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Taxonomic study of the Genus Anabaena (*Nostocophyceae Cyanophyta*) from Chickan Lake.Distt:Dadu.Sindh, Pakistan

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ABSTRACT: 11 species of blue green algae belonging genus Anabaena have been collected from three stations of Chickan Lake, District, Dadu, Sindh, Pakistan, during January 2013 to December 2013.

KEYWORDS: Taxonomy, *Anabaena*, Chickan Lake.

INTRODUCTION OF LAKE

Chickan Lake is the largest & oldest salt water lake in Sindh, it is located at Palh village 26º 57'33.94 N, 67º 51' 06. 10 E, nearly 25 Km in north from Dadu city. The Lake covers an area of 142 Hectors. The Lake collects water from numerous small agriculture channels from(Dadu canal). It was nearly 12 meters deep in the beginning but continually silting and deposition of decaying plants have decreased the depth up to 5 to 7 meters.

There are few studies of this genus have made from Pakistan for taxonomic point of view (Leghari *et al*, 2000, 2002; Sahato *et al*, 2003;Lashsri *et al,* 2008; 2009; 2014), but no taxonomic investigation was made so for.

A collection of *Anaebaena (Cyanophyceae*) was made from three stations of Chickan Lake, and detailed taxonomic study was carried out (Naz *et al,*2004a,b).The present work was described with the taxonomy of *Anabaena* in three stations of Chickan Lake.

MATERIAL AND METHODS

Three sampling stations established in Chickan Lake 1.Palh Village, inlet water from Dadu canal through river Indus.2.Fishing spot, centre of the Lake.3.Miyani village, Outlet of Lake,(fig 1). The methods used for the collection and studies of materials were the same as described with the previously (Naz et al.2004a;Lashari et al.2008,2009).The *Anabaena (Cyanophyta)* species were taxonomically described with the help of literature (Gomont.M,1892; Forti.A,1907; Tilden.J,1910;Fremy.p,1929; Geitter.L,1932;Desikachary,1959).

RESULT AND DISCUSSION

On the basis of their morphological characteristics 11 species of *Anabaena* systematically arranged according to the recently proposed classification.

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Class Nostocophyceae: filamentous, heterocyst's without true branching

Order Nostocales: Plants filamentous, with filament and trichome organization, hormogones present; heterocyst's, akinate endospores, hormocysts present; true branching absent, false branching present.

Family Nostocaceae: 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; hormogones present; heterocyst's present or absent, when present intercalary or terminal, generally single, in some more than one together; spores present or absent, singly or in series, formed in a definite manner beginning from near the heterocyst or in between two of them.

KEY TO SPECIES

Trichome straight_____1

Trichome irrigular_____2

1. Akinate spherical or sub- spherical _____3

1. Akinate otherwise _____4

2. Heterocyst barrel shaped _____*A.iyengarii*

2. Heterocyst spherical _____ 5

3. Akinateon one side of heterocyst_____6

3. Akinate on both sides of heterocyst _____7

4. Akinate barrel shaped with flattened end _____*A. variabilis*

4. Akinate ellipsoidal _____ *A. iyengarii var.tenuis*5.Akinate not contiguous with the intercalary heterocyst's but occasionallynext to the terminal heterocyst's_____ *A. oryzae*

5. Akinate up to 3-4 time as long as broad with round end _____*A. oscillarioides*

6. Heterocyst round 4-6.µ _*A.inaequalis*

6. Heterocysts sub- spherical _*A. spiroids*

7.Heterocysts 6-6.6 µ broad ___*A. orientalis*

7.Heterocysts 8-10 µ broad___*A. circinalis*

1. *Anabaenaoryzae*(Fritsch)

Fritsch, 1929; Desikachary, 1959

Characters

Thallus soft, green, gelatinous, membranous, trichomes short, straight, densely aggregated, generally paralleled cells 2.5-3µ (4.0µ) broad, more or less barrel- shaped 1½ -2 times as long as broad; heterocyst's terminal and intercalary, broader than the vegetative cells, 3-3.5µ (4.5µ),(6 µ) broad;spores rarely single next to terminal heterocyst's,spherical or short ellipsoidal 9 m in diameter, 12µ long, akinete yellowish brown.

Geographical distribution:

Faridpur,Bengal (Fritsch,1929),Pakistan.

Locality: Miyani village outlet of the lake

Remarks:It was reported from Miyani village outlet of a lake in the month of April, This species occurred large quantity in Spring Season at surface water.

2. *Anabaena spiroids* (klebahn)

Forti, 1907; Fremy, 1929; Geitler1932, Desikachary, 1959.

Characters:

Trichome single, free floating, regularly spirally coiled, spiral 45-54 µ (45 µ) broad. Cells spherical 6.5-8 µ (6 µ) broad. Spores spherical.

Geographical distribution:

India, Hyderabad (Ghousuddin, 1936), Calcutta (Biswas1942), Burma, (Skuja, 1949).Pakistan.

Locality: Palh village inlet water sources from Dadu canals through river Indus.

Remarks: It has been recorded first time from Chickan Lake. Collection mad from Palh village inlet water source of Lake during January 2013-December 2013.It has been observed large quantity.

3.*Anabaena circinalis var. crassa*(Ghose)

Forti, 1907; Geitler1932; Fremy, 1933; Desikachary, 1959.

Characters:

Trichome free floating single semicircular loosely coiled, cells nearly spherical cell 5-7 µ (5.5 µ) broad.

Geographical distribution:

Bengal (Biswas, 1926), Pakistan.

Locality: Fishing spot centre of the Lake.

Remarks: The collection was carried out in the month of June 2013, during summer season it recorded low quantity, but in winter season this species recorded in large quantity in the lake.

4.*Anabaenaorientalis Var. ellipsospora* (Rao,C.P)

Rao, 1937; Desikachary, 1959.

Characters:

Trichome 3.3-4 µ broad, apical cell 1.6 µ broad, cells 3.3-11 µ long; heterocyst's 6-6.6 µ broad and 6-11.6 µ long; spores one or two together on either side of the heterocyst's, 9.6-13.5µ broad and 11.6-19.8(23)µ long.

Geographical distribution:

India,Benaras (Rao,C.B,1937),Pakistan.

Locality: Palh village inlet water source from Dadu canal through river Indus and fishing spot centre of the Lake.

Remarks: Collections were carried out from two spot of Chickan Lake during August 2013. It occurred in bloom condition in both spot.

5.*Anabaenavariabilis* (kutzing ex Born.et Flah).

Bornet, 1888; Forti, 1907; Fremy, 1929; Geitler, 1932; Desikachary, 1959.

Characters

Thallus gelatinous, dark-green; trichome without any sheath, flexuous, 4-6 µ broad, more often 4.2-5 µ broad slightly constricted at the cross-walls,end-cells conical, obtuse; cells barrel-shaped ;heterocyst's spherical or oval, 6 µ broad, up to 8 µ long; spores formedcentrifugally, not contiguous with the heterocyst barrel- shaped, in series,7-9(-11) µ broad.8-14 µ long, epispore smooth, or with fine needles, colorless or yellowish brown.

Geographical distribution:

Burma (Ghose, 1924); Lahore (Ghose, 1924).Rangoon (Ghose, 1927); Calcutta (Banerji, 1938), Pakistan.

Locality: Miyani village out let of Lake.

Remarks: It was recorded for the first time from Chickan Lake, Dadu, Sindh, Pakistan.It appeared high quantity in Miyani spot out let of lake. It was mixed with *Nostoc* species.

6. *Anabaenaoscillarioides* (Bory.ex Bornet Flah)

Bory,1822;Bornet,1888;Forti,1907;Fremy,1929;Geitler1932;Fremy,1933;Desikachary,1959.

Characters

Thallus gelatinous, dark green , trichome 4.2-6 µ broad; cells barrel- shaped as long as broad; heterocyst's spherical or oval, 6-8 µ broad, 6-10 µlong, spores on both sides of the heterocyst's; single or 2-3, at first oval, later rounded cylindrical.8-10 µ broad, epispore smooth and pale brown.

Geographical distribution:

India,Bombay,(Gonzalve,1943a);Ragoon,(Skuja,1949).Pakistan.

Locality: Fishing spot centre of the Lake.

Remarks: Collection was made from fishing spot centre of the Lake during September 2013. It appeared in large quantity in free floating state.

7. *Anabaenaiyengarii* (Bharadwaja)

Singh, 1938b; Gupta, 1953;Desikachary, 1959.

Characters

Trichome single or irregularly curved, 5.2-6.3 µ board, end-cell conical with rounded apex; cells barrel - shaped, as long as broad, or slightly shorter or longer than broad, heterocyst's barrel – shaped, rarely spherical,7.3-8.4µ broad and 7.3-10.5µ long; spores ellipsoidal, spore thick, smooth and yellowish brown.

Geographical distribution:

India (Rao,1938).Pakistan

Locality: Palh village in let water sources, fishing spot centre of the lake,Miyani village out let of the lake.

Remarks: It was recorded from oligotrophic lake during summer2013,It occurred high quality in summer season and favorable for its growth.

8. *Anabaenaiyengarii var. tenuis* (Rao,C.B).

Rao.1937; Desikachary, 1959.

Characters

Plant mass floccose, thin, free- floating , pale blue-green; trichomes single, straight or irregularly, curved, 3.5-4.5 µ broad, end cells conical with rounded apices, cells barrel-shaped, as long as broad, or slightly shorter than or long than broad,(2.5)3-6. 4 µ long; heterocyst's more or less barrel- shaped, sometimes spherical, 4.8-6.4 (-8) µ broad and 5.2-9 (-12) µ long; spores ellipsoidal, or cylindrical, with rounded ends, single or in pairs on either side of heterocysts,7.5-9.6 µ rarely 10.5 µ broad and 9-19 µ rarely 21(-24) µ long, with smooth hyaline outer wall.

Geographical distribution:

India, Allahabad (Gupta, 1953).Pakistan.

Locality: Miyani village out let of the Lake.

Remarks: Collections were collected during July and September 2013.Specimens collected during July (Rainy day) was high quantity and obtained during September in low quantity.

9. *Anabaenaaequalis* (Borge)

Borge, 1907; G.W Preacott, 1961.

Characters

Trichomes straight, forming a small plant mass, or scattered among other algae; cells somewhat quadrate or barrel-shaped, (4.5)- 5.5-7.5 µ in diameter, 7.6-8.5 µ long; heterocyst's ovate to sub-cylindrical (5.5)-8 µ in diameter,(10)-13-(15.2) µ long; gonidia cylindrical remote from the heterocyst's, the wall smooth and colorless;5-7.6 µ in diameter (21)-35-41-(49.4) µ long.

Geographical distribution:

India Madras;Malyan lake (Nygaard.G 1926).Pakistan.

Locality: Palh village, in let water from Dadu canal through river Indus.

Remarks: It was reported for the first time from Sindh and it was collected from Palh village, inlet water from Dadu canal through river Indus, due to favorable condition it was found in large quantity.

10. *Anabaenainaequalis* (kuetz. Bornet and Flahault)

Bornet,1888;G.W.Prescott 1961

Characters

Cells broadly barrel-shaped,4-5 µ in diameter, heterocyst's rounded, 6 µ in diameter; akinates single or in group of 2-3, cylindrical, 6-8x14-17µ, smooth, yellow, trichomes straight, parallel , sheath absent or distinct around akinetes, forming blue-green masses.

Geographical distribution:

India; Benaras, Numdur (Rao, 1937, 1938).Pakistan.

Locality: Fishing spot, centre of the lake.

Remarks: The collection has been carried out in fishing spot; centre of the lake, during summer season 2013.It was mixed with other algae and floating free in marginal water.

11. *Anabaena oscillarioides var. angustus* (Bharadwaja).

Bory,1822;Bornet,1888;Forti;1907;Fremy,1929;Geitler,1932,Fremy,1933; Desikachary,1959.

Characters

Trichomes single, irregularly bent or spirally coiled 4.2-5.2 µ broad, end cell rounded; cells barrel-shaped, as long as or slightly shorter or longer than broad, heterocyst's intercalary, very rarely terminal, ellipsoidal, 5.2-6.3 µ broad and 7.3- 10.5 µ long, spores long, cylindrical, single or in short or long chains, on both sides of the heterocyst's, 6.5-8.4 µ board and 14.7-41.0 µ long, epispore smooth yellow brown.

Geographical distribution:

Rain water pools, Borivli near Bombay,(Gonzalves and Joshi,1943a) Royal lakes, Rangoon (Skuja,1949).Pakistan.

Locality: Miyani village out let of lake

Remarks: It has been collected for the first time from Miyani village, out let of lake. It was mixed with *Calothrix, Raviloria* and *Nostoc* in Chickan Lake.

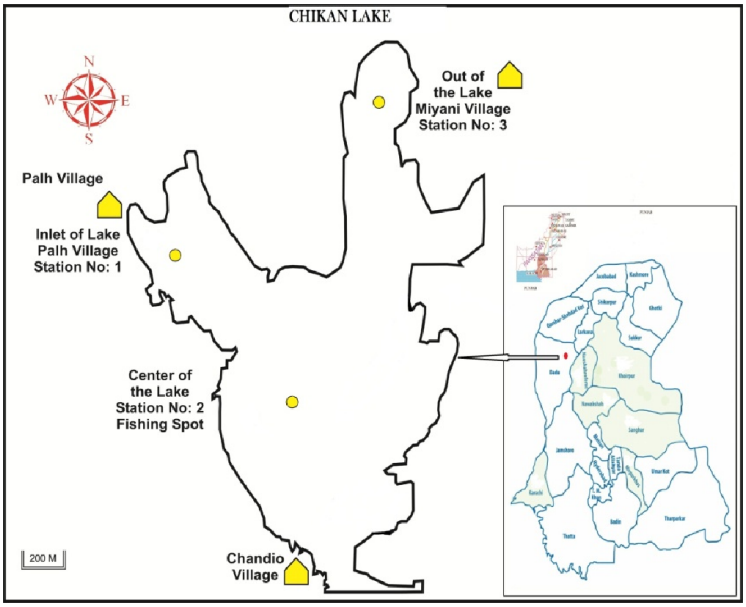

Fig 1. The position of three selected Stations at Chickan Lake.

1, Palh Village2, Fishing Spots 3, Miyani Village

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