BULL. BOT. SURV. INDIA
Vol.50, Nos.1-4 : pp.119-128, 2008

BARK ALGAE OF INDIAN BOTANIC GARDEN, HOWRAH

R. K. GUPTA

Botanical Survey of India, Cryptogamic Unit, Howrah 7111 03

ABSTRACT

Studies on the epiphytic algae on the bark of different trees in Indian Botanic Garden, Howrah were conducted between 2006- 2007. Of these 33 species belong to Cyanophyceae. The members of 53 algal species revealed that members of Chroococcaceae, Oscillatoriaceae, Scytonemataceae, Nostocaceae, Rivulariaceae (Cyanophyceae), and Trentepohliaceae, Pleurococcaceae (Chlorophyceae) exhibit a luxuriant growth. But certain members of Chlorophyceae, Xanthophyceae and Bacillariophyceae, exhibit scare growth. The correct names of the woody species that support the growth of the algae are also listed.

INTRODUCTION

Indian Botanic Garden, Howrah established in 1787, covers an area of about 273 acres on the west bank of the river Ganga (Hooghly). Geographically, it is located at 22°35´N latitude and 88°21´E longitude at the elevation of 4.6 m above the sea level. The area experiences annual rainfall of about 1536 mm and the temperature ranges from 21°C - 31°C. There are 24 artificial lakes and ponds of different sizes. The garden is a living repository of more then 12,000 trees, shrubs and climbers representing over 1400 species including wild and cultivated herbs.

The microclimatic conditions of the garden provide congenial environment for the growth of bark algae. The present study is based on the collections of the algae growing on bark by the author from 2006 – 2007.

Bark is a protective corky tissue of the dead cells present on the outside of older stems and roots of woody plants. It consists of cork only, or, when other layers of cork are formed at successively deeper levels within the cortex it may consists of alternating layers of cork and dead cortex tissue and may also include dead phloem tissue. Bark provide humus and suitable substratum for algal growth. It also protect from insects and fungal attack, besides, maintaining internal temperature of the plant. Generally, two types of bark are seen, they are ring-bark and scale-bark. The scale-bark exhibit longitudinal grooves which are more suitable for algal growth. The algae occurring on the bark are also called epiphloeophytes.

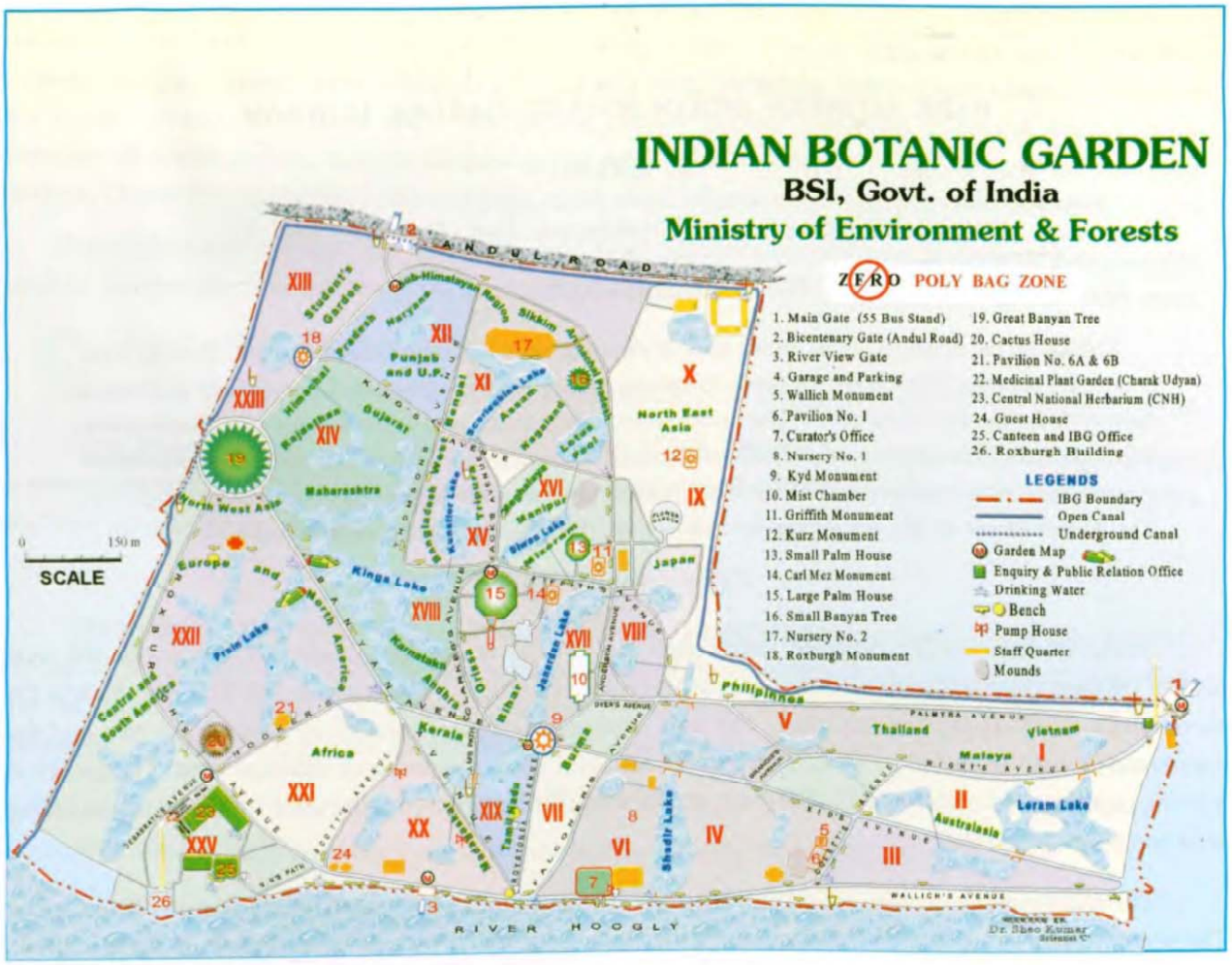
Corticolous or tree bark inhabiting algae have been studies by Edwards (1968), Cox and Hightower (1972) and Wylie and Schlichting (1973) from United States of America but in India not much work has been carried out on the bark algae except Brühl and Biswas (1923), Subramanian(1981).

MATERIAL AND METHODS

Bark algal samples were collected between April 2006 to December, 2007 from the different divisions of Indian Botanic Garden (**Map.1**) by gently scraping the bark with a scalpel and then picked up with the help of a forceps and preserved in 4% formalin solution. These specimens were studied using Olympus Cx41 compound microscope. The genera and species are arranged alphabetically.

The algal materials have been deposited in the Cryptogamic Section of the Central National Herbarium of Botanical Survey of India, Howrah. The specimens were identified with the help of Geitler (1932),

Date of Publication : 15 September, 2009



Map.1. Bark algal samples were collected between April 2006 to December, 2007 from the different divisions of Indian Botanic Garden.

Desikachary (1959), Philipose (1967), Ettl (1978), Gandhi (1998), Anand (1998), Gupta (2005) and some other relevant literature.

53 species belonging to 25 genera from 13 families have been enumerated in Table-1. Colour photographs of some species have also been provided.

RESULTS AND DISCUSSION

A total of 107 specimens were collected from the different divisions of Indian Botanic Garden. The specimens represent 53 species belonging to 25 genera from 13 families (Table-1; Pl. 1-8). Of the total, 8 genera and 16 species belong to Chlorophyceae, 13 genera and 32 species to Cyanophyceae, 3 genera and 4 species to Bacillariophyceae and one genus and one species of Xanthpophyceae were recorded. The surface of the bark is dominated by the members of blue green algae on *Swietenia mahagoni* (L.) Jacq., *Terminalia arjuna* Wt. & Arn., *Terminalia bellerica* (Gaertn.) Roxb., *Terminalia catappa* L. and *Mangifera indica* L. The prop root of *Ficus benghalensis* L. supports the growth of *Trentepohlia torulosa* Wilde. throughout the year.

Besides, bark also provides suitable substratum for microbial growth. The bark holds certain amount of moisture and its water holding capacity helps several other angiospermic taxa also to grow on it luxuriantly.

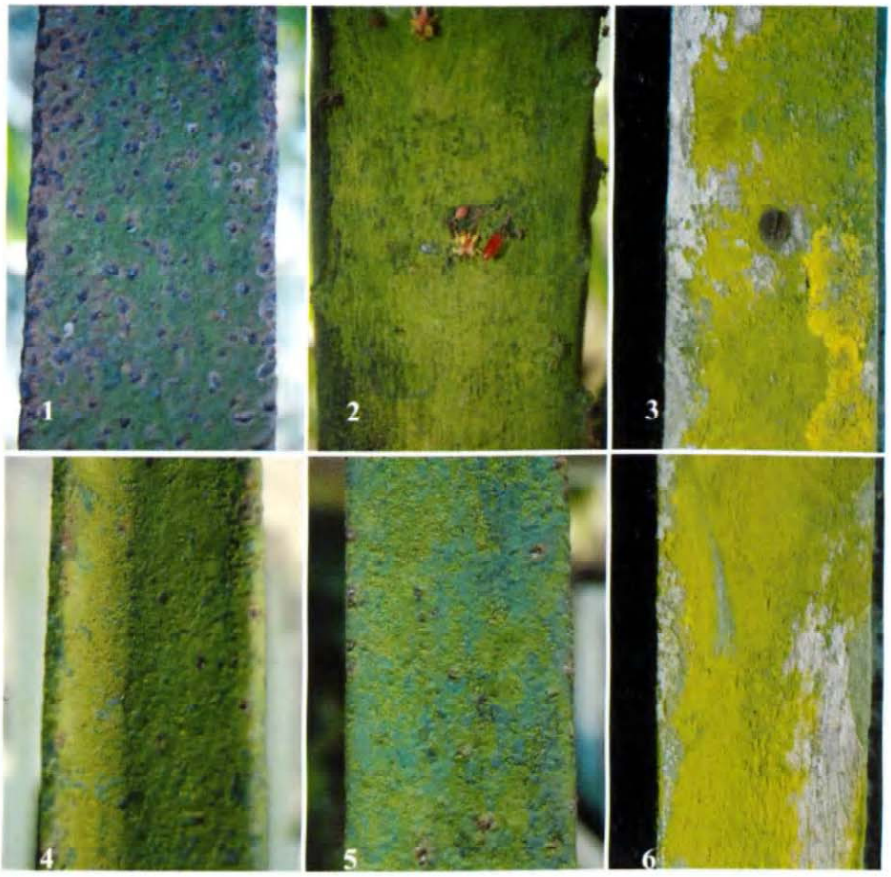


Plate - 1

Figs. 1-6: 1. *Phormidium lucidum* (C.A. Ag.) Kütz. [*Pterygota alata* (Roxb.) R. Br.]; **2.** *Lyngbya major* Meneg. (*Dalbergia sissoo* Roxb.); **3., 6.** *Hormidium flaccidum* (Kütz.) A. Br. (*Ficus benghalensis* L.); **4.** *Oscillatoria acula* Brühl *et* Biswas (*Strychnos nux-vomica* L.); **5.** *Oscillatoria granulata* Gardner (*Sterculia foetida* L.).

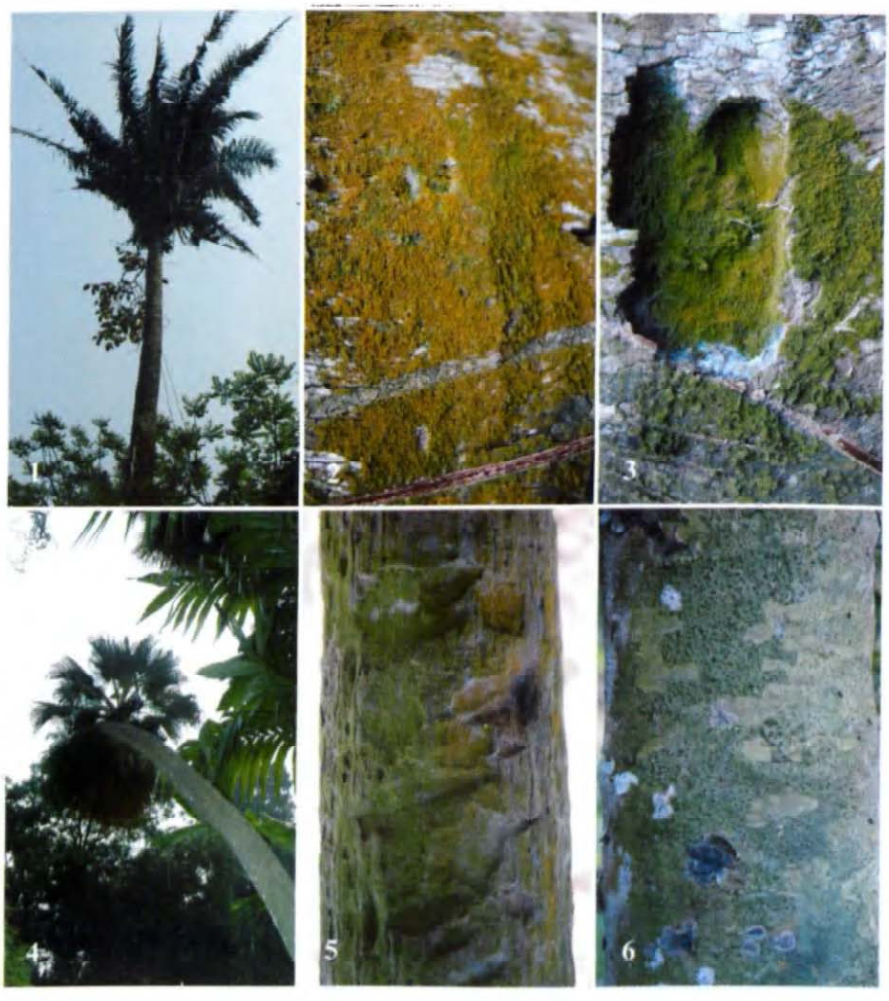


Plate - 2

Figs. 1-6: 1. *Microcystis marginata* Kütz. (*Attalea speciosa* Martius); **2.** *Trentepohlia aurea* (L.) Martius (*Ficus benghalensis* L.); **3.** *Trentepohlia gracilis* Iyengar (*Mangifera indica* L.); **4.** *Stipitococcus capense* Prescott [*Livistona chinensis* (Jacq.) R. Br. ex Martius]; **5.** *Vaucheria sessilis* (Vauch.) DC. [*Samanea saman* (Jacq.) Merrill]; **6.** *Nostoc commune* Vauch. (*Arucaria cookii* R. Br. ex D. Don.)

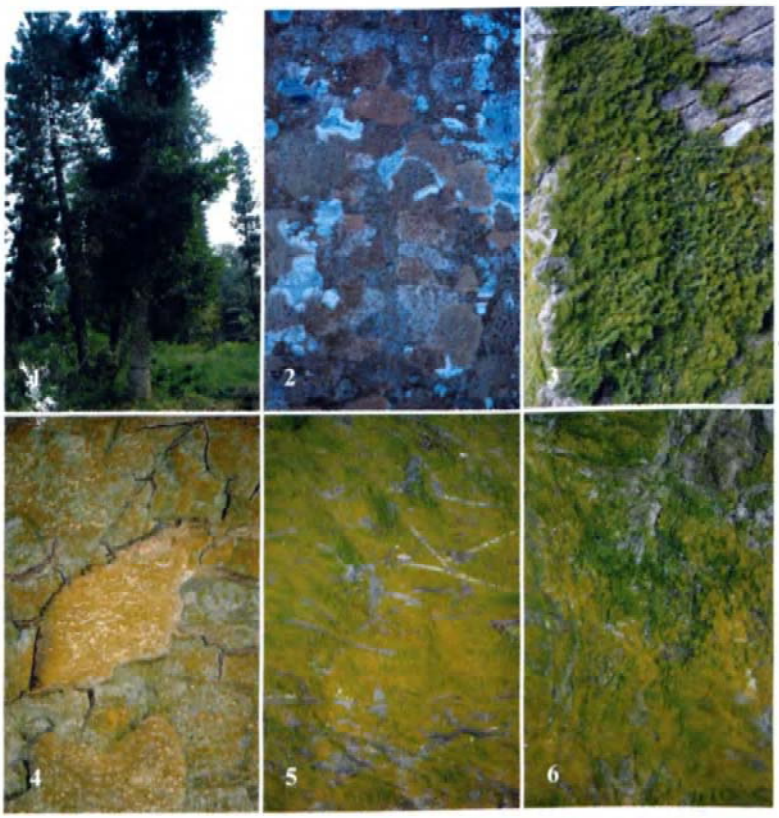


Plate - 3

Figs. 1-6: 1. *Calothrix Braunii* Bornet & Flahautt (*Araucaria Cunninghamii* Ait.); **2.** *Trentepohlia aurea* var. *tenuior* Brühl *et* Biswas (*Ficus benghalensis* L.); **3.** *Aphanocapsa pulchra* (Kütz.) Raben. (*Mangifera Indica* L.); **4.** *Trentepohlia iolitnus* (L.) Wallroth (*Teminalia chebula* Retz.); **5.** *Trentepohlia tenuis* (Zell.) De-Toni (*Ficus religiosa* L.); **6.** *Trentepohlia torulosa* Wilde (*Ficus benghalensis* L.)



Plate - 4

Figs. 1-6: 1. *Chroococcus minutus* (Kütz.) Naeg. (*Chloroxylon swietenia* DC.); **2.** *Chroococcus turgidus* (Kütz.) Naeg. (*Areca catechu* L.); 3. *Gloeocapsa aeruginosa* (Carm.) Kütz. (*Toona ciliata Roem.*); **4.** *Hormidium flaccidum* (Kütz.) A. Br. (*Terminalia chebula Retz.*); **5.** *Lyngbya arboricola* Brühl et Biswas [*Tabebuia chrysantha* (Jacq.) Nichol.]; **6.** *Calothirx parietana* (Naeg.) Thuret. [*Swietenia mahagoni* (L.) Jacq.].



Plate - 5

Figs. 1-6: 1-3. *Trentepohlia torulosa* Wilde. (*Ficus benghalensis* L.); **4-6.** *Trentepohlia aurea* (L.) Martius (*Ficus benghalensis* L.)



Plate - 6

Figs. 1-6: 1. *Stipitococcus capense* Prescott (*Terminalia arjuna* Wt. & Arn.); **2.** *Stipitococcus capense* Prescott [*Terminalia bellerica* (Gaertn.) Roxb.]; **3.** *Vaucheria terrestris* (Vauch.) DC. (*Chrysophyllum cainito* L.); **4.** *Schizothrix lasciculata* (Naeg.) Gomont [*Roystonea regia* (H.B. & K.) O.F. Cook]; **5.** *Scytonema mirabilis* (Dillw.) Bornet [*Swietenia mahagoni* (L.) Jacq.]; **6.** *Calothrix brannii* Bornet & Flahanlt (*Mangifera indica* L.)

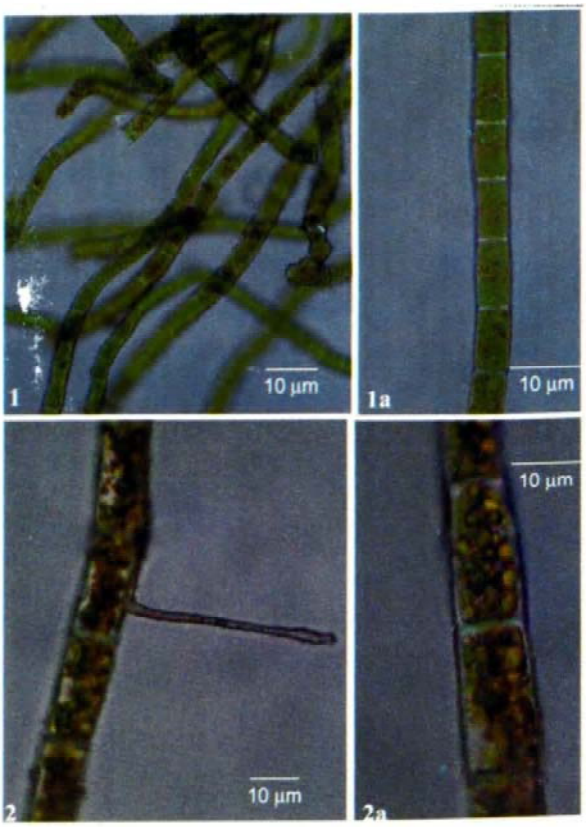


Plate - 7

Figs. 1-2: 1. *Trentepohlia aurea* (L.) Martius; **1a.** Same enlarged; **2.** *Trentepohlia tenuis* (Zell.) De-Toni; **2a.** Same enlarged

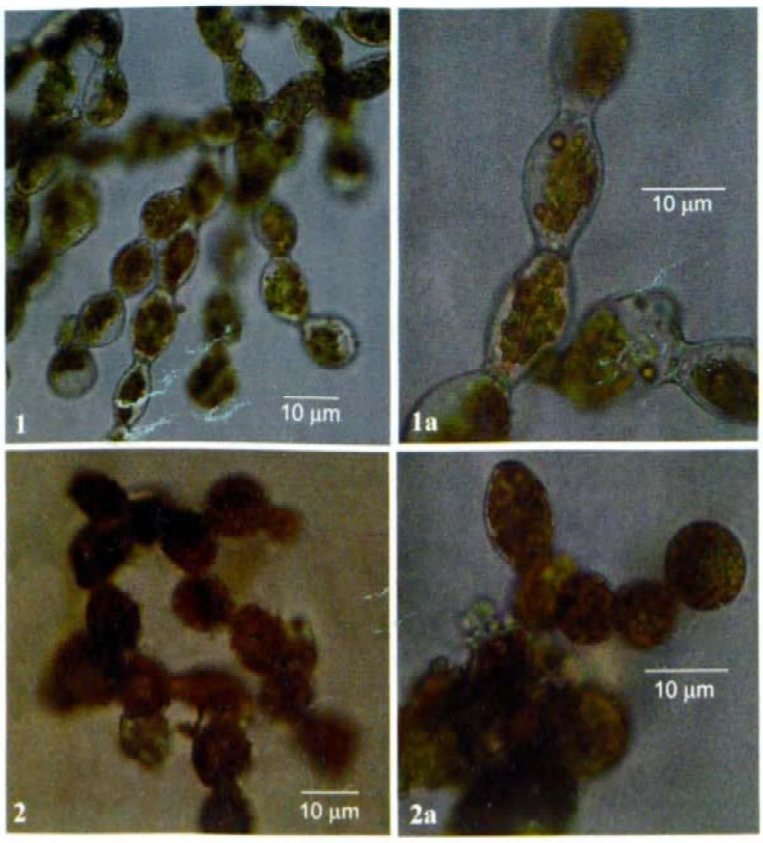


Plate - 8

Figs. 1-2: 1. *Trentepohlia torulosa* Wilde; **1a.** Same enlarged; **2.** *Tentepohlia umbrina* (Kütz.) Bornet.; **2a.** Same enlarged

Table - 1. Distribution of Bark algae on different tree species

Sl. No.	Name of the Algal species	Substratum (Tree species)
A. CYANOPHYTA		
1.	Nostocaceae *Anabaena circinalis* Raben.	*Samanea saman* (Jacq.) Merrill *Kigelia pinnata* DC.
2.	Chroococcaceae *Aphanocapsa delicatissima* West & West	*Toona ciliata* Roem.
3.	Chroococcaceae *Aphanocapsa pulchra* (Kütz.) Raben.	*Terminalia chebula* Retz.
4.	Rivulariaceae *Calothrix braunii* Bornet & Flahault	*Swietenia mahagoni* (L). Jacq. *Tectona grandis* L.f.
5.	Rivulariaceae *Calothrix parietana* (Naeg.) Thuret	*Swietenia mahagoni* (L.) Jacq. *Syzygium caryophyllatum* (L.) Alston
6.	Chroococcaceae *Chroococcus minutus* (Kütz.) Naeg.	*Tabebuia chrysantha* (Jacq.) Nichol.
7.	Chroococcaceae *Chroococcus turgidus* (Kütz.) Naeg.	*Tabebuia chrysantha* (Jacq.) Nichol.
8.	Chroococcaceae *Gloeocapsa acruginosa* (Carm.) Kütz.	*Cycas circinalis* L.
9.	Oscillatoriaceae *Lyngbya aerugineo – caerulea* (Kütz.) Gomont	*Dillenia indica* L.
10.	Oscillatoriaceae *Lyngbya aestuarii* (Mert.) Lieb.	*Swietenia mahagoni* (L.) Jacq. *Araucaria cookii* R.Br. ex D.Don
11.	Oscillatoriaceae *Lyngbya arboricola* Brühl et Biswas	*Aristolochia grandiflora* Swartz
12.	Oscillatoriaceae *Lyngbya corticicola* Brühl et Biswas	*Casuarina equisetifolia* Forst.
13.	Oscillatoriaceae *Lyngbya dendrobia* Brühl et Biswas	*Araucaria bidwillii* Hook. *Araucaria cookii* R.Br. ex D.Don
14.	Oscillatoriaceae*Lyngbya epiphytica* Hiero.	*Albizia lebbeck* Benth.
15.	Oscillatoriaceae *Lyngbya major* Meneg.	*Dalbergia sissoo* Roxb.
16.	Oscillatoriaceae *Lyngbya subtilis* W.West	*Ficus religiosa* L.
17.	Chroococcaceae *Microcystis marginata* Kütz.	*Madhuca indica* Gmel. *Aegle marmelos* Corr.
18.	Nostocaceae *Nostoc commune* Vaucher	*Swietenia mahagoni* (L.) Jacq. *Araucaria cookii* R.Br. ex D.Don
19.	Nostocaceae *Nostoc sphaericum* Vaucher	*Samanea saman* (Jacq.) Merrill
20.	Nostocaceae *Nostoc verrucosum* Vaucher	*Saraca indica* L.
21.	Oscillatoriaceae *Oscillatoria acula* Brühl et Biswas	*Strychnos nux-vomica* L.
22.	Oscillatoriaceae *Oscillatoria formosa* Bory	*Sterculia foetida* L.

Sl. No.	Name of the Algal species	Substratum (Tree species)
23.	Oscillatoriaceae *Oscillatoria granulata* Gardner	*Sterculia foetida* L.
24.	Oscillatoriaceae *Oscillatoria tenuis* C.A.Ag.	*Sterculia foetida* L.
25.	Oscillatoriaceae *Phormidium lucidum* (C.A.Ag.) Kütz.	*Pterygota alata* (Roxb.) R.Br. *Ficus krishnae* A. DC.
26.	Oscillatoriaceae *Schizothrix fasciculata* (Naeg.) Gomont	*Chrysophyllum cainito* L.
27.	Oscillatoriaceae *Schizothrix friesii* Gomont	*Agathis loranthifolia* Salisb.
28.	Scytonemataceae *Scytonema crispum* (C.A.Ag.) Bornet	*Mangifera indica* L. *Pinus roxburghii* Sargent
29.	Scytonemataceae *Scytonema mirabile* (Dillw.) Bornet	*Mangifera indica* L.
30.	Scytonemataceae *Scytonema tolypothricoides* Kütz.	*Mangifera indica* L.
31.	Scytonemataceae *Tolypothrix byssoidea* (Hassall) Kirchner	*Albizia lebbeck* Benth.
32.	Scytonemataceae *Tolypothrix limbata* Thuret	*Anthocephalus chinensis* Hassk.
B. CHLOROPHYTA		
33.	Chaetophoraceae *Chaetophora attenuata* Hazen	*Araucaria excelsa* R.Br. *Araucaria cunninghamii* Ait.
34.	Chlorococcaceae *Chlorococcum humicolo* (Naeg.) Raben.	*Elaeocarpus floribundus* Blume
35.	Ulotrichaceae *Hormidium flaccidum* (Kütz.) A. Br.	*Ficus benghalensis* L.
36.	Chlorellaceae *Chlorella vulgaris* Beijerinck D.Don ex Lamb.	*Podocarpus neriifolius* D.Don ex Lamb.
37.	Chlorococcaceae *Trebouxia humicola* (Treboux) West et Fritsch	*Pterygota alata* (Roxb.) R.Br.
38.	Ulotrichaceae *Stichococcus bacillaris* Naeg.	*Cinnamomum camphora* Nees & Eber.
39.	Ulotrichaceae *Stichococcus scopulinus* Hazen	*Cycas rumphii* Miq.
40.	Trentepohliaceae *Trentepohlia aurea* (L.) Martius	*Ficus benghalensis* L.
41.	Trentepohliaceae *Trentepohlia aurea* var. *tenuior* Brühl et Biswas	*Ficus benghalensis* L.
42.	Trentepohliaceae *Trentepohlia gracilis* Iyengar	*Mangifera indica* L.
43.	Trentepohliaceae *Trentepohlia iolithus* (L.) Wallroth	*Ficus religiosa* L.
44.	Trentepohliaceae *Trentepohlia tenuis* (Zell.) De-Toni	*Ficus religiosa* L.

Sl. No.	Name of the Algal species	Substratum (Tree species)
45.	Trentepohliaceae *Trentepohlia torulosa* Wilde.	*Ficus benghalensis* L.
46.	Trentepohliaceae *Trentepohlia umbrina* (Kütz.) Bornet	*Shorea robusta* Gaertn.
47.	Vaucheriaceae *Vaucheria sessilis* (Vauch.) DC.	*Samanea saman* (Jacq.) Merrill
48.	Vaucheriaceae *Vaucheria terrestris* (Vauch.) DC.	*Samanea saman* (Jacq.) Merrill
C.	XANTHOPHYTA	
49.	Heterorhizidaceae *Stipitococcus capense* Prescott	*Coccoloba acuminata* H.B. & K.M *Cangifera indica* L.
D.	BACILLARIOPHYTA	
50.	Naviculaceae *Gyrosigma attenuatum* (Kütz.) Rabenh.	*Dalbergia sissoo* Roxb. *Roystonea regia* (H.B. & K.) O.F.Cook
51.	Naviculaceae *Navicula cuspidata* Kütz.	*Araucaria cunninghamii* Ait.
52.	Naviculaceae *Navicula radiosa* Kütz.	*Araucaria cookii* R.Br. ex D.Don
53.	Naviculaceae *Pinnularia viridis* (Nitz.) Ehr.	*Araucaria cookii* R.Br. ex D.Don

It has been observed that the older bark on the trunk of living plants and dead log has more surface area on longitudinal grooves which has the capacity of retaining more moisture leading to conducive environment for algal growth. Further, it is also noticed that the algal growth are dominant in the basal portion (up to 8 ft.) of the trunk due to retention of more moisture and then expose the upper portion.

The present study provides base line information regarding the bark algal flora and can be used as a reference source of information for preparation of a detailed account of bark algae flora of the state in future.

ACKNOWLEDGEMENTS

The author is grateful to the Director, Botanical Survey of India for providing facilities and to Additional Director, Indian Botanic Garden for constant encouragement throughout the work. I am also grateful to Dr. S.K. Srivastava, Scientist – D, Central National Herbarium, BSI, Howrah, for valuable suggestions and going through the manuscript.

REFERENCES

ANAND, N. 1998. *Indian fresh water micro algae*. Bishen Singh Mahendra Pal Singh, Dehra Dun.

BRÜHL, P. AND K.P. BISWAS. 1923. Commentationes Algologicae II, Algae epiphyticae epiphloiae Indicae or Indian bark algae. *J. Deptt., Sci .Calcutta University* 5:1-22.

COX, E.R. AND J. HIGHTOWER. 1972. Some corticolous algae of McMinn County Tennessee, U.S.A. *J. Phycol.* 8:203-205.

DESIKACHARY, T. V. 1959. *Cyanophyta*. Indian Council of Agricultural Research, New Delhi.

EDWARDS, L. K. 1968. *Some non-aquatic epiphytic and lithophilous algae*. M.A. Thesis. The University of Texas at Austin.

ETTL. H. 1978. Xanthophyceae. In : Süsswasser – flora von Mitteleuropa (eds.) von, H. Ettl, Gerloff, J. and Heynig, H. Teil 1, Band 3 , Stuttgart, New York.

GANDHI, H. P. 1998. *Fresh water diatoms of Central Gujarat.* Bishen Singh Mahendra Pal Singh, Dehradun.

GEITLER, L. 1932. Cyanophyceae. In : Kryptogamen-flora (ed.) L. Rabenhorsts von Deutschland, Osterreich und der schweiz. Akademische Verlagsgesellschalt, Liepzig.

GUPTA, R. K. 2005. *Algal flora of Dehra Dun district, Uttaranchal.* Botanical Survey of India, Kolkata.

PHILIPOSE, M. T. 1967. Chlorococcales. Indian Council of Agriculture Research, New Delhi.

SUBRAMANIAN, D. 1981. On new Charophytes from Tamil Nadu. *Phykos*, 20 (1 & 2): 1-7.

WYLIE, P.A. AND H.E. SCHLICHTING. 1973. A floristic survey of Corticolous subaerial algae in North Carolina *J. Elisha Mitchell Sci. Soc.* 89: 179-183.

भारतीय वनस्पति उद्यान, हावड़ा के छाल शैवाल

आर.के. गुप्ता

भारतीय वनस्पति उद्यान, हावड़ा में विभिन्न वृक्षों की छाल पर उपरिरोही शैवाल पर अध्ययन हुआ। उनमें 33 जातियाँ सायनोफाइसी का प्रतिनिधित्व करती हैं। 53 शैवाल जातियों के सदस्यों से जाहिर हुआ कि क्रुकोकेसी, ओसिलेटोरिएसी, साइटोनेमेटेसी, नोस्टोकेसी, रिवुलेरिएसी (साइनोफाइसी) एवं ट्रेंटेपोहलिएसी प्ल्युरोकोकेसी (क्लोरोफाइसी) की अधिक वृद्धि हुई। किंतु क्लोरोफाइसी, जेंथोफाइसी एवं बेसिलेरिओफाइसी के कुछ सदस्यों में अल्प वृद्धि हुइ।