Studies on algal biodiversity of Ujani reservoir in Pune district of Maharashtra

A Minor Research project submitted to the

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Certificate

This is to certify that the Minor Research Project entitled "Studies on Algal Biodiversity of Ujani reservoir in Pune district of Maharashtra" was completed by Dr Bibhhishan Bhika Mahadik at the Department of Botany, Arts, Science and Commerce College, Indapur, Dist Pune, Savitribai Phule Pune University.

Project Investigator Principal

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Introduction

Algae a diverse group of plant kingdom, comprises a large heterogenous assemblage of autotrophs. They occur in variety of habitats such as fresh water, marine water, on or in soil, on wet rocks and on snow also. Majority of them are aquatic. Rivers, streams, pools, puddles, ponds, lakes, dams and are fresh water habitats where algae grows luxuriantly and found in diverse form. In present century more attention has been paid in the investigation of fresh water algal diversity in many parts of the world. Efforts were also made on applied aspects of algae.

Considering the importance of fact, the present research work has been carried out by collecting algae from fresh water Ujani reservoir of Maharashtra. It is one of the important reservoirs and occupies a geographical area of Pune, Solapur and Ahmednagar districts of Maharashtra. For collection of algae seven different sites of backwater located in Indapur tahsil area of Pune district have been selected. These sites are:

1) S1- Bhigwan
2) S2- Dalaj
3) S3- Kandalgaon

At these selected sites algae shows great diversity and seasonal variations. Algal forms which were found abundant were selected to study their effects on Moongbean (*Phaseolus radiata* L.) seed germination, and for antimicrobial potential *Cladophora crispata* (Roth) Kuetzing algae used.

These Moongbean crops are extensively cultivated by farmers of Indapur tahsil area.

Algae are admirable sources of antibiotics. In antibacterial assay algal extracts prepared in different solvents were tested against *Escherichia coli*, *Bacillus subtilis, Pseudomonas aeruginosa* and *Salmonella typhi*. Antifungal activities of algal extracts were assayed against *Metarhizium anisopliae, Curvularia lunata, Rhizoctonia solani, Penicillium oxalicum, Aspergillus niger, Trichoderma viride* and *Fusarium oxysporum.* Algae contain antimicrobial compounds which inhibits bacterial and fungal growth.

Origin of the research problem –

Ujani reservoir is one of the most important dam of Pune district. Survey of literature reveals that this reservoir has not been explored as its biotic diversity of algae is concerned. In Ujani

reservoir algae grows luxuriantly and found in diverse form. There is need to study algal biodervsity of Ujani reservoir.

Significance of study –

1. The present investigation will give an idea about algal biodiversity of Ujani reservoir.
2. It will give an idea about seasonal variation of algal flora.
3. The present study will be helpful in taxonomy and ecology

Objectives of research work -

1. To study and survey the algal flora of selected sites of Ujani reservoir from Indapur tahsil area of Pune district.
2. To study floating, planktonic, submerged and epiphytic algae of selected study area.
3. To study class-wise percentage contribution of algal flora of study area.
4. To study seasonal variations of algae for two consecutive years.
5. To study effect of algal extracts on seed germination.
6. To understand the antimicrobial potential of algae.

Review of Literature

A) ALGAL DIVERSITY OF FRESH WATER HABITATS

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

Dawning (1970) reported 61 taxa of algae from western lake of Erie. Haughey (1970) studied occurrence and Morphology of *Euglena acus* from sewage treatment ponds of Auckland city, Newzealand. Lam (1971) observed dynamics of Phytoplankton growth from Waiketo river of North Newzealand. Munawar (1972) studied ecological distribution of Euglenoids in certain polluted and unpolluted water bodies at Hyderabad. Robert *et. al*. (1974) investigated distribution of phytoplanktons and water quality indices of Colorao River. Anand (1975) worked on planktonic algae of Mansar Lake of Jammu. He reported 25 taxa of planktonic algae. Nasar and Datta (1974, 1976) studied physicochemical properties and algal flora of ponds of Bhagalpur, Bihar and reported 33 taxa of algae. Rai and Kumar (1976) carried out work on pollution tolerant algae from effluent of fertilizer factory at Varanasi. Aykula (1978) presented a quantitative study of the phytoplanktons of Avon River and reported 233 taxa of algae. Rai (1978) conducted ecological studies on algal flora of Ganga river of Varanasi. Ashtekar and Kamat (1978) extensively worked on Oedogoniaceae and zygnemataceae members in the region of Aurangabad district of Maharashtra. Singh and Swaroop (1979) recorded high population of Euglenoides in summer season. Freitas and Kamat (1979) worked on desmids of Nagpur. Gunale and Balakrishnan (1979) showed *Schizomeris leiblenii* as an indicator of eutrophication while studying pollution indicator algae of Mula –Mutha river of Poona.

Islam and Haroon (1980) reported 201 taxa of desmids from lakes of Dhaka. Pandey and Pandey (1980) studied algal flora of Alahabad and reported 80 forms of desmids. Ashtekar (1980) worked systematically on algal biodiversity of Aurangabad district of Maharashtra and recorded 617 algal taxa. Gunale and Balakrishnan (1981) used algae as biomonitors of eutrophication in the study of Pavna, Mula and Mutha rivers of Poona and assessed the organic pollution of rivers by using Palmers Index of pollution. Pingale (1981) extensively studied algal flora of different water bodies of Poona and assessed organic pollution by using Palmers Index of Pollution. Nandan and Patel (1983b, 1984a & 1985a) made quantitative, qualitative study of algae of Vishwamitri river of

Gujrat. They also focused on eutrophication and seasonal variation aspects of algae. Hedge and Bharti (1983) reported 61 taxa of fresh water algae from Bijapur district of Karnataka. Fatma (1985) recorded 22 epiphytic algal forms from fresh water ponds of Lucknow.

Sabater *et. al*. (1987) studied water quality of two rivers from Spain on the basis of diatom distribution. Ramberg (1988) showed relation between planktonic blue green algae and environmental factors from 4 eutrophic Swedish lakes. Mahajan and Mahajan (1988) studied algal communities in Vellhala lake of North Maharashtra and used algae as indicators of organic pollution. Senger *et. al*. (1990) studied algae with reference to water purification. Jose and Patel (1992) recorded Chlorococcales systematically from Kerala. Chaugule and Patil (1992) extensively studied and recorded Charophytes from western Maharashtra. Pandey *et. al*. (1992) observed species diversity of plankton in fish pond at Pune. Nandan (1992) studied algal blooms in Vishwamitri river of Gujrat and reported dominance of *Microcystis aeruginosa, Microcystis elongata* and *Anabaena reciborskii*. Waghodekar and Jawale (2001) reported 8 taxa of Euglenophyceae. Jain (2002) extensively carried out ecological studies on algae and reported 306 taxa from reservoirs of north Maharashtra. Misra and Srivastav (2003) recorded 38 taxa of desmids from north eastern parts of Uttarpradesh. Kumawat and Jawale (2003 a & b, 2004 a & b, 2006) studied algal flora of fish pond and recorded abundance o*f Schroederia, Oscillatoria* and *Euglenoids.* Johnson (2006) reported 116 taxa of algae from lakes of Hyderabad. Tiwari and Chauhan (2006) recorded 32 species of *Oscillatoria* from ponds of Agra and studied seasonal variation.

Kumawat *et. al*. (2007) described 31 taxa of Euglenineae. Nandan and Mahajan (2007) recorded 322 algal forms from Hartala reservoir of Tapti river. They observed that algal genera *Tetraedron, Oocystis, Scenedesmus, Spirogyra, Closterium* and *Cosmarium* were most frequent. Jadhav *et. al*. (2007) studied algal flora of Lonar crater. A total 35 taxa belonged to Chloropyceae, Bacillariophyceae, Euglenophyceae and Cyanophyceae were recorded. Cyanophycean algae dominated algal flora of Lona Crater. Yadav and Ashtekar (2007) recorded dominance of desmids which includes *Cosmarium, Closterium, Euastrum,* and *Staurastrum.* Magar (2008) recorded 364 algal taxa from Girna reservoir of North Maharashtra. Andhale (2008) reported 215 species of algae from Jayakwadi reservoir.

Das *et. al.* (2009) from Meghalaya reported 58 species of fresh water algae belonging to Chlorophyceae, Bacillariophyceae, Euglenophyceae and Cyanophyceae. Talekar (2009) extensively worked on algal diversity of Manjara River and its reservoirs in Beed district of

Maharashtra. He recorded 207 species of algae with the dominance of *Cosmarium, Spirogyra, Scenedesmus, Zygnema, Ulothrix, Pediastrum, Aphanothece, Phormidium, Oscillatoria, Chroococcus, Merismopedia, Microcoleus, Plectonema, Myxosarcina* and *Euglena.* Talekar and Jadhav (2010) studied diatom of Manjara River and reported dominance of *Fragilaria, Nitzschia, Cymbella and Pinnularia.*

B) EFFECT OF ALGAL EXTRACTS ON SEED GERMINATION

Pendurand and Reynaud (1987) screened 113 strains of Cyanobacteria to study their effect on germination and growth of rice. Nanda *et. al*. (1991) showed that presoaking of Pumpkin and Cucumber seeds in *Westiellopsis prolifica* extract can accelerate seed germination. Venkataraman *et. al*. (1993) studied effect of crude and commercial seaweed extracts on seed germination and seedling growth in green gram and black gram. Ko`s *et. al*. (1995) reported for the first time that cyanotoxin inhibited the growth of mustard seedling.

Adam (1999) worked on effect of extract of *Nostoc muscorum* on seed germination of Sorghum, Wheat and Maize. He found that exract of *Nostoc muscorum* enhances seed germination as well as nitrogen compound in selected crops.

Pingle and Abhang (2007) studied effect of fresh water algal extract on seed germination of vegetable. Kamble (2008) worked on role of *Schizomeris leibleinii, Cladophora callicoma, Hydrodictyon reticulatum, Spirogyra plena, Chara grovesii, Nitella batrachosperma, Spirulina platensis, Phormidium corium* and *Scytonema coactile* in seed germination of Sorghum, Mothbean and Sesamum. Cold water, hot water, toluene and acetone extracts of algae proved helpful for seed germination.

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C) ANTIMICROBIAL POTENTIAL OF ALGAE

Algae are an attractive and natural resource of bioactive compounds. Active principles of algae are responsible for antimicrobial activities.

a) Antibacterial activity

Pande and Gupta (1977) reported antibiotic properties of *Chlorococcum humicolum* against *Bacillus pumilus.*

Renu (2010) studied antibacterial activities of *Chlorella ellipsoidea.* Justella *et. al*. (2011) evaluated antibacterial potential of fresh water algae *Oscillatoria sancta, Lyngbya birgei, Oedogonium echinospermum, Spirogyra decimina, Spirogyra grantina, Spirogyra crassa, Spirogyra biformis* and *Spirogyra codensata* against human bacterial pathogen viz. *Eschrrichia coli, Staphylococcus aureus, Salmonella typhi, Proteus vulgaris, Proteus mirabilis* and *Sreptococcus pyogenes.* Uma *et. al*. (2011) worked on antibacterial activity of the acetone, methanol, ethanol and DMSO extracts of dried green microalgae *Desmococcus olivaceous, Chlorococcum humicola* and *Chlorella vulgaris* against *Klebsiella pneumonia, Pseudomonas vibriocholarae, Streptococcus pyrogenes, Escherichia coli* and *Staphyloscoccus aureus.* Nair and Krishinika (2011) tested antibacterial activity of *Scenedesmus* sp. against pathogenic bacteria such as *Sibgella sp., Pseudomonas* sp. and *Xanthomonas oryza.* Vijaykumar *et al*. (2011) studied

antibacterial activity of *Oscillatoria latevirus, Phormidium corium, Lyngbya martensiana, Chroococcus minor* and *Microcystis aeruginosa* against *Bacillus subtilis, Staphylococcus aureus, and Sreptococcus mutants. Escherichia coli, Micrococcus mutants* and *Klebsiella pneumoniae.*

b) Antifungal activity

Jaki *et. al*. (2001) extracted two novel cyclic peptides from Cyanobacterium *Tolypothrix byssoidea* which shows strong antifungal activity. Prashantkumar *et. al*. (2006) studied antifungal activity of bluegreen and green algae. Katirciglu *et. al.* (2006) screened 10 microalgal strains for their antifungal performance upon three yeast *Sacharomyces cerevisiae, Candida albicans* and *Candida tropicalis, Oscillatoria* sp. And *Chlorococcus* sp. were found to perform best. Ghasemi *et. al*. (2007) tested antifungal activity of *Chlorella vulgaris, Chlamydomonas reinhardtii, Oocystis* sp. and *Scenedesmus oblicus* against *Candida albicans, Aspergillus niger* and *Aspergillus fumigatus.* Abdein and Taha (2008) studied antifungal activity of green microalgae *Chlorella pyrenoidosa* and *Scenedesmus quadricauda* against *Aspergillus niger, Aspergillus flavus, Fusarium moniliforme, Helminthosporium* sp. and *Candida albicans.* Kim and Kim (2008) studied inhibitory effect of cyanobacterial extracts of *Nostoc commune* against tomato wilt pathogen *Fusarium oxysporum. f.* sp*., Lycopersici.* Kamble (2008) studied antifungal activities of cold water, hot water, acetone, methanol, ethanol, chloroform, petroleum ether and toluene extracts of fresh water algae *Schizomeris leibleinii, Cladophora callicoma, Hydrodictyon reticulatum, Spirogyra plena, Chara grovesii, Nitella batrachosperma, Spirulina platensis, Phormidium corium* and *Scytonema coactile* against *Alternaria alternata, Aspergillus flavus, Curvularia lunata, Fusarium roseum* and *Trichoderma harzianum.*

Hussien (2009) carried out experiments to evaluate the effect of culture filtrates of nine algal strains viz. *Anabaena floasaquae, Anabaena oryzae, Nostoc humifusa, Oscillatoria* sp. *Phormidium fragile, Spirulina platensis* and *Wollea saccata* at concentration of 10%, 20%, 30% and 40% on mycelium growth *Cercospora beticola* causing leaf spot disease in Sugarbeet comparing with different concentration of the synthetic fungicides. Hanan and Hala (2010) studied antifungal activity of extracts of *Anabaena flosaquae, Anabaena variabilis* and *Oscillatoria angustissima* on *Aspergillus niger* and *Aspergillus flavus.* Andreea *et. al.* (2010) evaluated antifungal potential of algae *Alaria esculenta, Fucus vasiculosus, Fucus* sp*., Spirulina platensis, Ecklonia maxima* against *Fusarium roseum, Fusarium oxysporum, Alternaria alternata, Alternaria dayci, Alternaria*

longipes, Trichoderma viride, Botrytis cinera, Aspergillus niger and *Penicillium expansum.* The potential biological effects were evaluated on mycelial growth. Pitchaimuthu *et. al*. (2011) assessed antifungal activity of *Acanthophra spicifera* against *Candida albicans, Microsporum gypseus* and *Aspergillus niger.* The methanolic extract shows promising antifungal activity than petroleum ether. Vijaykumar *et. al*. (2011) studied antifungal activity of cyanobacteria such as *Oscillatoria* latevirns, *Phormidium corium, Lyngbya martensia, Chroococcus minor* and *Microcystis aeuroginosa* against *Candida albicans.*Kadija *et. al*. (2012) tested antifungal activity of 22 sps. of marine algae belonging to Chlorophyta and Phaeophyta against *Candida tropicalis* and *Cryptococcus neoformans.* Methanolic extract showed best antifungal activity.