IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)
An International Open Access, Peer-reviewed, Refereed Journal

ISOLATION, IDENTIFICATION AND CHARACTERIZATION OF CYANOBACTERIA FROM PADDY FIELDS OF NIZAMABAD DISTRICT TELANGANA STATE.

M. ARJUN[1] and M. ARUNA[2]*

1 Research scholar, Department of Botany, Telangana University. T.S., INDIA.

2 Professor, Department of Botany, Telangana University. T.S., INDIA.

ABSTRACT

In this investigation cyanophyceae members were found in all selected locations of Nizamabad district, Telangana state. An attempt has been made to isolate Cyanobacteria from paddy fields of Nizamabad district Telangana State. These are characterized based on their morphological characters by using standard literature and key points. Cyanobacteria are the most important group of nitrogen fixing organisms.

Among algae, the cyanobacteria are considered to be very valuable in agriculture. To initiate the study, soil samples were collected in polythene bags and were brought to the laboratory. Cultures were maintained and periodical observations were made.

During the period of investigation and observation dominant species of cyanophyceae were identified. The *Nostocaceae* has been reported by maximum number of genera and species.

KEY WORDS: BGA, Paddy fields, Nizamabad district.

INTRODUCTION:-

Cyanobacteria is a group of cosmopolitan, gram negative, oxygenic, photosynthetic, prokaryotes which grow and multiply at the simple expense of water, light and air (Fay, 1983) and perform two biologically important functions such as carbon and nitrogen fixation and thus enriching the soil fertility with humus and nitrogen content. (Singh *et al.*, 2014).

They are ubiquitous in nature and sometimes found in extreme habitats too (Hoffmann, 1989; Whitton and Potts, 2000). During their long and slow evolution, they have achieved huge diversity both in morphology and genetics, ranging from simple unicellular organisms to complex filamentous organisms (Whitton, 1992). A few can fix atmospheric nitrogen in its usable form and have been shown to be agriculturally important as biofertilizer, particularly in tropical rice field soils (De, 1939; Stewart *et al.*, 1987; Singh *et al.*, 2014). Rice fields provide a very congenial condition for abundant growth of N_2-fixing cyanobacteria (Nayak *et al.*, 2001; Whitton, 2000, Srinivas *et al.*, 2016). They are also known to maintain the homeostasis of rice field as a sustainable system (Bhattacharya, 2013).

Cyanobacteria are a group of extraordinarily diverse, photosynthetic, oxygen evolving prokaryotes. Among the oldest surviving organism on earth, geological dating back with in the fossil recorded to nearly 3.5 million years ago, the cyanobacteria have evolved to provide a impressive array of biologically active compounds. Cyanobacteria are a simple, but primitive and diverse group of microorganism with characteristics in common to both bacteria and algae. Cyanobacteria are found all over the world in environmentally as diverse as Antarctic soils and volcanic hot springs often where no other vegetation can exist (Knoll, 2008).

The rice field ecosystem provides an environment favourable for the growth of cyanobacteria with respect to them requirements for light, water, high temp and nutrient availability (Roger *et al.*, 1993). Some species of heterocystous cyanobacteria i.e. *Nostoc*, *Anabaena*, *Cylindrospermum*, *Anabaenopsis*, *Scytonema*, *Calothrix*, *Stigonema*, *Tolipothrix*, *Aulosira*, *Mastigocladus*, *Fischerella*, *Gleoetrichia*, *Hapalosiphon*, *Chlorogloeopsis*, *Campylonema*, *Rivularia*, *Nostochopsis*, *Chlorogloea*, *Schytonematopsis*, *Westiellopsis*, and *Wollea* are efficient nitrogen fixers (Venkataraman, 1993). Some cyanobacterial strains i.e., *Aulosira fertilissima, Anabaena variabilis, Nostoc muscorum, and Tolypothrix*

Tenuis are being used in algal biofertilizer technology (Kaushik, 2014). Most of the fixed nitrogen of cyanobacteria is released only after decomposition and autolysis (Martinenz, 1984). The majority of cyanobacterial strains release an insignificant amount of ammonia during their growth period (Martinenz, 1984). Search for continuous ammonia secreting cyanobacterial strains are one of the primary goals of plant biologist. The cyanobacterial strain was isolated, characterized, and studied for ammonia secreting properties. Cyanobacteria are characterized by their capacity to perform biological nitrogen fixation and oxygenic photosynthesis. Cyanobacteria are very resistant to extreme environmental conditions and even they tolerate to high temperature upto 50ºC. They are assuming increasing importance in frontier areas of biotechnology.

The aim of the present work is to identify the cyanobacteria enriched in the field of paddy fields of chosen area. Observation revealed that most of them were from the orders Nostocales, Chroococcales and Stigonematales (Desikachary, 1959).

MATERIAL AND METHODS:-

ABOUT NIZAMABAD: Godavari is a rriver that runs from western to southern India and it enters Andhra Pradesh at Basara in Adilabad District. Nizamsagar is a reservoir constructed across the manjira River, a tributary of Godavari River between Achampet and Banjapalle villages of Nizamabad district. Ashok sagar is a major irrigation lake situated at a distance of 7Km from Nizamabad town. Other lakes are Choudamma lake Boddummidi Lake, Oora Lake Jaggasagar lake, Pochammakunta lake, Choutpally lake, Dharpally lake, Sakera lake, Bibipet lake, Jangampally lake, Yalamakuntla lake, Suddapally and Pipri ponds are very beautiful. Pochampad dam (SRSP) is one of the major projects in Nizamabad.

In the present experimental work Paddy fields of areas like Dichpally, Arepalle, Metrajpalle, Bardipur, Indalwai, Suddapally and other fields in the vicinity of district were selected for observation of BGA members.

The isolated pure cyanobacterial strains were maintained in BG-11 .All cultures were shaken twice to prevent cells clumping and to accelerate the growth process all inoculations were carried out under aseptic conditions. The cultures were periodically monitored for any biological contamination. The axenic cultures were maintained in an exponential growth phase by regularly sub-culturing into fresh medium under same culture conditions.Isolation and culture conditions for the isolation of strains, 1-g soil samples were inoculated in 100ml sterilized BG-11 medium (pH 7.5) without nitrogen. Isolation and purification of the organism were performed by serial dilution and plating method (Stanier *et al.*, 1971). Once isolated in pure form, the cultures were maintain in 250 mL flasks containing nitrogen free BG-11 medium (pH 7.5) at 25±2ºC under 2000 Lux light incubation with 16/8 hour photo period. The culture vessels were hand-shaken four to five times daily to maintain homogeneity. To maintain the axenic culture, repeated sub culturing of each strain was done by transferring into fresh medium in every 20 days. Stock cultures of the test organisms were maintained in the laboratory of Department of Botany, Telangana University. **Fig-1 s**hows shows maintenance of cultures under asceptic conditions

A bright field microscope (Edison) and digital camera was used to study the morphology of the collected algal members. Identification of cyanobacteria was done by using morphological variation studies and taxonomical approaches mentioned in the published literature of Desikachary (1959), and Anand (1989).

Morphological parameters as followed by Mishra *et al.*, 2019 were used for the identification of cyanobacterium. The morphological parameters of cyanobacterium were studied by viewing at Olympus 45X and 10X microscope. Morphological characters were analysed by Magnus Image Projector and image analysis with standards. The stain was assigned to cyanobacterial species following taxonomic description of Desikachary, 1959 & Rippka *et al.*, 1979.

Fig-1: Showing the culture of algal at aseptic conditions and culture flasks.

RESULTS AND DISSCUSSION:- Table-1 indicates the Cyanophycean members collected and identified from paddy fields of Nizamabad district.

Table-4.1 Showing BGA collected from paddy fields

Cyanobactera Members	Family	Order
Chroococcus micrococcus (Kutz.)Nag	Chroococcaceae	Chroococcales
Chroococcus minutus (Kutz.) Nag.	Chroococcaceae	Chroococcales
Chroococcus minor (Kutz.) Nag.	Chroococcaceae	Chroococcales
Chroococcus limneticus Lemm.	Chroococcaceae	Chroococcales
Chroococcus turgidus (Kutz.) Nag.	Chroococcaceae	Chroococcales
Merismopedia minima Beck.	Chroococcaceae	Chroococcales
Merismopedia punctate Meyen	Chroococcaceae	Chroococcales
Merismopedia elegans A. Br.	Chroococcaceae	Chroococcales
Merismopedia marginata	Chroococcaceae	Chroococcales
Merismopedia incerata	Chroococcaceae	Chroococcales
Microcystis flos-aquae (Wittr.) Kirchner	Chroococcaceae	Chroococcales
Gloeocapsa decorticans (A.Br.) Richter.	Chroococcaceae	Chroococcales
Gloeocapsa punctate Nag.	Chroococcaceae	Chroococcales
Gloeocapsa atrata (Turp.) Kutz.	Chroococcaceae	Chroococcales
Gloeocapsa rupestris	Chroococcaceae	Chroococcales
Aphanocapsa biformis A. Br.	Chroococcaceae	Chroococcales
Aphanothece nageli	Chroococcaceae	Chroococcales
Oscillatoria raoi De Toni, J.	Oscillatoriaceae	Nostocales
Oscillatoria princeps	Oscillatoriaceae	Nostocales
Oscillatoria curviceps Ag. Ex Gomont	Oscillatoriaceae	Nostocales
Oscillatoria formosa Bory ex Gomont.	Oscillatoriaceae	Nostocales
Oscillatoria amoena (Kutz.) Gomont.	Oscillatoriaceae	Nostocales
Spirulina laxa G. M. Smith.	Oscillatoriaceae	Nostocales
Spirulina meneghiniana Zanard. Ex Gomont	Oscillatoriaceae	Nostocales
Phormidium fovelarum	Oscillatoriaceae	Nostocales
Phormidium jenkelianum	Oscillatoriaceae	Nostocales
Lyngbya mesotricha Skuja	Oscillatoriaceae	Nostocales

Lyngbya major Menegh ex Gomont.	Oscillatoriaceae	Nostocales
Lyngbya corticicola et Biswas	Oscillatoriaceae	Nostocales
Lyngbya lachmeri	Oscillatoriaceae	Nostocales
Lyngbya criptovaginata	Oscillatoriaceae	Nostocales
Cylindrospermam doryphorum Bruhl et Biswas	Oscillatoriaceae	Nostocales
Anabena azollae Strasburger.	Nostocaceae	Nostocales
Anabena flo-saquae (Lyngb) Breb. Ex Born. Et Flah.	Nostocaceae	Nostocales
Anabena circinalis var. crassa Ghose.	Nostocaceae	Nostocales
Anabena oryzae Fritsch	Nostocaceae	Nostocales
Anabena ferilissima Rao, C.B.	Nostocaceae	Nostocales
Anabena varibilis Kutzing ex Born. Et Flah.	Nostocaceae	Nostocales
Nostoc punctiformi (Kutz.) Hariot.	Nostocaceae	Nostocales
Nostoc muscorum Ag. Ex Born. Et Flah	Nostocaceae	Nostocales
Nostoc commune Vaucher ex Born et Flah	Nostocaceae	Nostocales
Nostoc linckia var. arvense Rao. C.B.	Nostocaceae	Nostocales
Nostoc spongiaeforme	Nostocaceae	Nostocales
Nostoc ellipsosporum (Desm) Rabenh. Ex. Born at Flah	Nostocaceae	Nostocales
Plectonema indica Dixit	Scytonemataceae	Nostocales
Scytonematopsis wornchinii	Scytonemataceae	Nostocales
Scytonema simplex Bharadwaja.	Scytonemataceae	Nostocales
Tolypothrix boutellei	Scytonemataceae	Nostocales
Rivularia aquatica De Wilde	Rivulariaceae	Nostocales
Gleotrichia natans Rebenhorst ex Born. Et Flah	Rivulariaceae	Nostocales
Calothrix epiphytica	Rivulariaceae	Nostocales
Stigonema occelattum	Stigonemataceae	Stigonematales

Characterization of BGA was carried out based on some morphological feateres such as Thallus color, thallus morphology and dimension, size of heterocyst, vegetative and reproductive cells. Heterocyst -forming cyanobacteria were also cultured in *Anabaena* sp., *Nostoc* sp., *Oscillatoria* sp., and *Chroococcus* sp., (Table 1).

As the most of cyanobacteria were associated with other microorganisms, these must be purified from any contaminants, hence exposed to different trials for purification. However, washing, ultra violet irradiation and mercuric chloride treatments were the most effective method for obtaining cyanobacteria cultures free from bacteria, while the other methods gave some success for killing bacteria on one side and some failure of the other side, which could be lethal for cyanobacteria themselves.

These isolates were examined for their morphological and cultural characteristics, according to Venkataraman (1981) & Roger and Ardales (1991), in liquid and solid watanabe medium (Staub, 1961).

Identification of cyanobacterial species:

Class: CYANOPHYCEAE Sachs

Unicellular or multicellular algae without a true nucleus or chromatophore. Protoplast differentiated into peripheral zone with photosynthetic pigments (chromatoplasm) and a central colourless portion with a generative function (centroplasm), and assimilation pigments chlorophyal, phycocyanin, phycoerythrin. carotinoids' contents blue-green, olive-green, yellowish, rose, violet seldom yellow-green. Green or yellowish brown, never really chlorophyll green or real brown coloration seen. Cell wall thin or after gelatinization very thick, colourless, or aften yellow to brown, seldom red, blue of violet coloured. Photosynthetic product glycogen or glycosides, starch absent. Reproduction by division or through endospores, exospores, hormogones, phanococci, seldom through the heterocysts, fragmentation of the thallus and also of the trichome into parts or individual cells (hormogones). Spores or pseudohormogonia (hormocytes). Motile flagellated stages absent. Sexual reproduction not known or absent.

KEY TO THE ORDERS

The class divided into five orders:

1.Unicellular or colonial, sometimes forming a pseudofilamentous colony, never with a trichome organisation, no differentiation into base and apex, endospores not formed in sporangia; no exospores; nannocytes present…………………**……..... Chroococcales**.

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

3. Distinctly filamentous, attached, arrangement very uniform, Chroococcaceous structure, often forming parenchymatous thalli with prostrate and erect filaments, without differentiation into trichome and filaments, no hormogones, no beterocysts, endospores in sporangia……………………………………………………….. **…….Pleurocapsales**

4. Filamentous, with trichome and filament organised or hormogonalen organisation, hormogones present, often with heterocysts, akinetes, exospores, or endospores, pseudo-hormogonia present.

a. Without true branching, unbranched or with false branching……….... **Nostocales**

b. With tree branching or dichotomous branching, and often with heteratrichous condition, i.e., with a differentiation of prostrate and erect portions… ……………………………………………………...…...**Stigonematales**

Order: CHROOCOCCALES Wettstein

Plant unicellular of colonial, sometimes forming a pseudofilamentous colony, never with a trichome organisation, no differentiation into base and apex: endospores not formed in sporangia; no exospores, nannocytes present.

Key to the family

1. Cells unicellular or forming colonies, not forming filament-like growth

…….**Chroococcaceae**.

Family: CHROOCOCCACEAE Nageli

Cells mostly spherical, ellipsoidal, cylindrical, seldom spindle shaped, single or forming colonies; membrane thick, mucilaginous, often lamellated with an overall formation of amorphous mucilaginous masses; colony spherical, ellipsoidal, tabular or hemispherical or shapeless, cell đivision in two or three directions, in elongate cells often only in one direction transverse; cells of many generations in a single parent sheath; multiplication by division, sometimes through nannocytes, spores with firm membranes present in some genera.

Key to the genera

1. **Chroococcus minor:-** Cells nearly spherical. After division daughter cells in gropus of 2-4-8-16 in a gelatinous cells sheath which is often homogenous with the surrounding mucilage bit may be lamellate in some species.
   It is usually forms small groups of cells which can either be free floating or attached. Cells have distinct sheaths which may be reformed after each cell division resulting in a multilayered sheath. Only planktonic species have gas vacuoles. Planktonic species do not tend to have district sheaths since surface layers are often confluent with the surrounding mucilage. Thallus slimy-gelatinous, dirty blue green; cells spherical, 3-4 µ in diameter, irregularly scattered, singly; sheath thin and colourless, hardly visible Desikachary (1959).

Order: NOSTOCALES Geitler

Plants filamentous, with filament and trichome organisation, hormogones present; heterocysts, akinetes,endospores,hormocysts present; true branching absent, false branching present. The filamentous forms include both branched and unbranched forms. The branching is of two types, false branching and true branching.

Key to the families:

1. Trichomes without false branching or with incipient false branching……
2. Trichomes commonly false branched………

1. Without heterocysts; spores commonly absent …………..*Oscillatoriaceae*

2. Trichomes not so differentiated………………………………. *Nastocaceae.*

3. without an intercalary meristematic zone and generally without a terminal hair.
……………. Scytonemataceae

3. with an intercalary meristematic zone and a terminal hair. …...*Rivulariaceae*

Family: OSCILLATORIACEAE Kirchner

Trichomes with a single row of similar and uniformly broad cells, only sometimes tapering at the extreme ends, not forming a hair, not branched, without or with different mucilage or a homogeneous or more or less lamellated firm sheath, generally unbranched but occasionally branched in genera with a firm sheath: growth intercalary in some apical; trichome straight or regularly or irregularly spirally coiled; beterocysts and spores absent; hormogones present, many showing a spiral movement by rotation along the longitudinal axis

Key to the genera

1. Not in bundles ……………………………………………*Oscillatoria*

1. Trichome broader, end cell slightly capitates………….. *O.princeps*

1. ***Oscillatoria princeps*** voucher ex. Gomont

2. Trichomes blue green, more or less brownish, violet or reddish, mostly forming a thallus, mostly straight, not constricted at the cross-walls, 16-pous broad. Trichomes bent or spirally coiled. Commonly 25-50µ, blue green to dirty green, slightly or briefly attenuated at the apices and bent; cell 1 / 11-1/4 as long as broad, 3,5-7 µ long, end cells flatly rounded. End cell slightly capitate.

Family NOSTOCACEAE Kutzing

Trichomes free or in a common mucilage, generally with cells in a single row, cells generally similar throughout, ends or end cells sometimes attenuated, with intercalary growth; sheath thick and gelatinous or thin and firm, homogones present, heterocysts present or absent, when present intercalary or terminal, generally single, in some more than one together, spores present or absent. Single or in series, formed in a definite manner beginning from near the heterocyst or in between two of them.

Key to the genera

1. Heterocysts present commonly terminal with a single large spore adjoining ………………………………………………………………..…..*Cylindrospermum*
2. Filaments single or in a formless gelatinous mass……………………..…… *Anabaena*
3. Filaments generally in a definite colony, thallus otherwise………………..…*Nostoc*

CYLINDROSPERMUM Kutz

Thallus mucilaginouos, mostly dull blue-green; trichome uniformly bread. Short. without sheath, but in a common mostly very delicate and often imperceptibles mucilage of thin consistency: cells cylindrical, constricted at the cross walls; heterocysts terminal, at both ends or at one end only, sometimes intercalary, spores single, rarely in series, next to the heterocyst on one side much bigger than the vegetative cells.

Key to the species

1. Spores with sculptured epispore, with papillae spores10-15X20-30 (-30) µ ……………………………………………………………….*C. majus*

Cylindrospermun majus Kützing ex Born. et Flah.

Thallus expanded, mucilaginous, blackish green; trichome 4-5 µ broad, constricted at the cross-walls, light blue-green; cells cylindrical,5-6 µ long: heterocyst terminal, oblong, somewhat broader than the trichome, up to about 10 µ long; spores ellipsoidal, 10-15 µ broad, 20-30 µ long, epispore brownish with distinct papillae.

ANABAENA Bory.

Trichomes uniformly broad throughout or apices alone somewhat attenuated, sheath absent or more or less diffluent, forming a free, torn or floccose or soft mucilaginous thallus; heterocysts generally intercalary; sports single or in long series, formed form near the heterocysts or in between the heterocysts.

Key to the species

1. Trichomes spirally coiled, 8-10 μ broad, with gas-vacuoles, akinetes 16-18 μ broad. up to 34 μ long………………………….*A. circinalis*

Anabaena circinalis Rabenhorst ex Born. et Flah.

Thallus frothly, floating; trichome mostly circinate, seldom straight, mostly without a sheath, 8-14\mu broad, cells barrel-shaped or spherical, somewhat shorter than broad, with gas-vacuoles: heterocysts subspherical, 8-10 μ broad: spores cylindrical, sometimes curved. ends rounded, 16-18 μ broad up to 34 μ long, Ordinarily away from the heterocysts epispore smooth and colourless.

NOSTOC Vaucher

Thallus mucilaginous, gelatinous or coriaceous, first globose to oblong. later globose, foliose, filiform, bullose, solid or hollow, free or attached, the periphery dense and darkly coloured; filaments flexuous, curved or entangled: sheath sometimes distinct, generally diffluent; trichome torulose: cells depressed, spherical, barrel-shaped or cylindrical; heterocysts intercalary, and in young condition terminal; spores spherical or oblong, formed centrifugally in series in between the heterocysts.

Key to the species

1. Trichomes with no definite mode of arrangement........ *N.muscorum*

Nostoc muscorum Ag. ex Born. et Flah.

Thallus gelatinous membranous, irregularly expanded, attached by the lower surface, tuberculate, dull olive or brown, 2-5 cm diam; filaments densely entangled: sheath distinct only at the periphery of the thallus, yellowish brown; trichome 3-4(-5) H broad; cells short barrel-shaped to cylindrical, up to twice as long as broad; heterocysts nearly spherical, 6-7 μ broad, spores oblong, many in series, 4-8 μ broad. (7-) 8-12 μ long, epispore smooth and yellowish.

Order: STIGONEMATALES Geitler

Heterotrichous filamentous forms showing true branching, mostly with heterocysts and usually showing clear pit connections between cells. Multiplication by hormogones and pseudohormogonia, more rarely akinetes.

Key to the family

1. Branching true and lateral ....*Stigonemataceae*

Family: STIGONEMATACEAE Kirchner

Thallus made of free variously bent filaments; filaments irregularly laterally branched with one or more rows of cells; often with main and lateral filaments; lateral branches short with Jonger cells, often growing erect and forming hormoganes; main filaments often prostrate , often forming spores or in a chroococeaceous stage growth of filaments by the division of an apical cell: branch intiation by the longitudinal division of the parent cell; heterocysts intercalary or lateral and sessile, pedicellate heterocysts absent; hormogonia present, spores and hormocysts occasionally present.

Key to genera

1. Filaments prostate without a distinct erect system...........Stigonema

STIGONEMA Ag.

Thallus of free irregularly laterally branched, variously curved filaments in order parts with two to many rows of cells; sometimes with apical growth and division; lateral branches like the prostrate parent filaments and as many rows of cells as the main filaments, sheath when young close to the trichome in older ones broader, old filaments with Gloeocapsa-like sheath and cell grouping: heterocysts intercalary or lateral; homogonia formed at the end of young branches, two 10 a few celled, seldom many celled.

Key to the species

1. Filaments 24-45μ broad. ....*S. ocellattum*

Stigonema ocellatum **(Dillw.) Thuret ex Bom. et Flah.**

Thallus cushion like, caespitose, woolly or tomentose, brownish: filaments prostrate or partly erect, about 3-8 mm high, 35-45(-50) μ broad, irregularly branched; branches as broad as or smaller than the main filament, at the ends with. hormogones; sheath thick, mostly distinctly lamellated, mostly yellow to brown, sometimes colourless in the young portions at the ends of filaments; cells in a single row or in two rows, often wider than long, 18-30 μ broad, with a colourless or brown individual envelopes: heterocysts mostly lateral, sparse, hormogones 50.65 al long and about 15u broad.

SUMMARY AND CONCLUSION:-

The present study reveals that more than 50 species under 11 genera of BGA are found to occur in rice field soil, water and nearby rice field which are *Microcystis marginata (Menegh) Kutz., Chroococcus turgidus (Kutz.) Nag.,Aphanocapsa banaresensis Bharadwaja., Aphanocapsa Montana Cramer, Aphanothece microscopic Nag., Aphanothece saxicola Nag., Merismopedia elegans, A. Br., Oscillatoria accuminata Gomont., Phormedium tenue (Menegh.) Gomont., Phormidium uncinatum (Ag.) Gomont., Nostoc commune Vaucher ex Born et Flah., Nostoc linckia var. arvense Rao, C.B., Nostoc paludosum Kutz. Ex Born. et Flah. Nostoc punctiforme (Kutz.) Hariot, Anabaena azollae Strasburger., Anabaena* *orientalis Dixit., Anabaena oryzae Fritsch., Anabaena variabillis Kutzing. Ex Born. et Flah., Aulosira fertilissima Ghose., Scytonema bohneri Schmidle., Scytonema hofmanni Ag ex. Born. et Flah., Scytonema simplex Bharadwaja. And Calothrix, marchica Lemmermann.* A total 13 filamentous heterocystous blue green algae belonging to genera *Nostoc Anabaena Aulosira ,Scytonema* and *Calothrix* and 3 filamentous non heterocystous form which are Oscillatoria and *Phormidium* were recorded.

Cyanobacteria contribute greatly to global primary production, fixing a considerable measure of biologically available carbon, especially in nutrient-limited environmental niches, from oligotrophic marine surfaces to desert crusts (Partensky *et al.*, 1999; Garcia-Pichel *et al.*, 2003). In addition, cyanobacteria are key conferrer to global nitrogen fixation (Zehr *et al.*, 2008), and many produce unique secondary metabolites (Welker and Von Dohren, 2006).

ACKNOWLEDGEMENT:-

We are grateful to **Prof. Vidyavati,** Former Vice-Chancellor of Kakatitya University, Warangal, Telangana State for her constant encouragement and valuable suggestions.

REFERENCES:-

1. Anand, N., (1989). Hand book of blue-green algae. Bishen Singh Mahendra Pal Singh, Dehra Dun. P. 77.
2. Bhattacharya, S., Deep, P.R., Sahu, J.K. and Nayak, B. 2013. Diversity of Rice Field Cyanobacteria from Tropical Rice Field of Western Odisha. Internat. J. Sci. Res. 4(8): 121-124.
3. De, P.K. 1939. The role of blue green algae in nitrogen fixation in rice fields. Proc. R. Soc. Lond. Serb. 127: 121-139.
4. Desikachary, T. V. (1959). “Cyanophyta”. Indian Council of Agricultural Research. New Delhi, 686 pp.
5. Fay, P. 1983. The blue green (Cyanophyta- Cyanobacteria), (Arnold-Heinemann, London).
6. Garcia-Pichel F, Belnap J, Neuer S, Schanz F (2003). Estimates of global cyanobacterial biomass and its distribution. Algol Stud 109:213–227.
7. Gupta,K.K. and Pandy,D.J.(1979).Potential use of cyanobacterial species in bioremediation of industrial effuents. Arch. Microbiol., 195.
8. Hoffmann, L. 1989. Algae of terrestrial habitats. The Botanical Review 55: 77-105.
9. Kaushik, B.D. (2014). Developments in Cyanobacterial Biofertilizer. Proc Indian Natn Sci Acad. Spl. Sec. 80 (2): 379-388.
10. Kiran Gupta and P.P. Baruah, (2017). Isolation, identification and characterization of rice field Calothrix spp. of Assam. *J. Algal Biomass Utln.* 8(4): 77-81.
11. Knoll, A., (2008). Cyanobacterial and earth history, In: Herrero A, floreE, Eds. The cynobacteria molecular biology, UK, Casiter Academic Press pp.1-20.
12. Martinez, M.R. (1984). Algae: biofertilizer for rice. Philippines Council for Agricultural Research and Resources Development (PCARRD), Monitor 12: 9-12.

13. Mishra S.K., J.Songh, A.R. Pandey & N. Dwivedi (2019). Indole-3-acetic acid production by the cyanobacterium Fishella musciola NDUPC001. Current science 116(7): 1233-1237.
14. Nayak, S., Prasanna, R., Dominic, T.K., Singh, P.K., (2001). Floristic abundance and relative distribution of different cyanobacterial genera in rice field soil at different crop growth stages. Phykos 40: 14-21.
15. Parensky, F.; Blanchot, J. & Vaulot, D., (1999). Differential distribution and ecology of Prochlorococcus and Synechococcus in oceanic water.- In: Charpy, L. & Larkum, A. W. D. (Eds.): Marine Cyanobacteria, p. 457-475. Inst. Oceanogr. Monaco, pp.457-475.
16. Rippka, R., J. Deruelles, J.B. Waterburry, M. Herdman and R.Y. Stainer (1979). Generic assigenements, strains Histories and Properties of Pure culture of cyanobacteria. Journal of general microbiology, 111: 1-61.
17. Roger, P.A. and Ardales, S. (1991). "Blue-Green algae collection". International Rice Research Institute, IRRI, Pub. Manila, Philippines.
18. Roger, P.A., Zimmerman, W.J., & Lumpkin T.A., (1993). Microbiological management of wetland rice fields. Fots meeting Jr. (ed), Soil microbial ecology. Application in agricultural & environmental management, M.Deleker New York, 417-455.
19. Singh, D. P., Khattar, J. I. S., Gupta, M. and Kaur, G., (2014). Evaluation of toxicological impact of cartap hydrochloride on some physiological activities of a non-heterocystous cyanobacterium Leptolyngbya foveolarum. Pest. Biochem. Physiol. 110: 63-70.
20. Srinivas, M., Aruna, M., (2016). Diversity of Blue Green Algae from Paddy fields. International journal of Sciences, 5: pp-27-30.
21. Stanier, R.Y.; Kunisawa, R.; Mandel, M. & Cohen-Bazire, G., (1971). Purification and properties of unicellular blue-green algae (Order Chrococcales). Bact. Rev. 35 : 171-205.
22. Staub, R. (1961). "Ernahrungsphysiologisch aurakologische untersuchengen an der planktischen blualg Oscillatoria rubescence D. C". Scheweiz. Zeitschr Hydrobiologie, 23:82-198.
23. Stewart, W.D.P., P. Rowell, N.W. Kerbly, R.H. Reed and G.C. Machray., (1987). N2–fixing cyanobacterioa and their potential applications. Phil. Trans. R. Soc. Lond. 17: 245-258.
24. Venkataraman, G.S. (1981). "The cultivation of algae". Indian Council Agric. Res., New Delhi, India.
25. Venkataraman, G.S. (1993). Blue-green algae (Cyanobacteria). Pp. 45-76 In: Biological nitrogen fixation, S. N. Tata, A. M. Wadhwani and M. S. Mehdi (eds). *Indian council of agriculture research*, New Delhi.
26. Welker, M, Von Dohren H (2006). Cyanobacterial peptides: nature's own combinatorial biosynthesis.FEMS Microbiol Rev 30: 530-563.
27. Whitton BA, Potts M (2000) Introduction to the cyanobacteria. In: Whitton BA, Potts M (eds) Ecology of cyanobacteria: their diversity in time and space. Kluwer Academic Publishers, Dordrecht, pp 1–11, 689 pp.

28. Whitton BA, Potts M., (2000). Introduction to cyanobacteria. In Whitton BA, Potts M (eds), The ecology of cyanobacteria: Their diversity in time and space (pp. 1–11). Dordrecht: Kluwer Academic.
29. Whitton, B.A., (1992). Diversity, ecology and taxonomy of the cyanobacteria. In: Mann N.H., Carr N.G. (eds) Photosynthetic prokaryotes, Plenum press, New York, pp. 1-51.
30. Whitton, B.A., (2000). Soils and rice fields. In; The Ecology of Cyanobacteria Ed. Whitton, B.A. and M. Potts, Kluwer Academic Publishers, Dordrecht, pp. 233-255.
31. Zehr JP, Bench SR, Carter BJ, Hewson I, Niazi F, Shi T, Tripp HJ, Affourit JP (2008). Globally distributed uncultivated oceanic N_2 fixing cyanobacteria lack oxygenic photosystem II. Science 322:1110–1112.