

Ph.D. Thesis Title:
**FRESHWATER ALGAE FROM LOTIC HABITATS
OF EASTERN REGIONS OF INDIA**

JRF/SRF Under Projects:

1. **AICOPTAX- algae (MoEF) (2008-2010; 2011-2013) at Utkal University, Bhubaneswar and Visva-Bharati, Santiniketan**
2. **DBT Biofuel project at IMMT-CSIR, Bhubaneswar**
3. **Dr. B. P. Pal Awarded Project to SPA (MoEF) at Visva-Bharati, Santiniketan**
4. **UGC Major Research Project on Antimicrobial properties of Cyanobacteria**

Awards and Honors

- ✓ **University gold medal award** from North Orissa University, Orissa (2006).
- ✓ **Young Scientist Award** from School of Life Sciences, Sambalpur University, Odisha (2014).
- ✓ **UGC-Dr. D.S. Kothari Post Doctoral Fellowship** on 08.08.2014 by University Grants Commission, Government of India.



Dr. Sukumar Bhakta
Regd. no. 08 – Botany, 2007 – 08
Awarded on: 29.11.2014

Under the Guidance of
Prof. Siba Prasad Adhikary
P.G. Department of Botany, Utkal University

Annual Action Plan Project Title:

Biodiversity assessment of microalgae from thermal springs of Maharashtra state, India

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Pune – 411001, Maharashtra, India**

INTRODUCTION

- Hot springs are specialized lotic environments distributed in widely separated geographical areas. Temperature is fairly constant near the source in these springs and lowered down to above ambient temperature depending on the volume of non-thermal water entering into the system from the surroundings.
- **Thermal springs represent a pool of new strains possessing attractive biochemical pathways and unique metabolic products for biotechnological applications.**
- **In the late nineteenth century a geological survey report showed a total of 286 hot springs located throughout the India (OLDHAM & OLDHAM 1882).**

- Very few reports available on the systematic account of algae and cyanobacteria in the thermal springs of India (**PRASAD & SRIVASTAVA 1965; VASISHTA 1968; JANA 1973; PRASAD et al.1984; SINHA & CHAUBEY 1986; JHA & KUMAR 1986; BHARDWAJ & TIWARI 2010; PATTANAİK & RAO 1972, RAO & PATTANAİK 1975, ADHIKARY & SAHU 1987**), which is not significant enough to explore the biodiversity of the inhabitants of the extreme ecosystem.
- From the state of Maharashtra, the diversity of algae is recorded so far from only hot spring Unapdev of the state (**Thomas & Gonzalves, 1965 and Patil & Deore, 2010**).
- The possibility of occurrence of novel algal taxa is mostly expected as the harsh environment minimizes contamination risk and can provide buffering against fluctuations in temperature.

OBJECTIVES

- Collection of cyanobacteria and microalgae from thermal springs of Maharashtra state through several tours.
- Preservation of the algal samples with collection number will be deposited in the algal repository at Botanical Survey of India, Western Regional Centre, Pune.
- Identification and documentation of algal community from the thermal aquatic habitats.
- Culture and maintenance of dominant algal taxa if possible.
- Qualitative determination of thermo-tolerant species.

Materials and Methods



Plate-1 (Figs. 1-7): 1. Akloli, 2. Ganeshpuri, 3. Unhere, 4&5. Tural, (68°C) 6&7. Unhavare (70°C)



Occurrence of algae in hot springs of Nimboli

Inexplicit and threatened habitats

Banganga, Thane



Koknere, Palghar



Pingemal, Pimplas



Pingemal, Pimplas



Sahapur, Palghar



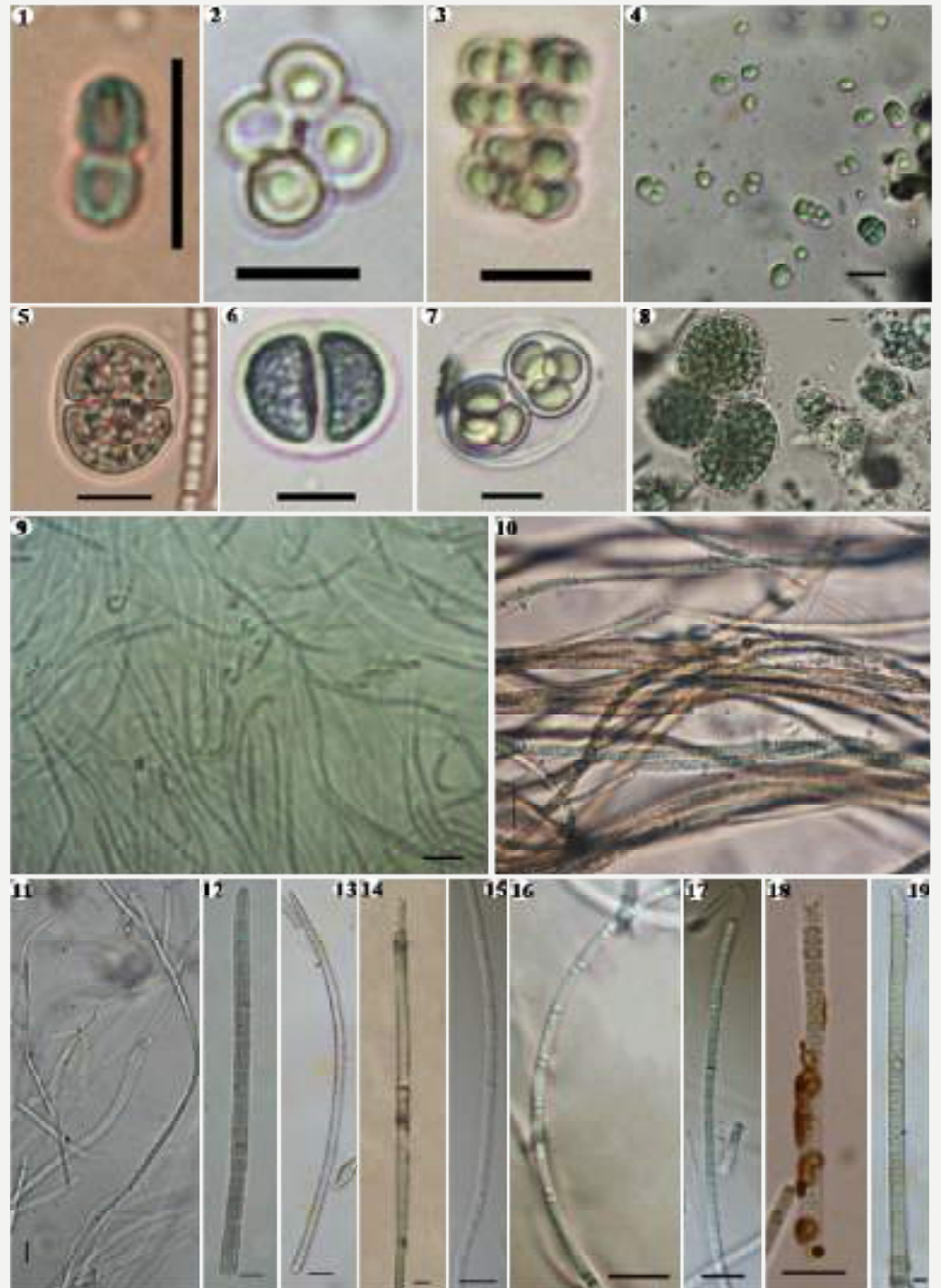
Ganga, Rajapur



Results

Plate-1(Figs. 1-19)

1. *Cyanobacterium minervae*
2. *Synechocystis aquatilis*
3. *Aphanocapsa grevillei*
4. *Aphanocapsa biformis*
- 5,6 – *Chroococcus turgidus*
7. *Gloeocapsa alpina*
8. *Myxosarcina* sp.
9. *Jaaginema geminatum*
10. *Trichocoleus thermales*
11. *Geitlerinema thermale*
12. *Limnothrix rosea*
13. *Geitlerinema acuminatum*
14. *Pseudanabaena thermale*
15. *Limnothrix mirabilis*
16. *Limnothrix redekei*
17. *Pseudanabaena lonchoides*
18. *Leptolyngbya foveolarum*
19. *Geitlerinema lemmermanii*



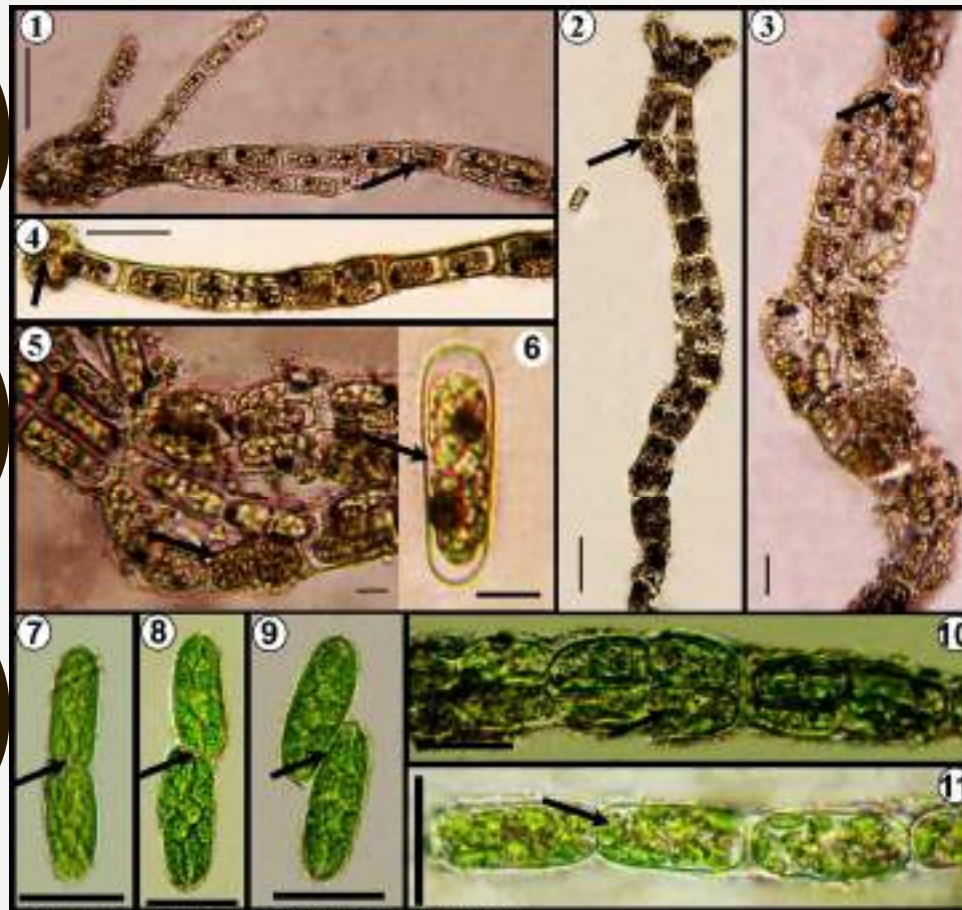
1. *Lyngbya* sp.
2. *Brasilonema sennae*
3. *Lyngbya* sp.
4. *Cylindrospermum gregarium*
5. *Calothrix clavatooides*
6. *Calothrix confervicola*
7. *Gloeotrichia pilgeri*
8. *Calothrix kuntze*
9. *Nitzschia angustata*
10. *Nitzschia polaris*
11. *Nitzschia scalpelliformis*
12. *Nitzschia sigma*
13. *Pinnularia stricta*
- 14, 20. *Navicula jaagi*
15. *Amphipleura rutilans*
16. *Neidium dubium*
17. *Navicula vanhoffeni*
18. *Pinnularia biceps*
19. *Anomoeoneis exilis*
21. *Achnanthes bottnica*
22. *Frustulia styrica*



Total taxa identified – 39
Total genera - 25
Cyanoprokaryota – 26
(Heterocystous-5; Non Heterocystous – 21)
Bacillariophyceae (Heterokontophyta) - 13

Summary of Research work so far

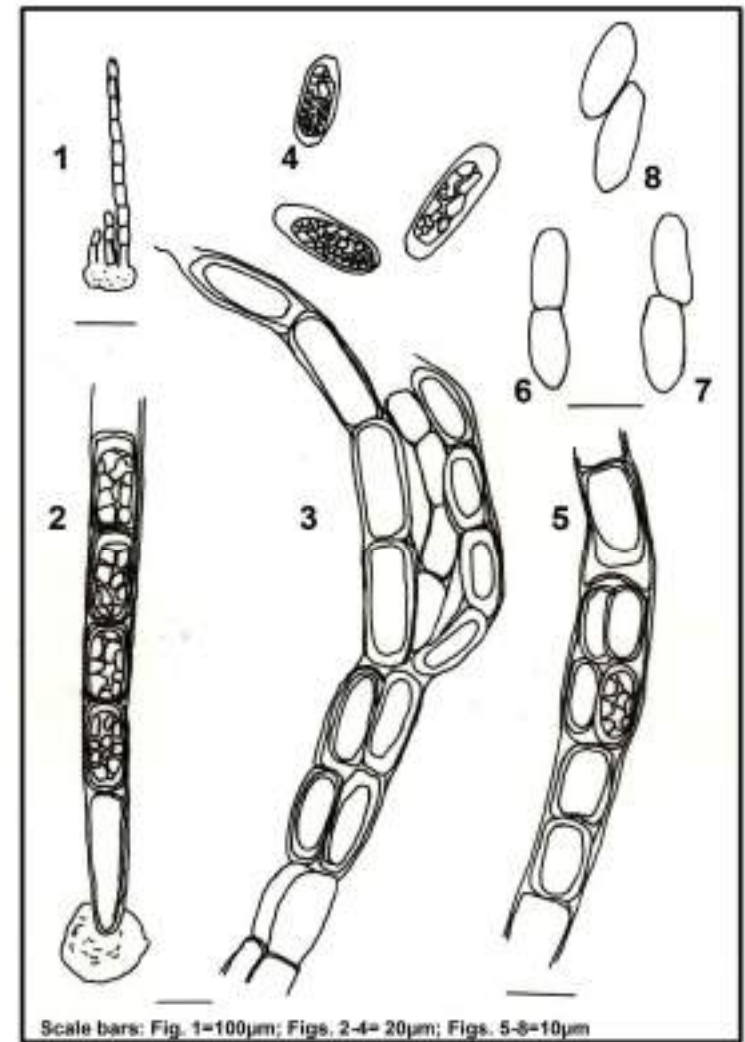
- ✓ No. of Projects Carrying out individually : 1
- ✓ No. of Projects carried out Jointly : 2
- ✓ No. of Papers Published as first author : 12
- ✓ No. of Papers Published as co-author : 5
- ✓ No. of new taxa (One sp. one var.) : 2



Scale bar: Figs. 5-11 = 10µm; Fig. 3 = 20µm; Figs. 1, 2 & 4 = 50µm

PLATE-1

Fig. 1. *Ecballocystopsis* sp.1 (*E. himalayansis*), (A) cells dividing longitudinally, (B-C) formation of loop with 2-6 rows of cells, (D) mucilaginous base of the filament, (E) autospores in the filament and (F) a single autospore liberated from the filament; *Ecballocystopsis* sp. 2 (*E. dichotomus* var. *minuta*), (G-I) cells dividing (G) transversally, (H) obliquely and (I) longitudinally, (J) formation of loop in the filament, and (K) presence of parietal chloroplast.



Scale bars: Fig. 1 = 100µm; Figs. 2-4 = 20µm; Figs. 5-8 = 10µm

PLATE-2

Fig. 2. *Ecballocystopsis* sp. 1 (*E. himalayansis*), (A,B) erect filament with uniseriate cells and mucilaginous base, (C) branched filament showing loop formation, (D) autospores liberated from matured filament; *Ecballocystopsis* sp. 2 (*E. dichotomus* var. *minuta*), (E) formation of loop within the filament, (F) cell dividing transversely, (G) obliquely and (H) longitudinally.

Administrative works

1. Taking care of Botanical Museum by cleaning, rearranging and documenting the museum specimen routine wise.
2. Visitors to botanical museum were guided and demonstrated about exhibited specimens time to time.
3. A total of the **881 exhibits** were labelled, corrected and displayed.
4. Prepared and displayed posters on micro and macro algae as well as other posters on Swachh Bharat Mission and Plastic waste free Pune were carried out.
5. Worked for the renovation of Museum.
6. Physical verification of store.
7. Assisted other scientists for research as well as official work wherever it is asked.

Future plan

- Completion of project on thermal algal diversity
- Diatom frustule study with SEM
- Establishment of algae culture room

Acknowledgements

Dr. Paramjit Singh
Director, Botanical Survey of India

Dr. P. Lakshminarasimhan
HoO, Botanical Survey of India, WRC,
Pune

Staff members
Botanical Survey of India, WRC, Pune



Thank you