

PLANKTONIC CYANOPHYCEAE (OSCILLATORIACEAE) IN FISH PONDS OF LOWER SINDH — II

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Abstract

The present paper provides an information about 17 phytoplankton algal sheathed species belonging to genera Phormidium and Lyngbya family Oscillatoriaceae collected in fish ponds of lower Sindh Pakistan.

The examination of morphological and taxonomical characters were conducted on living and formalin preserved samples, the aim has been to obtain as many data as possible to increase our knowledge about fresh water algal flora of Sindh province.

The paper is based on original material from these ponds.

Introduction

A considerable number of collections were made from the ponds of lower Sindh. During the course of present work specimens of 17 species of the two genera Phormidium and Lyngbya have been studied. About 90% of the species is accredited now for the first time to the flora of Sindh.

The comparative morphology of the members of Oscillatoriaceae was treated critically by Thuret (1875) and were followed by Gomont (1892), Geitler (1932), Biswas (1932) Rao (1938, 40), Bharadwaja (1940), Neilson (1940, 54), Gupta (1950) and Madson (1950).

The present study concerns with the taxonomical studies of the species belonging to genera Phormidium and Lyngbya of Oscillatorias distinguished from other families of the blue green algae, by the filamentous forms, and lack of

heterocysts and resting cells of any type; the members of these two genera are also distinguished from other members of Oscillatoriaceae by the presence of sheath.

Material and Method

Algal collections were made in the manner described earlier Arbani & Sahito (1991). The microscopic examination of the species is based on the criteria given by Geitler (1932) i.e. trichome type, cell size, cell shape and cellular inclusions. The diagrams are original and were drawn with the help of Camera lucida.

The general appearance and morphology of the organisms as studied with the optical microscope give a basis for taxonomical criteria of these species belonging to genus Phormidium and Lyngbya of Oscillatoriaceae.

The list of the species observed in these ponds .

Phormidium

- | | | |
|----|--------------------------------------|-------------|
| 1. | <i>P. ambiguum</i> | Lemm |
| 2. | <i>P. ambiguum</i> var. <i>major</i> | Lemm |
| 3. | <i>P. anamal</i> | Rao. C.P |
| 4. | <i>P. calcicola</i> | Gardener |
| 5. | <i>P. corium</i> | (Ag) Gomont |

Lyngbya

- | | | |
|-----|-----------------------------|---------------------|
| 1. | <i>L. aerugino-coerulea</i> | Agarth ex Gomont |
| 2. | <i>L. birgei</i> | Smith |
| 3. | <i>L. confervoides</i> | Agarth ex Gomont |
| 4. | <i>L. contorta</i> | Lemm. (After Smith) |
| 5. | <i>L. cryptovaginata</i> | Schkroob |
| 6. | <i>L. Digueti</i> | Gomont |
| 7. | <i>L. hieronymusii</i> | Lemm. |
| 8. | <i>L. major</i> | Menegh. ex Gomont |
| 9. | <i>L. martensiana</i> | Menegh. ex Gomont |
| 10. | <i>L. putealis</i> | Mont. ex Gomont |
| 11. | <i>L. sordida</i> | (Zonard) Gomont |

12. *L. versicolor* (Wartm) Gomont
1. *Phormidium ambiguum* Gomont

Monogr. Oscillariees, 178, pl. 5 f.10 1892; Forti in. De Toni, Sylloge Algarum ,5:240; 1907; Fremy, Myxo. d Afr equat. franc., 156 f. 137, 1929; Geitler Kryptogamenflor, 1015, f. 647 e, 1932; Fr emy, Cayno. cotes d. Eur., 91, pl. 24., f.1, 1933, Desikachary in Caynophyta, pl. 44, f16 & pl. 45, f.5-8, p.266, 1959.

Pl. 1 Fig. 1

Thallus more or less expanded, bright blue green, filaments flexous, trichomes slightly constricted at the ends not attenuated not capitate 4-6 μ (4.5 μ broad blue) green sheath thin and firm, cells shorter than broad, rarely granulated at cross walls end cells rounded. Calyptra absent.

In ponds of fish hatchery, Chillia.

2. *Phormidium ambiguim* Gomont var. *major* Lemmermann

Monogr. Oscillarie, 178, pl.5, f.10, 1892; Forti in De Toni, Sylloge Algarum, 5: 240, 1907; Fremy, Myxo. d Afr. equat. franc, 156, f. 137, 1929, Geitler, Kryptogamen flora, 1015, f. 647 e, 1932; Fremy, Cyano cotes d' Eur. 91 p.24, f.1. 1933; 127, 1920; Desikachary in Caynophyta , p.267, 1959.

Pl. 1 Fig 2

Thallus more or less expanded, bright, blue green colour, filament flexous, trichomes slightly constricted at cross walls, end cells rounded, not attenuated, not capitate, trichomes 9.5 μ broad, bright blue green, cells 2.5-3.0 μ long, cross walls rarely granulated.

Ponds of dist Thatta.

3. *Phormidium anomala* Rao. C.B.

The Myx. of Unit. Prov, III, Proc. Indian Acad. Sci., B, 6:371, f. 7f-l, 1936 Desikachary in Caynophyta , pl 45, f. 11 -13, p. 266, 1959.

Pl. 1 Fig. 3

Thallus thick expanded, deep blue green, trichomes of uniform width 8-10 μ (9 μ) board, without constriction at he cross walls. Sheath thin, colorless. Cells disc shaped, end cells bluntly rounded with cap or calyptra.

In ponds of dist. Thatta.

4. *Phormidium calcicola* Gardner

New Myx. from Poto Rico, Mem. N.Y. bot Gdn, 7:44, pl.9, f.87, 1927; Geitler Kryptogamenflora 1013, f.646 a, 1932; Desikachary, pl.43, f.4 & 5, p.267, 1959.

Pl. 1 Fig. 4

Thallus thick firm with densely entangled filament; filament 7-8 μ broad; sheath thick colorless; trichomes 5-8 μ (5.5-7.0 μ) broad, not constricted at the cross walls, not attenuated; cells quadric or slightly longer than broad, blue green and cells truncated rounded with thickened out membrane.

In fish ponds at Chillia Thatta.

5. *Phormidium corium* (Ag) Gomont

Essai class. Nostacacees, homocystees, Morots J. Bot., 4:355, 1890; Monogr. Oscillariees, 172, pl. 5, f. 1 & 2, 1892; Forti in De Toni, Sylloge Algarum, 5: 235, 1907; Freymy, Myxo. d Afr equat franc. 150, f.133, 1929; Geitler, Kryptogamenflor, 1018, f. 649 b,c. 1932, Freymy, Cyano. Cotes d Eur 89, pl. 23, f6, 1933, Desikachary in Cyanophyta, pl, 44, f.10.-11, p269, 1959.

Pl. 1 Fig.5

Thallus expanded membranous leathery, blue green, more or less flexous, sheath thin gelatinizing, trichomes blue green, not constricted at cross walls, ends straight briefly attenuated not capitate, 3-4.5 (6.0 μ) broad; cells nearly quadrate, upto twice as long as broad, 3-4-8 μ long, not granulated at cross walls, end cells abtuse conical, calyptra absent.

In paddy fields and ponds.

1. *Lyngbya aerugino-coerulea* (Kuetz) Gomont

Monogr. Oscillariees, 146, pl. , f 1-3 1892; Forti in De Toni, Sylloge Algarum, 5: 281, 1907, Freymy, Myxo. d Afr. equat, franc, 190, f. 157, 1929, Geitler Kryptogamenflora, 1062, f.670, 1932, Desikachary in Cyanophyta, pl. 48, f.9, p.315, 1959.

Pl. 1 Fig. 6

Filament single or more rarely forming a dull blue green expanded thallus, flexous, fragile shaerth thin firm not lasmellated, trichomes 4-6.0 μ board, not constricted at the cross wall, some time granulated, apex of the trichome occasionally capitate.

In stagnant and floating waters.

2. *Lyngbya birgei* Smith

New or intresting Algae from lakes of Wisconsin, Bull. Torrey bot. 61; 43: 482, pl,26, f.e8, 1916; Geitler, Kryptogamenflora, 1048, f.663, 1932; Desikachary in Cyanophyta pl.50, f.7,8,p.296, 1959.

Pl. 1 Fig. 7

Filament straight, seldom coiled free floating, 20 -24 μ (40 μ) broad. Sheath firm colorless mostly unlamellated, 0.5 -4.0 μ thick, trichomes not constricted at the cross walls, end rounded, not attenuated, not capitate, cells shorter than broad, some time with gas vacoules.

Distributed in lakes and ponds.

3. *Lyngbya confervoides* C. Agradh ex Gomont

C. Agardh, Syst. Alg., 73, 1824 Gomont Monogr. Oscillariees, 156, pl 3, f. 5-6, 11893; De Toni, Syll. Algar 5: 271, 1907, Geitler, Kryptogamenflora, 1061, f. 672 b. 1932; Frey, Myxo. Cotes d Eur., 106, pl. 28, f2. 1933, Lemmermann, Algenfl. Sandwich- Insulin. Bot Jahrb 34:620, 1905, Collin, Notes on Alg. IX, Rhodera 10: 160, 1908; Tilden, Minnesota Alg Pl. V. F39, p.120, 1910, Biswas, Alg. flora of the Chilka lake, Mem. Asiatic. Soc. Bengal, II (5) p.170, 1932. Dicit. The Myx, of Bombay Presidency, India, proc. Ind. Acad. Sci B. 3., p.95, 1938; Desikachary in Caynophyta pl. 49, f.9. pl. 52, f.13, p. 31.4, 1959.

Pl. 1 Fig. 8

Thallus caespitose, expanded, fasciculate, about 5 cms in height, mucus dull yellowish or dark green, when dried becoming violet. Filaments at the base decumbent, above ascending and entangled, straight sheah colourless when old upto 5 μ thick; trichomes 9-25 μ mostly 10-16 μ in diameter, not constricted at the cross walls, commonly granulated, not attenuated at the apics, end cells rounded. Calyptra absent.

In ponds and lakes.

4. *Lyngbya contorta* Lemm (after Smith)

Phytoplant. Saehs Tiech in Ploner Forschber., 6: 202, p 5, 10- 13, 1898; Forti in De Toni, Syllöge Algarum, 5:288; 1907; Frey, Myxo. d Afri equat franc, 202, f. 172, 1929, Geitler, Kryptogamenflora, 1043 f. 660 a-b, 1932, Frey, cyano. Cotes d Dur., 109, pl 29. f.2. 1933, lemmermann, Protophyten, Planton von Cylon. zool. Johrb. 25, Systematic 263, 1907, Skvortzow, On some fresh water algae from Cylon. ann Ray Bot Gdn. Perediniya 1928. Zur susswasseralgenflora Burmas. Nova Acta Reg. Soc. Sci Uppsal. ser IV, 14(5): 1-88, 1949. Desikachary, Caynophyta pl. 48, f. 5, pl.52, f.5&9, p.290, 1959.

Pl. 1 Fig. 9

Filament single free floating, regularly spirally coiled, with a delicate nearly circular coils, 1-15 μ broad; sheath narrow colourless; cells 1-2 μ broad, 3-5 μ long, not constricted at the cross walls, granulated with a single granule or without them; end cells round, not attenuated.

Plankton in lakes and ponds.

5. *Lyngbya cryptovaginata* Sckkorb.

Beobachtung über einige Cyanophyd. Charkov (Ukraine) Arch. Russ. Protislogia 6(-4): 125, pl. 8, f.14-16, 1927; Geitler, 12: 401, 1925; Gollerbax et al., Guide to fresh-w. Alg. U.S.S.R., Vol.2, Blue Green Alg., f.271, 6-7, p.527, 1953; Desikachary in Cyanophyta, pl. 50, f.6, p.296, 1959.

Pl. 2 Fig. 10

Filaments single, free floating, straight 4-9 μ (6 μ) broad; sheath colourless, delicate, at first not often distinctly visible but latter distinct, trichomes slightly constricted at cross walls, blue green; cells quadrate or upto 1/2 as long as broad, with pseudovacuoles; end cells rounded.

In ponds and rain water pools.

6. *Lyngbya digueti* Gomont

In Hariot, Algues de Golfe de Californie recuiles, J.De Bot., 9: 169, 1895; Forti in De Toni Sylloge Algarum, 5:284, 1907; Fremy, Myxo. d' Afr. Equat. franc., 19, f.163, 1929; Geitler, Kryptogamenflora, 1058, f.656a, 1932; Desikachary in cyan phyta Pl.53, f.8, p.310, 1959.

Pl. 2 Fig. 11

Filament light green, 2.5-3 μ broad, sheath thin, colourless, papyraceous, trichomes not constricted at the cross walls. Cells nearly quadrate or seldom shorter than broad, 2-3 μ (6 μ) broad, cells rotund without calyptra.

Fish ponds and canals of dist Thatta.

7. *Lyngbya hieronymusii* Lemmermann 1905, p.146.

Forschbers., Plon, 12: 146, pl. 4, f. 12,13, 1905; Kryptogamenflora de Mark Brandenburg, 3, 139, f.6(p.102), 1910; Fremy Myxod' equat. franc. 192. f.160, 1929; Geitler, Kryptogamenflora, 1047, f.656 a, 1932; Desikachary in Cyamophyta in pl.48, f.4, p.297, 1959; Prescott, Alg. of the West Great lake Ara, pl. 112, f.4. p.501, 1951.

Pl. 2 Fig. 12

Filament single, scattered among other algae or littoral free floating plankton. Trichomes straight and not tapering at apex, 11-13 μ (9- μ) in diameter, 3.0 - 4.5 μ long, not constricted at cross walls, which are granular, usually with gas vacuoles, end cells broadly round. in fish Ponds of dist. Thatta.

8. *Lyngbya major* Menegh ex. Gomont

Meneghini, Conopectus Algologia euganraeae, 12, 1837; Gomont, Monogr. Oscilltories, 144, pl.3, f.15, 1892; DeToni, sylloge Algarum, 55, 279, 1907; Geitler, Kryptogamenflora, 1066, f.679 a, 1932, non Kutz, non Rabenh. Wolle, Fresh -w. Alg. Jour. of Bot. 42:291.1904; Tilden, Minn. Alg.

pl.V, f.46, p.1265, 1910; Prescott Alg the West Gt. Lake Area p.112, f.10, p.502, 1951; Desikachary Cyamophyta pl. 52.f. 11, p.320, 1959.

Pl. 2 Fig. 13

Plant solitary among other algae or some what gregarious, but not forming expansions or plant masses; filaments straight, trichomes not or very slightly tapering at the apices, which are indistinctly capitate in other plant $11-17 \mu$ (10.5μ) in diameter. Cells not constricted at their cross walls which are distinctly granulose; cells content homogenously laminated, become roughed in age; filaments $20-26 \mu$ in diameter.

Hab. Widely distributed in variety of lakes and ponds.

9. *Lyngbya martensiana* Menenghini 1837

Conspectus algolgiae engancae p.23, 1837; Prescott, Alg. of the West Gt. lake Area, p.112, f.11, p.502, 1951.

Pl. 2 Fig. 14

Plant dark blue green colour; trichomes $6-10$ (12μ) in diameter, not tapering towards the apices; which are broadly convex. Cells $1-3 \mu$ long, not constricted at the cross walls. Content homogenous. Sheath firm.

In ponds and lakes.

10. *Lyngbya putealis* Mont. ex Gomont

Montagne, Zo centurie de Plantes Cellulaires exotiques, Ann. Sci.nat., Z ser., Bot.13: 200, 1840; Gomont, Mongr. Oscillaries, 143 pl.3, f.14, 1892; Forti in De Toni, Sylloge Algarum, 5: 277, 1907; Frem, Myxo. d' Afr. equat. franc., 193, f.159, 1929; Geitler, Kryt. gamenoflora, 1063, f.675, 1932; Crow in Jour. Bot. 61, p.142, 1923; Tilden, Myx. in Minn. Alg 1, pl. 5, f.45, p.125, 1910; Li in Ling, Sc. Jour 14, p.472, 1935; Wang in contr. Biol. Lab Sci. Soc. China 10, p.159, 1936; Yoneda in Cyan. of jap. III, Acta. Phylotax, Geobot, N.9, Vol VII, p.175, 1938; Gollertax et al in Guide to Fresh-2. Alg. U.S.S.R. Blue Gr. Alg., vol.2, f.277-1, p.539, 1953.

Pl. 2 Fig.15.

Stratum caespitose, widely expanded, elongate, penicillate some times becoming dark violet or black, filaments very long, more or less flexous or entangled at base above straight parallel, rigid. Sheaths thin colourless. Trichomes $7.5-13 \mu$ (9μ) in diameter, distinctly constricted at cross walls, Apex of the trichome not tapering; apical cells rotund; calyptra absent, Cells $3-10 \mu$ in length; transverse walls some times granulated; cell content granular blue or blue green.

Widely distributed in stagnant and flowing waters.

In fish ponds hatchery Chillia Thatta.

11. *Lyngbya sordida* (Zonard) Gomont

Monogr. Oscillariees, 126, pl. 2, f.21, 1892; Forti in DeToni, sylloge Algarum, 5:260, 1907, Tilden Minnesota Alg. pl.V, f.37, p.118, m 1910; Geitler, Kryptogamenflora, 1039, f. 657 b, 1932, Freymy, Cyano. cotes d' Eur; 103, pl26, f.5. 1933, Boegresen Some marine alg. from Cylon, J.Sci. Sect. Bot. 12(2), p.66, 1936; Desikachary in Cyanophyta pl, 52, f.1, p.285, 1959.

Pl. 2 Fig. 16

Thallus conspicuous, fasciculate, dull or dirty yellow green. Filaments more or less straight some what rigid, not constricted at the cross walls, ends not attenuated, apical cells rotund, calyptra non, trichomes 14-30 μ in diam., cells 4-10 μ in length. Cells content frequently showing scattered granules.

In ponds and lakes.

12. *Lyngbya versicolor* (Wartm), Gom.

Monogr. Oscillariees, 147, pl.4,f.-5, 1892; West & West, A Cont. to fresh-w. Alg. Cylon, Trans. Linn. Soc. Bot Ser. 2,6; p.204, 1902; Freymy in De Toni, Sylloge, Algarum, 5 282, 1907; Freymy Myx. D; Afr. equat franc., 198, f.164 1929; Geitler, Kryptogamenflora 1059, f. 656 f, 1932; Gollerbax et al, Guide to fresh-w Alg. U.S.S.R., Vol.2 Blue Green Alg. f.276-4, p.537, 1953; Desikachary in Cyanophyta, pl.53, f.6, p.311, 1959, Prescott, Alg. of Gt. West Lake Area, Pl.113, f.4, p.504, 1951.

Pl. 2 Fig. 17

Plants forming mucus expansion on submerged objects, later free floating, lubericons, some what soft, rusty on outside and inside olive green, filament long tuberos, closely entangled ; sheath colourless, some what yellowish; musilagenous, upto 2 μ thick, trichomes not constricted at cross walls, 2.8-3.2 (4.5 μ) in diameter, apics not attenuated, not capitate, cross walls not granulated, cells blue green, end cells rounded, calyptra absent.

Tycho plankton in artifical lakes & submerged logs.

In fish ponds at Chillia, dist. Thatta.

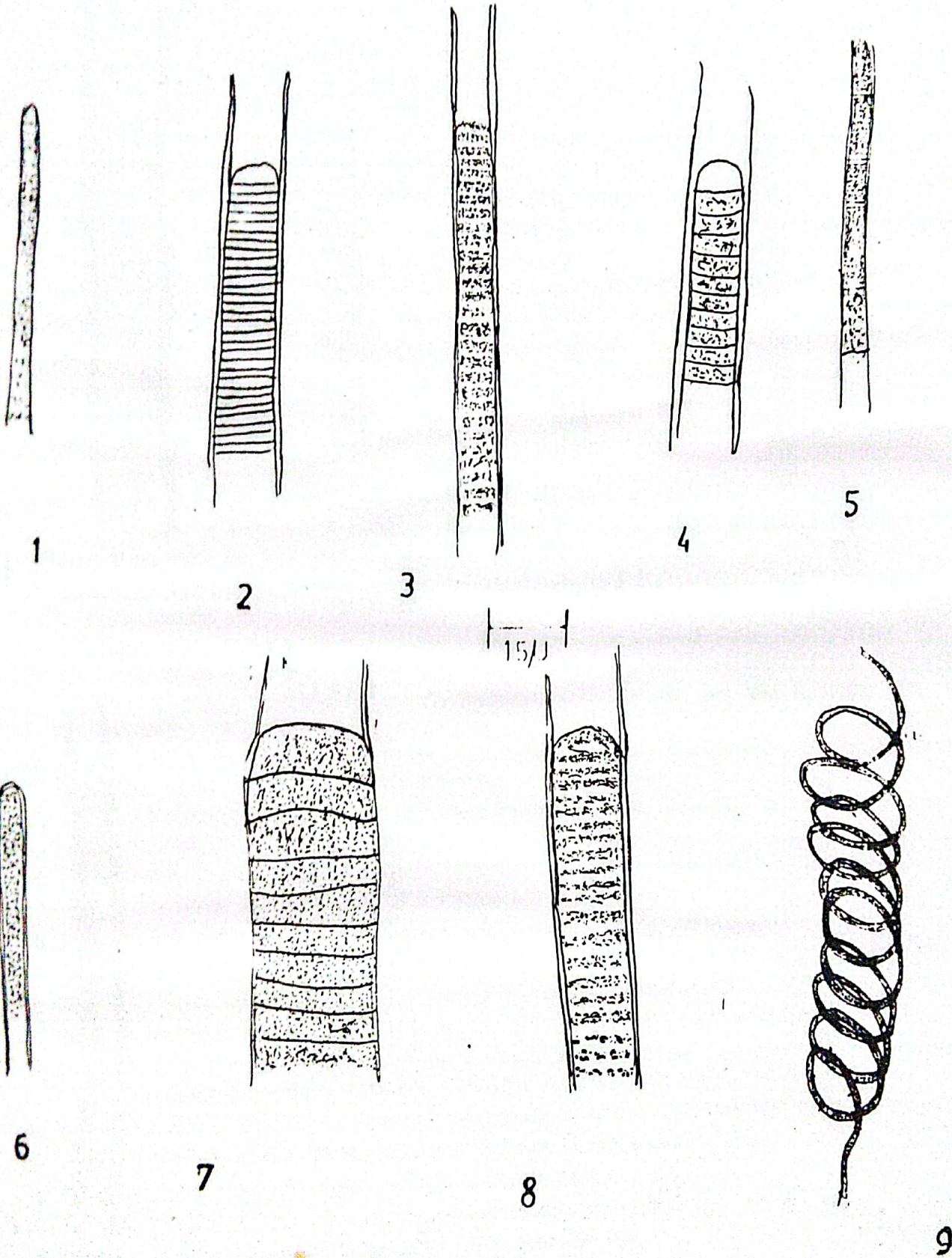


Plate - 1

- 1. *Phormidium ambiguum*
- 2. *P. ambiguum* var. *major*
- 3. *P. anamal*
- 4. *P. calciola*

- 5. *P. corium*
- 6. *Lyngbya aerugino-coerulea*
- 7. *L. birgei*
- 8. *L. confervoides*



10



11



12



13

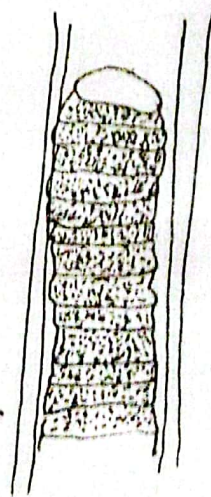
15μ



14



15



16



17

Plate - 2

9. *Lyngbya contorta*
 10. *L. cryptovaginata*
 11. *L. digueti*
 12. *L. major*
 13. *L. martensiana*

14. *L. hieronymusii*
 15. *L. putealis*
 16. *L. sordida*
 17. *L. versicolor*

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