus dimorphus* (Trupin) Kuetz. Ftortus Smith	-	+	-
33)	*Scenedesmus longus* Meyen V. *dispar* (Breb) G.M. Smith	+	+	+
34)	*Scenedesmus opoliensis* P. Richter	-	+	-
35)	*Scenedesmus quadricauda* (Trup.) Breb V. *longispina* (Chodat) Smith	-	+	-
36)	*Scenedesmus quadricauda* (Trup.) Breb de Brehbisson	+	+	-
37)	*Scenedesmus aqautiformis* Schorder	+	-	-
38)	*Mougeotia jogensis* Iyengar	-	+	-
39)	*Mougeotia viridis* (Kuetz.) Wittrock	-	-	+
40)	*Spirogyra aequinoctialis* G.S. West	+	+	+
41)	*Spirogyra biformis* Jao	-	-	+

42)	*Spirogyra subsalsa* Kuetzing	+	-	+
43)	*Zygnema melanosporum* Lagerheim	+	+	+
44)	*Zygnema mucigenum* Randhawa	+	+	+
45)	*Euastrum ireegulare* Gonzalves et Gangla	+	+	+
46)	*Euastrum spinulosum* Delp.	+	+	+
47)	*Cosmarium contractum* Kirchner	+	-	-
48)	*Cosmarium libogense* West et. West V. *inevolutum* West et West.	-	+	+
49)	*Cosmarium margaritatum* (Lund) Roy et Bisset F. *minor* (Boldt) West at West	+	-	-
50)	*Cosmarium obtusatum* Schmidle	+	+	+
51)	*Cosmarium speciosum* Lund V. *simplex* Nordst	-	+	+
52)	*Cosmarium subcostatum* Nordst.	+	-	+
53)	*Cosmarium sublatereundatum* West at West	+	-	-
54)	*Cosmarium bioculatum* Breb	+	+	-
55)	*Desmidium pseudostreptonema* West at West	+	-	-
II	**CHAROPHYCEAE**			
1)	*Nitella tenuissima* (Desv.) Kuetzing	+	-	+
2)	*Chara excelsa* Allen	+	+	+
III	**BACILLARIOPHYCEAE**			
1)	*Fargilaria brevistriata* Grun V. *vidarbhensis* V. Nov.	+	+	+
2)	*Fargilaria contruens* (Ehr.) Grun V. *venter* Grun if pusilla.	+	+	-
3)	*Gyrosigma khandeshensis* sp. Nov.	+	-	+

4)	*Navicula cuspidata* Kuetz. F. *brevirostrata* Gandhi	-	+	+
5)	*Navicula cuspidata* Kuetz. V. *ambigua* (Ehr) Cleve	-	+	+
6)	*Pinnularia aestuarii* Cleve V *interrupta* (Hustedt)	+	+	-
7)	*Cymbella aspera* (Ehr.) Cleve	+	-	+
8)	*Cymbella bengalensis* Grun.	+	+	+
9)	*Nitzschia closterium* W. Smith	-	+	-
10)	*Nitzschia obtusa* W. Smith V. *scalpelliformis*	+	-	-
11)	*Nitzschia palea* (Kuetz.) W. Smith	+	+	+
12)	*Surirella ovata* Kuetz	-	+	+
IV	**EUGLENOPHYCEAE**			
1)	*Euglena acus* Ehrenberg	+	-	+
2)	*Euglena convolute* korshikov	+	+	-
3)	*Euglena deses* Ehrenberg	-	-	+
4)	*Euglena proxina* Dangeard	-	+	-
5)	*Phacus angulatus* Pochmann	-	+	-
6)	*Phacus birgei* Prescott	-	-	+
7)	*Phacus meson* Hubner P.	+	+	-
8)	*Phacus* sp.	-	+	-
9)	*Trachelomonas intermedia* Dangeard	-	-	+
10)	*Trachelomonas oblonga* Lemmermann	+	-	-
V	**CYANOPHYCEAE**			
1)	*Microcystis aeruginosa* Kuetzing	-	-	+
2)	*Microcystis robusta* (Clark) Nygard	+	-	-
3)	*Chroococcus minor* Kuetzing	+	+	+

4)	*Chroococcus turgidus* Kuetzing	+	+	+
5)	*Gloeocapsa gelatinosa* Kuetzing	+	-	-
6)	*Gloeocapsa rupestris* Kuetzing	-	+	-
7)	*Gloeothece palea* (Kuetz.) Rabenh.	+	-	+
8)	*Gloeothece samoensis* Wille	+	-	-
9)	*Aphanocapsa banaresensis* Bharawbaju.	-	+	-
10)	*Aphanothece nidulans* Richter	+	+	+
11)	*Merismopedia glauca* (Ehr.) Nag.	-	+	+
12)	*Merismopedia punctata* Meyen	+	-	+
13)	*Merismopedia tenuissima* Lemm.	+	+	+
14)	*Johannesbaptistia pellucida* (Dickie) Taylor et Drouet.	-	+	-
15)	*Myxosarcina burmensis* Skuja	+	-	+
16)	*Myxosarcina spectabilis* Geitler	-	-	+
17)	*Arthrospira platensis* (Nordst.) Gomont	-	+	-
18)	*Spirulina gigantea* Schmidle	+	+	+
19)	*Spirulina laxissima* West G.S.	-	+	+
20)	*Spirulina meneghinian* zanard ex Gomont	+	-	-
21)	*Oscillatoria acuta* Brahl at Biswas orth. Mut. Gertler	-	+	-
22)	*Oscillatoria abscura* Brahl at Biswas	+	+	-
23)	*Oscillatoria chlorina* Kuetz ex. Gomont	-	+	-
24)	*Oscillatoria ornata* Kuetz	-	-	+
25)	*Oscillatoria subbrevis* Schmidle	+	+	+
26)	*Phormidium abronema* Skuja	-	+	-
27)	*Phormidium ambiguum* Gomont	+	-	+

28)	*Phormidium molle* (Kuetz.) Gomont	+	-	+
29)	*Phormidium mucosum* Gardner	+	+	+
30)	*Phormidium rubroterricola* Gardner	+	-	+
31)	*Phormidium stgnina* Rao C.B.	+	-	-
32)	*Lyngbya aestuarii* Liebm ex Gomont	+	-	-
33)	*Lyngbya ceylanica* Wille	+	-	-
34)	*Lyngbya subconfervoides* Borge	+	+	+
35)	*Lyngbya majuscula* Harbey at Gomont	+	-	-
36)	*Plectonema gracillimum* (Zopf) Hansgirg.	+	-	+
37)	*Plectonema nostocorum* Bornet ex Gomont	+	-	+
38)	*Plectonema radiosum* (Schiederm) Gomont	-	+	-
39)	*Calothrix brevissima* West, G.S.	-	-	+
40)	*Calothrix breviarticulata* W. et. G.S. West	+	-	-
41)	*Calothrix fusca* (Kuetz) Bornet et. Flahault	-	-	+
42)	*Calothrix geitonos* (Skuja)	-	+	+

+ Present, - Absent

Table.02 Class wises dominance of algal taxa in Bindusara Reservoir.

Sr.No.	Name of Class	Genera	Species
01	Chlorophyceae	18	55
02	Charophyceae	02	02
03	Bascillariophyceae	07	12
04	Euglenophyceae	03	10
05	Cyanophyceae	16	42
Total		46	121

Graph.01 Class wises dominance of algal taxa in Bindusara Reservoir.

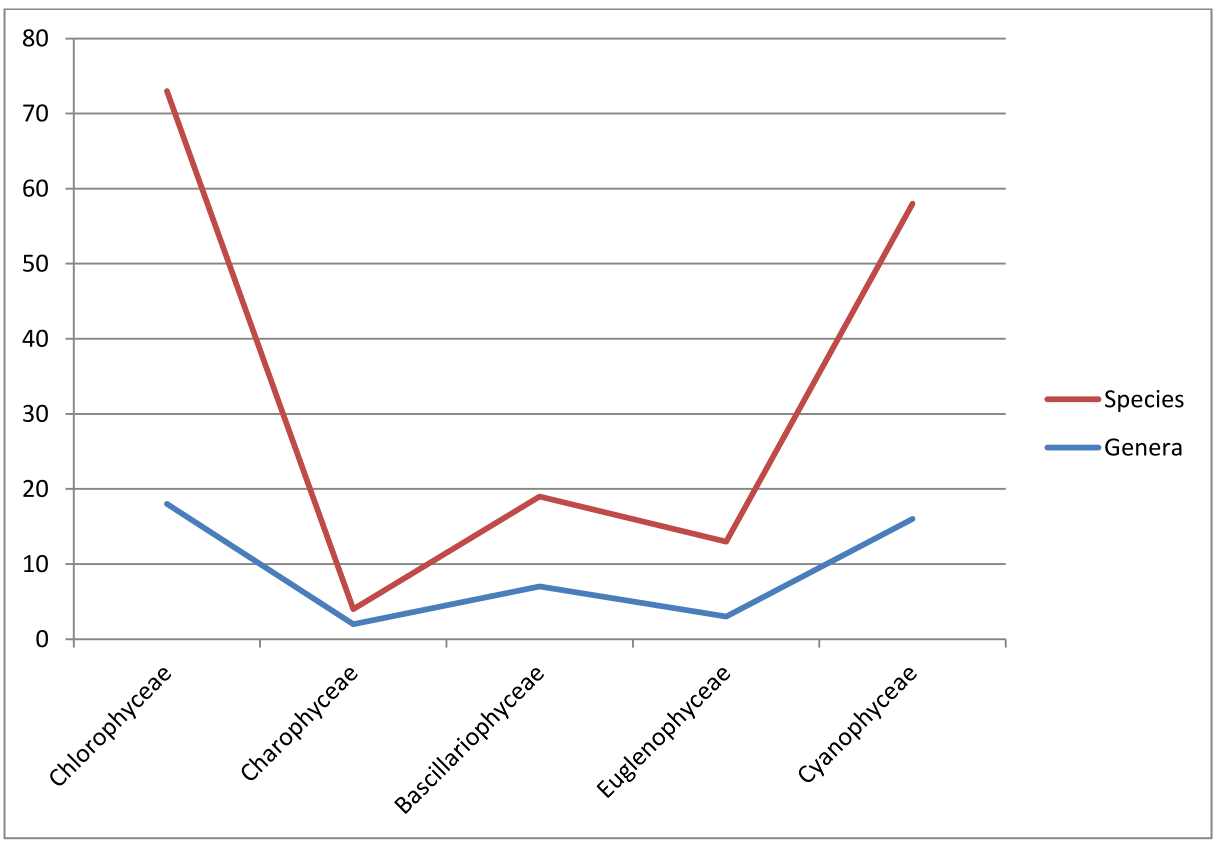


Table.03 Month wise dominance of algal taxa in Bindusara Reservoir.

Sr. No	Name of Class	June 2013 to May 2014											
		Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
01	Chlorophyceae	38	42	44	41	38	35	37	36	33	28	24	26
02	Charophyceae	-	-	-	-	01	02	02	02	01	01	01	01
03	Bascillariophyceae	04	06	05	06	05	07	08	07	08	07	09	10
04	Euglenophyceae	02	04	03	02	04	02	04	05	07	06	08	09
05	Cyanophyceae	25	28	31	33	32	40	44	43	30	28	34	33
Total		69	80	83	82	80	86	95	93	79	70	76	79

Graph.02 Month wise dominance of algal taxa in Bindusara Reservoir .

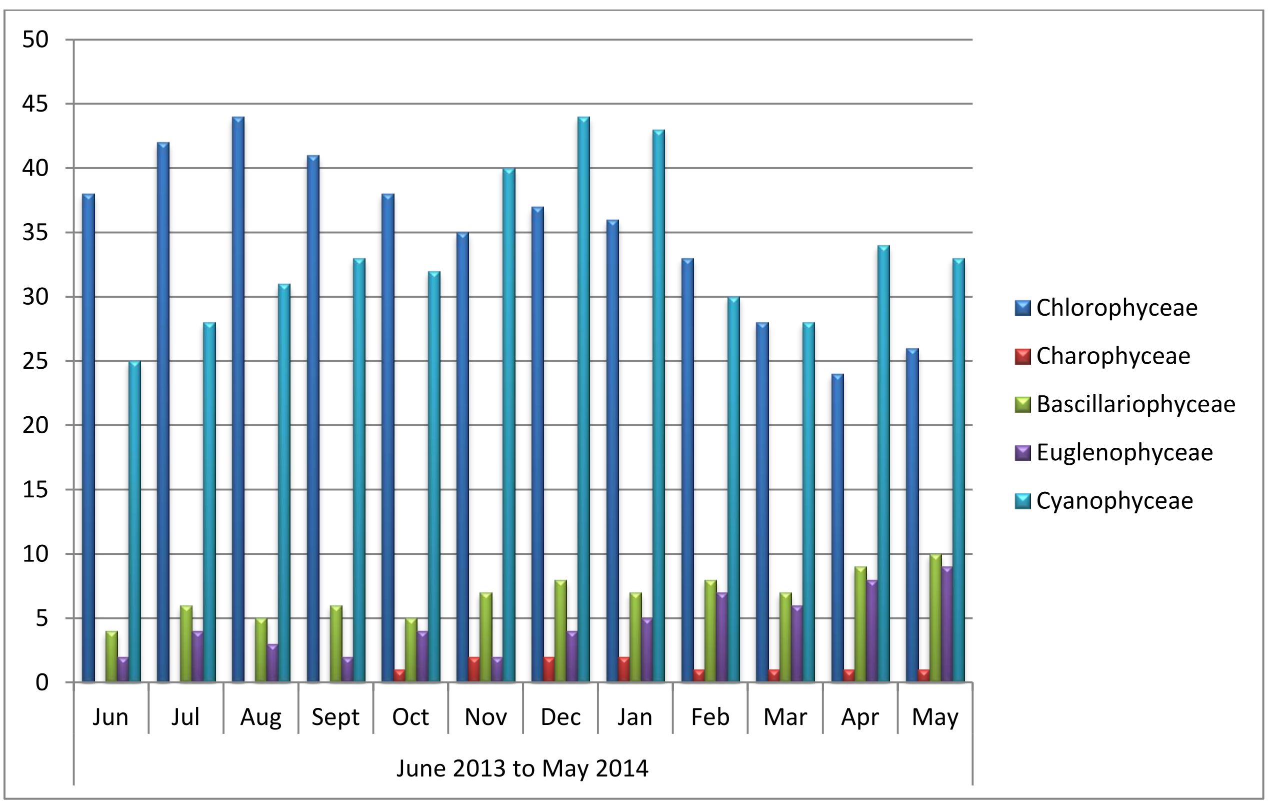


Table.04 Month wise dominance of algal taxa in Bindusara Reservoir.

Sr. No	Name of Class	June 2014 to May 2015											
		Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
01	Chlorophyceae	38	39	40	37	36	35	38	36	30	32	27	26
02	Charophyceae	-	-	-	01	01	02	02	02	01	-	-	-
03	Bascillariophyceae	02	04	03	04	06	07	06	08	07	08	07	09
04	Euglenophyceae	04	03	02	04	05	07	08	06	08	07	09	06
05	Cyanophyceae	26	08	30	28	34	38	36	32	34	36	38	34
Total		70	54	75	74	82	89	90	84	80	83	81	75

Graph.03 Month wise dominance of algal taxa in Bindusara Reservoir .

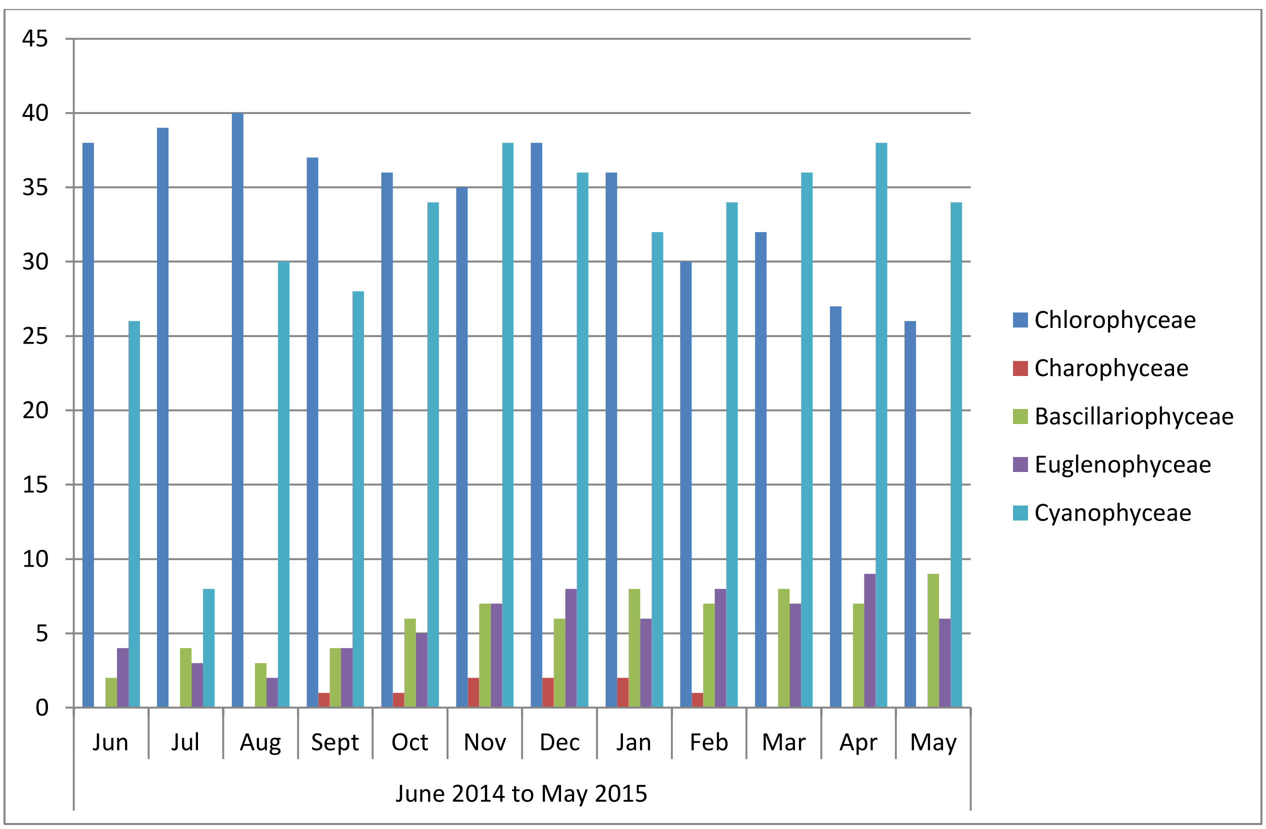


Table.05 Seasonal Variation of algal taxa in Bindusara Reservoir.

Name of Class	June 2013 to May 2014			June 2014 to May 2015		
	Monsoon	Winter	Summer	Monsoon	Winter	Summer
Chlorophyceae	41	36	27	38	36	28
Charophyceae	-	02	01	01	02	01
Bascillariophyceae	5	07	08	03	06	07
Euglenophyceae	03	04	07	03	06	07
Cyanophyceae	29	39	31	23	35	35
Total	78	88	74	68	85	78

Graph.04 Seasonal Variation of algal taxa in Bindusara Reservoir.

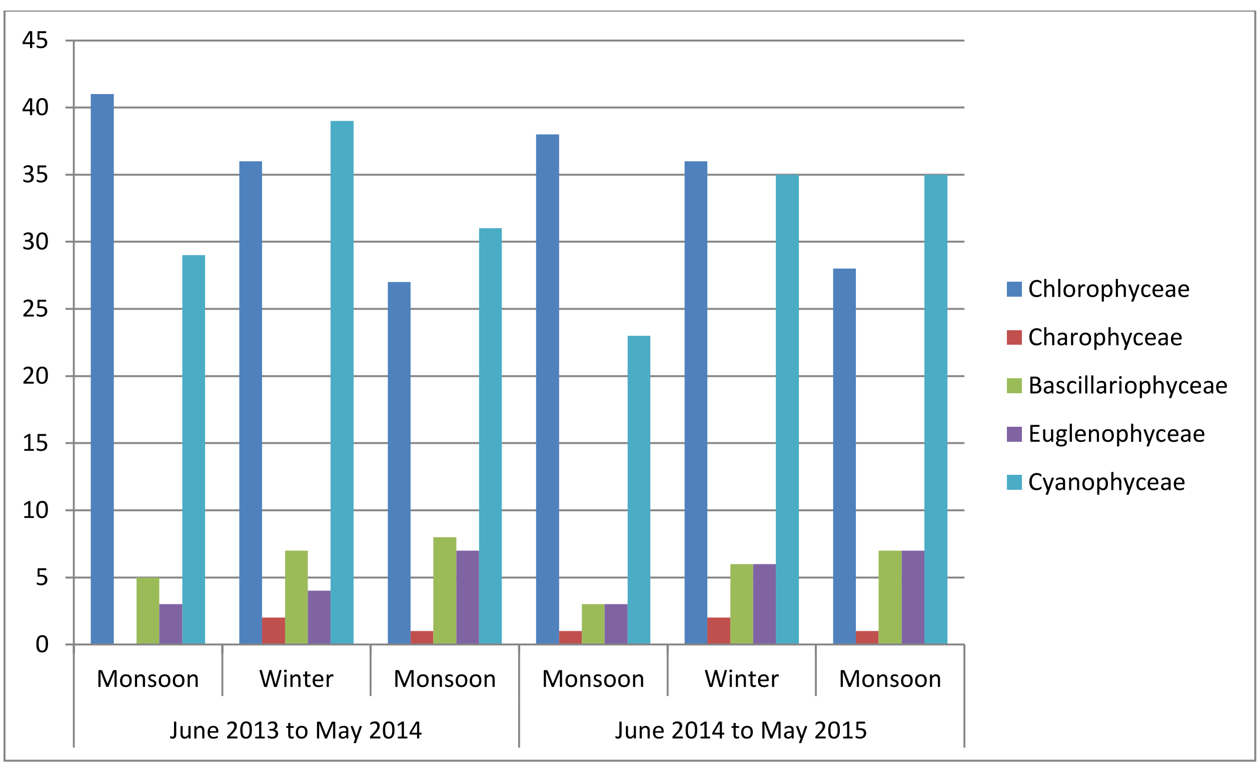


Table.06 Class wises dominance of algal taxa in S1 (Central Outlet).

Sr.No.	Name of Class	Genera	Species
01	Chlorophyceae	08	31
02	Charophyceae	02	02
03	Bascillariophyceae	05	08
04	Euglenophyceae	02	03
05	Cyanophyceae	10	26
Total		27	70

Graph.05 Class wises dominance of algal taxa in S1 (Central Outlet).

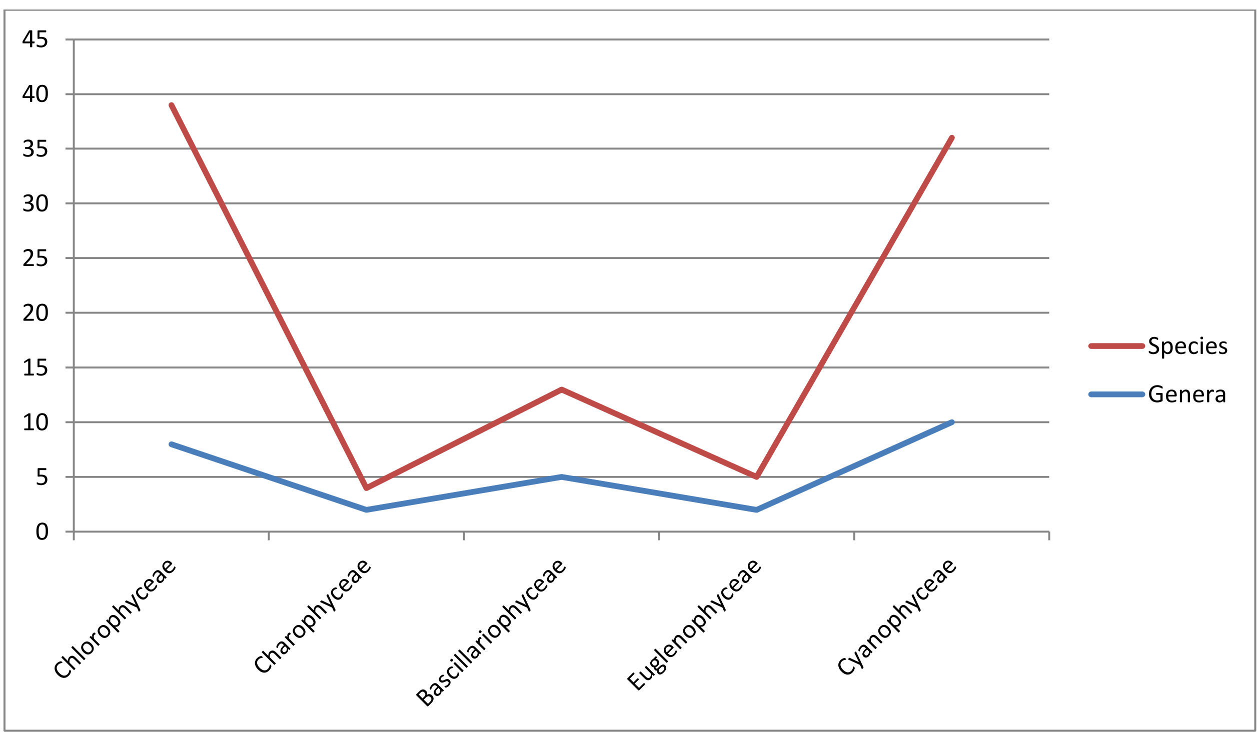


Table.07 Class wises dominance of algal taxa in S2 (Road Side).

Sr.No.	Name of Class	Genera	Species
01	Chlorophyceae	12	32
02	Charophyceae	01	01
03	Bascillariophyceae	04	09
04	Euglenophyceae	02	05
05	Cyanophyceae	11	21
Total		30	68

Graph.06 Class wises dominance of algal taxa in S2 (Road Side).

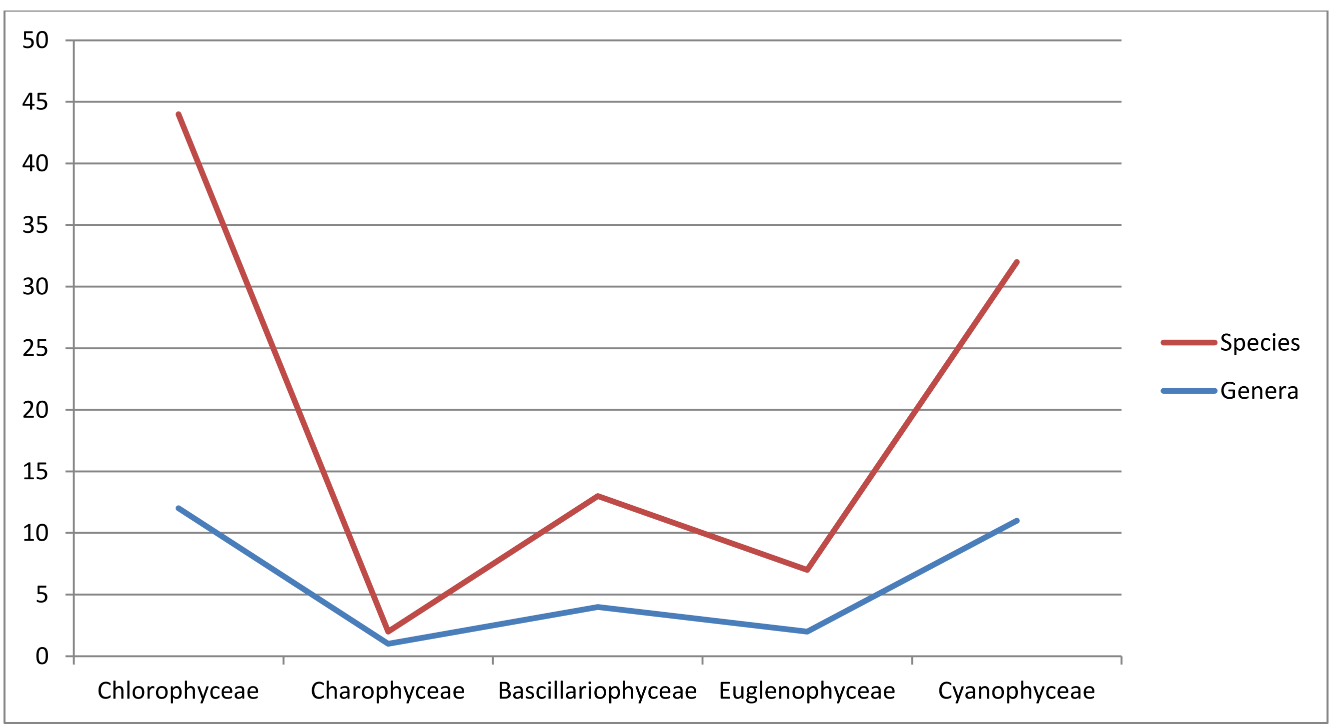


Table.08 Class wises dominance of algal taxa in S3 (Shantiban).

Sr.No.	Name of Class	Genera	Species
01	Chlorophyceae	16	25
02	Charophyceae	02	02
03	Bascillariophyceae	04	08
04	Euglenophyceae	02	04
05	Cyanophyceae	10	24
Total		34	63

Graph.07 Class wises dominance of algal taxa in S3 (Shantiban).

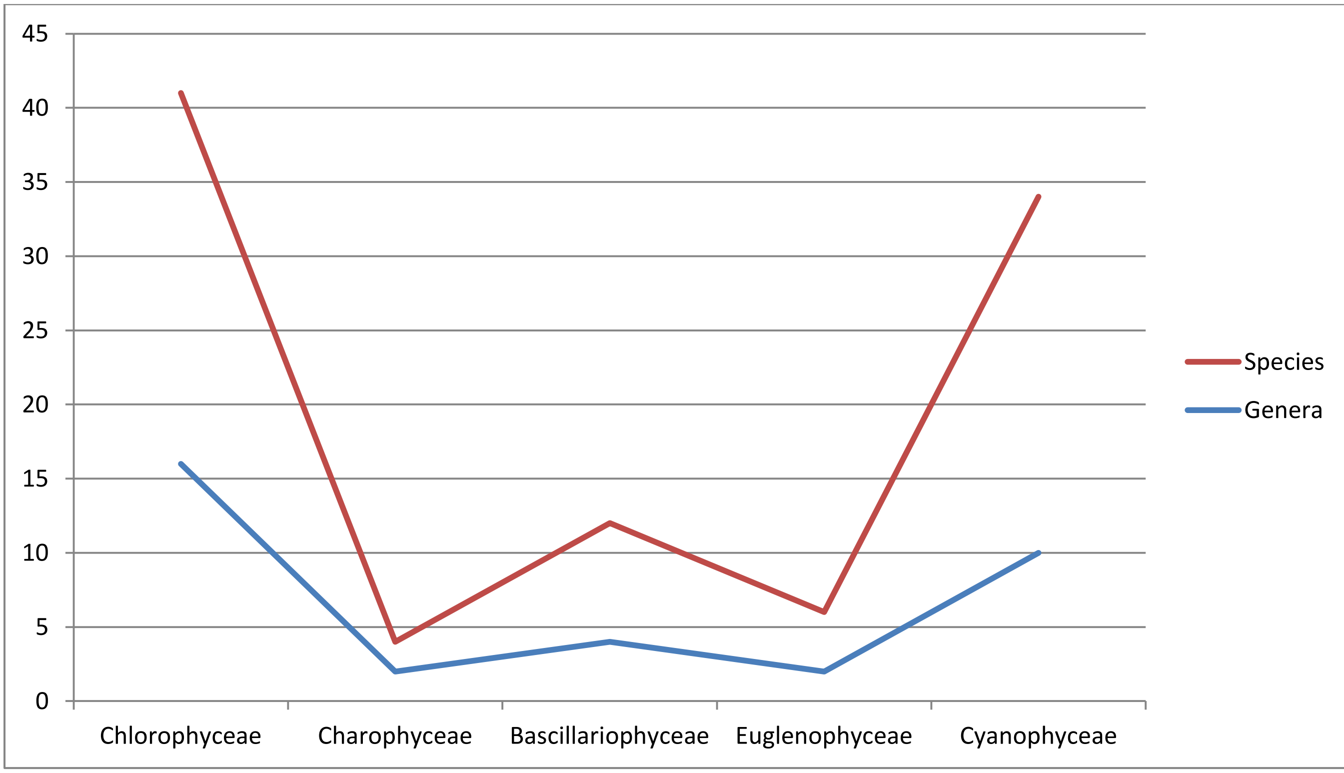
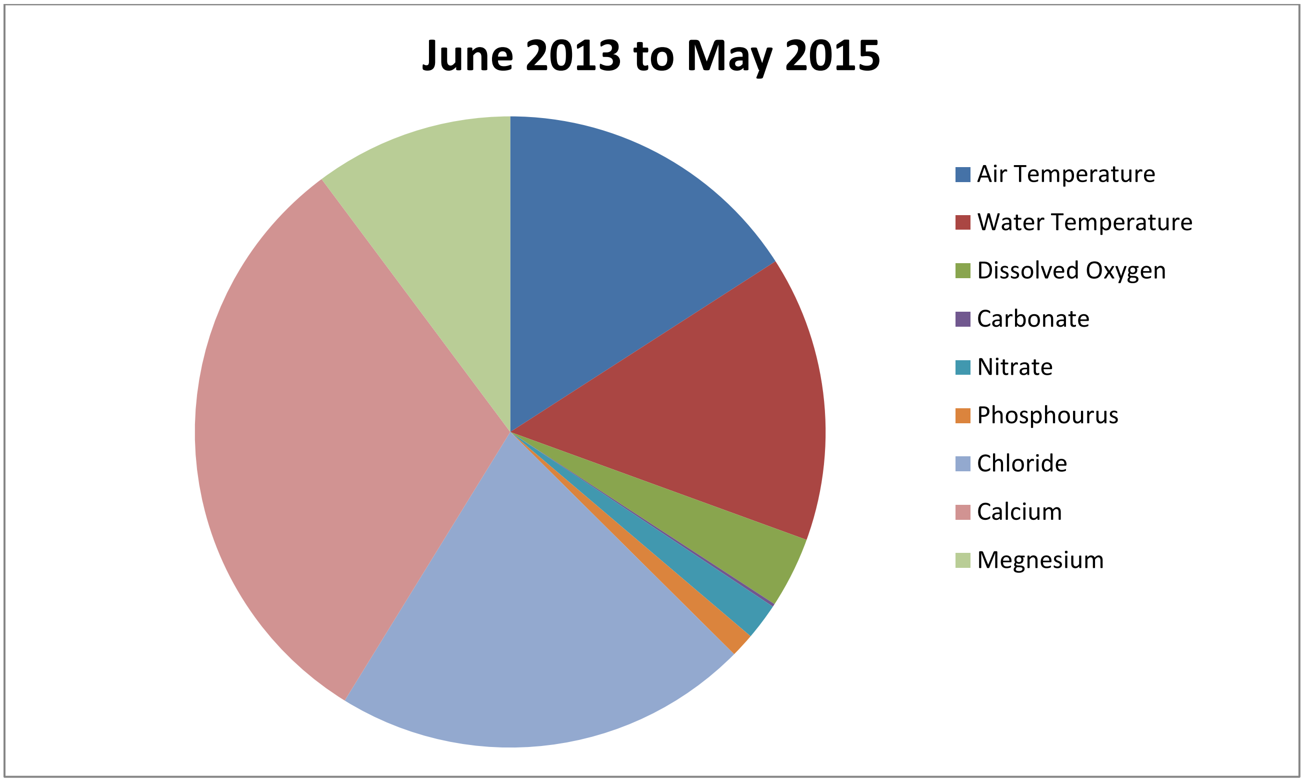


Table.09 Average Seasonal variation of Physico-chemical Parameters in Bindusara Reservoir.

Parameters	Sites	June 2013 to May 2015		
		June 2013 to May 2014	June 2014 to May 2015	Average June 2013 to May 2015
Air Temperature	S_1	28.60	27.30	27.95
	S_2	26.71	28.10	27.405
	S_3	29.08	28.50	28.79
Water Temperature	S_1	26.30.	25.00	25.65
	S_2	25.20	26.30	25.75
	S_3	27.10	25.10	26.1
Dissolved Oxygen	S_1	6.70	6.30	6.5
	S_2	5.90	6.20	6.05
	S_3	6.40	6.90	6.65
Carbonate	S_1	0.26	0.27	0.265
	S_2	0.28	0.29	0.285
	S_3	0.27	0.25	0.26
Nitrate	S_1	3.10	3.70	3.4
	S_2	2.90	3.10	3
	S_3	3.60	3.40	3.5
Phosphourus	S_1	1.50	2.30	1.9
	S_2	2.10	2.60	2.35
	S_3	2.40	2.10	2.25
Chloride	S_1	38	37	37.5
	S_2	35	37	36
	S_3	40	39	39.5
Calcium	S_1	54	56	55
	S_2	59	57	58
	S_3	50	52	51
Megnesium	S_1	17	18	17.5
	S_2	19	16	17.5
	S_3	18	20	19
Total Dissolved Solids (TDS)	S_1	310	370	340
	S_2	340	310	325
	S_3	390	370	380

Graph.08 Average Seasonal variation of Physico-chemical Parameters in Bindusara Reservoir.



In Marathwada region of Maharashtra very few researchers have been paid their attention on the algal biodiversity. Beed district of Marathwada region is rich in large number of fresh water bodies. The Bindusara reservoir one of the important source of water for irrigation and drinking purpose for all villages and towns of Beed.In order to study on Ecobiodiversity studies of algae of Bindusara reservoir in Beed district of Maharashtra.Algal samples were collected form 03 selected sites. The work has been carried out for the period of two years, form June 2013 to May 2015.

The algal forms were identified and described with the help of standard literature on algae as for as possible to the species level. The algal taxa encountered form the different ten sites of Bindusara reservoir are listed in Table 1. In all 121 species under 46 genera were identified and recorded from five groups of algae i.e. Chlorophyceae, Charophyceae, Bacillariophyceae, Euglenophyceae and Cyanophyceae. 55 species under 18 genera belonged to Chlorophyceae, 2 species under 2 genera belonged to Charophyceae, 12 species under 7 genera belonged to Bacillariophyceae, 10 species under 3 genera belonged to Euglenophyceae, and 42species under 16 genera belonged to Cyanophyceae (Table 2). Unicellular, colonial and filamentous algal forms were recorded throughout the period of investigation. The members of Chlorophyceae were dominant followed by Cyanophyceae, Bacillariophyceae, Euglenophyceae and Charophyceae.

Chlorophyceae (Green algae)

The various genera with maximum number of species were *Scenedesmus, Cosmarium, Pediastrum, Spirogyra, Closterium, Ulothrix* and *Oocystis*. The genera with a single species were *Hydrodictoyon, Chlorella, Selenastrum,* and *Desmidium*; among the desmids *Closterium, Cosmarium* and *Desmidium* were observed (Table 1). These were observed in maximum number during summer season. Desmids were observed in the water at all the sites.

Charophyceae:

The class is represented by species of *Nitella and Chara*. (Table 1). In present study Charophyceae members were recorded at S_1 in winter and summer seasons.

Bacillariophyceae (Diatoms):

This class of algae is mainly represented by the species of *Fargilaria, Navicula. Gyrosigma Pinnularia*, *Cymbella, Nitzschia* and *Surirella* (Table 1). During present investigation Bacillariophyceae members were found at all sites of study area. Diatoms showed luxuriant growth in winter and summer seasons.

Euglenophyceae (Euglenoids):

This class was represented by species of *Euglena, Phacus and Trachelomonas*. (Table 1). During present study Euglenophyceae members were recorded in all seasons, maximum number of species were found in summer seasons.

Cyanophyceae (Blue green algae):

The various genera with maximum number of species were *Oscillatoria, Phormidium, Spirulina*, *Lyngbya*, *Nostoc and Calothrix*. The genera with single species were *Dactylococcopsis, Chlorogloea, Johanesbatptistia, Arthrospira and Hapalosiphon* (Table 1).

Seasonal variations of Bindusara reservoir study showed Chlorophyceae members were dominant in winter season while Cyanophyceae members were dominant in summer season. Diatoms are maximum in summer season whereas Euglenophyceae showed seasonal variation maximum in summer followed by winter and monsoon season . Charophyceae members were recorded in winter and summer season (Table 5).

Monthwise variation study of five groups of algae of study area reveals that Chlorophyceae members were maximum in the months of August. Charophyceae members were recorded in the months of January to April. Bacillariophyceae members were found maximum in the months of February, April and May. Cyanophyceae members were found dominant typical in summer months, February to May, while (Table 4 and 5).

Overall seasonal variation studies of algal flora of Bindusara reservoir for two consecutive years reveals that Chlorophyceae members were found dominant in winter season followed by monsoon and summer seasons. Cyanophyceae members were found dominant in summer season as compared to monsoon and winter. Bacillariophyceae members found maximum typically in months summer and winter seasons. Similarly Euglenoids were maximum in summer and winter seasons. No Charophytes were found in monsoon season. Charophytes were recorded in winter and summer seasons. (Table 5). Winter and summer seasons are found favorable for the growth of algae.

Seasonal variation studies of Physico-chemical water analysis of Bindusara reservoir for two consecutive years reveals that Air temperature and water temperature of S_3 side was maximum as compare to another sides. Similarly average Dissolved Oxygen, Nitrate, Chloride, Magnesium and Total Dissolved Solids (TDS) were recorded maximum at S_3 side followed by S_2 and S_3. The maximum amount of Carbonate, Phosphorus and Calcium were observed at S_2 side followed by S_3 and S_1.

DISCUSSION

In Marathwada region of Maharashtra very few researchers have been paid their attention on the algal biodiversity. Beed district of Marathwada region is rich in large number of fresh water bodies. The Bindusara reservoir one of the important source of water for irrigation and drinking purpose for all villages and towns of Beed.In order to study on Ecobiodiversity studies of algae of Bindusara reservoir in Beed district of Maharashtra.Algal samples were collected form 03 selected sites. The work has been carried out for the period of two years, form June 2013 to May 2015.

The algal forms were identified and described with the help of standard literature on algae as for as possible to the species level. The algal taxa encountered form the different ten sites of Bindusara reservoir are listed in Table 1. In all 121 species under 46 genera were identified and recorded from five groups of algae i.e. Chlorophyceae, Charophyceae, Bacillariophyceae, Euglenophyceae and Cyanophyceae. 55 species under 18 genera belonged to Chlorophyceae, 2 species under 2 genera belonged to Charophyceae, 12 species under 7 genera belonged to Bacillariophyceae, 10 species under 3 genera belonged to Euglenophyceae, and 42species under 16 genera belonged to Cyanophyceae (Table 2). Unicellular, colonial and filamentous algal forms were recorded throughout the period of investigation. The members of Chlorophyceae were dominant followed by Cyanophyceae, Bacillariophyceae, Euglenophyceae and Charophyceae. In similar kind of studies form freshwater habitats of Aurangabad district of Maharashtra 618 algal taxa were recorded by Ashtekar (1980). Here Chlorophyceae members were dominant followed by Cyanophyceae, Euglenophyceae, Chrysophyceae and Rodophyceae. Jain (2002) studied Algal biodiversity of Sonvad and Devbhane dam in Dhule district of Maharashtra. He reported 304 algal forms, of which 97 belonged to Chlorophyceae, 90 belonged to Cyanophyceae, 87 belonged to Bacillariophyceae and 30 to Euglenophyceae. Mahajan (2004, 2005) reported 102 alga taxa belonged to 23 genera of blue green algae form Hartala lake, Jalgaon district Maharashtra. Kumawat and Jawale (2003 a & b) extensively studied phytoplanktons of some fish ponds at Anjale, in Jalgaon district and reported 65 taxa. Magar (2008) reported 364 algal taxa form Girna dam of Nashik district, of these 141 belonged to Chlorophyceae, 102 belonged to

Cyanophyceae, 101 belonged to Bacillariophyceae and 20 to Euglenophyceae. Andhale (2008) studied algal flora of Jayakwadi bird sanctuary of Aurangabad district. He recorded 215 taxa of algae. Verma (2008) studied phytoplankton of Narmada river of Maheshwar (M.P.) and recorded 48 species belonging to Bacillariophyceae, Chlorophyceae, Cyanophyceae and Euglenophyceae. Several workers extensively worked an algal biodiversity of freshwater habitats, their results are agreed with present algal biodiversity study. (Hillaird 1959, Clearance 1960, Aykula 1978, Gophen 1994, Huszar 1996, Lausevik 1997, Rodrigues 1998, Iqbal *et. al.,* 2006, Kamat 1962, Heddge 1983, Johnson, 2006, Senthikumar and Sivkumar 2007, Vanjari *et. al.,* 2007, Nandan *et. al.,* 2007 and Jadhav *et. al.,*2007).

Seasonal variations of Bindusara reservoir study showed Chlorophyceae members were dominant in winter season while Cyanophyceae members were dominant in summer season. Diatoms are maximum in summer season whereas Euglenophyceae showed seasonal variation maximum in summer followed by winter and monsoon season . Charophyceae members were recorded in winter and summer season (Table 5). Monthwise variation study of five groups of algae of study area reveals that Chlorophyceae members were maximum in the months of August. Charophyceae members were recorded in the months of January to April. Bacillariophyceae members were found maximum in the months of February, April and May. Cyanophyceae members were found dominant typical in summer months, February to May, while (Table 4 and 5). The results agreed with Venkateshwarlu (1969), Munawar (1972), Hosmani and Bharti (1975) and Magar (2008). But Singh (1959) observed maximum development during winter season. Charophyceae was very less as compared to the other groups of algae, not showing any seasonal trends, only they were recorded in winter and summer months.

Overall seasonal variation studies of algal flora of Bindusara reservoir for two consecutive years reveals that Chlorophyceae members were found dominant in winter season followed by monsoon and summer seasons. Cyanophyceae members were found dominant in summer season as compared to monsoon and winter. Bacillariophyceae members found maximum typically in months summer and winter seasons. Similarly Euglenoids were maximum in summer and winter seasons. No Charophytes were found in monsoon season. Charophytes were recorded in winter and summer seasons. (Table 5). Winter and summer seasons are found favorable for the growth of algae. Result of present study agreed with the results of Roy (1955). Chakraborty *et. al.,* (1959), Venketswarlu (1969c) Nandan and Patel (1984a), Patil (1995), More (1997), Jain (2002) and Magar (2008). Kapoczynska (1980) noticed the enhanced growth of algal flora during pre monsoon period.

Seasonal variation studies of Physico-chemical water analysis of Bindusara reservoir for two consecutive years reveals that Air temperature and water temperature of S_3 side was maximum as compare to another sides. Similarly average Dissolved Oxygen, Nitrate, Chloride, Magnesium and Total Dissolved Solids (TDS) were recorded maximum at S_3 side followed by S_2 and S_3. The maximum amount of Carbonate, Phosphorus and Calcium were observed at S_2 side followed by S_3 and S_1.

CONCLUSIONS

The algal taxa encountered form the different ten sites of Bindusara reservoir are listed in Table 1. In all 121 species under 46 genera were identified and recorded from five groups of algae i.e. Chlorophyceae, Charophyceae, Bacillariophyceae, Euglenophyceae and Cyanophyceae. 55 species under 18 genera belonged to Chlorophyceae, 2 species under 2 genera belonged to Charophyceae, 12 species under 7 genera belonged to Bacillariophyceae, 10 species under 3 genera belonged to Euglenophyceae, and 42species under 16 genera belonged to Cyanophyceae Unicellular, colonial and filamentous algal forms were recorded throughout the period of investigation. The members of Chlorophyceae were dominant followed by Cyanophyceae, Bacillariophyceae, Euglenophyceae and Charophyceae.The various genera with maximum number of species were *Scenedesmus, Cosmarium, Pediastrum, Spirogyra, Closterium, Ulothrix* and *Oocystis*. The genera with a single species were *Hydrodictoyon, Chlorella, Selenastrum,* and *Desmidium*; among the desmids *Closterium, Cosmarium* and *Desmidium* were observed .These were observed in maximum number during summer season. Desmids were observed in the water at all the sites. The class is represented by species of *Nitella and Chara*. In present study Charophyceae members were recorded at S_1 in winter and summer seasons. This class of algae is mainly represented by the species of *Fargilaria, Navicula. Gyrosigma Pinnularia, Cymbella, Nitzschia* and *Surirella* During present investigation Bacillariophyceae members were found at all sites of study area. Diatoms showed luxuriant growth in winter and summer seasons.This class was represented by species of *Euglena, Phacus and Trachelomonas*. During present study Euglenophyceae members were recorded in all seasons, maximum number of species were found in summer seasons. The various genera with maximum number of species were *Oscillatoria, Phormidium, Spirulina, Lyngbya, Nostoc and Calothrix*. The genera with single species were *Dactylococcopsis, Chlorogloea, Johanesbatptistia, Arthrospira and Hapalosiphon.*

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