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ATHENA INFONOMICS

CGIAR RESEARCH PROGRAM ON Water, Land and Ecosystems

LED BY: IWMI International Water Management Institute

BIODIVERSITY STUDY OF EKRUKH LAKE – SOLAPUR

MINOR RESEARCH PROJECT

INTEGRATED RURAL URBAN WATER MANAGEMENT FOR CLIMATE BASED ADAPTATIONS IN INDIAN CITIES (IAdapt)

Final Report of Minor Research Project

Proposal Code:	**Proposal # A-69683**
Submitted to:	International Development Research Centre (IDRC) Canada
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Project Consortium:	ICLEI South Asia (Lead Member) Athena Infonomics LLC International Water Management Institute (IWMI) Indian Institute of Technology, Madras (IIT M)

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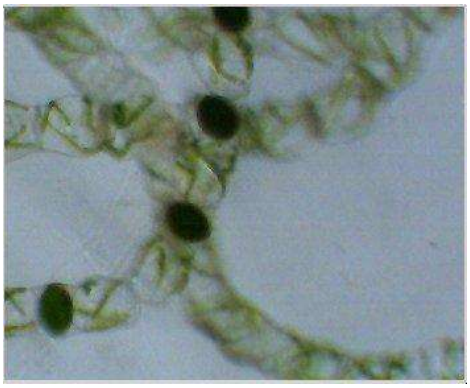
ICLEI Local Governments for Sustainability

ATHENA INFONOMICS

IWMI International Water Management Institute

FINAL REPORT OF MINOR RESEARCH PROJECT OF ICLEI -IADAPT

Biodiversity study of Ekrukh (Hipparga) Lake of Solapur (Maharashtra)



UNDER

MINOR RESEARCH PROJECT

Submitted to
ICLEI -IADAPT

Submitted by

Dr. M.N. Jagtap

M.Sc. M, Phil. Ph.D.

Principal investigator

Research Centre and Post Graduate Department of Botany

D.B.F. Dayanand College of Arts and Science, Solapur. 413 002

SOLAPUR UNIVERSITY, SOLAPUR

1. Project report No. 1st /2nd /Final -------- **Final**

2. UGC Reference No.------ F-03/Hiparga / DBF /Solapur

3. Period of report: 1st Sep 2018 to 1st Sep 2019

4. Title of research project -------"Biodiversity study of Ekrukh (Hipparga) Lake of Solapur (Maharashtra)

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(ii) Sex : Male

(iii) Date of Birth : 01 – 06 – 1965

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6. Effective date of starting of the project-------- 1st Sep 2018

7. Grant approved and expenditure incurred during the period of the report:

a. Total amount approved Rs. 60,000 (Sixty thousand rupees only)

Report of the work done: (Separate sheet attached)

(i)Brief objective of the project _

1. To evaluate the physico-chemical status of different types of agriculture soils and water of Ekrukh lakes .
2. To study hydrobiological study of Ekrukh lakes .
3. To isolate toxic cyanobacteria from Ekrukh lakes
4. To isolate phytoplankton from Ekrukh lakes.
5. To study Plant Biodiversity around Ekrukh Lake
6. To develop awareness among society about water management

(iii) Has the progress been according to original plan of work and towards achieving the objective. if not, state reasons ---------- Yes

(iv) Please indicate the difficulties, if any, experienced in implementing the project_____No_____

.

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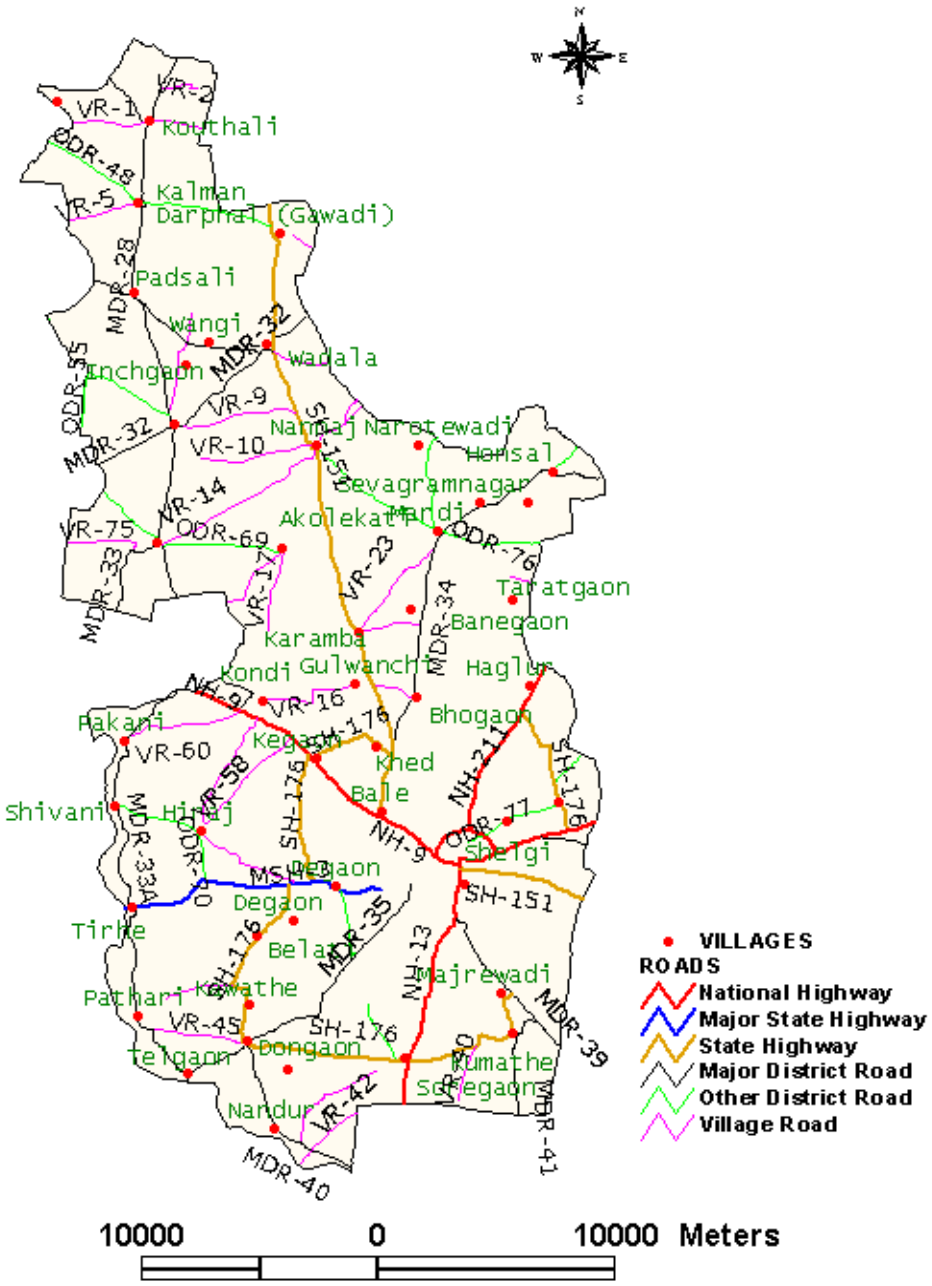
Biodiversity study of Ekrukh(Hipparga) Lake of Solapur (Maharashtra)

Introduction:

Shola'pur, between 17 10' and 1832' north latitude and 74 42' and 76 15' east longitude, has an area of 4521 square miles. In 1881 it had a population of 582,487 or 128.84 to the square mile, and in 1882 a realizable land revenue of 104,969 (Rs. 10,49,690). The climate of Sholapur is healthy, and except the hot months of March April and May, is agreeable and free from extremes of heat or of cold. The year may be roughly divided into three nearly equal seasons; the cold season from November to February, the hot season from March to mid-June, and the rainy season from mid-June to the end of October. October is a time of transition from the rainy to the cold season. During the cold season the air is generally bright, clear, and bracing, the nights and mornings being especially cool and freshening. Easterly and north-easterly winds prevail but are not strong enough to be unpleasant. The hot season from March to June, especially during March and April, is marked by a dry scorching heat. The mean temperature during this period is 40degree; and the climate is oppressive with strong hot winds and occasional dust-storms. In March the hot winds blow from the east and in April and May from the west. The hot winds generally cease after nine and the nights are usually cool. During May clouds begin to gather, the wind grows fitful, and heavy thunderstorms generally cool the air. The rainy, months are pleasant. The sky is more or less overcast, rain falls in frequent heavy showers broken by gleams of sunshine, the moisture is never excessive, the temperature is generally mild and even, and the wind almost always fresh and cool from the west and south-west, a delightful change from the dry stifling hot winds.

SOLAPUR NORTH TALUKA



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1. To evaluate the physico-chemical status of different types of agriculture soils and water of Ekrukh lakes .
2. To study Hydrobiological study of Ekrukh lakes .
3. To isolate toxic cyanobacteria from Ekrukh lakes
4. To isolate phytoplankton from Ekrukh lakes.
5. To study Plant Biodiversity around Ekrukh Lake
6. To develop awareness among society about water management.

Review of literature :

One of the central questions in ecology is how biological diversity relates to ecological function. This question has become increasingly relevant as anthropogenic transformation of the earth has intensified (Peterson et al., 1998). The distribution and abundance of species have been radically transformed as massive land-use changes have eliminated endemic species. This biotic reorganization is occurring with a variety of other global changes, including climate change, alteration of nutrient cycles, and chemical contamination of the biosphere. Despite the demonstrated link between richness of species and ecological stability over small scales, the nature of this connection remains uncertain.

Biological monitoring is often used exclusively to observe the response of the ecosystem to changes in water quality. Selection of phytoplankton species and assembly of plankton communities in rivers is steered mainly by physical factors such as (Ibelings et al., 1998). The relation of phytoplankton with other chemical variables (salinity, heavy metals etc.) is not well characterized.

Gregor and Marsálek (2004) have undertaken a comparative study of in vitro, in vivo and in situ methods for phytoplankton quantification by chlorophyll a and have concluded that the use of submersible probes for in situ phytoplankton quantification can be recommended as a sensitive tool for water management, especially in the case of drinking water resources.

Zeta potential and acid-base titrations of active, inactivated, and dead Planktothrix sp. and Synechococcus sp. of cyanobacteria were performed to determine the degree to which cell surface electric potential and proton/hydroxyl adsorption are controlled by metabolism or cell membrane structure (Martinez et al., 2008). Dwivedi et al. (2005) have reported extensive account of cyanobacterial diversity of agro-climatic zones of Uttar Pradesh, India. The distribution of 45 species was as follows: 13 belonged to order Chroococcales, 31 to order Nostocales, while only 1 species belonged to order Stigonimatales i.e. Fischerella mucicola. The physico-chemical parameters like pH, temperature, dissolved oxygen; electrical conductivity, nitrate, nitrite and rainfall play an important role in the periodicity of blue green algae (BGA). A positive correlation was found between dissolved oxygen (DO) of different ponds and diversity of species, except in the case of western region of Uttar Pradesh where a positive correlation was found in electrical conductivity and total dissolved solids.

Cyanobacteria, belonging to the order Chroococcales and families Oscillatoriaceae and Nostocaceae occur ordinarily as planktonic forms. Cyanobacteria in freshwaters have been reported from sea level to high altitudes. They also occupy a variety of terrestrial environments. Soil is one of the most potential habitats for algal growth, particularly in moist or waterlogged conditions (Thajuddin and Subramanian, 2005).

Parikh et al. (2006) have studied the diversity of cyanobacteria in effluents originating from pesticides, agro-chemicals, textile dyes and dyestuffs industries and their relationship with water quality. Cyanobacterial community structure was found to be influenced by the anthropogenic pollution. 40 different cyanobacterial species were recorded from 14 genera of 5 families and an elevated occurrence of *Phormidium*, *Oscillatoria* and *Chroococcus* genera was observed in all the sampling sites.

Material and Method

1. **Biodiversity study :**

Plant specimens will be collect with frequent excursion visits throughout the years. Special attention is given to collect the plant specimens in each season, most of the plant materials were collecting during rainy season. correct names were ascertained in consultation with International code of Botanical Nomenclature (ICBN) Families were arranged in accordance with Bentham Hooker system of classification and species diversity index is also studied by Qudrat method The plants were collected and photographed with the help of Pine pix digital camera(USA) and the specimens were proceeds for herbarium by using methodology (Rao and Sharma1990) specimens were preserved in P.G.Department of Botany Dayanand College Solapur.

Identification were confirmed by direct comparison with authentic specimens at BSI Herbarium Western circle Pune and from Dr, S.R.Yadav Shivaji University Kolhapur.

2. Hydrobiological Study :

Methodology: The analysis of industrial effluents will be carried out according to- APHA (22Edition) for color, appearance, turbidity, odour, acidity, alkalinity, hardness, conductivity, BOD, COD and solids (total, fixed and volatile).

3. Isolation of Cyanobacteria :

Media Composition:

A] BG11- Medium	**(g/lit.)**
$NaNO_3$	1.5
K_2HPO_4	0.04
$MgSO_4.7H_2O$	0.075
$CaCl_2.2H_2O$	0.036
Citric Acid	0.006
Ferric ammonium citrate	0.006
EDTA	0.001
Na_2CO_3	0.02
Trace Metal mix	1ml
Distilled water	1000 ml
p^H	7.4

The trace metal mix contains constituents in (g/lit.)

H_3BO_3	2.86
$MnCl_2.4H_2O$	1.81
$ZnSO_4.7H_2O$	0.222
$Na_2MoO_4.2H_2O$	0.39
$CuSo_4.5H_2O$	0.079
CO $[NO_3]_{2.6H2O}$	0.0494
Distilled water	1000 ml
p^H	5.0

B] Gerloff's medium, **(g/lit.)** [Gerloff's et- al., 1950]

$NaNO_3$	0.0413
Na_2HPO_4	0.0082
KCl	0.0086
$MgCl_2.6H_2O$	0.02
Na_2SO_4	0.015
$CaCl_2.2H_2O$	0.359
Ferric Citrate	0.003
Citric Acid	0.003

Na_2CO_3	0.02
$Na_2SiO_3.9H_2O$	0.025
Distilled water	1000 ml
p^H	7.0
Trace Metal mix	1ml

The trace metal mix contains constituents in g\l [A5 solution]

H_3BO_3	2.86
$MnCl_2.4H_2O$	1.81
$ZnSO_4.4H_2O$	0.222
$CuSo_4.5H_2O$	0.079
MoO_3	0.0177
Distilled water	1000 ml
p^H	5.

C] Chu's#10 Medium	**(g/lit.)**
Ca $[NO_3]_{2.}4H_20$	0.04
K_2HPO_4	0.01
$MgSO_4.7H_2O$	0.025
Na_2CO_3	0.02

$Na_2SiO_3.9H_2O$	0.025
Ferric Citrate	0.003
Citric Acid	0.003
pH	6.5 -7.0

D] Nutrient Agar

Peptone	1 gm
Meat extract	0.3 gm
Nacl	0.5 gm
D/w	100 ml
pH	7.0 – 7.2
Agar-agar powder	2.5 gm

E] Sabourad's (Dextrose) Agar

Peptone	10.0 gm	
Dextrose	40.0 gm	
Agar-agar powder	25.0 gm	
pH	6.5 Distilled Water	1000 ml

Analysis of physiological parameters:

Soil and water analysis was done at P.G. Department of Botany Dayanand College Solapur Samples were analyzed as per the standard procedure APHA (22 Edition) Soil temperature and moisture were recorded during soil sampling. Soil pH was measured in a 1:2.5 soil–water suspension using a glass electrode (Systronics, Digital pH meter, India). Soil electrical conductivity (EC) was determined by measuring the electrical conductance of soil-saturation extract with a conductivity meter (Equip-Tronics, India). Salinity (ppt) was calculated using online conversion of electrical conductivity to salinity at sampling temperature (http://www.fivecreeks.org/monitor/sal.html). Soil and water analysis was done at P.G.Department of Botany Dayanand College Solapur . Samples were analyzed as per the standard procedure ((22nd Edition 2012 APHA, 1995).

Soil temperature and moisture were recorded during soil sampling. Soil pH was measured in a 1:2.5 soil–water suspension using a glass electrode (Systronics, Digital pH meter, India). Soil electrical conductivity (EC) was determined by measuring the electrical conductance of soil-saturation extract with a conductivity meter (Equip-Tronics, India).

Colour:

Presence of cyanobacteria exhibits blue green colour to sites. Most of soils and sediments samples collected have such colour. But water samples had slighted of green colour.

Observations:

Table: 1 soil sample analysis

Parameter \ Site	**Site-1**	**Site-2**	**Site-3**	**Site-4**
Soil texture	Lome	Silt	Sludge	Lome
pH	7.8 (0.89)[a]	6.6 (0.66)	5.8 (0.57)	7.5 (0.83)
EC (S/m)	0.72 (0.65)	0.92 (0.58)	1.14 (1.12)	2.24 (1.72)
$CaCO_3$ (%)	2.14 (1.65)	1.93 (0.94)	1.45 (1.06)	2.22 (1.84)

Total organic carbon, mg/l	28.18 (7.21)	42.32 (8.54)	55.14 (6.77)	24.97 (11.14)
Water holding capacity (%)	44.60 (12.06)	58.12 (10.22)	62.55 (14.14)	73.26 (8.96)
CEC, mEq/100g	16.41 (3.75)	27.18 (4.52)	13.23 (4.66)	23.96 (2.76)
SAR	5.66 (1.65)	5.24 (1.80)	3.41 (0.94)	6.68 (1.38)

Table 2: Hydrobiological Study :

Parameter	Hipparga lake
pH	7.5
EC (S/m)	1.3
Total Alkalinity	121
Hardness (mg/lt)	180
Transparency (cm)	18.19
VAC	0.87
Air temp	35
Water temp	27
Dissolved oxygen	11.35
Odour	fishy
Colour	Blue

Isolation of phytoplankton from Ekrukh lake.

The utilisation of lentic water bodies for domestic purposes and fish culture has assumed importance in developing countries. The disposal of agricultural waste and untreated sewage into water bodies adversely affect the plant and animal life. Sukumaran (2002) is of the opinion that the constant discharge of sewage into the aquatic system enriches the organic content, leading to eutrophication and deterioration of the quality of water. In India, inland water bodies attracted the attention of various workers leading to the studies on water quality and distribution of phytoplankton from time to time, (Zafar, 1967, Munawar 1974). Although considerable work has been done on the limnological studies on some lakes of Maharashtra .The Ekrukh lake of Solapur city selected for the present study remains scientifically unexplored.

Materials and Methods:

- The samples for phytoplankton were collected during field visits.
- pH was measured on the spot using pH paper and later confirmed in the laboratory using digital pH meter.
- The chemical analysis was carried out following the methods suggested by Trivedy and Goel (1986) and standard methods of APHA (1995).
- For the enumeration of phytoplankton, each site in a 50mL sample bottle by filtering about 50 liters of water through plankton net.
- sample was fixed simultaneously with 20 ml of 1% lugol solution for sedimentation.
- This sedimented sample was observed under microscope.
- The identification of phytoplankton up to the level of species was made with the help of literature cited [Philipose M.T(1967), Deshikachary (1959), Gandhi (1955)]. And photographs are taken by using microphotographic camera (Adicon)

Ecology and diversity of Cyanobacteria

Cyanobacteria are a large and morphologically diverse group of phototrophic prokaryotes occurring in almost every habitat on the earth. Cyanobacteria can grow photoheterotrophically in oxygenic and anoxygenic environments. In most of ecosystems, cyanobacteria are the primary producers. They are characterized by a great morphological diversity and their widespread

distribution reflects a broad spectrum of physiological properties and tolerance to environmental stress (Tandeau de Marsac and Houmard 1993).

Cyanobacteria exist in a variety of terrestrial environment. Moist and waterlogged conditions of soil are suitable to the growth of algae and cyanobacteria. They play an important role in soil reclamation and soil fertility. A Waterlogged rice field is an ideal habitat for cyanobacteria, which are capable of nitrogen fixation. These include species of *Anabena, Aulosira, Calothrix, Cylindrospermum, Gleocapsa, Nostoc, Rivularia, Scytonema* and *Tolypothrix* (Venkataraman, 1975). In sugarcane and maize fields in Maharashtra, N_2 fixing cyanobacteria have been reported by Singh (1961). Other species viz. *Lyngbya, Microcoleus, Prophyrosiphon* and *Schizothrix* form crusts on soils.

The families, *Nostacaceae, Oscillatoriaceae* and order *Chroococceals* are found to dominate in fresh water habitats. Desikachary (1959) lists as many as 251 species belonging to 41 genera of cyanobacteria that occur as fresh-water planktons. *Microcystis* is one of the dominant organisms associated with almost permanent blooms.

3 Enrichment of samples:

The mixed population of soil, water, etc. is considered to be a community of competing species or metabolic types. Changes of external conditions will favour growth of one or few particular species will result in the establishment of their predominant population at the expense of other species. It is the aim and art of the enrichment culture technique to control those selective conditions which quickly and reproducibly lead to the predominant population of one special organism, thereby facilitating its isolation.

In present investigation the samples collected from Ekrukh lake were enriched in presence of light and BG.11 and Chu's#10 medium. In flat glass bottles sterile BG.11 medium (50 ml) were inoculated with 5 ml of sample collected from different habitats. The bottles were incubated under continuous light illumination (Fluorescent tubes) at 24± 2 °C. The growth of cyanobacteria was judged on the basis of visual observations (7 day incubation). The enriched samples were transferred to sterile medium containing same BG.11or Chu's#10 medium.

4. Isolation of cyanobacterial cultures from enriched sample:

Enriched samples were streak plated on BG11 agar plates and kept under continuous exposure to light. Well-isolated colonies were noted for their colony characters and further transferred to BG-11 agar plates(fig.3.1) for culture purification. Purified cultures were maintained on BG-11 agar slopes(3.2). Following was the scheme for preparation of agar plates used for culture isolation.

Scheme for isolation of cultures

(BG-11 agar 200ml)

Flask1

(100ml distilled water + Agar)

□

Flask2

□

Autoclaved separately

□

Mixed both flasks

□

Poured in molten condition

□

Incubation for 10 to 15 days at discontinuous illumination at 800 lux

□

Isolated colonies were observed.

5. Microscopic observation:

The isolates were observed under oil immersion and high power microscopy for examining the morphology and microphotography was done under computer microcope (Adicon)

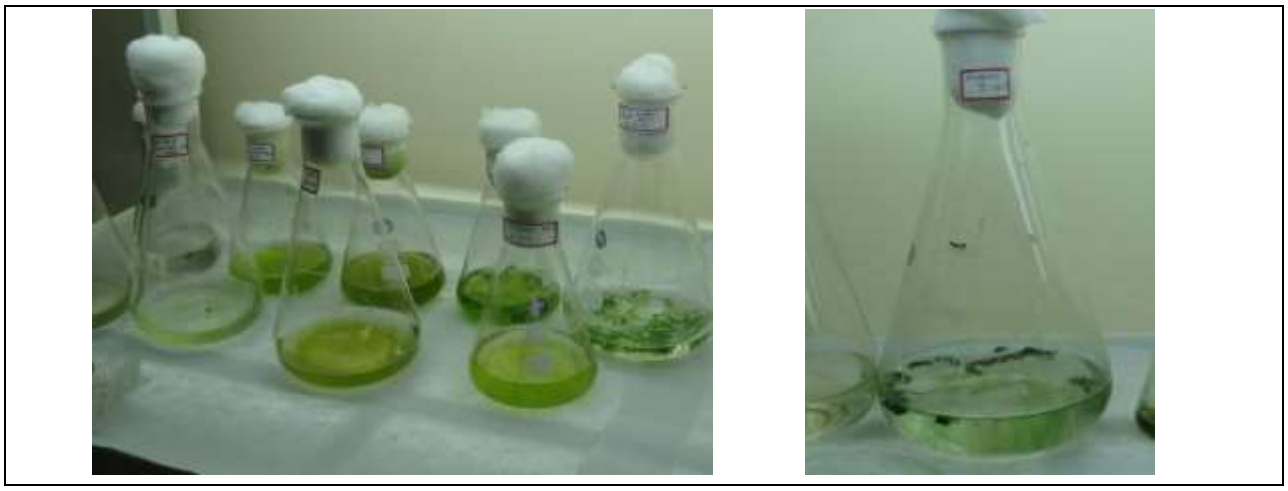


Fig. ISOLATES ON BG -11 BROTH

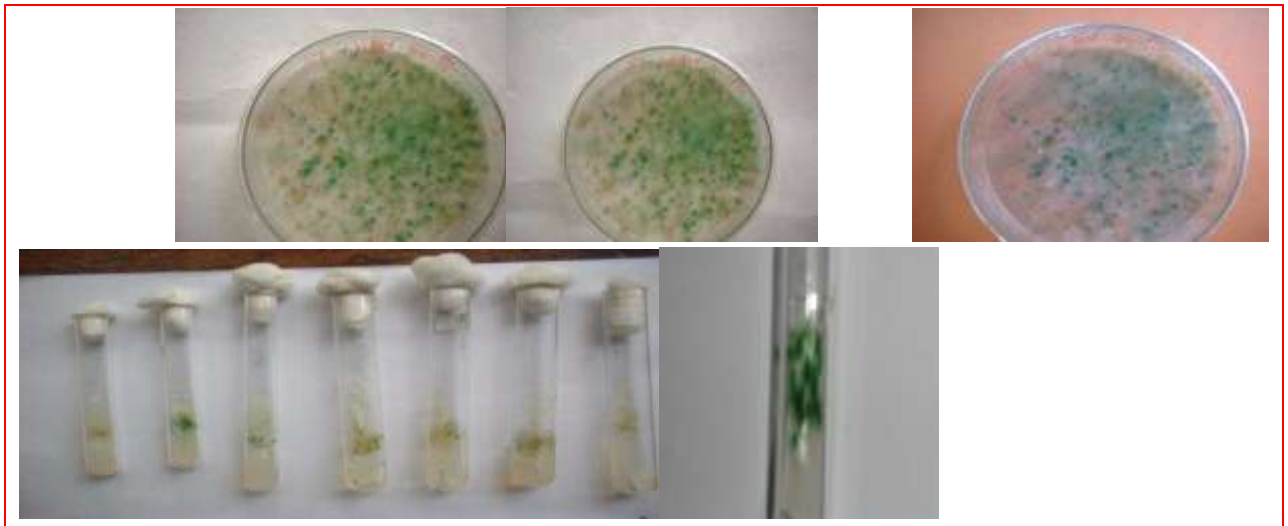


Fig: ISOLETS ON BG - 11 AGAR

6. Maintenance of Culture:

The fresh slants prepared, were inoculated in a growth chamber to provide proper environmental conditions. After a suitable growth, the slants were preserved at 800 lux intensity of light and at 28+- 2ºC for one to two months and these cultures were used for our further studies .

7. To isolate toxic cyanobacteria from urban lakes

Cyanobacteria have come to the attention of public health workers because many freshwater and brackish species can produce a range of potent toxins (Stewart, 2004; van Apeldoorn et al., 2007). This observation was first reported over 120 years ago, when sheep, horses, dogs and pigs were seen to die within hours of drinking water from a lake affected by a bloom of the brackish-water cyanobacterium Nodularia spumigena. Since then, many reports of livestock and wild animal deaths have appeared in the literature. Such reports have been collated by several authors (Stewart, 2004). Some reports are dramatic in terms of the number of animals affected or the rapid progression of illness and death, with mass deaths of thousands of animals (Carmichael, 2008), and large animals succumbing within minutes (Codd et al., 1995).

Toxic cyanobacteria are found worldwide in inland and coastal water environments.At least 46 species have been shown to cause toxic effects in vertebrates (Sivonen & Jones, 1999).
The most common toxic cyanobacteria in fresh water are

1 Microcystis spp.
2 Cylindrospermopsis raciborskii
3 Planktothrix (syn. Oscillatoria) rubescens
2 Gloeotrichia spp.,
3 Anabaenaspp.,
4 Lyngbya spp.,
5 Aphanizomenon spp
6 Nostoc spp.
7 Oscillatoria spp.

The Hipparga lake is perennial wet lands present in and around the Solapur city having great socioeconomic value, the main aim of the study this lakes is to monitor important wet land of

the city , to study biodiversity of the lakes because these lakes are famous for migratory birds and ultimately to conserve the lake ecosystem.

The samples were collected in (July2018 to Dec2018) pH was measured on the spot using Hand digital pH meter and later confirmed in the laboratory using digital pH meter and enriched with BG -11 Medium .

Cyanobacteria are one of the most diverse groups of Gram-negative photosynthetic prokaryotes which frequently form cyanobacterial harmful blooms (CyanoHAB) in eutrophic water bodies. Some species of cyanobacteria are able to produce toxins which may be divided in to three main groups; hepatotoxin, neurotoxin and cyanotoxin (Codd, 2000). These toxins can cause water quality problems for fisheries, aquaculture, farming

and sanitary hazards for human and animals. Therefore, survey of CaynoHAB and cyanotoxin have been carried out in several countries, avoiding sanitary risks by a safe use of cyanotoxin-contaminated water (Chorus and Bartram, 1999). However, in water irrigation, cyanotoxin surveys have not yet been considered within any water quality.

official monitoring programme, in spite of the possible contamination of edible plants constituting a significant indirect route of human exposure to cyanobacterial toxins ((Codd, 2000). Accordingly, many studies clearly indicate that irrigation with water containing cyanotoxin can be a threat for both the quality and yield of crop.

Observations:

The classification of cyanobacateria is largely based on morphological or visible differences such as trichome width, presence or nature of sheath, number of trichomes per sheath and colour.

As per the cyanophyta, (Desikachary, 1959) cyanobacteria are classified under five orders as follows:

1. *Chroococcales*: Unicellular or colonial, sometimes forming a pseudo filamentous colony, never with a “trichome organization”, no differentiation into base and apex, endospores not formed in sporangia and no exospores.

2. *Chamaeosiphonales:* Unicellular, attached, typically differentiated into base and apex, reproduction by endospores or exospores.

3. *Pleurocapsales:* More or less distinctly filamentous attached arrangement very uniform, chroococcaceous structure, often forming parenchymatous thalli with prostrate and erect filaments, without differentiation into trichome and filament, no hormogones no heterocyst, endospores in sporangia.

4. *Nostocales:* Filamentous, with trichomes and hormogones present, often with heterocysts, akinetes, exospores or endospores, pseudo-hormogonia present.

   a) Without true branching, unbranched or with false branching

5. *Stigonematales:* Filamentous, with trichomes and hormogones present, often with heterocysts, akinetes, exospores or endospores, pseudo-hormogonia present.

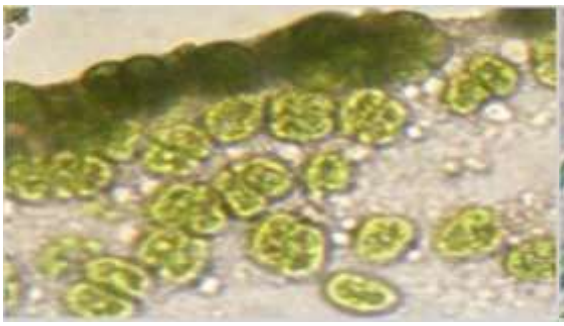
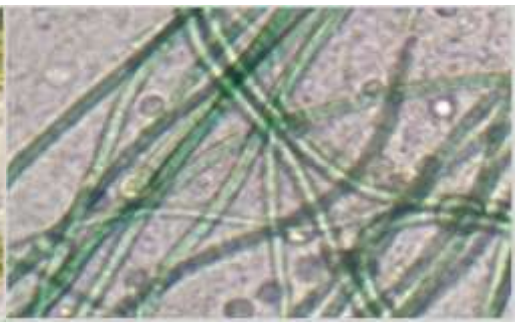
   --a) With true branching or dichotomous branching and often with heterotrichous condition i.e. with a differentiation of prostate and erect position

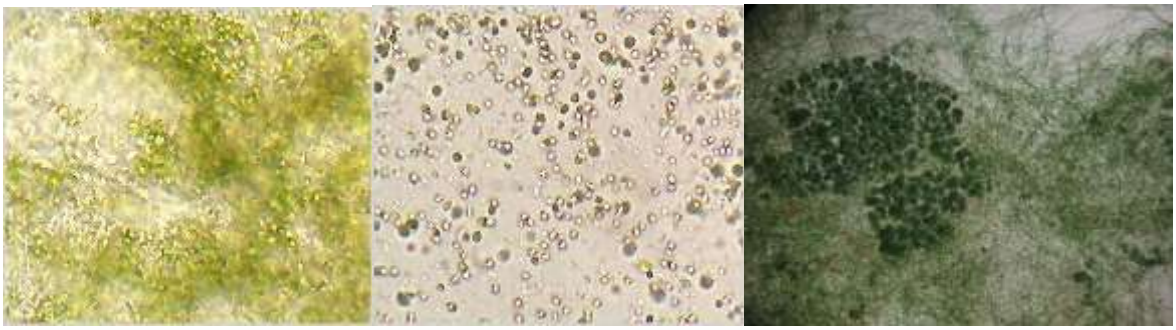
The occurrence of cyanobacterial forms was recorded after sampling, using microscopic observations. The identification of cyanobacteria was based on morphological forms observed under the microscope, which were compared with literature-description. Following is the list of cyanobacterial forms which occurring in various habitats. The description of some cyanobacterial genera and species are as per a Desikachary (1959) and Rippka *et al.* (1979).

Isolation and purification of BGA





Aphanocapsa littoralis *Synechocystis salina* *Chroocicocus montanus*

Fig. Isolates from water

Table 3. Characterization and identification of cyanobacterial isolates from soil/Water

Sr. No.	Isolate No.	Morphology	Identification	Enrich. Medium	S/W
1	NS-1	Uni	*Gloeotheceae zeller*	BG-11	S
2	NS-2	Fil, NH	*Oscillatoria chlorina*	BG-11	S
3	NS-3	Fil, NH	*Phormidium tenue*	BG-11	S
4	NS-4	Fil, NH	*Oscillatoria martini*	Chu's#10	S
5	NS-5	Fil, NH	*Oscillatoria subproboscidea*	Chu's#10	S
6	NS-6	Fil, NH	*Phormidium majuscule*	BG-11	S
7	NS-7	Fil, H	*Nostoc commune*	BG-11	S
8	NS-8	Fil, H	*Anabaena doliolum*	BG-11	S
9	NS-9	Fil, NH	*Oscillatoria protens*	Chu's#10	S
10	NS-10	Fil, NH	*Trichodesmium hildebrantii*	BG-11	S

Sr. No.	Isolate No.	Morphology	Identification	Enrich. Medium	S/W
11	NS-11	Fil, NH	*Phormidium sp.*	Chu's#10	S
12	NS-12	Fil, NH	*Oscillatoria ornate*	BG-11	S
13	NS-13	Uni	*Chroococcus minutus*	BG-11	S
14	NS -14	Fil, H	*Anabaena doliolum*	BG-11	S
15	NS-15	Fil, NH	*Lyngbya puteali*	Chu's#10	S
16	NS -16	Fil, H	*Nostoc muscorum*	BG-11	S

Uni -02 Fil, NH -10 Fil, H -04

Oscillatoria chlorina : The cyanobacterium is dark blue green in colour, due to the presence of the phycobilin pigments phycocyanin and phycoerythrin. Individual filaments are blue green to olive green in colour. Growth takes place only by transverse division hence the trichome comprises a single row of cells stacked one above the other. A cytoplasmic sheath is present which is very thin, hyaline and indistinct.

Phormidium tenue : Diagnostic feature of cynobacteria is it is an unbranched filaments of short cylindrical cells in a fine sheath and the filament may glide within the sheath.They occurs in streams and rivers of all sorts of water quality. They are Potentially toxic.

Oscillatoria martini: common in freshwater , including hot springs. This unbranched filamentous alga, occurring singly or in tangled mats, derives its name from its slow, rhythmic oscillating motion, which is thought to result from a secretion of mucilage

Nostoc muscorum: This is a free-living microorganism which inhabits both terrestrial and freshwater aquatic environments *N. muscorum* cells are filamentous, gram-negative green-brown colored algal cells which can form spores under desiccation conditions They are important for the nutrient cycling of carbon and nitrogen within the soil ecosystems in which they are found. The process of fixing atmospheric nitrogen contributes plant-available nitrogen to the soil, improving plant growth.

Lyngbya puteali: This type is characterized by single trichome within a rigid sheath, sheath may be clear or yellow, filaments are aggulutinated.

Anabaena doliolum: The unicellular halophilic cyanobacterium unique prokaryotic photoautotrophs that possess plant type metabolism and oxygenic photosynthesis

Chroococcus minutes: The order is characterized by single, floating cells or colonies which are embedded to a matrix. Also, a lack of differentiation between apical and basal structures exists. s blue-green in color and macroscopic colony mounded. Within the outside sheath, microscopic colonies are found with indistinct trichomes. *Chroococcus* are usually found in colonies of two, four, or eight cells with a transparent protective covering sheath containing photosynthetic pigments.

Oscillatoria ornate: The body is ovoid to elongate, and uniformly ciliated, with a single macronucleus and a partial hypostomial frange (*synhymenium*) running from the left side of the cell to the oral aperture

Phormidium: Some algae produce toxins that threaten the health and safety of living things that come in direct contact. usually develop on the sediments of lakes and ponds. These mats later become floating mats in standing water bodies

Trichodesmium hildebrantii: is a genus of filamentous cynobacteria. They are found in nutrient poor tropical and subtropicalocean waters. *Trichodesmium* is a diazotroph; that is, it fixes atmospheric nitrogen into ammonium , a nutrient used by other organisms. *Trichodesmium* is thought to fix nitrogen on such a scale that it accounts for almost half of the nitrogen fixation in marine systems globally.

Oscillatoria protens : generally grows in freshwater.

Phormidium majuscule: These are widely distributed Gram-negative oxygenic photosynthetic prokaryotes with a long evolutionary history. They have potential applications such as nutrition.

Table 4: Biodiversity of Ekrukh lake

Growth habitat (TR, Trees; SH, Shrubs; CL, Climbers; HB, herbs; AH, Aquatic herb);

Sr. No.	Botanical Name	Local Name	Family	Growth Habit	Month
1	*Abrus precatorius* L.	Gunj	*Fabaceae*	CL	October-December
2	*Abutilon indicum* (L) Sweet.	Petari	*Malvaceae*	SH	January- March
3	*Acacia farnesiana* (L) Willd.	Pandhra-khair	*Mimosaceae*	TR	January-May
4	*Acacia nilotica* (L) Willd.	Babhul	*Mimosaceae*	TR	January-May
5	*Achyranthes aspera* L.	Aghada	*Amaranthaceae*	HB	October-November
6	*Ageratum conyzoides* L.	Osadi	*Asteraceae*	HB	Ocober-November
7	*Albizzia chinensis* (Osb) Meer	Udal	*Mimosaceae*	TR	January-May
8	*Oxallis corniculata* L.	Ambushi	*Oxalidaceae*	HB	August-November
9	*Prosopis julifera* (Sw) DC	Vedibabal	*Caesalpiniaceae*	SH	January- May
10	*Alternanthera sessilis* (L) R.Br.	Reshmikata / Kachari	*Amaranthaceae*	HB	October-December
11	*Ammania baccifera* L.	Jalmukhi	*Lythraceae*	HB	August- December
12	*Andrographis paniculata* (Burm.f) Wall.	Kalpa	*Acanthaceae*	HB	August- November
13	*Antigonon leptopus* H. & Arn.	Ice-cream creeper	*Polygonaceae*	CL	October-December
14	*Argemone maxicana* L.	Piwla-dhotra, Bilayet	*Papaveraceae*	HB	January- April
15	*Asclepias curassavica* L.	Piwla-chitrak	*Asclepiadaceae*	HB	October- December
16	*Azadirachta indica* A. juss	Nim	*Meliaceae*	TR	January- May
17	*Balanites aegyptiaca* (L) Del	Hinganbet	*Balanitaceae*	TR	January- May
18	*Barleria cuspidate* L.	Kate-koranti	*Acanthaceae*	SH	January- March
19	*Barleria grandiflora* Dalz.	Dev-koranti	*Acanthaceae*	HB	January- March
20	*Barleria involucrate* Nees.	Jambhli-koranti	*Acanthaceae*	SH	Jnuary- March
21	*Barleria terminalis* Nees.	Nili-koranti	*Acanthaceae*	SH	January- March
22	*Biophytum sensitivum* (L) DC	Lajwanti	*Oxalidaceae*	HB	October- November

Sr. No.	Botanical Name	Local Name	Family	Growth Habit	Month
23	*Boerhaavia fruticosa* L.	Jambhli punarnava	*Nyctaginaceae*	SH	October- December
24	*Boerhaavia repens* L.	Punarnava	*Nyctaginaceae*	HB	October- December
25	*Butea monosperma (*Lamk) Taub	Palas	*Fabaceae*	TR	January- May
26	*Caesalpinia cristata* L.	Sagar-lata	*Caesalpiniaceae*	CL	January- MAY
27	*Caesalpinia decapetala (Roth) Alst.*	Chilhar	*Caesalpiniaceae*	CL	January- May
28	*Caesulia axillaries* Roxb.	Maka	*Asteraceae*	HB	October-November
29	*Ruellia tuberosa* L.	Ruwel	*Acanthaceae*	HB	October- December
30	*Calophyllum inophyllum* L.	Undi	*Clusiaceae*	TR	January- March
31	*Calotropis gigantia* (L) R.Br.	Mandar	*Asclepiadaceae*	SH	January- May
32	*Canscora diffusa* (Vahl) R.Br.	Kilwar	*Gentianaceae*	HB	October- November
33	*Cardiospemum helicacabum* L.	Kpalphodi	*Sapindaceae*	CL	August- December
34	*Cassia auriculata* L.	Tar wad	*Caesalpiniaceae*	SH	October- December
35	*Cassia fistula* L.	Bahawa, Amaltash	*Caesalpiniaceae*	TR	October- March
36	*Celosia argentea* L.	Kurdu	*Amaranthaceae*	HB	August- November
37	*Cocciiea grandis* (L) Voigt	Tondli	*Cucurbitaceae*	CL	January- March
38	*Cocculus villosus* (Lamk) DC.	Vasanvel	*Menisperaceae*	CL	April- May
40	*Commelina benghalensis* L.	Kenna	*Commelinaceae*	HB	October- December
41	*Commelina hasskarlii* Cl.	Kamalini	*Commelinaceae*	HB	October- December
42	*Convolvulus arvensis* L.	Chandwel	*Convolvulaceae*	HB	January- MAY
43	*Sida acuta* Burm.f.	Jungle-methti	*Malvaceae*	HB	August- November
44	*Cryptostegia grandiflora* R.Br.	Chabuk chhuree	*Asclepiadaceae*	CL	October- December
45	*Cynadon dactylon* Pers.	Harali	*Poaceae*	HB	October- November
46	*Cyanotis cristata* (L) D.Don.	Nabhali	*Commelinaceae*	HB	August- October
47	*Cyanotis fasciculate* (HeynelEx-Roth) J.A. & J.H.Schult	Nilwanti	*Commelinaceae*	HB	August- October

Sr. No.	Botanical Name	Local Name	Family	Growth Habit	Month
48	*Cyanotis tuberosa* (Roxb) J.A. & J.H.Schult	Abhali	*Commelinaceae*	HB	August- October
49	*Cyperus rotundus* L.	Nagarmotha	*Cyperaceae*	HB	January- MARCH
50	*Dalbergia lanceolaria* L.f.	Phanshi	*Fabaceae*	TR	October- MAY
51	*Datura inoxia* (L.) Mill.	Dhotra	*Solanaceae*	SH	August- December
52	*Digeria muricata* (L) Mart.	Getan	*Amaranthaceae*	HB	October- December
53	*Echinops echinatus* Roxb.	Kate-chendu	*Asteraceae*	HB	October- December
54	*Eriocaulon sedgewickii* Fyson.	Gend	*Eriocaulaceae*	HB	October- December
55	*Triumfetta rhomboidea* Jacq.	Thinjhira	*Tiliaceae*	HB	October- December
56	*Euphorbia laeta* Heyne ex Roth.	Dudhi	*Euphorbiaceae*	HB	October- December
57	*Evolvulus alsinoides* L.	Vishnukranta	*Convolvulaceae*	HB	October- December
58	*Tridex procumbens* K.	Garsoli, Ekdandi,	*Asteraceae*	HB	October- april
59	*Hemidesmus indicus* R.Br.	Anantmool, Anantwel	*Aclepidaceae*	CL	October- December
60	*Hibiscus hirtus* L.	Dupari	*Malvaceae*	HB	October- December
61	*Vernonia divergens* (Roxb) edg.	Bundar	*Asteraceae*	SH	October- December
62	*Tribulus terrestris* L.	Sarata	*Zygophyllaceae*	HB	October- December
63	*Indigophera linifolia* (L.f.) Retz.	Lal-godhadi	*Fabaceae*	HB	October- December
64	*Ipomoea aquatica* Frosk	Nilachi bhaji	*Convolvulaceae*		December- March
65	*Ipomoea obscura* (L) Ke-Gawl.	Piwli-pungli	*Convolvulaceae*	CL	December- March
66	*Ipomoea quamoclit* L.	Ganesh pushpa	*Convolvulaceae*	CL	December- March
67	*Sonchus oleraceus* L.	Mhatara	*Asteraceae*	AH	December- March
68	*Striga densiflora* Kuntz.	Agya	*Scrophulariaceae*	HB	October- November
69	*Jatropha gossypifolia* L.	Vilayti erndi	*Euphorbiaceae*	SH	January- May
70	*Jatropha curcus* L.	Mogali ernd	*Euphorbiaceae*	TR	January- May
71	*Lagascea mollis* Cav.	Jharwad	*Asteraceae*	HB	October- December

Sr. No.	Botanical Name	Local Name	Family	Growth Habit	Month
72	*Polygonum auriculata* Meissn.	Paral	*Polygonaceae*	HB	October- December
73	*Polygonum glabra* Willd.	Sheral	*Polygonaceae*	HB	October- December
74	*Lantana camara* L.	Tantani, Gochadi	*Verbenaceae*	SH	October- December
75	*Launaea procumbens* (Roxb) Ramayya & Rajgopal.	Pathari	*Asteraceae*	HB	October- December
76	*Leonotis nepetifolia* (Pers) R. Br.	Deepmal	*Lamiaceae*	HB	October- December
77	*Leucas aspera* (Willd) Link	Tamba	*Lamiaceae*	HB	October- December
78	*Merremia emarginata* (Burm) Hallier	Underkani	*Convolvulaceae*	AH	October- December
79	*Mimosa hamata* Willd.	Gulabi-babhul	*Mimosaceae*	SH	October- may
80	*Bacopa monneiri* (L) Wettst.	Neer-bramhi	*Scrophulariacea e*	HB	October- December
81	*Chlorophytum tuberosum* R.Br.	Kuli	*Liliaceae*	HB	October- December
82	*Peristophe biacalyculata* (Retz) Nees.	*Kali gandhadi*	*Acanthaceae*	HB	October- December

Sr. No.	Name of Plant	Family	Habit	Month
83	*Evolvus arbuscula* Poir.	Convolvulaceae	H	September- November
84	*Cyperus rountadus* L.	Poaceae	H	October-December
85	*Cyperus scariosus* R Br.	Poaceae	H	
86	*Tephrosia purpurea* (L.) Pers.	Papillionaceae	S	December-May
87	*Aeschenomene Americana* L.	Papillionaceae	S	August-November
88	*Aeschenomene indica* L.	Papillionaceae	S	August-November
89	*Sida retusa* L.	Malvaceae	H	October-December
90	*Crotalaria mysorensis* L.	Papillionaceae	H	August-November
91	*Eriocaulon spp*. L.	Poaceae	H	October-December
92	*Dhatura metal* L.	Solanaceae	S	September-November
93	*Euphorbia hirta* L.	Euphorbiaceae	H	August-November

Sr. No.	Name of Plant	Family	Habit	Month
94	*Phyllantus amerus*L.	Phyllanthaceae	H	October-December
95	*Argemone Mexicana* L.	Papavaraceae	H	December- May
96	*Parthenium histerophorus*L.	Astraceae	S	March-May
97	*Striga densifolia* (Benth.) Benth.	Orobanchaceae	H	October-November
98	*Ageratum conizoids* (L.) L.	Astraceae	H	December- May
99	*Clome viscose* L.	Clomeaceae	S	August-May
100	*Solanum indicum* L.	Solanaceae	S	August-May
101	*Indigofera trifoliate* L.	Papilionaceae	S	August-November
102	*Abechulon idicum* L.	Malvaceae	H	January- March
103	*Cynadon dyctilon* L.	Poaceae	H	October-November
104	*Cusuta reflexa* Roxb.	Cuscutaceae	C	August-November
105	*Agave Americana* L.	Agavaceae	S	January-May
106	*Oxalis corniculata* R. Kunth.	Oxalaceae	H	October-November
107	*Wodfordia fruticosa* L.	Lytheraceae	S	December-March
108	*Tinospora cordifolia* (Willd.) Miers..	Menispermacea e	C	October-December
109	*Biophytum sensitivum* (L.) DC.	Oxalidaceae	H	August- November
110	*Clitoria ternatea* L.	Papillionaceae	C	August-May
111	*Boerhhavia diffusa* L.	Nyctagenaceae	H	August-May
112	*Gardinia gummefera* (Kunth.)Berto.	Rubiaceae	H	October-December
113	*Achyeranthus aspera* L.	Ameranthaceae	S	August- November
114	*Portulaca grandiflora*	Portulaceae	H	August-November
115	*Cucumis sativus*	Euphorbiaceae	C	August - November
116	*Polygala arvens*	Polygonaceae	H	August- November

Sr. No.	Name of Plant	Family	Habit	Month
117	*Lantena camera*	verbenaceae	S	August-December
118	*Coldenia procumbence*	Boragenaceae	H	August-October

54 – Families 68 – Genus 118- Species

Conclusion:

1) During this project two field visits are carried out in every month.

2) Total of 24 field visits are carried out during the project.

3) During these visits water samples, soil samples and plant specimens are collected according to month and in respective seasons.

4) It was observed that the huge diversity and variations are found among the occurrence of plant species.

5) In mansoon seasons most of the herbaceous species are dominant.

6) In Winter season some herb species and shrub species are dominant.

7) In summer season Late flowered shrub and tree species are dominant.

8) Along with the plants there is diversity in ecotone and ecoline.

9) In the month of October –November the whole plateau of Ekrukh lake is occupied by *Portulaca* species.

10) In the month of December- March the whole plateau of Ekrukh lake is occupied by *Alternanthera* species.

11) In the month of September- December the whole plateau of Ekrukh Lake is occupied by *Cleome and Euphorbia* species.

12) These huge diversions among the ecosystem and relatively its impact on diversity are due to savior changes in climatic conditions and pollution.

13) During the project it was observed that if we planted Species of *Cassia, Aletrnanthera, Parthenium,* it will helps to avoid pollution in water sources.

14) During the project a total of 54 families, 64 genus and 118 species are collected.

15) A total of 16 cynobacterial isolates are cultured and maintained in D.B.F. Dayanand College Cynobacterial laboratory. Out of 16 Isolates Uni – 02 , Fil.NH-10 – FH- 04.

16) Cyanobacterial toxins, Cyanobacteria have come to the attention of public health workers because many freshwater and brackish species can produce a range of potent toxins (Stewart, 2004; van Apeldoorn et al., 2007). This observation was first reported over 120 years ago, when sheep, horses, dogs and pigs were seen to die within hours of drinking water from a lake affected by a bloom of the brackish-water cyanobacterium Nodularia spumigena. Since then, many reports of livestock and wild animal deaths have appeared in the literature. Such reports have been collated by several authors (Stewart, 2004). Some reports are dramatic in terms of the number of animals affected or the rapid progression of illness and death, with mass deaths of thousands of animals (Carmichael, 2008), and large animals succumbing within minutes (Codd et al., 1995).

In present work *Microcystis, Anabena, Planktothrix,Hapalosiphon, Nodularia, Lyngbya, Microcystis viridis, M. Aeruginosa, O. aghardii* has been isolated.

17) Some blue green algae are utilized in making biofertilizers.

18) From current study of it was concluded that Ekrukh lake is rich in biodiversity. The most dominant plant families are Poaceae, Fabaceae, Boraginaceae, Portulacaceae & Caesalpinaceae.

19) cyanobacteria like *Oscillatoria, Cosmarium, Nostoc, Lyngbia, Formedium, Spirogyra, Chara, Volvox, microcystis, Cylindrospermopsis, planktothrix, Gleotrichika, Anabena, Lynghya, Aphanizomenon* etc were isolated from lake

20) Toxic cynobacteria like *Microcystis, Anabena, Planktothrix, Hapalosiphon, Nodularia, Lyngbya, Microcystis viridis, M. Aeruginosa, O. aghardii* has been isolated.

21) Many phototrophic prokaryotes are adapted to grow in a variety of extreme environments. The cyanobacteria are especially recognized among the photosynthetic prokaryotes for their ability to grow in a wide range of conditions. Traditionally, cyanobacterial taxonomy is based upon morphological and physiological observations (Narayan et al., 2006). Taxonomy, on the basis of morphological characters, has been debated vigorously and revised many a time (Turner, 1997). The taxonomy and classification of cyanobacteria have been under study since about the middle of the 19th century using morphological and cellular criteria, similar to other microalgae. However, more modern approaches in the last four decades have emphasized important structural and molecular characteristic.

The present study was an attempt to address the diversity of cyanobacteria in Ekrukh lake . The identification of cyanobacteria was based on microscopic morphological observations. Total 16 isolates were isolated from soil and water.Out of 16 Isolates Uni – 02 , Fil.NH-10 – FH- 04.

22) The current study on Ekhrukh Lake shoes that three types of soil samples are recorded from Ekrukh region viz. lomy, silty and sludge and tested for the parameters like Soil texture, pH, EC, hardness, alkalinity, water holding capacity of soil, CEC and SAR. Also, the water analysis study was conducted for the parameters like Color, Appearance, Turbidity, Odor, Acidity, alkalinity, Hardness, Conductivity, BOD,COD and solids (total, fixed and volatile). Total organic content is high in sludge soil, highly acidic pH & high water holding capacity. While lomy type of soil has alkaline pH, low water holding capacity as compare to sludge.

23) Along with that our observation is that there is crucial change in Ekrukh Lake Biodiversity due to climatic change i.e. low rain fall, high temperature. Earlier the species of *Heliotropium* is abundant in the study region but now these species are replaced by species of portulacerae family and *Alternanthera* species. It shows that the hydrosphere is converted in to Xerosere this is the drastic change in biodiversity due to climate change. Highly polluted water which causes critical damage and loss of biodiversity of both useful cyanobacteria as well as plant diversity. The polluted water highly damages the useful cyanobacteria.

Biodiversity of Ekhrukh Lake (Plate –I)

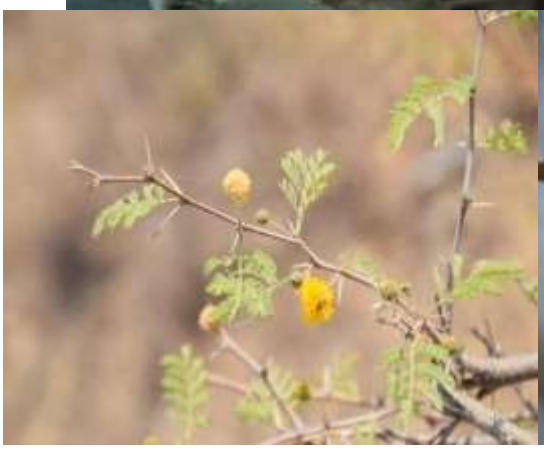
a) *Cynadon dyctylon* b) *Alternanthera sessilis* c) *Portulaca grandiflora* d) *Coldenia procumbence* e) *Sida acuta* f) *Polygonum glabra*

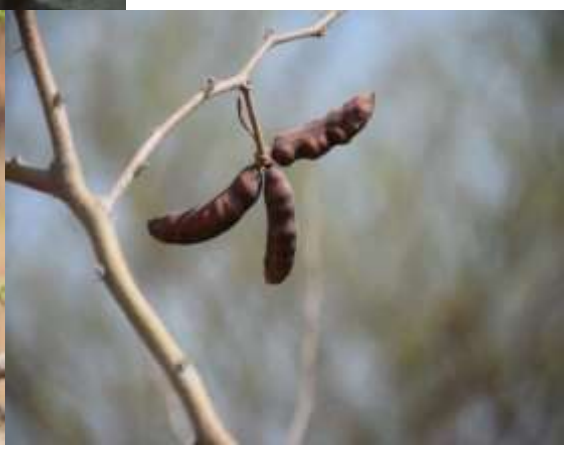
a) *Cassia tora* b) *Ericolon spp.* c) *Cleome* viscosa d) *Tephrosia purpurea* e) *Cyperus routundifolius* f) *Tridax procumbence*

a) *Calatropis procera* b) *Lablab purpurence* c) *Linum astriaticum* d) *Cleome viscosa* e) Ipomea *fistula* f) *Cassia auriculata*

a) *Ocimum bacilicanse* b) *Calatropis gigantea* c) *Dalbergia sisso* d) *Tavernaria cunifolia* e) *Echinops echinatus* f) *Vernonia divergens*

a) *Lantana camera* b) *Euphorbia heterophylla* c) *Cardiospermum atropurpurium* d) *Tinospora cordifolia*





a) *Abitulon indicum* b) *Cyperus scariosus* c) *Acacia nilotica* d) *Acacia longifolia*

a) *Xanthium strumarium* b) *Convolvulus alba* c) *Acacia horrida* d) *Acacia Senegal*

e) *Morinda citrifolia* f*) Borhavia repens*

a) *Comelina elegens* b) *Acmella olercea* c) *Passiflora foeitida* d) *Heliotropium indicum*
e) *Polygala arvensis* f) *Cucumis sativus*

a) *Rhynchosia minima* b) *Clitoria ternatea* c)*Convolvulus arvensis* d) *Codium varigatum* e) *Indigofera cordifolia*

f) *Ipomoea pes-caprae*

Isolation and Maintenance of Cyanobacterial Culture (Plate-II)

Field View of Ekhrukh Lake (Plate III)

A product from Cyanobacteria

Ananad Biofertilizer

Any special information about project:

I am happy to inform you that the two abstract are presented in National level conference organized by Department of Botany ,Shivaji University Kolapur in association with Mangrove Society of India Goa and Mangrove foundation Mumbai on 12th April 2019.the details are as follows .

P-18

DIVERSITY OF BLUE-GREEN ALGAE IN EKRUKH LAKE, SOLAPUR

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Cynobacteria are the large group of photosynthetic bacteria. Cyanobacteria can be found in almost every terrestrial and aquatic habitat,ocean, fresh water, damp soil, temporarily moistened rocks in deserts, bare rock and soil. They can occur as planktonic cells or form phototrophic biofilms. They are found in endolithic ecosystem. Aquatic cyanobacteria are known for their extensive visible blooms that can form in both freshwater and marine water environments. The blooms can have the appearance of blue-green paint or scum. These blooms can be toxic and frequently lead to the closure of recreational waters when spotted. Based on environmental trends, cyanobacteria will likely increase their dominance in aquatic environments. This can lead to serious consequences, particularly the contamination of sources of drinking water. Cyanobacteria have been found to play an important role in terrestrial habitats. It has been widely reported that cyanobacteria soil crusts help to stabilize soil to prevent erosion and retain water.The cyanobacteria were traditionally classified into five sections, referred as Chroococcales, Pleurocapsales, Oscillatoriales, Nostocales and Stigonematales. Current study is based on identification of toxic & non-toxic cynobacteria their isolation and preparation of pure cultures. In the present study 13 strains of cynobacteria have been isolated viz. *Oscillatoria rooi, O. amoena, O. amphibia, O. salina, O. limosa, O. tenuis, Lyngbya commune, L. cortiola,L. major, Gloeocapsa decortticans, G. samoensis, Nostoc linkia* and *Phormidium fragile* most of them are utilized as an of biofertilizers.

Keywords: BGA, Biodiversity, Ekrukh Lake.

Keywords: Flamingo, Mangroves, Near Threatened species.

O-08

STUDIES ON FLORISTIC BIODIVERSITY OF EKRUKH LAKE, SOLAPUR WITH REFERENCE TO CLIMATE CHANGE

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Solapur city is located in the southwestern region of Indian State of Maharashtra. The district is spread over 1501 thousand hectares with 11 Talukas. Ekrukh Tank, which is located in the Solapur city of Solapur district of Maharashtra, is the second largest irrigation project in Deccan region. This artificial tank was built mainly for irrigation and drinking purpose, having near about 7 square miles of water surface area. In this present work, the studies related to climate change on floristic biodiversity, physiological changes' occurring in plants, soil texture as well as different water parameters has been studied. Ecotones and other boundary concepts are important in biological processes. The scale of biological boundaries is from molecular, cellular to landscape and biome. Traditionally, ecotones have been considered as a junction zones between two or more communities where the processes of exchange or competition between neighbouring communities or subunits of communities occur. Depending on climate, topography, soil characteristics, scale, species interactions, physiological parameters and population genetics are important considerations at ecotonal boundaries. A last twelve years study has been showed that due to huge climatic change there is drastic change in ecotone. Ekhrukh Lake in year (2004) is surrounded by large plateau of Heliotropium species but due drastic change in climate, irregular rainfall there is drastic change in biodiversity form *Heliotropium* species to members of crassulaceae. The whole plateau of *Heliotropium* is changed in to members of Crassulaceae. The plant is reported to possess antibacterial, antitumor, uterine stimulant effect, antifertility, wound healing, anti-inflammatory, antinociceptive and diuretic activities. Therefore, the present study have shown

that the direct impact of climate change occurrence on plant of diversity will occur. There is an urgent need to concentrate on biodiversity areas which results in the loss of floristic biodiversity.

Keywords: Biodiversity, Climate change.

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