IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 3, March 2022
Impact Factor: 6.252

Ecological and Quantitative Analysis of Blue Green Algae from Paddy Fields of Patan and Karad Tehsil, Satara District, Maharashtra

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Abstract: *Paddy fields are best studied aquatic ecosystems on earth. Blue green algae are the important components of paddy field soils expressively contribute to its fertilization. Present investigation was carried out to study the Ecological and quantitative analysis of blue green algae and correlate them with diversity of blue green algal flora in paddy field soils of Patan and Karad tehsil. Ecological and quantitative analysis of BGA showed that there is bit difference found in Simpsons diversity index (H) and Shannon's diversity index (SDI) as well as species richness and evenness from both tehsil. This showed that blue green algal flora from paddy field soils of both tehsil is considerably correlated (0.776).*

Keywords: Ecological, Patan, Karad, Paddy, BGA.

I. INTRODUCTION

Blue green algae are the first photosynthetic prokaryotes which emit oxygen in the atmosphere. Cyanobacteria show connecting link between bacteria, eukaryotic algae and higher plants. They resemble with bacteria in lack of membrane bound organelles like true nucleus, chloroplast and mitochondria (Feldgarden and Cohn, 2003). On the other hand they contain photosynthetic system as that of eukaryotic algae and green plants (Castenholz and Waterbury, 1989).

They contain bluish green colored pigment phycocyanin 'cyan' means dark blue; so the name 'Cyanobacteria' and this pigment in conjunction with green chlorophyll so the common name is 'Blue green algae'. Besides chlorophyll, other pigments also present and give different coloration to them are carotenoids, phycobilins (phycocyanin, phycoerythrin). They also appear bluish, purple, brown, black and green in color. (Kondo and Yasuda, 2003).

Blue green algae are important component of soil microflora in paddy field. They play important role in maintaining and improving soil fertility as they have ability of nitrogen fixation. Rice fields provide ideal environment for luxuriant growth of blue-green algae. They are found in paddy field soil throughout the year at various growth stages of rice crop. The occurrence, distribution and proliferation of those blue green algae is controlled by physical and chemical nature of paddy field soil. These parameters of soil show profound effect on distribution of blue-green algae (Nayak et al. 2004).

Extensive work on blue-green algae of paddy fields has been carried out in various regions of India viz. West Bengal, Kerala, Chattisgarh, Manipur, Mizorum, U. P. M. P., Orrisa, Bangladesh, Kerala, Tamilnadu, Maharashtra etc. (Anand & Revati, 1987; Anand et al.,1988; Banarjee 1935; Ahmed 2001; Goyal et al.1984; Fernandez & Quesada, 2004; Sahu et al. 1997; Roger and Kulassoriya 1980; Nikam et al.2013; Nayak et al.2001). There have been some reports on growth and nitrogen fixation potentials of blue-green algae (Parasad & Mehrotra, 1980; Allen1968; Allen & Stanier,1968; Santra, 1991; Gupta,1964). Marked variations among the species of blue green algae from rice field soils of different regions of India have been recorded by Sinha & Mukherjee (1975a, 1975 b, 1984) Tiwari (1972) and Anand (1990). Effect of soil pH on the blue green algal diversity in rice field soils was studied by Nayak and Prasanna (2007), Sardeshpande & Goyal, (1981b) and Singh (1978).

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Studies on blue green algal flora from paddy fields of Maharashtra was undertaken by (Patil & Satav,1986; Gonzalves & Gangla, 1949; Kolte & Goyal 1985 and Patil & Chougule 2009). Biodiversity of blue green algae from paddy fields of Satara district was studied by (Karande 2009 and Kamble 2010, 2017). Blue green algal diversity other than paddy was studied by (Kamat 1962, 1963; Jawale & Kumawat 2004; Auti & Pingle 2006 and Nikam et al. 2013). However, there is no any report on comparative study of blue green algae in accordance to geographical and climatic conditions from of paddy soil from Patan and Karad tehsils of Satara district. So, present work was taken up with a view to screen blue green algal diversity in relation to Geographical and climatic conditions of the paddy fields from the study area. The blue green algal taxa recorded from the study region are the first reports.

II. Material and Methods

For the present work two hundred eighty eight paddy fields from different agroclimatic conditions were selected from Patan and Karad Tehsils of Satara district Maharashtra. Patan and Karad tehsils differ in several aspects like agroclimatic conditions, geography, topography, soil types etc. (Table 1).

Table 1: Comparative account of Geographical and climatic conditions from Study area

Sr. No.	Geographical/Climatic conditions	Patan Tehsil	Karad Tehsil
1	Longitude	73.8992	74.2003
2	Latitude	17.3734	17.2759
3	Height from mean sea level	582 m (1909 feet)	578 m (1856 feet)
4	Soil type	Red loamy, Basaltic red lateritic	Black cotton soil, clay loamy soil
5	Temperature	In summer – 39^0c In winter – 10^0c	In summer – 34^0c In winter – 10^0c
6	Rainfall	2000 mm (200 cm)	691 mm (69.1 cm)

Patan is 65 km away to the south-west of Satara. Most of the part of Patan tehsil is hilly with deep valleys while some part is at plains. This tehsil receives high rainfall and is famous for cultivation of local varieties of paddy viz. Dombya, Dodkya, Kolambya, Bhados, Panwel, Indrayani, Champakali, Ghansal, Jiresal, Teliansh 6444, Kaveri 888, Krishnakusal, Basmati, Ambemohar etc.

Karad is 52 km far to the south-east of Satara. Karad city situated at southern part of Satara district near Agashiva, at the confluence of Koyna and Krishna rivers; this confluence called as 'Preeti sangam'. Tahasil receives moderate rainfall and common soil type is black cottony soil. It is famous for cultivation of local varieties of rice viz. Indrayani, Rethare Basmati, Pusa Basmati, Hansa, Khadkil Kolhapuri, Kolhapuri, and Kaveri etc.

Ecological and quantitative analysis of blue green algae isolated from paddy fields of two tehsils was done by using following formulae:

1. Shannon's Diversity Index 'H': This index is used to measure species diversity mathematically and calculated by following formula (Table 20)

$$H = \sum_{i=1}^{s} pi \ In \ pi$$

Where s= Number of species in the samples
Pi = Relative abundance of the species in the community
In = log to base 2
H = Diversity of Shannon

2. Simpson Diversity index 'SDI': This is used to measure community dominance and calculated by following formula (Table 20)

$$D = 1 - \frac{\sum n\,(n-1)}{N\,(N-1)}$$

Where n = Number of individuals of each species
N = Total number of individuals of all species

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3. Species Richness– The number of species present in community is calculated by **Memhinick's** index 'D' (Table 20)

$$D = \frac{S}{\sqrt{N}}$$

Where S = Number of different species represented in sample
N = Total number of individual organisms in sample.

4. Species Evenness: Distribution of individuals over species and calculated by following formula. (Table 20)

$$\frac{H}{\ln (s)}$$

Where H = Shannon's diversity index
In (s) = Natural logarithm of species richness

5. Soerenson Correlation Coefficient 'cc': It is used to calculate community similarity. (Table 20)

$$CC = \frac{2xC}{S1+S2}$$

Where C = Number of species common in both communities
S1 = Total species found in community I
S2 = Total species found in community II

III. Results and Discussion

Comparison of blue green algal diversity in paddy field soils of Patan and Karad tahasil showed bit more diversity of blue green algae in paddy field soils of Patan tahasil than paddy field soils of Karad tahasil. Simpson's diversity index (H) of blue green algae of paddy field soils of Patan tahasil is more (0.288) than that of Karad tahasil (0.254) as well as Shanon's diversity index (SDI) of Patan tahasil is also more (1.6344) than that Karad tahasil (1.593). Blue green algal species richness (6.729) and species evenness (0.565) in paddy field soils of Patan is also bit more than paddy field soils of Karad tahasil i. e. (6.066) and (0.419). The result of sorenson correlation coefficient showed very much similarity in blue green algal communities within paddy field soils of both the tahasils (0.776). (Table 2)

Table 2: Ecological and quantitative analysis of blue green algae of study region

Sr. No.	Region	No. of species	Total Isolates	Simpsons Diversity Index 'H'	Shannon's Diversity Index 'SDI'	Species richness	Species evenness	Correlation coefficient (Sorenson)
1	Patan	131	379	0.288	1.6344	6.729	0.565	0.776
2	Karad	93	235	0.254	1.593	6.066	0.419	

IV. Conclusion

The blue green algal flora of the paddy field is unique one. Ecological and quantitative analysis showed there is very much correlation in taxaonomical data of blue green algae from paddy field soils of both tehsils; climatic conditions and physicochemical characters of soils influence the distribution of cyanobacteria in paddy field soils. These investigations provide the knowledge about indigenous species of blue green algae in accordance to geographical and climatic conditions which will help in development of niche specific inoculants as biofertilizers for rice fields of this region.

Acknowledgements

I am thankful to Dr. Mohan Rajmane, Principal, Sadguru Gadage Maharaj college, Karad for the encouragement during the work. Thanks are also due to the Head Department of Botany and plant protection, S. G. M. College, Karad for the facilities and support. We are thankful to staff members and colleagues and friends for the keen interest and suggestions during this work.

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International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
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REFERENCES

[1]. **Allen, M. (1968)**. Simple conditions for growth of unicellular blue green algae on plates. *J. Phycol.* 4: 1 - 4.
[2]. **Allen, M. & Stanier R. (1968)**.Selective isolation of blue green algae from water and soil. *J. Gen. Microbiol* 51 : 203 – 209
[3]. **Anand N., Shantha Kumar and R. S. Hooper (1988).** Blue- green algae from rice fields in Kerala state, India. *Hydrobiologia* 144: 223-232.
[4]. **Anand, N. & G.Revathi, (1987).** Blue green algae from rice fields of Tamil Nadu. *Phykos*, 26:17-21.
[5]. **Anand, N. (1990).** A hand book of Blue green algae. Bishen singh, Mahendra pal singh, Dehra Dun. pp.1-79.
[6]. **Ahmed, S. U. (2001).** Distribution pattern of blue green algae in rice field soils of Hojai sub-division of Assam. *Phykos* 40 (1 and 2) : 33- 38.
[7]. **Auti, B. K. & S. D. Pingle (2006).**Nostocales from Northern circle of Ahmednagar district (M. S.) *Indian Hydrobiology* 9 (2): 147-150.
[8]. **Banarjee, J. C. (1935).** On algal found on soil samples from alluvial paddy field of Faridpur, Bengal, *Scientific Cultural. Journal* 298.
[9]. **Castenholz, R. W. & J. B. Waterbury (1989)**. In : Staley, M. P. Bryant, N. P. fenningand J. G. Holt (Eds) *Bergey's Mannual of Systematic Bacteriology*. Vol. 3, Williams and Wilkins, Baltimore, 1710-1727.
[10]. **Desikachary, T. V. (1959).** *Cyanophyta*, Indian council of Agricultural Research, New Delhi pp-685
[11]. **Feldgarden, M. N. Byrd & F. M. Cohan, (2003)**. Gradual evolution in bacteria: evidence from *Bacillus* systematics. Microbiology 149: 3565–3573.
[12]. **Fernandez-valiene E. & A. A. Quesada (2004).**Shallow water ecosystem : rice fields. The relevance of cyanobacteria in the ecosystem, Limnetica **23**: 95-108
[13]. **Goyal, S. K., B. M. Shrama & R. S. Gupta (1984).** Algal flora of rice field soils of Jammu and Kashmir states. *Phykos* 23: 59 – 64.
[14]. **Gonzalves, E. A.& K. S. Gangla (1949).** Observations on the algae of paddy field soils *Journal of University of Bombay* 18: 51-59.
[15]. **Gupta, A. B. (1964).**Algal flora and its importance in the economy of rice fields. *Hydrobiologia* 38: 213-222.
[16]. **Jawale, A. K. & D. A. Kumawat (2004).**Some blue green algae from Maharashtra in National Symposium on Biology and Biodiversity of fresh water algae. Chennai. P : 37.
[17]. **Kamat, N. D. (1962).** The Cyanophyceae and Chlorophyceae of Panhala. *Journal of University of Bombay* 30: 22-31.
[18]. **Kamat, N. D. (1963).**The Algae of Kolhapur, India. *Hydrobiologia* 22 (3 and 4) : 209-305.
[19]. **Karande, C. T. (2009).** Cyanobacterial biodiversity in paddy fields from Satara district- A project submitted to UGC (Unpublished.)
[20]. **Kamble, P. B. (2010).** Isolation purification and biochemical characterization of blue green algae from paddy field soils of Satara district -M. Phil Dissertation submitted to Shivaji university, Kolhapur. pp 185.
[21]. **Kamble, P. B. (2017).** Studies on Filamentous blue green algae from Satara district Maharastra - A Ph. D. Thesis submitted to Shivaji University, Kolhapur. pp 265
[22]. **Kolte, S. O. & S. K. Goyal (1985).**Distribution pattern of blur\e green algae in rice field soils of Vidarbha region of Maharashtra state. *Phykos* 24: 156-162.
[23]. **Kondo, M. & M. Yasuda (2003).**Seasonal changes in N_2 fixation activity and environment in paddy soils of Japan. *Japan Agricultural research quarterly*, 37: 105-111.
[24]. **Nayak, S., R. Prassana, T. K. Dominic & P. K. Singh (2001).**Floristic abundance and relative distribution of different cyanobacterial genera in rice field soil at different crop growth stages. *Phykos* 40: 14-21.
[25]. **Nayak, S., R. Prasanna, T. K. Dominic & Singh P. K. (2004).** Effect of BGA – *Azolla* biofertilizers on nitrogen fixation and chlorophyll accumulation at different depths in soil cores. *Biology and Fertility of Soils*, 40: 67-72.

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[26]. Nayak, S. & R. Prasanna (2007). Soil pH and its role in cyanobacterial abundance and diversity in rice field soils. *Applied ecology and environmental Research* 5(2): 103-113. **.**

[27]. Nikam, T. D., J. N. Nehul, Y. R. Gahile, B. K. Auti, M. L. Ahire, K. M. Nitnaware, B. N. Joshi & N. Jawali (2013). Cyanobacterial diversity in Western Ghats region of Maharashtra, India. *Bioremediation, Biodiversity and Bioavailability* **7** (1): 70-80.

[28]. Patil, S. R. & B. B. Chaugule (2009). Diversity of blue green algae in paddy fields of Western Maharashtra *Indian hydrobiology* 12: 89-94.

[29]. Patil, P. L. & S. D. Satav (1986). Study of nitrogen fixing blue green algae from rice fields of Western Maharashtra *Phykos* 25 **(**1 and 2): 113-116.

[30]. Prasad, B. N. & R. K. Mehrotra (1980). Blue green algae of paddy fields of U. P. *Phykos* 19 :121 – 128.

[31]. Roger, P. A. & S. A.Kulasooriya (1980).Book of blue green algae and Rice. The International Rice Research Institute, Los Banos, Laguna, Philippines. pp.117

[32]. Santra, S. C. (1991). Rice field blue green algae (Cyanobacteria) and its utilization prospects as biofertilizer in West Bengal, *India, Proceeding of National. Symposium*. On Cyanobacterial Nitrogen fixation New Delhi : 385-389.

[33]. Sardeshpande, J. S. & S. K. Goyal (1981b). Distribution pattern of blue green algae in rice field soils of Konkan region of Maharashtrra state, *Phykos* 20 **:** 102-106.

[34]. Sinha, J. P. & D. Mukherjee (1984). Blue green algae from the paddy fields of Bankura District of West Bengal –III. *Phykos* 23 (1 and 2) : 142-143.

[35]. Sinha, J. P. & D.Mukherjee (1975a). On Blue green algae from the paddy fields of Bankura district of West Bengal- I. *Phykos* 14 (1 and 2): 117-118.

[36]. Sinha, J. P. & D.Mukherjee (1975b). On Blue green algae from the paddy fields of Bankura district of West Bengal – II, *Phykos* 14 (1 and 2) : 119-120.

[37]. Sahu, J. K., H. Naik & S. P. Adhikary (1997) Blue green Algae of rice field soils of Orissa state – I Distributional pattern in different agroclimatic zones. *Phykos* 35: 93 – 110.

[38]. Singh, P. K. (1978). Nitrogen economy of rice soils in relation to nitrogen fixation by blue green algae and Azolla. In Proc. National, Symp. On increasing rice yield in Kharif (CFRI, India.) 12-23.

[39]. Tiwari, G. L. (1972). Study of blue green algae from paddy field soils of India. *Hydrobiologia* 29: 335-350.