

A DETAIL STUDY OF CYANOPHYCEAN ALGAE OF UPPER BRAHMAPUTRA VALLEY, ASSAM, INDIA

***D. Hazarika**

D. R. College, Golaghat

**Author for Correspondence*

ABSTRACT

The Upper Brahmaputra Valley (includes 5 sub-division of 3 Districts of Upper Assam viz. Golaghat, Jorhat and Sivasagar) shows luxurious growth of Blue-Green Algae (BGA) in natural habitat in rice field, moist soil surface and low lying area of the studied area. Collection also made from hot water springs of Nambor Reserved forest. About 78 species of blue-green algae belonging to 20 genera were collected and duly identified where 61 were newly reported from this area. The present work can enrich our knowledge of BGA flora of this state.

INTRODUCTION

During the last decades much work has been done on soil algae and established the existence of algal flora (Banerji, 1935; Rao, 1938; Singh R.N. 1939; Bhardwaja, 1940; Subba Raju, 1972; Shitina, 1972 etc.). Attempts have been made to study the algal flora of soils, rice fields, user soils and hot springs in our country still today (Singh, 1961; Mitra, 1951; Gonzalves, E.A., 1947; Gonzalvas and Gangla, 1949; Dutta and Venkataraman, 1958; Gonzalvas and yalavigi, 1959; Thomoas *et. al.* 1965c & 1965d; Subba Raju, 1967 & 1972; Desikachary, 1959 & 1972 & 1982; Prashad and Srivastava, 1968 & 1992; Sinha and Mukharjee, 1975; Hazarika, 1988 & 1990; Deshmukh, 2008). Rice field conditions provide an ideal environment for the luxurious growth of algae Watanabe 1962; Shitina, 1972 ; Subrahmanyam, *et al.* 1965 a,b; Sankaram, *et al.*, 1967),, and Sankaram, 1971 have demonstrated significant increase in the rice yields due to algal inoculation. Recently, Dadhich, *et al.*, 1969, have demonstrated that due to inoculation of blue –green algae e.g. *Calothrix anemolai* yields in *Capsicum annum* and *Lactuca sativa* plants increase. The control of algal growth can provided positive help in tackling some problems such as industrial sewage, treatment, pollution of water etc.

Study of algae has almost remained untouched and uncared in this proposed area. In the last part of twentieth century a number of workers were also associated on the studied on blue-green algal flora in some restricted area of lower Assam. However a little works have been done by different algologists covering different localities Biswas, 1930; Parukutty, 1939; Bordoloi, 1974; Devi, 1981; Devi and Boissa, 1981; Hazarika, 1985; Hazarika and Gogoi, 1988; Hazarika, Boissa and Gogoi, 1990; Deka and Bordoloi, 1991; Saikia and Bordoloi, 1994; Hazarika and Barukial, 2012; Hazarika, D and Duarah, I & Barukial, J 2012.

MATERIALS AND METHODS

Algal sample were collected from natural habitat from paddy field, moist soil and other low lying area at monthly interval for two consecutive years 2004 to 2010. Collection also made from hot water springs of Nambor Reserve Forest. Collected materials were preserved in 4% formalin and identified by relevant monographs and recent available literature of Desikachary, 1959, 1972 &1982; Prashad and Srivastava, 1992; Anand, 1990, 1993a & 1993b; A total of 77 species of blue-green algae belonging to 20 genera were collected and duly identified where 61 were newly reported from this area. In this work Desikachary (1959) classification has been followed so far as the arrangement of the families is concerned. However the arranging the genera and species under the families alphabetic order has been followed.

Research Article

Taxonomical Account

Class: - Cyanophyceae Sachs (1874. 248)

Family:-Chroocoaceae Nägeli

1. *Aphanothece.bullosa* (Menegh) Rabenh Fl, Eur.Alg.2:65, 1865; Forti in De Toni, Syllaoge Algarum,5:84,1907; Fre'my .Myxo. d'Afr,equat. Franc. 30, fig. 33, 1929; Geitler, Kryptogamenflora, 172, 1932; Desikachary, Cyanophyta, 142, 1959.

Habitat: - Moist soil surface.

Locality: Golaghat, & Kamarbondha Ali

Hazarika- 4918 & 4878.

2. *A. nägeli* Wartm. Rabenhorst Fl, Eur.Alg.2:65, 1865; Forti in De Toni, op.cit.,5:77,1907; Lemmermann, Kryptogamen flora der mark Brandenburg, 3: 70, 1910; Geitler, op.cit., 172, 1932; Desikachary, op. cit., 141, pl. 22, fig. 7, 1959.

Habitat: - Moist soils surface.

Locality: Golaghat

Hazarika- 4964

3. *A. pallida* (Kü tz) Rabenh, op. cit., 2:64, 1865; Krypto.- Fl. Sachsen, 1: 76, 1863; Forti in De Toni op.cit., 5 :83,1907; Fre'my op. cit.; 29, fig.31, 1929; Geitler, op.cit.,171, fig. 78, 1932; Fre'my, Cyano. Cotes d'Eur., 19, pl. 3, fig.7, 1933; Desikachary, op. cit., 141,pl. 22, fig. 3, 1959.

Habitat: - Moist soils surface.

Locality: Golaghat

Hazarika- 4977.

4. *Chroococcus minor* (Kü tz) Nägeli op. cit., 47, pl.1, A, fig.4, 1849; Forti in De Toni op.cit., 5 :23, 1907; Fre'my op. cit.; 45, fig.50, 1929; Geitler, op.cit., 240, fig. 116g, 1932; Fre'my, Cyano. Cotes d'Eur., 19, pl. 3, fig.7, 1933; Desikachary, op. cit., 141, pl. 22, fig. 3, 1959.

Habitat: - Along with other blue –green algae of the hot springs.

Locality: Nambor Reserved forest

Hazarika- 4993, 4994.

5. *C. minutes* (Kü tz) Nägeli op.cit., 46, 1849; Forti in De Toni op.cit., 5 :14, 1907; Fre'my op. cit.; 39, fig.42, 1929; Geitler, op.cit., 232 fig. 112a, 113 c, 1932; Fre'my, Cyano. Cotes d'Eur., 24, pl. 4, fig.6, 1933; Desikachary, op. cit., 103 , 1959.

Habitat:-Moist soil surface along with *Lyngbya* sp.

Locality: Golaghat

Hazarika- 4971 .

6. *Gloeocapsa decorticans* (A. Br.) Richter ex Wilie, Nyt. Mag. Natu., 62: 168, 1925; Geitler, op.cit., 184, fig. 83b, 1932; Desikachary, op. cit., 114, pl. 24, fig. 9, 1959.

Habitat:-Moist soil surface and in stagnant water, attached to aquatic plant

Locality: Golaghat & Nambor forest.

Hazarika- 4978 & 4990

7.*Gl. pleurocapsoides* Novacek Prace Moravske Prirodo Moravy a Slezka Oddel, Bot., 7: 1,1929; Sukuja, Zur Susswasser algenflora Burmens, 17, pl. 1, figs. 3-5, 1949; Desikachary, op. cit., 118, pl. 24, Fig. 3, 1959.

Habitat: - Attached to floating tree trunk and aquatic plant and along with other algae

Locality: Nambor.

Hazarika- 4996

Research Article

8. *Microcystis flos-aquae* (Wittr.) Kirchner, In Engler and Prantl, Naturlichen Pflanzenfam 1. (1a ; 56, fig. 49 (n), 1898; Forti in De Toni op.cit., 5 : 86, 1907; Crow. Tax. Gen. Microcystis, New Phytol., 22: 61, 1932a; Fre'my op. cit.; 19, fig.16, 1929; Geitler, op.cit.,138, fig. 59e,f, 1932; Desikachary, op. cit., 94, pl. 17, fig. 11, 1959; *Microcystis aeruginosa* f. *flos-aquae* (Wittr.), Elenkin, Monogr. Algar. Cyano., Pars Spec., 1 :103, 1938; *Anacystis cyanea* (Kü tz.), Drouet & Daily, Butler Univ. Bot. Stud.,10 : 221, 1952; Rev. Coccoid Myxophyceae. 36, 1956.

Habitat:- Free floating or on mucilaginous sheath of other algae

Locality: Golaghat & Kamar bondha ali.

Hazarika- 4902 &4923

9. *Chlorogloea microcystoides*. Geitler Neue. Cyano., Grupee Chamaesiphon Arch. Protistenk., 51: 359, 1925; Kryptogamenflora, 310, fig.155, 1923; Cyno. Desikachary, op.cit., 163, pl.19, fig.8, 1959.

Habitat:-Sub-merged concrete wall of hot springs and mixed with other algae.

Locality Nambor hot springs

Hazarika - 4985.

Family :- Oscillatoriaceae Krichner.

10. *Lyngbya aerugineo- coerulea* (Kütz.) Gomont, Monogr. Op.cit., 146, pl.4, figs. 1-3, 1882; Forti in De Toni, op. cit., 5:281, 1907; Fre'my op. cit.; 190, fig.157, 1929; Geitler, op.cit., 1062, fig. 670, 1932; Desikachary, op. cit., 315, 1959.

Habitat:-On most soil surface, intermixed with *Camptylomenopsis* sp. and aquatic angiosperms.

Locality: - Galabil

Hazarika- 4931, 4932, 4936.

11. *L. allorgei* Fre'my, op. cit., 189, fig.156, 1929; Geitler, op.cit., 1059, fig. 671, 1932; Desikachary, op. cit., 313, 1959.

Habitat:-In running and stagnant water along with *Anabaena laxa*, *Oscillatoria chlorine* and *Cylindrospermum stagnale* and other Chlorophycean algae.

Locality: - Golaghat.

Hazarika- 4958 & 4992.

12. *L. corticola* Bruhl et Biswas. Indian Bark algae, J. Dept. Sci., Calcutta Univ., 5 : 9, pl. 4, fig. 13 a-c, 1923; Geitler, op.cit., 1052, 1932; Desikachary, op. cit., 303 , pl. 55, fig. 5, 1959.

Habitat:-Moist soil surface mixed with other algae.

Locality :- Nambor

Hazarika- 4948, 4945

13. *L. küetingiana*. Kirchner Kryptogamen flora Von Schlesien, Algen, 242, 1878; Forti in De Toni, op. cit., 5: 278, 1907; Geitler, op.cit., 1059, 1932 non Thuret; *Phormidium obscurum* Kütz., Phy, germ., 162, 1845; non Rabenh. 1865; Desikachary, op. cit., 311, 1959.

Habitat: - Moist soil surface along with *Micorocoleus chthonoplastes* forming a thin expanded dark green layer.

Locality: - Golaghat, Kamarbondha .Ali & Borholla

Hazarika - 4919, 4966, 4992.

14. *L. laxespiralis* Skuja.Zur. Süsswasseralgen flora Burmas., p. 53, pl. 10, figs. 10-11, 1949; Desikachary op. cit., 289, pl. 50, fig. 4, 1959.

Habitat:- On- moist soil, intermixed with *Spirogyra* sps, and Diatoms

Locality: - Chinatoli

Hazarika- 4912

Research Article

15. *L. major* Menegh ex Gomont Meneghini, conspectus Algologiae euganeae, 12, 1837; Gomont, op. cit., 144, pl. 3, fig. 15, 1892; Forti in De Toni, op. cit., 5 : 279, 1907; Geitler, op.cit., 106, fig. 679a, 1932; on Kütz., non Robenh; Desikachary, op. cit., 320, pl. 52, fig. 11, 1959.

Habitat: Moist soil surface along with *Micorocoleus chthonoplastes*

Locality: - Galabil

Hazarika- 4936

16. *L. martensiana* Menegh ex Gomont, Meneghini, conspectus Algologiae euganeae 12, 1837; Gomont, op. cit., 145, fig. 17, pl. 3, 1892; Forti in De Toni, op. cit., 5 : 279, 1907; Fre'my op. cit., 191, fig.158, 1929; Geitler, op.cit., 1064, fig. 676, 1932; Fre'my op. cit.; 107 , pl. 29, fig.1, 1933, non Robenh 1865; Desikachary op. cit., 318, 1959.

Habitat: Intermixed with other algae in hot water springs

Locality: - Nambor

Hazarika- 4987

17. *L. mesotricha* Skuja Zur Suss. Warseralgenflora Burmas, 54, pl. 9, figs .1-7, 1949; Desikachary op. cit., 282, pl. 50, figs. 1, 2, 1959.

Habitat: - Rice field, epiphytic on *Oedogonium*, *Chara*, *Nitella* species and aquatic angiosperms.

Locality: - Kamarbondha .Ali, Borholla & Titabor.

Hazarika - 4905, 4926, 4991.

17. *L. putealis* Mont. Ex. Gomont Montagne, 20, cent. Urie de Plantes cellulaires exotiques, Ann.Sci. nat., 2 ser., Bot., 13 : 200, 1840; Gomont, op. cit. 143, pl. 3, fig. 24, 1892; Forti in De Toni, op. cit., 5 : 277, 1907; Fre'my op. cit., 193, fig. 159, 1929; Geitler, op. cit., 1063, fig. 675, 1932; Desikachary op. cit., 318, 1959.

Habitat: - Intermixed with *Chlorogloea microcystoides*, forming a layer on walls of a built in tank of hot springs.

Locality: - Nambor

Hazarika- 4996

18. *L. rivularianum* Gomont. op. cit. 148, 1892; Forti in De Toni, op. cit., 5 : 282, 1907; Fre'my, op. cit., 201,158, 1929; Geitler, op .cit., 1048, 1932; Fre'my, op. cit.; 112, pl. 29, fig. 6, 1933; Desikachary, op. cit., 293, 1959.

Habitat: - Plantonic and attached, in the mucilage of *Anabaena variabilis* Var. *ellipsospora* and *Cylindrospermum stagnale* f. *variabilis*

Locality: - Rangamatia, Kaziranga.

Hazarika- 4997, 4999.

19. *Microcoleus acutissimus* Gardner New Myxophyceae from Porto Rico., Nem. N.Y. Bot. Gdn., 7: 55, pl. 11, fig. 2, 1927; Geitler, op. cit., 1138, fig. 744a, 1932; em. Drouet, Amer. J. Bot., 24: 603, 1937; Desikachary, op. cit., 344, pl. 60, fig.1., 1959; Incl. *M. delicatulus* West et West Var. *attenuates* Ghose, J, Burma. Soc., 16: 223, pl. 11, fig. 7, 1927a.

Habitat :- Moist soil surface; Stagnant water along with *Spirulina subsalsa* and on cemented walls of the hot springs along with *Chlorogloea microcystoides* and Diatoms.

Locality Nambor

Hazarika- 4985, 4995

20. *M. chthenoplastes*. Thruet ex. Goment Ann. Sci. nat. Bot. 6th. Ser., 1: 378, 1875; Gomont , Mongor. Oscillariees, 353, pl. 14, figs. 5-8, 1892; Forti in De Toni, op. cit., 5 : 371, 1907; Fre'my, op. cit., 78, fig.78, 1929; Geitler, op.cit., 1133, fig. 739, 1932; Desikachary, op. cit.,

Research Article

343, 1959; *Chthonoblastus salinus* Kütz., Phyc. Gene. 197, 1843; *Chthonoblastus lyngbyei* Kütz., Phyc. Gene. 197, 1843.

Habitat: - On moist soils mixed with *Lyangbya kuetzingiana* and stagnant water with *Oedogonium* sps..

Locality: - Golaghat, Gelabil and K.B.Ali

Hazarika:- 4919;4930;4909.

21. *M. paludosus* (Kütz.) Gomont, .Mongor. Oscillariees, 358, pl. 14, fig. 13, 1892; Forti in De Toni, op. cit., 5 : 376, 1907; Fre'my, op. cit.; 80, 1929; Geitler, op.cit., 1144, fig. 753, 1932; Desikachary, op. cit., 344, 1959.

Habitat: - Stagnant water and On moist soils mixed with *Lyangbya corticicola* and *Oscillatoria subbrevis*.

Locality:-Nambor

Hazarika:-4945, 4946.

22. *Oscillatoria acuminata*. Gomont. Op. cit., 227, pl. 7, fig. 12, 1892; Forti in De Toni, op. cit., 5 : 177, 1907; Fre'my, op. cit., 222, fig, 192, 1929; Geitler, op. cit., 978, fig. 603d, 1932; Desikachary, op. cit., 240, 1959.

Habitat: - Stagnant water and On moist soils .

Locality:-Nambor

Hazarika:-4993, 4994.

23. *O. acuminate f.tenuis* Parukutty , Collection of algae from Assam , Proc. Indian. Acad. Sci., B., 9: 234, 1939; Desikachary, op. cit., 240, 1959.

Habitat: - Growing on cemented wall of the hot springs along with *Aphanathece saxicola* and *Spirulina subsalsa* and on moist soil surface along with *O. chlorine*

Locality:-Nambor

Hazarika:-4988, 4997.

24. *O. chlorine* Kütz.ex. Gomont.. Kützing, Phyc. Gene. 185, 1843; Gomont. op. cit., 223, 1892; Forti in De Toni, op. cit., 5 : 172, 1907; Fre'my, op. cit.; 215, fig, 183, 1929; Geitler, op. cit., 951, fig. 611c, 1932; Desikachary, op. cit., 215, pl. 40, fig. 4, 1959; *Oscillatoria tenuis* Ag. Var. *chlorine* (Kütz.) Playfair, Biol .of. Richmond River, 132, pl.6, fig.10, 1914.

Habitat :-Hot springs and overflow water of hot spring along with other algae and on moist soil surface and stagnant water.

Locality:-Nambor, Borpather.

Hazarika:-4949, 4984, 4952.

25. *O .curviceps* Ag. Ex. Gomont. Agardh, Syst. Alg. 68, 1824; Gomont, op. cit., 213, pl .6 ,fig.14, 1892; Forti in De Toni, op. cit., 5 : 157, 1907; Fre'my, op. cit.; 117, pl. 30, fig, 5, 1933; Geitler, op .cit., 947, fig. 598e, 1932; Desikachary, op. cit., 209 .1959 .

Habitat: - Rice field, mixed with other green algae.

Locality:- Chinatoli,

Hazarika:-4915, 4916.

26. *O. fre'myii* De Toni, J. Noterelle di nomenclatura algological, 1:7, 1934; *O.neglecta* Lemmermann,Kryptogamenflora der Mark Brandenburg 3:112, 1910; Geitler. Op. cit., 963, 1932. Non Wood, 1872; Desikachary, op.cit., 225, 1959.

Habitat:-Hot springs and overflow water of hot spring along with other algae

Locality:-Nambor, Borpather,

Hazarika:-4993,4994.

Research Article

27. *O. laete-virens* (Crouan) Gomont, Bull. Bot. Soc. Fr., 7: 371, p1. 1860; Monogr, op. cit., 226, pl. 7, fig. 11, 1892; Forti in De Toni, op. cit., 5 : 177, 1907; Geitler, op. cit., 949, fig. 603c, 1932; Fre'my, op. cit., 126. pl. 31, fig, 12, 1933; Desikachary, op. cit., 213, 1959 .

Habitat:-On moist soil or on mud, in stagnant water along with other algae. (i.e. *O. subbrevis*, *Aphanothece Naegelii* and *Lyngbya* sps.)

Locality: - Golaghat.

Hazarika:-4923, 4924.

28. *O. laete-virens* Var. *minimus* Biswas , Algal flora of Chilka lack, Mem. Asiatic Soc., Bengal, 11: 187, pl. 28, 1932b; Desikachary, op. cit., 213, 1959.

Habitat:-On moist soil, forming a thin layer open the soil surface.

Locality: - Kuralgurit.

Hazarika:-4925

29. *O. limosa* Ag. Ex. Gomont. Agardh, Dispositio. Algarum Sueciae, 35, 1812; Gomont, op. cit., 210, pl .6 ,fig.13,1892; Forti in De Toni, op. cit.,5 : 154, 1907; Fre'my op. cit.; 212, fig.178, 1929; Geitler, op.cit., 944, fig. 598d, 1932; Fre'my op. cit.; 117, pl.30, fig.4, 1933; Desikachary op. cit., 206, 1959 .

Habitat:- In stagnant water, rice fields, forming a thick layer over the water surface; free floating or attached to aquatic plant.

Locality:-Kamarbondha .Ali.

Hazarika:-4901.

30. *O. proboscidea* Gomont, op. cit.209, pl .6, figs.10, 11, 1892; Forti in De Toni, op. cit.,5 : 152, 1907; Fre'my op. cit.; 211 , fig.176, 1930; Geitler, op.cit., 948, fig. 598b, 1932; Desikachary op. cit., 211, pl. 38, fig 9, 1959.

Habitat: - Free floating or attached, forming a layer on a cemented wall along with *O. cholorina*, *Spirullina subsalsa* and Diatoms. .

Locality:-Nambor

Hazarika:-4984.

31. *O. pseudogeminata*. G. Schmid, Ber.dtsch. bot. Ges., 32: 124, fig. 4, 1914; Geitler, op. cit., 966, fig.616, 1932; Desikachary op. cit.,pl. 41, fig.10, 228,1959.

Habitat: - Free floating or attached, forming a ball or mate, in rich field along with *Cylindrospermum stagnale f.variabilis*, and on moist soil. .

Locality: - Borpather, Nambor.

Hazarika:-4972, 4973.

32. *O. raoi* De Toni, J. Diagnoses Algarum novarum J. Cent. 6: 560, 1939; *O. variabilis* Rao. Myxophyceae of the United Provinces II, Proc. Ind. Acad. Sci., B, 3: 172, fig.s. A-D, 1936, non. *O. variabilis* Desvaus, 1865; Desikachary op. cit.,223, 1959.

Habitat: - Mixed with other algae on moist soil and in stagnant water, epiphyte on aquatic grasses.

Locality: - Kaziranga.

Hazarika:-4998,

33. *O. subbrevis* Schmidle, Engler's Bot. Jahrb., 30: 243, pl. 4, fig. 7, 1901 ; Forti in De Toni, op. cit., 5 : 208, fig. 174, 1907; Fre'my op. cit.; 208 , fig.174, 1929; Geitler, op.cit., 949, fig. 601b, 1932; Desikachary op. cit., 207, 1959

Habitat: - Mixed with other algae on moist soil and in stagnant water.

Locality: - Golaghat

Research Article

Hazarika:-4939,

34. *O. subbrevis f. major* West, G.S.J. Linn. Soc. (London) Bot., 38:78, 1907; Desikachary op. cit., 209, 1959.

Habitat: - On moist soil along with *L. corticicola* and *Nostoc paludosum*, forming gelatinous thalli.

Locality: - Nambor

Hazarika - 4945.

35. *O. subtilissima* Kütz. Tab. Phycologicae, 1: pl. 38, fig. 7, 1876; ; Forti in De Toni, op. cit., 5: 171, 1907; Geitler, op.cit.,950, 1932; Desikachary op. cit.,215, 1959

Habitat: - On moist soil surface with Diatoms and *O. acuminate f. tenues*, along with other algae of the hot springs

Locality: - Nambor

Hazarika - 4995, 4996.

36. *O. tenuis* Ag.ex. Gomont,Alg. Dec.2 :25 ,1813; Gomont, op. cit., 220, pl. 7, figs. 2-3, 1892; Forti in De Toni, op. cit.,5 :166, 1907; Fre'my op. cit.;217. Fig.186, 1929; Geitler, op.cit., 959, fig. 611f-g, 1932; Fre'my op. cit.; 121 , pl.30, fig.10, 1933; Desikachary op. cit., 222, pl. 42, fig. 15, 1959; Incl. *O. viridis* Vaucher, Hist. conf. d'eau. Douce, 195, pl.15, fig.7, 1803.

Habitat: - On moist soil surface forming a thin layer and in rice fields.

Locality: - Golaghat

Hazarika - 4991

37. *O. terebriformis* Ag. Ex. Gomont, Aufzahlung, Flora, 10 : 634, 1827, Gomont, op. cit., 234, pl. 7, fig. 24, 1892; Forti in De Toni, op. cit.,5 :189, 1907; Geitler, op. cit., 954, fig. 607d-, 1932; Desikachary op. cit., 217, 1959.

Habitat: - Free floating or attached, mixed with *Chroococcus minor* and *O. chlorine*.

Locality: - Nambor

Hazarika, 4993

38. *Oscillatoria obscura* Bruhl et Biswas, Algae of the Bengal filter beds, J. Dept. Sci., Calcutta Univ.,4: 6, pl. 2, fig. 9, 1922; Geitler op. cit., 945, 1932; Desikachary , op. cit.,207, 1959.

Habitat: - Rice field, epiphyte on aquatic grasses among *Oedogonium* spp. Diatoms and *Hapalosiphon welwitschii* and *Anabaena* spp.

Locality: - Kuralguri

Hazarika - 4927, 4929.

39. *Phormidium retzii* (Ag.) Gomont, Essai class. Nostoc. Homo.,J. de. Bot.,Fr., 4 : 355, 1890; Gomont, op. cit., 175. pl. 5, figs. 6-9, 1892; Forti in De Toni, op. cit.,5 :241, 1907; Fre'my op. cit.; 152. Fig.135, 1929 Geitler, op. cit., 1012, fig. 647, 1932, non Kütz.; *Phormidium papnum* Kütz., phyc. Germ. 195, 1843; Desikachary op. cit., 268, pl. 44, figs. 13, 15, 1959.

Habitat: - On moist soil surface and on submerged object in slow running streams, mixed with Diatoms.

Locality: - Kaziranga

Hazarika - 4980

40. *P. sub incrustatum* Fritch et. Rich. Ttans.roy.Soc. S. Afr., 18: 82, fig.27, j-I, 1929; Geitler, op.cit, 1016, 1932; Desikachary op. cit., 267, 1959.

Habitat: - Hot springs and overflow water of hot spring among *Aphanothecce bullosa* and *Gloeocapsa pleurocapsoides* and on moist soil alongwith *Aphanothecce bullosa*

Locality: - Nambor

Research Article

Hazarika - 4924, 4996.

41. *P. tenue* (Menegh) Gomont, op. cit.,169,pl.4, figs. 23-25, 1892; Forti in De Toni, op. cit.,5 :227, 1907; Frémy op. cit.; 146. fig.131, 1929; Geitler, op.cit., 1004, fig. 642d,e, 1932; Frémy op. cit.; 88 pl.23, fig. 4, 1933; ,Desikachary op. cit.,259, 1959; *Leptothrix subtilissima* Kütz., Tab. Phyc. 1: pl. 65, 1845; *Hyphaeothrix subtilissima* Rabehn., Fl. Eur. Alg., 2 : 77, 1867.

Habitat: - On moist soil surface with other algae (i.e. *O. subbrevis Aphanethece* sps.)

Locality: - Golaghat.

Hazarika - 4923

42. *Schizothrix lacustris* A. Br. In Kütz., Species Algarum, 320, 1848; Gomont, op. cit.,301 , pl.6, figs. 9-12, 1892; Frémy op. cit.; 96. . fig.92,1929; Geitler, op.cit. 1092, figs. 698,699, 1932; Frémy Cyano. Cotes d' Eur., 77, pl. 20, fig. 4, 1933; Desikachary op. cit.,252 pl. 56, figs. 6, 10, 1959;

Habitat: - On cemented walls of built in tank along with *Spirulina subsalsa* and *l. martensiana*; submerged or exposed , forming a dominant form in hot water springs.

Locality: - Nambor.

Hazarika - 4985

43. *Spirulina major* Kütz. ex .Gomont , Kütz., op. cit., 183, 1843; Gomont, op. cit.,251 ,pl.7, fig. 29, 1892; Forti in De Toni ,op. cit.,5 : 210,1907; Frémy op. cit.; 234. fig. 208, 1929; Geitler, op.cit. 930, figs. 595, 1932; Desikachary op. cit., 196, pl. 36, fig. 13, 1959.

Habitat: - On moist soil or stagnant water with other algae. .

Locality: - Golaghat, Nambor, Borpather

Hazarika,:- 4959 , 4957, 4973.

44. *Spirulina subsalsa*, Öerst. ex. Gomont, Öersted., Beretn. Exc. till Trindelen etc., Nat. Tidskr., 17, pl.7, fig. 4, 1842; Gomont, op. cit.,253 , pl.7, fig. 32, 1892; Forti in De Toni ,op. cit.,5: 214, 1907; Frémy op. cit.; 236. fig.211, 1930; Geitler, op.cit., 927, figs. 593d, 1932; Frémy op. cit., 133, pl.31, fig.24, 1933 ; *Sp. turtosa* Cramer, Hedwigia, 2 : bl, pl. 12, fig.1, 1863; *Sp. tenuirsima* Kütz., Alg. Aq. dulc., 14, no. 131, 1836; Phyco. Gene., 183, 1843; Phyc. germ., 156, 1845; Tab. Phycologicae, 1 : 26, pl. 37, fig. 4, 1845. Non Nordst; Desikachary op. cit.,193 1959.,

Habitat: - On moist soil surface with other algae and among other algae of hot springs and overflows.

Locality: - Nambor , Borpather.

Hazarika - 4985, 4995,4991.

45. *Symploca muscorum* (Ag.) Gomont, Ersia clars. Home, J. de. Bot., 4 : 354,1890; Gomont, op. cit.,110, pl.2, figs. 9, 1892; Forti in De Toni , op. cit.,5: 303, 1907; Frémy op. cit.,126. 1929; Geitler, op.cit., 1122, figs.730,1932; Frémy op. cit.,82 , pl. 22, fig.2, 1933; Desikachary op. cit.,337, pl. 59, figs. 3,4, 1959.

Habitat: - On moist soil forming a thick layer.

Locality :- Golaghat.

Hazarika - 4922.

46. *Anabaena azollae* Strasb, Fritsch, Structure and Reproduction of algae, Vol.-11 cup Vikas student`s edition, pp. 809,874, fig. 309, 1979; Desikachary op. cit., 402, 1959.

Habitat: - Endophytic on *Azolla pinnata* which are abundant in ponds, beels, and paddy fields.

Locality: - K.B.Ali, Borpather, Galabil, Kazaranga.

Hazarika - 4907c, 4939, 4989b, 4996b.

Research Article

47. *A. flos-aquae* (Lyngb.) Brebission, in Breb. Et. Godey, Algues des environs de Falaise, 36, 1835; Bornet and Flahault, op. cit., 228, 1888; Forti in De Toni , op. cit., 5: 441, 1907; Fre'my op. cit.; 326. figs. 297, 1929; Geitler, op.cit., 890, fig. 571a,b,,1932; Desikachary op. cit., 415, 1959.

Habitat: - Free floating

Locality :- Golaghat.

Hazarika - 4921.

48. *A. fullebornii* Schmidle. Englar's Bot. Jahrb., 32: 61, pl.1, fig.4, 1892; Forti in De Toni , op. cit., 5: 449, 1907; Fre'my op. cit.; 367, fig. 305, 1929; Geitler, op.cit., 904, fig.567e, 1932; Desikachary op. cit.,401, pl. 71, fig. 11,1959.

Habitat: - Rice fields and tanks mixed with other algae, attached or Free floating

Locality: - Chinatoli

Hazarika: - 4914, 4915.

49. *A. iyengarii* Bharadwaja , Myxophyceae of the United Provinces, 1, Proc. Ind. Acad. Sci., B, 2: 105, fig. 6H-K, 1935; Desikachary op. cit., 406, pl.78, fig.2, 1959.

Habitat: - Among other algae in stagnant water and in rice fields, free floating or attached.

Locality: - Rangamotia (Kaziranga)

Hazarika - 4997

50. *A. laxa* Rabehn. in Bornet and Flahault, Bull. Soc. Bot.Fr., 32: 120, pl.4, figs. 2, 3, 1885; Revision des Nostocacee's heterocystee', 233, 1888; *Anabaena inaequalis* (Kütz.) Bornet and Flahault, op. cit.,231, 1888; Forti in De Toni , op. cit., 5: 446, 1907; Fre'my op. cit.; 365, fig. 301, 1929; Geitler, op.cit., 896, fig. 578,1932 non cooke, 1884; Desikachary op. cit., 413, 1959; *A . oblonga* Wildemann, Ann. Jrdn Buitenz., 1: 50, 1897; *A. küetingiana* De Toni J. Noterelle di nomencl. Algo. 8: 2, 1936,

Habitat: - In stagnant water, attached or floating

Locality: - Kaziranga

Hazarika - 4981

51. *A. orientalis* Dixit.The Myxophyceae of the Bombay Presidency, I. Proc. Indn. Acad. Sci., B,3:101, fig.4(d-e)1936; Desikachary op. cit.,405,pl. 77, fig.6, 1959.

Habitat: - In stagnant water, or rice fields ; attached or mixed with other algae

Locality: - Kamar bondha ali.

Hazarika - 4902

52. *A. sphaerica*. var. *attenuate* Bharadwaja op. cit.,B; 2: 103, fig.5g-h, 1935; Desikachary op. cit., 395,1959.

Habitat: - In stagnant water, or rice fields, mixed with other algae, free-floating or attached..

Locality :- Kuralguri.

Hazarika - 4926.

53 .*A. torulosa* (Carm.) Lagerh. ex Born. et Flah .Bidrag.till Sveriges algaflora, K. Vet. Akad. Forh., 40 (2) :47, 1883; Bornet and flahault, op. cit., 236, 1888; ; Forti in De Toni , op. cit.,5: 455, 1907; Fre'my op. cit.; 370,fig. 306, 1929; Geitler, op.cit., 887, fig.56 d, 1932; Fre'my op. cit.,186 , pl. 62, fig.1, 1933; ,Desikachary op. cit.,337, pl. 59, figs. 3,4, 1959.

Habitat: - In stagnant water, and rice fields, attached on aquatic plant.

Locality: - Kamar bondha ali .

Hazarika - 4903

Research Article

54. *A. vaginocola f. fertilissima* Prasad Some Nostocaceae from Utter Pradesh, J. Ind. Bot. Soc., 31: 361, figs. 14- 17, 1932; Desikachary op. cit.,401, 1959.

Habitat: - Entangled with angiosperm roots or in submersed cementing walls in tank of hot springs..

Locality: - Nambor

Hazarika - 4987.

55. *A. variabilis var. ellipsospora* Fritsch , The genus Anabaena etc., J .Indian bot. Soc., 28, 142, figs. 40-50, 1949; Desikachary op. cit., 411, 1959.

Habitat: - Moist soil along with *Nostoc microscopicum*

Locality: - Kaziranga.

Hazarika - 4997.

56. *Aulosira fertilissima var tenuis* Rao, C.B. The Myxophyceae of the United Provinces-111.

Proc. Indian Acad. Sci., B, 6: 353, fig.3f-I, 1937b; Desikachary op. cit.,431,pl.80, figs. 2-5,1959.

Habitat:- Stagnant water, along with O. spp. And *Hapalosiphon welwitschii*.

Locality:-Kuralguri

Hazarika:- 4926.

57. *A. fritschii* Bharadwaja Contribution to our knowledge of the Myxophyceae of India Ann. Bot. London.,47: 123, figs. 3.4.1933b; Desikachary op. cit.,432, pl.80, figs. 7-12,1959.

Habitat: - Rice fields, along with other algae or on moist soils.

Locality: - Chinatoli

Hazarika - 4915

58. *Cylindrospermum doryphorum* Bruhl et Biswas , On a few species of *Cylindrospermum* from Bengal-C. *doryphorum*, J. and Proc. Asiatic Soc. Bengal, N.S., 18(10):577, 1922; Desikachary op. cit.,368, pl.64, 2, 1959.

Habitat: - Stagnant water, floating, admixed with other algae.

Locality: - Chinatoli

Hazarika - 4914

59. *C. indicum* Rao, C.B., The Myxophyceae of the United Province, India – 11, Proc. Indn. Acad. Sci., B,3:169, fig. 2, d,e,1936; Desikachary ,op. cit.,369, pl.64, figs. 4, 11, 1959.

Habitat: - In moist soils and in Stagnant water along with other algae, .

Locality: - Chinatoli

Hazarika:- 4914, 4915.

60. *C. muscicola* Var. *longispora* Dixit The Myxophyceae of the Bombay Province-1, Proc. Indn. Acad. Sci., B,3: 100,fig. 3a,b, 1936; Desikachary ,op. cit.,367, pl.64, figs. 2, 10, 1959.

Habitat: - In moist soils and in Stagnant water mixed with *Anabaena laxa* and *O. chlorina* .

Locality: - Golaghat

Hazarika - 4992

61. *C. stagnale* Ff. *variabilis* Prasad, B.N.,Some Nostocaceae from Uttar Pradesh, J. Indn. Bot. Soc. ,31: 358, figs. 5-8, 1952; Desikachary , op. cit., 364, 1959.

Habitat: - In moist soils and in stagnant water forming a ball or mat; attached to aquatic plants or free floating.

Locality: - Borpather, Rangamati (Kaziranga)

Hazarika:- 4972, 4974, 4975 &.4997.

Research Article

62. *Nostoc entophysolum* Born. Et Flah.,op. cit., 190, 1888; Forti in De Toni , op. cit., 5: 389, 1907; Geitler, op.cit., 836, 1932; Fre'my op. cit.,174 , pl. 57, 1933; Desikachary, op. cit.,375, 1959.

Habitat: - In moist soils surface.

Locality: - Gelabile

Hazarika: - 4932, 4933, 4937.

63. *N. linckia Var. arvense* Rao. C.B., op. cit., B, 6: 358, fig. 4a, 1937b; Desikachary, op. cit., 377, pl. 67, fig. 1, 1959.

Habitat: - In moist soils surface.

Locality: - Golaghat

Hazarika - 4962

64. *N. microscopicum* Carm. In Harvey, Hooker's British Flora, 5: 399, 1833; Bornet and Flah. Op. cit., 210,1888; Forti in De Toni , op. cit., 5: 413, 1907; Fre'my , op. cit., 348, fig. 287, 1929; Geitler, op.cit., 849, 1932; Fre'my, op. cit., 174 , pl. 57, 1933; Desikachary, op. cit., 388, 1959.

Habitat :- In moist soils surface .and epiphyte on wet logs, intermixed with other algae.

Locality:- Kaziranga

Hazarika:- 4997c.

65. *N. muscorum* Agardh., Despositia Algar. Sueciae 44, 1812; Bornet and Flah..op. cit., 200, 1888; ; Forti in De Toni , op. cit.,5: 400, 1907; Fre'my , op. cit., 340, fig. 281 , 1929; Geitler, op.cit., 844,fig. 535, 1932; ,Desikachary, op. cit., 385, pl. 70, fig. 2, 1959.

Habitat :- In moist soils surface.

Locality:- Golaghat

Hazarika:- 4966

66. *N. paludosum* Kütz., Tab. Phycologicea, 2: 1, pl.1, fig, 2, 1850; ; Bornet and Flah. Op. cit.,191,1888; Forti in De Toni , op. cit.,5: 390 ,1907; Fre'my, op. cit., 332, fig. 275 ,1929; Geitler, op.cit., 836,fig. 528d, 1932; ,Desikachary, op. cit., 375, 1959.

. *N. paludosum* form. Rao, Myxophyceae of United Provinces-111, Proc. Indn. Acad. Sci., B, 6: 358, 1937b.

Habitat :- In moist soils surface along with *Microcoleus paludosus* and *Lyngbya corticicola*.

Locality:- Nambor.

Hazarika:- 4945

67.. *N. puncitiforme* (Kütz.) Hariot, J. de Bot. , 5: 31, 1891; Bornet and Flah. op. cit., 189, 1888; Forti in De Toni , op. cit., 5: 388, 1907; Fre'my, op. cit., 331, fig. 274 , 1929; Geitler, op.cit., 834, 1932; *Nostoc hederulae* Meneghini in Kützing, Sp. Alg., 287, 1849; Desikachary, op. cit., 374, 1959.

Habitat :- In moist soils and in stagnant water..

Locality:- Golaghat

Hazarika:- 4963

68. *Calothrix weberi* Schmidle,Einig. Alg. Dus Pruess. Hochmoor, Hedwigia, 38: 173, 1899; Forti in De Toni , op. cit.,5: 625 ,1907 ; Geitler, op.cit., 606, 1932; Desikachary, op. cit., 540, 1959.

Habitat :- Rice field , mixed with other algae.

Locality:- Chinatoli.

Hazarika:- 4915

Research Article

69. *C. wembaerensis* Hieron.et. Schmidle, Kirchner, Schizophyceae in Engler and Prantl. Naturlichen pflanzenfam ., 1: 1a, 87, fig. 59c, 1898; Forti in De Toni , op. cit., 5: 628, 1907; Frémy , op. cit., 264 ,1929 ; Geitler, op. cit., 615, 1932; Desikachary, op. cit., 526, 1959.

Habitat :- Rice field , mixed with other algaee.

Locality:- Golaghat.

Hazarika:- 4968.

70. *Calothrix ghosei* Bharadwaja , The Myxophyceae of the United Provinces, 1, Proc. Indian Acad. Sci., B, 2 : 99, fig. 3c-f, 1935; Desikachary , op. cit., 526, pl. 112, fig. 2. 1959.

Habitat :- Rice field , along with other algaee.

Locality:- Golaghat.

Hazarika:- 4959

71. *Camptylonemopsis minor* Desikachary, On *Camptylonema indicum* Schmidle etc., Proc. Indian Acad. Sci.,B ., 18 : 47, figs. 25-29. 1948; Desikachary, op. cit., 444, pl. 84, figs. 1-5, 1959.

Habitat :- In rice field with other algaee,

Locality :-Galabil

Hazarika :-4931, 4932.

72. *Scytonema fritschii* Ghose, A systematic and ecological account of collection of blue-green algae from Lahor and Simla, J. Linn. Soc. Bot. Lond, 46: 342, pl. 31, fig. 11, 1924; Geitler, op. cit., 755, fig. 480, 1932; Desikachary, op. cit., 485, pl. 95, fig. 1, 1959.

Habitat :- In stagnant water

Locality:-- Golaghat

Hazarika :-49442.

73. *S. malaviyaensis* Bharadwaja Scytonema malaviyaensis sp. nov., Rev. algol. Paris, 3: 233, pl. 14, 1930; Desikachary, op. cit., 483, 1959.

Habitat :- On moist soil surface

Locality: - Nambor

Hazarika :-4982

74. *S. millei* Bornet in Bornet and Thuret, Notes. Algologiques, 2: 147, 1880; Bornet in Flah., Revision des Nostocaceaes heterocystee/s, 93, 1887; Forti in De Toni , op. cit., 5: 505, 1907; Frémy, op. cit., 306, fig. 261 ,1929 ; Geitler, op.cit., 757, figs. 483&484, 1932; Desikachary, op. cit., 460 , pl. 93, figs. 2,3, 1959.

Habitat :- On moist soil surface

Locality::: Goghat

Hazarika :-4986

75. *S. mirabile* (Dillw) Born. Nostoc heteroc. Du syst. Alg. De C. A. Agarh. Bull. Soc. Bot. Fr. 36 : 155, 1889; Forti in De Toni , op. cit., 5: 517, 1907; Frémy, op. cit., 319, fig. 269 , 1929; Geitler, op.cit., 775, figs. 497,498, 1932; Frémy, op. cit., 171. pl. 54, fig. 1, 1933; Desikachary, op. cit., 483, pl. 91, figs. 3, 1959 ; *Scytonema figuratum* Ag. Syst. Alg., 38, 1824; Bornet and Flah. op. cit., 101, 1887.

Habitat: - On moist soil surface and on foot steps of old buildings

Localit y : - Golaghat

Hazarika :- 4979.

76. *S. pascheri* Bharadwaja, The taxonomy of *Scytonema* and *Tolypothrix*, Rev. Algol. Paris, 7: 158, fig. 1c,d, 1934; Desikachary, op. cit., 463, 1959.

Research Article

Habitat: - Rice field soil, commonly on Fern rhizome.

Locality:- Gabil.

Hazarika :-4935,4936.

77. *Hapalosiphon stühlmannii* Hieron, in Engler, Pflanzenwelt Östafr., Tell.C. 10, 1895; Fre'my, op. cit., 429, 1929; Geitler, op.cit., 534, 1932; Desikachary, op. cit., 593, pl. 129, figs.,4-7, 1959.

Habitat :- Floating or attached to angiospermic plant and admixed with other algae .Locality:- Golaghat.l.

Hazarika :-4910

78. *H. welwitschii* W. et. West, G.S.,*Form Rao*, Myxophyceae of the United Provinces,-111, op. cit., B ,6: 349, fig. 3c-d, 1937b; Desikachary, op. cit., 588, 1959.

Habitat :- Admixed with other algae in rice field.

Locality :- Kuralguri

Hazarika 4929

RESULTS AND DISCUSSION

The present study reflect the interesting composition of Blue-green algal floristic diversity of different genera and species of blue-green algae in this region. A total number of 78 species belonging to 20 genus have been recorded. From some selected areas of Upper Brahmaputra valley . The species *Chroococcus minor*, *Chlorogloea microcystoides*, *Lyngbya martensiana*, *L. puitealis*, *Microcoleus acutissimus*, *Oscillatoria acuminate f. tenuis*, *O. chlorine*, *O. fremyii*, *Phormidium sub incrustatum*, *Spirulina subsalsa*, *Anabaena vaginocola f. fertilissima* were found in hot water springs and overflows of hot springs. It was seen that the diversity of Genus and species is more in undisturbed perennial water reservoir than the cultivated area. In rice field few species are dominant but in moist soils the number of diversity is high. The Identification of taxa is mainly based on Morphological characteristics. The presence of sheath, calyptas, modification of terminal cells, gas vacuoles, granules adjacent to cross wall and the resolvability of cross walls, length and breadth of the cells, akinetes and heterocysts etc. were the main criteria for splitting of species. In the present study it was revealed that a number of taxa viz. *Anabaena flos-aquae*, *A. iyengarii*, *Cylindrospermum doryphormus*, *C. stanale*, *Nostoc muscorum*, *Lyngbya aerugineo-coerulea*, *Oscillatoria fremyii*, *O. late-verens var. minimum* and *O. proboscidea* showed their morphological variation such as length and breadth of cells, heterocysts and spores, from that type materials describe by Desikachery, 1959. Similarly *Lyngbya major* differ from the type materials only in having 3-layered sheath. A number of factors (i.e. salinity, water, temperature, light, humidity, rainfall etc.) might play definite roles in changing the morphological variation of characters of algae. . This observation supported the views put forwarded by Whitton, 1972 and Forest and Khan, 1972. The author try to identified the taxa keeping the views of all criteria by the standard literatures and other characters.

REFERENCES

- Anand, N (1990).** A hand book of blue-green algae edited by Bishen Singh and Mahendra pal Singh, Dehradun. 1-79.
- Anand, N (1993a).** Blue Green Algae (Cyanophyta/Cyanobacteria) A Preamble In: *Indian Phycological Review Cyanophyta 2* edited by Bishen Singh Mahendra pal Singh, Dehradun.

Research Article

- Anand, N (1993b).** Morphology, Classification and Taxonomic Studies In: *Indian Phycological Review Cyanophyta 2* edited by Bishen Singh Mahendra pal Singh, Dehradun.
- Banerji, JC (1935).** On algae found on soil samples from alluvial Paddy fields of Faridpur, Bengal, *Science & Culture 1* 289-299.
- Bharadwaja, Y (1935).** The Myxophyceae of the United Provinces, India-1, *Proceedings of the Indian Academy of Science B 2* (1) 95-107.
- Biswas ,K (1930).** Contribution sto the knowledge of the fresh water algae of Monipur, Assam. *Journal of Bombay Natural Historical Society 34* 189-192.
- Bordoloi, RPM (1974).** PhD Thesis, Gauhati University, Guwahati. (Unpublished)
- Dadhich, KS, Varma, AK & Venkataraman, GS (1969).** *Effect of Calothrix*, Society for Philosophy and Psychology. Inoculation on vegetative crops Plant and soil 31 377.
- Deka, M & Bordoloi, RPM (1991).** *Studies on the Blue-Green Algae from Rice Field of Assam. Phykos 30* 175-180.
- Deshmukh, BS (2008).** Algal Diversity of Pravara River in Ahmednagar District (Maharastra) Advances in Plant Science **21**(1) 199-204
- Desikachary, TV (1959).** Cyanophyta Monograph ICAR New Delhi.
- Desikachary, TV (1972).** *Taxonomy and Biology of Blue-Green Algae*. Centre for Advance Study in Botany Madras.
- Desikachary, TV (1982).** *Status of Classical Taxonomy*. In: (eds. Carr, NG and Whitton, BA) Biology of blue-green algae Blackwell scientific Publication, London.
- Devi, P (1981).** PhD Thesis, Gauhati University, Guwahati. (Unpublished)
- Devi, P & Boissya (1981).** Addition to the algal flora of Assam, 11-A few Phormidium sps from the paddy fields of Assam. *National Academy of Sciences 4* (2) 65-67.
- Dutta, Nand Venkataraman, GS (1958).** An exploratory study of the Algae of some cultivated and uncultivated soils. *Indian Journal Agronomy 3* 109-115.
- Forest, HS & Khan, KR (1972).** *The Blue Green Algae A Programme of Evaluation of Francis Drouet's Taxonomy. Taxonomy and Bluegreen Algae* (Ed.) Desikachary, TV Madras University, 128-138.
- Gonzalves, EA (1947).** The algal flora of the hot springs of Vajreswari near Bombay *Journal of University of Bombay 16* 22-27.
- Gonzalves, EA and Gangla, KS (1949).** *Observation on the Algae of Paddy Field Soils. Journa ofl University of Bombay 18* (3) 51-59.
- Gonzalves, EA & Yalavigi, VS (1959).** *Algae of the Rhizopheres of Some Crop Plants*. Proceedings of the Symposium in Algae ICAR New Delhi 335-342.
- Hazarika, D (1988).** PhD Thesis, Gauhati University, Guwahati. (Unpublished).
- Hazarika, D & Gogoi, P (1985).** Thermal algae from Hot Springs of Nambor Forest, Assam *Geobios News Report 4* 187-190.
- Hazarika,D, Gogoi, P & Boissay, CL (1990).** Few species of *Anabaena* Bory from Assam India. *Advances in Plant Sciences 3*(1)151-152.
- Hazarika, D & Barukial J (2012).** *Occurrence and Distribution of Blue Green Algae* in paddy fields of Golaghat district, Assam India *Advances in Plant Sciences 25*(1) 341-345.
- Hajarika, D, Duarah, I & Barukial, J (2012).** An Ecological Assessment of Algal Growth with Particular reference to Blue -Green Algae from Upper Brahmaputra Valley of Assam <http://www.cibtech.org/jls.html> 2012 2(3) July-September 29-35 *Indian Journal of Fundamental and Applied Life Science (Online)*

Research Article

- Mitra, AK (1951).** The Algal Flora of certain Indian Soils *Indian Journal of Agricultural Science* **21** 357-373
- Parukutty, PR (1939).** Collection of Algae from Assam *Proceedings of the Indian Academy of Sciences B* **IX** (5) 229-235
- Prashad, BN & Srivastava, MN (1968).** *Systematic and Ecological Studies on Aalgae of Alkaline Usar Soils.* Phykos **7** (1 & 2) 102-111.
- Prashad, BN & Srivastava, MN (1992).** Fresh Water Algal Flora of Andaman & Nicobar Island I & II edited by Bishen Singh and Mahendra pal Singh, Dehradun.
- Rao, CB (1938).** The Myxophyceae of Madras Presidency, India. *Journal of the Indian botany society* **17** 81-96.
- Saikia, P & Bordoloi, RPM (1994).** Blue-green algal flora from the rice fields of Assam, *Phykos* **33** 53-57.
- Sankaram, A (1971).** Work done on blue-green algae in relation to Agriculture. Bulletin No. 27. ICAR New Delhi 28.
- Sankaram, A, Mudholkar, NJ & Sahay, MN (1967).** Inoculation of blue-green algae on the yield of rice under field condition, *Indian Journal of Microbiology* **7** 57.
- Shtina, EA (1972).** *Some peculiarities of the Distribution of Nitrogen Fixing Blue-Green Algae in Soils.* (cited from Venkataraman, GS 1972)
- Sinha, JP and Mukherjee, D (1975).** On blue-green algae from the paddy fields of Bankura District of West Bengal 1. *Phykos*, **14** (1&2) 117-118.
- Singh, RN (1939).** An investigation in to the algal flora of paddy field soils of the United Prov. *The Indian Journal of Agricultural Sciences* **9** (1) 55-77.
- Singh, RN (1961).** Role of blue-green algae in Nitrogen economy of Indian Agriculture ICAR, New Delhi .
- Subba Raju, N (1967).** An ecological and Taxonomical study of the algal flora of certain soils of Andhra Pradesh. PhD Thesis, Osmania University.
- Subba Raju, N (1972).** *The Blue Green Algae from the Soils of India.* Taxonomy of Bluegreen Algae (Ed.) Desikachary, TV Madras University 332-352
- Subrahmanyam, R, Relwani, LL & Manna GB (1965a).** Preliminary observation on the interaction of different rice soil types to inoculation of blue -green algae in relation to rice culture. *Proceedings of the Indian Academy of Sciences* **62** (B) 171.
- Subrahmanyam, R, Relwani, LL & Mann. GB (1965b).** Fertility built up of rice field soils by blue-green algae. *Proceedings of the Indian Academy of Sciences* **6** (B) 252.
- Thomoas, J & Goncalves EA (1965c).** Thermal algae of Western India -111, Algae of the hot springs at Sav, *Hydrobiologia* **26** 21-26.
- Thomoas, J & Goncalves EA (1965d).** Thermal algae of Western India -1v, Algae of the hot springs at Aravali tooral and Rajewadi, *Hydrobiologia* **26** 29-40.
- Tiwari, GL (1972).** Study of Blue green algae from Paddy field soils of India. *Hydrobiologia* **29** 335-350.
- Venkataraman, GS (1972).** *Algae bio-fertilizers and Rice Cultivation* IAAR New Delhi.
- Watanabe, A (1962).** *Effect of Nitrogen Fixing Blue-Green Algae.* Tolyphothrix tenuis on the nitrogenous fertility of paddy soils and on the crop yield of rice plants. *Journal of the General Microbiology* **8** 85.
- Whiton, BA (1972).** Fine Structure and Taxonomy in the Blue-Green Algae. Taxonomy and Bluegreen Algae (Ed.) Desikachary, TV Madras University 18-26.