

# Occurrence of Blue Green Algae from Maize Fields of Mohol Tahasil in Solapur

Seema Khadatare<sup>1</sup>, D. S. Suryawanshi<sup>2</sup>

<sup>1,2</sup>Department of Botany, Jawahar Arts, Science and Commerce College, Andur, Tal. Tuljapur, Dist. Osmanabad.

**Abstract:** Blue-green algae make a major contribution to the fertility of the soil. It has been suggested that blue-green algae (BGA) assist higher plant growth by supplying growth substances. There are numerous works about roles of blue-green algae on growth of maize fields. Increase in use of synthetic fertilizers in the field badly affected the fertility of the soil. These synthetic fertilizers are effecting on flora and fauna of the field responsible for productivity of the crop plants. Most of the farmers are utilizing these fertilizers blindly to increase productivity. To check proper dosage and relative abundance of the blue green algae efforts were made to evaluate abundance of blue green algae from Mohol tehsil of Solapur district. During the investigations, 19 species of bluegreen algae belonging to three families of heterocystous and non-heterocystous from maize fields in Mohol Tahasil of Solapur district were identified, out of which seven species are new to this region.

**Keywords:** Blue green Algae, biofertilizer, Cyanophyta, Solapur

## 1. Introduction

Cyanobacteria represent a small taxonomic group of photosynthetic prokaryotes which some of them are able to N<sub>2</sub> fixation and also possess a tremendous potential for producing a wide range of secondary metabolites. Cyanobacteria have drawn much attention as prospective and rich sources of biologically active constituents and have been identified as one of the most promising groups of organisms capable of producing bioactive compounds (Fish & Codd 1994, Schlegel *et al.* 1999). Production of bioactive molecules such as auxins, production of secondary metabolites linked to bio control of bacterial and fungal diseases as well as improving soil structure and porosity through secretion of polysaccharides aiding in soil aggregation are the most important functions of these microorganisms (Karthikeyan *et al.* 2007, Sergeeva *et al.* 2002). De (1939) attributed the natural fertility of maize field soil and its maintenance to the process of biological nitrogen fixation by cyanobacteria. This was the first report, which recognized the agronomic potential of cyanobacteria in India. The widespread application of single element fertilizers (especially N in Asian countries) in the cultivation of major crops has led to accelerated exhaustion of other major and minor nutrients leading to nutrient imbalances and poor soil fertility. In the current scenario therefore, an urgent need has been felt to deploy microbial bio-fertilizer which are multifaceted such as cyanobacterial biofertilizer. As yet for substitution of chemical fertilizers by microbial bio fertilizers many studies have been done. Gupta & Shukla (1967) studied the algal influence on growth, yield and protein content of maize plants and showed that pre-soaking maize seeds with BGA cultures or extracts enhances germination, promotes the growth of roots and shoots, and increases the weight and protein content of the grain.

Svircev *et al.* (1997) also reported that plant growth was enhanced in the presence of cyanobacterium, even without organic N fertilizer application. Beneficial effects of cyanobacterial inoculation were reported, not only for maize, but for other crops such as wheat, soybean, oat,

tomato, radish, cotton, sugarcane, chili, bean, muskmelon and lettuce (Venkataraman 1972, Rodgers *et al.* 1979, Singh 1988, Arif *et al.* 1995, Thajuddin & Subramanian 2005, Saadati & Riahi 2009, Maqubela *et al.* 2008, Karthikeyan *et al.* 2007). Several reasons have been proposed for beneficial effects of cyanobacteria on the growth of different plants. The capacity for biosynthesis of growth promoting substances such as auxins, amino acids, sugars and vitamins (Vitamin B12, Folic acid, Nicotinic acid and Pantothenic acid) was reported by Misra & Kaushik (1989 a, b) that can enhance growth of plant.

Additionally, cyanobacteria excrete complex organic carbon compounds that bind to the soil particles and improve soil aggregation, hence improve soil structure, soil permeability and water holding capacity of soil (Kaushik 2007). However, to date, the effect of single species cyanobacterial biofertilizer on plant growth has not yet been fully investigated. The primary aim of this research was to study cyanobacteria species isolated from soil.

There are numerous works about roles of blue-green algae on growth of maize fields. Increase in use of synthetic fertilizers in the field badly affected the fertility of the soil. These synthetic fertilizers are effecting on flora and fauna of the field responsible for productivity of the crop plants. Most of the farmers are utilizing these fertilizers blindly to increase productivity. To check proper dosage and relative abundance of the blue green algae efforts were made to evaluate abundance of blue green algae from Mohol tehsil of Solapur district.

## 2. Materials and Methods

Soil samples were collected from the depth of 0–5 cm on several maize fields in Mohol tahasil of Solapur district of Maharashtra. (Rangaswamy 1996).

### - Isolation of cyanobacteria:

Soil samples were transferred to sterile Petri dishes and added to them sterilized BG-11 medium with pH: 7.1. The Petri dishes were placed in a culture chamber at 25° C and a

12/12 h light dark cycle atartificial illumination (2000–2500 Lux) for two weeks.After colonization, for purification, identification andmultiplication of colonies, a part of each colony wasremoved by a loop and transferred to a new plate. Afterpurification of taxa, taxonomic determination was carriedout by light microscopy and based on Desikachary(1959), Prescott (1970) and Wehret *al.* (2002),and corrected based on algaebase website([www.algaebase.org](http://www.algaebase.org)).

### 3. Results

In the present study, seven taxa of heterocystous and12 taxa of non-heterocystouscyanophyta were identified.*Nostocaceae*with four genera and seven species,*Oscillatoriaceae*with three genera and six species and*Chroococcaceae*with four genera and six species wereincluded in the list of isolates (Table 1).

**Table 1:** The list of Cyanobacterial taxa occurred in MoholTahasil

<i>Nostocaceae</i>	<i>Oscillatoriaceae</i>	<i>Chroococcaceae</i>
<i>Anabaena vaginicola</i> F.E. Fritsch & Rich	<i>Oscillatoria angustissima</i> W.W est&G.S.West	<i>Aphanothecegelatina</i> (Hennings) Lemmermann
<i>Cylindrospermumichailovskoense</i> Elenkin	<i>Oscillatoria chilkinsis</i> Biswas	<i>Chroococcusminutus</i> (Kützing) Nägeli
<i>Nostocpunctiforme</i> (Kützing) Hariot	<i>Phormidiumterebriiforme</i> (C. Agardh ex Gomont)	<i>Chroococcusminimus</i> (Keissler) Lemmermann
<i>Nostocmuscorum</i> C. Agardh ex Bornet&Flahault	Anagnostidis&Kovář	<i>Chroococcuspallidus</i> (Nägeli) Nägeli
<i>Nostoccalcicola</i> Brébis son ex Bornet&Flahault	<i>Phormidiumgranulatum</i> (Gardner) Anagnostidis	<i>Gleocapsasp.</i>
<i>Nostocsp.</i>	<i>Phormidiumarticulatum</i> (Gardner) Anagnostidis&Kovář	<i>Gloeothecesp.</i>
<i>Nodulariaharveyana</i> (Thwaites) Thuret	<i>Lyngbyasp.</i>	

Among these taxa, three species of heterocystouscyanobacteria, *Anabaena vaginicola*, *Nostocsp.* and*Nodulariaharveyana*, which were isolated from maize fieldsoils.

**Table 2:** Total percent abundance of cyanobacteria genera (summed up over all locations)

Genus	Localities in MoholTahasil				Total No. of species	Percentabundance
	Anagar	Aasti	Penar	Kamati		
<i>Anabaena</i>	+	+	+	+	2	5.2
<i>Nostoc</i>	+	+	+	+	4	21
<i>Cylindrospermum</i>	-	-	+	+	1	5.2
<i>Nodularia</i>	+	+	+	+	2	5.2
<i>Oscillatoria</i>	+	+	-	+	2	10.6
<i>Lyngbya</i>	+	+	+	+	1	5.2
<i>Phormidium</i>	-	-	-	-	3	16
<i>Chroococcus</i>	+	+	+	+	3	16
<i>Aphanothece</i>	+	+	+	+	1	5.2
<i>Gloeothece</i>	+	+	-	-	1	5.2
<i>Gleocapsa</i>	+	-	+	+	2	5.2
				<b>Total</b>	<b>22</b>	<b>100</b>

Abundance of these species was studied of these species. It was observed that *Nostoc*was most abundant with 25 % occurrence followed by *Phormidium* and*chrooccus*up to 16 percentage followed by *Oscillatoria* with 10.6 %. This was followed by *Anabaena*, *Cylendrospermu*, *Nodularia*, *Aphanothece*, *Gloeotheca*and*Gleocapsa* with 5.2 %.

### 4. Conclusion

From the above results it could be concluded that *Nostoc*is the dominating blue green algae plays its role in productivity of maize crop. *Promidium* and *Chroococcus*are the second largest species play their vital role productivity of crops and

are the second largest group of blue green algae. If dose of synthetic utilized properly, they may nurture are favorable for the growth of blue green algae. This will lead to fertility of soil and will definitely effect on productivity of crop plants such as Maize.

### 5. Acknowledgement

Authors are thankful to Principal,Jawahar Arts, Science and Commerce College, Andur, Tal. Tuljapur, Dist. Osmanabad for providing laboratory facilities to carry out the research work.

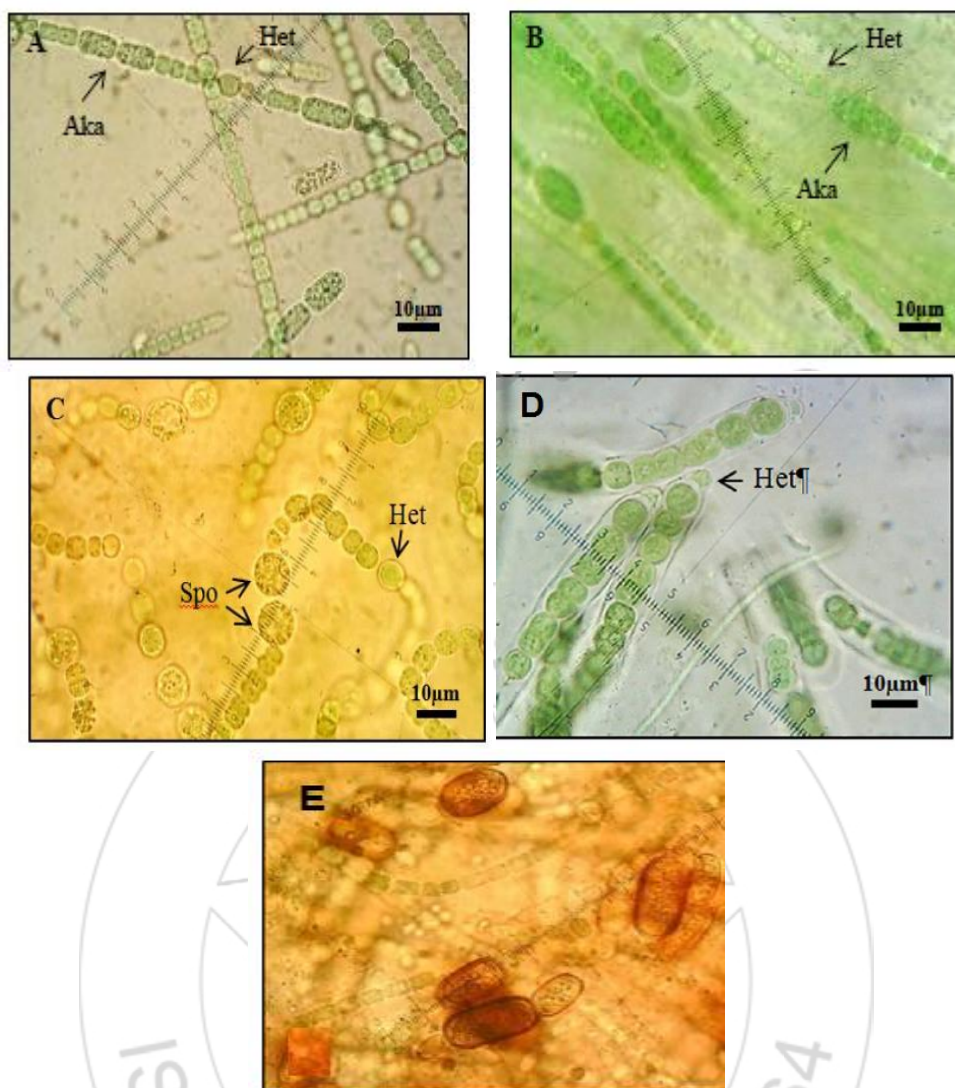


Figure: A, *Anabaena inaequalis*; B, *Anabaena fuellbornii*; C, *Nostocpruniforme* D. *Calothrixfusca* E. *Cylandrospermum*

## References

- [1] Desikachary, T.V. 1959. Cyanophyta. New Delhi: Indian Council of Agricultural Research. 686 pp.
- [2] De, P.K. 1939. The role of blue-green algae in nitrogen fixation in rice fields. Proceeding of the Royal Society of London. Series B 127: 121–139.
- [3] Fish, S.A. & Codd, G.A. 1994. Bioactive compound production by thermophilic and thermo tolerant cyanobacteria (blue-green algae). World Journal of Microbiology and Biotechnology 10:338–347.
- [4] Karthikeyan, N., Prasanna, R., Nain, L. & Kaushik, B.D. 2007. Evaluating the potential of plant growth promoting cyanobacteria as inoculants for wheat. European Journal of Soil Biology 43: 23–30.
- [5] Kaushik, B.D. 2007. Cyanobacterial biofertilizer technology. Pp. 53–59. In: S. Kannaiyan, K. Kumar & K. Govindarajan (eds). Biofertilizer technology. Scientific Publishers. India.
- [6] Maqubela, M.P., Mnkani, P.N.S., Malamissa, O., Pardo, M.T. & Acqui, L.P.D. 2008. *Nostoc* cyanobacterial inoculation in South African agricultural soils enhances soil structure, fertility and maize growth. Plant and Soil 315: 79–92.
- [7] Misra, S. & Kaushik, B.D. 1989a. Growth promoting substances of cyanobacteria I. Vitamins and their influence on rice plant. Proceeding of the Indian Science Academy B55: 295–300.
- [8] Misra, S. & Kaushik, B.D. 1989b. Growth promoting substances of cyanobacteria II. Detection of amino acids, sugars and auxins. Proceeding of the Indian Science Academy B55: 499–504.
- [9] Prescott, G.W. 1970. Algae of the western great lakes area. W.M. C. Brown Company Publishers. 977 pp.
- [10] Rangaswamy, G. 1996. Agricultural microbiology. Asia Publishing House, Bombay, p. 54–76.
- [11] Saadatnia, H. & Riahi, H. 2009. Cyanobacteria from paddy-fields in Iran as a biofertilizer in rice plants. Plant Soil Environment 55(5): 207–212.
- [12] Schlegel, I., Doan, N.T., De Chazol, N. & Smit, G.D. 1999. Antibiotic activity of new cyanobacterial isolates from Australia and Asia against green algae and cyanobacteria. Journal of Applied Phycology 10: 471–479.
- [13] Sergeeva, E., Liaimer, A. & Bergman, B. 2002. Evidence for production of the phytohormone indole-3-acetic acid by cyanobacteria. Planta 215: 229–238.

- [14] **Singh, P.K. 1988.** Biofertilization of rice crop. pp.109–114. *In:* S.P. Sena. & P.C. Palit (eds). Biofertilization potentialities and problems. Plant Physiology Forum.
- [15] **Svircev, Z., Tomas, I., Nenin, P. & Drobac, A. 1997.** Co-cultivation of N<sub>2</sub>-fixing cyanobacteria and some agriculturally important plants in liquid and sand culture. *Applied Soil Ecology* 6:74–81.
- [16] **Thajuddin, N. & Subramanian, G. 2005.** Cyanobacterial biodiversity and potential application in biotechnology. *Current Science* 89: 47–57.
- [17] **Venkataraman, G.S. 1972.** Algal biofertilizer and rice cultivation. *Today and Tomorrows* Printer and Publishers. New Delhi. 71 pp.
- [18] **Venkataraman, G.S. & Neelakantan, S. 1967.** Effect of the cellular constituents of the nitrogen fixing blue-green algae *Cylindrospermum muscicola* on the root growth of rice seedlings. *Journal of General and Applied Microbiology* 13: 53–61.
- [19] **Wehr, J.D., Sheath, R.G. & Thorp, J.H. 2002.** Freshwater algae of North America: Ecology and classification. Aquatic Ecology Press. 917 pp.
- [20] <http://www.algaebase.org>

