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Morphological studies on certain Non-heterocystous filamentous Blue-green algae

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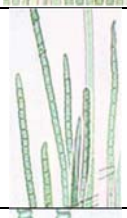
Abstract
The present study of Non-heterocystous filamentous Blue-green algae is based on observation of cyanobacterial culture isolated from various habitats of different districts of Uttar- Pradesh. The studies revealed the occurrence of 16 genera *Pseudanabaena* Lauterborn 1915, *Limnothrix* Meffert 1988, *Jaaginema* Anagnostidis et Komarek 1988, *Geitlerinema* Anagnostidis 1989, *Spirulina* Gomont ex Turpin 1892, *Leibleinia* (Gomont) L. Hoffmann 1985, *Schizothrix* Kutzing ex Gomont 189, *Arthronema* Komarek et Lukavsky 1988, *Planktothrix* Anagnostidis et Komarek 1988, *Pseudophormidium Anagnostidis et Komarek* 1988, *Phormidium* Kützing ex Gomont 1892, *Porphyrosiphon* Kutzing ex Gomont 1892, *Microcoleus* Desmazieres ex Gomont 1892, *Symplocastrum* Gomont 1892, *Oscillatoria* Vaucher ex Gomont 1892, *Lyngbya* C. Agardh ex Gomont 1892, in different habitats Pond. ditches, up and low land rice fields soil and stones of districts Allahabad, chitrakoot, Banda, Fatehpur, Kaushambi, Pratapgarh and Mirzapur of Uttar- Pradesh. All these Non-heterocystous filamentous Blue-green algae were characterized for morphological features like colour of thallus, sheath character, diameter of cells, present or absent of aerotopes, motality and reproduction.

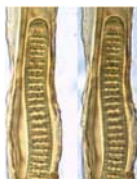
Keywords: Oscillatoriales Cyanoprokaryotes

Introduction
Blue- green algae or Cyanobacteria are one of the important groups of the word. Blue- green algae are prokaryotic micro-organism with oxygen evolving photosystem and they are known to have bestowed a plant characteristic chloroplast to heterotrophic eukaryotic cell by the process called endosymbiosis.
Organism without heterocyst akinetes are called Non-heterocystous filamentous Blue-green algae and dominated on earth for about 2 billion year ago.
At the global level members of Oscillatorials have been studies by many workers like Drouet (1968, 1981), Castenholz (1968), Baker and Bold (1970), Faridi and khalil (1974), Hindak (1985), Anagnostidis and Komerek (1988), Anagnostidis (2001), Komerek and Anagnostidis (2005).
In India Non-heterocystous filamentous Oscillatorial have been studies by many workers some recent publications include Santra, Anand, Adhikari, Tiwari (1975), Grover and Pandhol (1975), Hazarika *et al*. (2002), Kamat (1962-1963), Kumawat and Jawale (2001,2006) and Mishra and Srivastava (2005), most of these studies are based on single collection or record from enrichment cultures. Except Yadav and Pandey (1982), no effort was made to study them critically under culture condition.
Most of Indian authors were interested in study of Non-heterocystous filamentous Blue-green algae because of their ability and use in biofertiliser technology. Therefore the present study was aimed to reveal morphological comparative studies of 16 genera of Non-heterocystous filamentous Blue-green algae.

Material and Methods
Non-heterocystous filamentous Blue-green algal samples (total 75 genera) were collected from seven disticts of U.P. ofter a thorogh scrutiny samples only 16 genera were selected for study in present work. Prepration of BG-11 (stanier *et al.* 1971). Prepration of trace metal mixture. Prepration of *Spirulina plateis* medium. Macro observation has been taken with the help of Nikon coolpin 8400 digital camera and micro observation have been taken with the help of Leica DMLB microscope and DC 300 camera with Quin imaging system.
Non-heterocystous filamentous taxa were studied by examining their morphological characters and identification was confirmed by cross-checking with the authentic illustration and description of related papers, Monographs and manuals of Tilden (1910), Geitler (1932), Tiffany (1952), Desikachary (1959), Anagnostidis and Komerek (1988, 2005).

The present work have been mentioned with the help of comparative chart of sixteen genera shown below

Gen-era	Identical features	Figures	Thallus and colour	Sheath	Diameter of cells	Const. at cross-walls	Aerot-opes	Motality	Reproduction
1. *Pseudanabaena*	Uni-cells, terminal cells cylindrical rounded		Solitary tri. or in fine mats	Fine, diffluent Mucilage	1-1.5 x 2	Central perforation in cross-walls & ring between cells	- or terminal	Slow gliding	Binary fission i.e. one to several or multicelled hormogonia.
2. *Limnothrix*	Usually cells longer than wide, apical or central aerotopes		Dark blue-green, mucilaginous, Fascicles or cluster	- or fine	1x5	Very slightly const.	+ i.e. both side of cross wall	Trembling or gliding	Disintegration of trichomes into non-motile hormocytes without necridic ce**lls**
3. *Jaaginema*	Cells cylindrical, longer than wide		Thin, membranaceous Cluster, blue-green	-	1-3 x 1-4	-	-	-	By fragmentation without necridic cells
4. *Geitlerinema*	Cells longer than wide, apical cells hooked or bent		Thin delicate, bright blue-green or brown	-	2-6 x 8	- or rarely	-	Intense gliding in the forward & backward or waving & circling	By disintegration of trichomes into motile hormogonia without necridic cells
5. *Spirulina*	Regular close to tight screw like coiled		Fine compact mucila. mats, dark blue-green,	-	0.08 x 2.5	Cross-walls thin	-	Intense motile (gliding, rapid clock wise or anti clock wise)	Fragmentation into motile hormogonia without necridic cells
6. *Leibleinia*	Filaments solitary or small groups, mostly epiphyte, attached along their length		Dull blue-green	Colour-less, firm, thin	0.8 x 6-7	-	-	-	By non-motile hormogonia or hormocytes, without necridic cells
7. *Schizothrix*	Sheath usually with one to several trichomes		Clusters, fascicles, mats, crusts	Obligatory, thick (closed)	3-4 x5-6	Slightly or -	-	Hormogones motile	Hormogonia without necridic cells
8. *Arthrospira*	± regular loose Screw like coiled		Fine mats or irregular mat, Light yellow blue-green	-	5-6 x 4-6	Cross-walls thick	+ Facultative	Rarely motile	by fragmentation of trichomes into short hormogonia or hormocytes with the help of necridic cells

9. *Planktothrix*	Water bloom, aerotopes over whole cell		Free floating forming water bloom	-	7-10 x 5.5	-	Scattered over whole cell volume	Trembling & gliding forward and backward	Immotile hormocytes
10.*Pseudophormidium*	*Scytonema* like false branching,		Tufty, Fils. often densely entangled, tuft	Thin	1-5 x 1-5	+	-	-	Hormogonia formed mainly apical part of trichome & growth at both side
11.*Phormidium*	Distinctly motile in side sheath		Mat, expanded, almost leathery felt like to leathery cluster	Rarely + Under stress condition	4-10 x 1.4-10	faculta-tive or obliga-tory in old	-	Gliding trembling, oscillation	By fragmentation of trichomes with the help of necridic cells
12. *Porphyrosiphon*	One trichome in red, firm, thick coloured sheath		Compact or mats	Firm, thick, lamellated, red coloured but not stable	18-20 x6-11	±	-	-	By fragmentation of filaments or trichomes into hormogonia
13. *Microcoleus*	Often rope like contorted, sheath open at end		Fine, thin strata	Wide, homogeneous	3-4 x 6.7	Rarely present	-	-	Frequently by fragmentation of trichomes into short hormogonens
14 .*Symplocastrum*	Parallel and tightly linked filaments with thick common sheath		Felt like, tuft, expanded, fascicles erect, pseudo branched.	Wide, coloured, firm, lamellated, cont. few to no. tris.	5-6x5	+	-	-	by hormogonia
15. *Oscillatoira*	Isopolar trichome with out sheath, cells width more than length		Smooth, layered	Usually -	4-59 x1.5-7	- rarely +	-	Oscillation, gliding	By fragmentation of trichomoes into Short hormogonia with necridic cells
16. *Lyngbya*	Trichomes with sheath mainly compact rarely solitary		Large, leather like strata	Firm, usually +	5-18 x 1-5	±	-	-	By fragmentation of filaments into ± short motile hormogonia

Result and discussion

The paper deals with the taxonomic description delineations of 16 non-heterocystous Cyanobacteria recorded from different habitats but most of genera recorded from paddy fields of various districts of U.P. out of 16 genera 5 genera having thick sheath. Sheath of *Schizothrix*, *Symplocastrum* and *Microcoleus* usually with one to several trichomes. *Lyngbya* and *Porphyrosiphon* showing single trichome within sheath. *Pseudophomidium* showing *Scytonema* like false branching. *Planktothrix* forming water bloom and aerotopes present whole cell. *Geitlerinema* and *Phormidium* are very sensitive to light and growing in low light intensity. *Oscillatoria priceps* was thickest (20-56 micro meter broad) form among all Oscillatoriales. *Spirulina* and *Arthrospira* are widely used in medicine and trichomes are screw like coiled.

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