

Det Kgl. Danske Videnskabernes Selskab.  
Biologiske Meddelelser **XII**, 2.

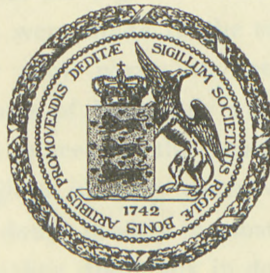
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# A LIST OF MARINE ALGAE FROM BOMBAY

BY

F. BØRGESEN

WITH 10 PLATES



KØBENHAVN  
LEVIN & MUNKSGAARD  
EJNAR MUNKSGAARD

1935



Elsewhere I have given an account<sup>1</sup> of my voyage to India 1927—28 caused by an invitation from the University of Bombay, and I therefore refer the reader to this paper merely mentioning now that I stayed in Bombay from the middle of December to the end of January. During this time I was occupied with the examination of the algal vegetation of Bombay and its environs, only interrupted by two journeys northward. No luxuriant algal vegetation can be said to exist in the environs of Bombay. This is surely in a great measure due to the highly polluted water the colour of which is yellowish-grey and quite unclear. Furthermore, long stretches of the coasts consist of loose and soft material or are occupied by ports which are not good growing places for algae.

The gatherings were made in the early mornings while it was still fairly cool, partly on the peninsula Kolaba and along the shores of Back Bay and Malabar Hill and partly in different places to the north, e. g. Bandra and Santa Cruz. Dredgings in deep water were not attempted. The bottom is no doubt muddy in most places and the polluted water also makes dredgings in deep water difficult. It is therefore only the littoral and upper sublittoral algal vegetation which has been examined. The examination of the

<sup>1</sup> BØRGESEN, F., Fra en Rejse i Indien 1927—28. Botanisk Tidsskrift vol. 41, København 1930.

material was carried out in the Royal Institute of Science, where I had a room for this work. I wish to thank the students and especially Messrs. S. C. DIXIT, GOPAL AYENGAR and K. G. NAIK for their valuable help in obtaining the gatherings.

Besides the species found in my own material the list contains too a few species from Bombay found in a collection of Indian Algæ, especially from Karachi, belonging to the British Museum (Natural History) which the Keeper of the Herbarium Dr. H. M. RAMSBOTTOM, and Dr. G. TANDY have most kindly sent me for examination.<sup>1</sup>

<sup>1</sup> This collection belonging to the British Museum included a great number of species from Karachi collected by J. A. MURRAY. By far the greater part of these species were the same as those found in the collection of the Kew Herbarium; they therefore have been mentioned in my papers dealing with these. But the collection of the British Museum contained also some species from Karachi which were not present in the collection belonging to the Kew Herbarium and which therefore have not been mentioned in the paper in which I have summed up the algae found in the northern part of the Arabian Sea in K. Danske Videnskabernes Selskab, Biologiske Meddelelser XI, 6, København 1934. These species are: *Ulva reticulata* Forssk., *Chamædoris auriculata* Boergs. (this species is described on material from Dwarka and has been omitted from the list by a mistake), *Caulerpa racemosa* var. *corynephora*, *Colpomenia sinuosa* (Roth) Derb. et Sol., *Rosenvingea orientalis* (J. Ag.) Boergs., *Sporochneus Gærtneri* Ag., *Spathoglossum asperum* J. Ag., *Padina tetrastromatica* Hauck, *Sarconema indicum* (J. Ag.) Kylin, *Gracilaria tenuioides* J. Ag. (of this species two specimens, male and female, are present in the collection. They were both gathered by MURRAY at Karachi. The female specimen agrees well with KÜTZING's figure in *Tabulæ Phycologicæ*, 18, pl. 75. The male specimen was quite like the one found in the Kew Herbarium which in my above quoted paper I have referred to *Gr. confervoides*. But when I now refer it to *Gr. tenuioides* I wish to point out that I have not seen any original specimen of *Gracilaria tenuioides* to compare with these specimens), *Lophocladia Lallemandii* (Mont.) Schmitz.

But the most important result of the examination of the collection of the British Museum was to establish that none of the northern and arctic algæ mentioned in my list were found in the collection. When I heard that the British Museum also possessed a

In this paper 82 species are mentioned, a number which after further examinations no doubt will be much increased. As will be seen from the list, the species found in the environs of Bombay differ much from those found in the northern part of the Arabian Sea, as most of the species found near Bombay are such as have their distribution in the tropical belt of the Indian Ocean with adjacent areas.

I wish to thank Dr. KAI GRAM for his valuable help with the photographs. The habit illustrations I owe to Mr. ALLAN SJÖDAL, cand. mag., who has also drawn most of the figures in Chinese ink for reproduction.

To the TRUSTEES OF THE CARLSBERG FOUNDATION I am greatly indebted for a grant, especially for the production of the drawings.

large collection of J. A. MURRAY'S Algæ from Karachi I was of course especially interested in finding out whether the northern species were found there too. This not being the case greatly increases my doubts as to whether they really live there, and seems to me to render it probable that they have come into MURRAY'S collection found in the Kew Herbarium by mistake.

# CYANOPHYCEÆ

Professor Abbé FRÉMY, Saint-Lo, France, has been so kind as to determine the few gatherings I have of this group of algae. The species are arranged after FRÉMY: Les Cyanophycées des Côtes d'Europe in Mémoires de la Société Nationale des Sciences Naturelles et Mathématiques de Cherbourg, t. XLI, Saint-Lo 1934.

## I. Hormogoneales.

### HOMOCYSTEÆ

#### *Fam. 1. Oscillatoriaceæ.*

#### **Microcoleus** Desm.

##### 1. **Microcoleus** *chthonoplastes* Thur.

FRÉMY, l. c., p. 67.

Growing on various algae.

Bombay: Bandra Seaface.

Geogr. Distrib.: Cosmopolitan.

#### **Sirocoleum** Kütz.

##### 1. **Sirocoleum** *Kurzii* (Zell.) Gom.

FRÉMY, l. c., p. 71.

Found on various algae.

Bombay: Bandra Seaface, Malabar Hill.

Geogr. Distrib.: Atlantic Ocean, Mediterranean Sea, Guyana, Gulf of Bengal.

## Lyngbya Ag.

### 1. *Lyngbya majuscula* Harv.

FRÉMY, l. c., p. 106.

Found intermingled among various algae.

Bombay: Kolaba.

Geogr. Distrib.: In all seas.

### 2. *Lyngbya confervoides* C. Ag.

FRÉMY, l. c., p. 106.

Bombay: Bandra Seaface. Bandra, GOPAL IYENGAR.

Geogr. Distrib.: Everywhere.

### 3. *Lyngbya infixa* Frémy.

FRÉMY, l. c., p. 110.

Bombay: Bandra Seaface.

Geogr. Distrib.: France, Mediterranean Sea, Canary Islands.

# CHLOROPHYCEÆ

## I. Ulothricales.

### Fam. 1. *Ulvaceæ*.

#### **Enteromorpha** Link.

##### 1. *Enteromorpha flexuosa* (Wulf.) J. Ag.

J. AGARDH, Till Algernes Systematik, 3. afdeln., p. 126 (Lunds Universitets Årsskrift, t. XIX). *Ulva flexuosa* Wulf., Crypt. Aquat. no. I, p. 1.

This species seems to be common in the environs of Bombay. It resembles *Enteromorpha intestinalis* very much being, as pointed out by COLLINS (Green Algae of North America, p. 203), a southern substitute of this species. It differs from *Ent. intestinalis*, its cells being smaller and arranged more or less in rows.

Bombay: Back Bay, Koloba, Bandra, Napear Sea Road, Santa Cruz.

Geogr. Distrib.: Most probably widely spread in temperate and warm seas.

##### 2. *Enteromorpha tubulosa* Kütz.

KÜTZING, Tabulæ Phycologicae, vol. VI, tab. 32, II. AHLNER, Bidrag till Kännedommen om de svenska Formerna af Algsläktet Enteromorpha, Stockholm 1877, p. 49, fig. 9 a, b. *Enteromorpha intestinalis* var. *tubulosa* Kütz., Spec. Alg., p. 478.

The specimens found are nearly terete, slender, up to 700  $\mu$  thick, and unramified. The cells are arranged in



regular rows; they are almost square, having a diameter of about 20  $\mu$ .

Bombay: Santa Cruz in tide pools.

Geogr. Distrib.: Most probably widely distributed.

### 3. *Enteromorpha prolifera* (Fl. Dan.) J. Ag.

J. AGARDH, Till Algernes Systematik, 3. afdeln. (Lunds Universitets Årsskrift t. XIX).

The cells in the thinner filaments are always arranged in longitudinal rows; this is not so clearly seen in the thicker and older parts of the filaments.

A thin form with numerous short proliferations arranged regularly up along the filaments and with rather large cells arranged in longitudinal rows was found at Koloba, forming entangled masses.

Bombay: Back Bay, Koloba.

Geogr. Distrib.: Widely spread.

## Ulva L.

### 1. *Ulva Lactuca* (L.) Le Jolis.

LE JOLIS, Liste Algues mar. de Cherbourg, 1880, p. 38.

var. *rigida* (Ag.) LE JOLIS, l. c.

Bombay: Back Bay, Koloba, Napear Sea Road, Malabar Hill, Bandra.

Geogr. Distrib.: Extensive.

### 2. *Ulva reticulata* Forssk.

FORSSKÅL, Flora Egypt.-arab., p. 187. J. AGARDH, Till Algernes Systematik, 3. afdeln., p. 166 (Lunds Universitets Årsskrift, t. XIX). ZANARDINI, Pl. mar. rubr., p. 294, no. 148. *Phycoseris reticulata* Kütz., Tab. Phycol., vol. VI, pl. 29.

The specimens found are very like KÜTZING's figure a, l. c. Compared with FORSSKÅL's original specimens the

reticulate tissue is broader in the Indian specimens which in this respect take an intermediate place between the figures of KÜTZING.

A transverse section of the thallus shows that the cells are almost square with rather thin cuticula; the thallus is about  $45 \mu$  thick.

Bombay: Bandra.

Geogr. Distrib.: Red Sea, Indian Ocean, Japan, Australia, Pacific coast of America.

## II. Siphonocladiales.

### Fam. 1. *Boodleaceæ*.

#### *Cladophoropsis* Boergs.

##### 1. *Cladophoropsis Zollingeri* (Kütz.) Boergs.

The Journal of the Indian Bot. Society, vol. XII, 1933, p. 1, fig. 1.

Bombay: Malabar Hill, Bandra Seaface, Bandra (leg. GOPAL AYENGAR).

Geogr. Distrib.: Malayan Archipelago.

##### 2. *Cladophoropsis sundanensis* Reinbold.

REINBOLD, Einige neue Chlorophyceen aus dem Ind. Ozean (Nuova Notarisia, Ser. XVI, 1905, p. 147); Algues du Siboga, p. 77, fig. 18.

The specimens (Fig. 1) referred by me to this species are very like those referred to the above mentioned species, their thallus being only somewhat thinner, that is about  $90-140 \mu$  thick, thus thicker than the measurements given by REINBOLD for this species. The ramification is very irregular, long parts of the filaments are unramified, but in between they may be much ramified. As often with

*Cladophoropsis* the ramification is in parts unilateral. The septation too is very irregular, rather long parts of the thallus not being septated whereas in other parts the cells are quite short. The plant agreed fairly well with the one

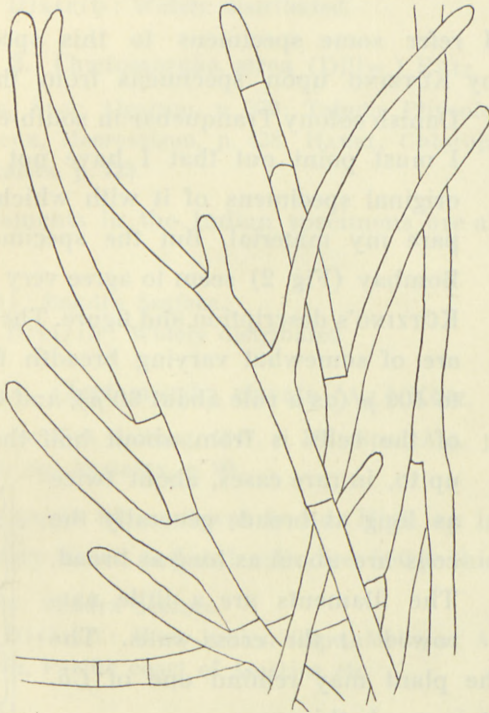


Fig. 1. *Cladophoropsis sundanensis* Reinb. Parts of the thallus.  
( $\times 30$ ).

mentioned in my paper on the marine algae from the northern part of the Arabian Sea (Biol. Meddelelser, XI, 1934, p. 9), the only difference is that the plant from Bombay is a little thicker than the one from Dwarka.

Bombay: Worli Seaface.

Geogr. Distrib.: Malayan Archipelago.

## Fam. 2. *Cladophoraceæ*.

### *Chætomorpha* Kütz.

#### 1. *Chætomorpha indica* Kütz.

KÜTZING, Spec. alg., p. 376; Tabulæ Phycologicæ, vol. III, tab. 52, fig. III.

When I refer some specimens to this species, first described by KÜTZING upon specimens from the former

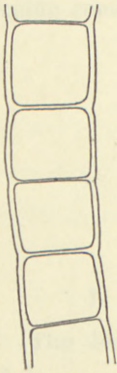


Fig. 2. *Chætomorpha indica* Kütz.  
Part of a filament. (×100).

Danish colony Tranquebar in south-east India, I must point out that I have not seen any original specimens of it with which to compare my material. But the specimens from Bombay (Fig. 2) seem to agree very well with KÜTZING's description and figure. The filaments are of somewhat varying breadth from 40  $\mu$  to 100  $\mu$  (as a rule about 60  $\mu$ ), and the length of the cells is from about half the breadth up to, in rare cases, about twice

as long as broad; generally the cells are about as long as broad. The filaments are a little narrowed at the cross-walls. The

shape of the plant may remind one of *Ch. ærea*, but it is much thinner.

Bombay: Worli Seaface.

Geogr. Distrib.: India, Samoa.

#### 2. *Chætomorpha Linum* (Muell.) Kütz.

KÜTZING, Phycologia germ., p. 204. HAUCK, Meeresalgen, p. 439. HAMEL, Chlorophycées des côtes Françaises, p. 125. *Conferva Linum* Müller, Flora Danica, tab. 771.

form *brachyarthra* Kütz., Tabul. Phycologicæ, vol. III, tab. 53, fig. IV.

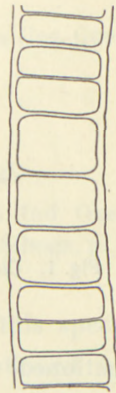


Fig. 3. *Chætomorpha Linum* (Muell.) Kütz. forma *brachyarthra* Kütz. (×100).

The Indian specimens (Fig. 3) are very like KÜTZING's above quoted figure, the length of the cells being from about  $\frac{1}{3}$  to as long as broad. The filaments are about  $120 \mu$  broad.

Bombay: Malabar Hill facing the Arabian Sea.

Geogr. Distrib.: Widely distributed.

### 3. *Chætomorpha ærea* (Dillw.) Kütz.

KÜTZING, Spec. Algarum, p. 379; Tabulæ Phycolog., vol. III, tab. 59. HAUCK, Meeresalgen, p. 438. HAMEL, Chlorophycées des côtes Françaises, p. 123.

The filaments in the Indian specimens are about  $150 \mu$  thick.

Bombay: Bandra Seaface.

Geogr. Distrib.: Widely distributed.

### 4. *Chætomorpha clavata* (Ag.) Kütz.

KÜTZING in Bot. Zeitung, 1847, p. 166; Spec. Alg., p. 380. *Conferva clavata* Ag., Systema, p. 99.

Only a single filament was found. High up in the filament the very much inflated cells are  $550 \mu$  thick.

Bombay: Bandra Seaface.

Geogr. Distrib.: West Indies, Cape, Malayan Archipelago, Ceylon, Japan, Pacific coast of America etc.

## Lola A. et G. Hamel.

### 1. *Lola*(?) *capillaris* (Kütz.) A. et G. Hamel.

G. HAMEL, Chlorophycées des côtes françaises. Paris 1930, p. 120. *Rhizoclonium capillare* Kütz. in Bot. Zeitung, 1847, p. 166. BORNET, Algues de SCHOUSBOE, p. 205. *Chætomorpha capillaris* Boergs., Mar. Alg. from the Canary Islands, I, Chlorophyceæ, p. 45, fig. 13.

The specimens referred to this species seem to agree rather well with my description and figures. The filaments

are about 30—50  $\mu$  thick and the cells about  $1\frac{1}{2}$ —2 times as long as broad; the cells contain 4—10 nuclei according to the size of the cells. Lateral rhizoids were not observed, but knee-like bent filaments occurred. The specimens formed entangled yellow-green masses in tide-pools.

HAMEL (l. c.) refers this species, though with a (?) to the genus *Lola* created by him; this genus differs from *Chaetomorpha* by its heterogamous reproduction.

Bombay: Santa Cruz.

Geogr. Distrib.: Atlantic Ocean, Mediterranean Sea.

## Rhizoclonium Kütz.

### 1. *Rhizoclonium Kochianum* Kütz.

KÜTZING, *Phycologia germanica*, 1845, p. 206.

STOCKMAYER, Ueber die Algengattung *Rhizoclonium* (Verhandl. d. zool.-bot. Gesellsch. in Wien, 40, 1890, p. 522). VICKERS, *Phycologia Barbadosensis*, 1904, p. 18, pl. XI. BØRGESEN, *Mar. Alg. D. W. I.*, vol. I, p. 19, fig. 7.

The specimens found form intricate masses. The filaments are about 12—13  $\mu$  thick and the cells about  $1\frac{1}{2}$ —2 times the breadth (Fig. 4).

India: Bombay, Kolaba.

Geogr. Distrib.: West Indies, Europe.

### 2. *Rhizoclonium grande* Boergs. spec. nov.

*Filamenta crassa*, 275—400  $\mu$  lata, rigida, irregulariter curvata, caespites subdensos, colore obscure-viridi in rupibus formantia. Filamenta ex cellulis diametro aequalibus vel 2—3 plo longioribus, parietibus cellularum crassis et striatis composita.

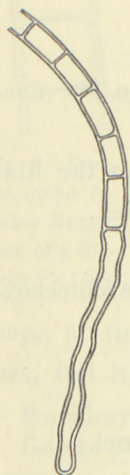


Fig. 4. *Rhizoclonium Kochianum* Kütz. Part of a filament with terminal rhizoid. ( $\times 200$ ).

Ramuli rhizoidei numerosi, firmiores, curti aut longiores, non septati, sæpe in parte basali disciferi.

India: Bombay, Worli Seaface, BOERGESEN 5130 (type), Bandra Seaface.

This very large *Rhizoclonium* (Figs. 5, 6) was found on rocks in exposed places in the littoral zone. It forms dark-

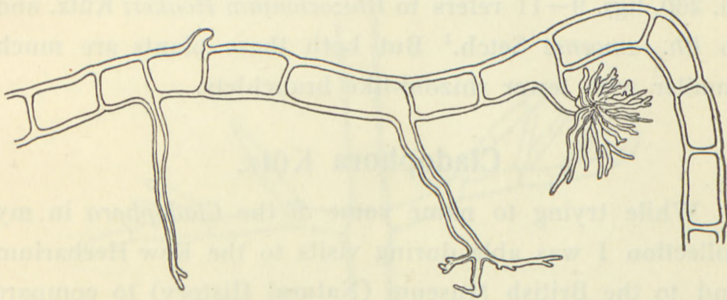


Fig. 5. *Rhizoclonium grande* Boergs. Part of a filament with rhizoids. ( $\times 20$ ).

green tufts fixed to the rocks by means of the numerous vigorous rhizoid-like branchlets. The stiff filaments are irregularly curved and felted together. They are from 275—400  $\mu$  broad and the cells from 1—3 or sometimes 4

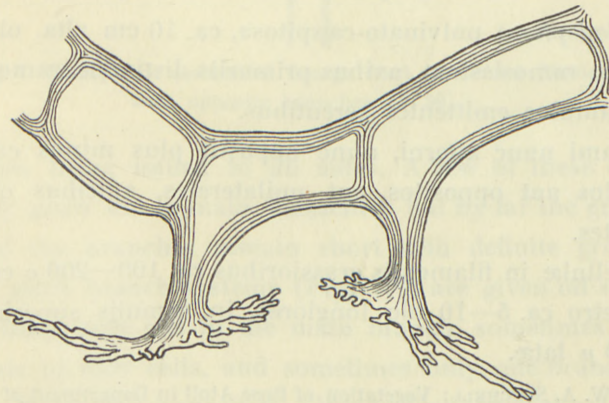


Fig. 6. *Rhizoclonium grande* Boergs. Part of a filament showing the stratified walls. ( $\times 45$ ).

times as long. The walls of the cells are very thick about  $33 \mu$  or even more and clearly stratified (Fig. 6). The dark-green dense parietal chromatophores contain numerous pyrenoids. By its size this *Rhizoclonium* differs from all earlier known species. It seems nearest related to the plant which OKAMURA in *Icones of Japanese Algæ*, vol. VI, p. 16, pl. 260, figs. 9—11 refers to *Rhizoclonium Hookeri* Kütz. and to *Rh. samoense* Setch.<sup>1</sup> But both these plants are much smaller with fewer rhizoid-like branchlets.

### Cladophora Kütz.

While trying to name some of the *Cladophora* in my collection I was able during visits to the Kew Herbarium and to the British Museum (Natural History) to compare my specimens with the large number of species found in these herbaria. I met with some specimens resembling those in my collection very much, and some of these specimens were named, but no description of them seemed to have been given.

#### 1. *Cladophora saracenicæ* n. sp.

*Cladophora pulvinato-cæspitosa*, ca. 10 cm alta, obscure viridis, ramosissima, axibus primariis distinctis, ramos breves ramulos emittentes gerentibus.

Rami nunc alterni, nunc oppositi plus minus curvati, ramulos aut oppositos aut unilaterales, apicibus obtusis gerentes.

Cellulæ in filamentis crassioribus ca. 100—200  $\mu$  crassæ, diametro ca. 5—10 plo longiores, in ramulis superioribus ca. 30  $\mu$  latæ.

<sup>1</sup> W. A. SETCHELL: *Vegetation of Rose Atoll* in *Department of Marine Biology of the Carnegie Institution of Washington*, vol. XX, 1924, p. 177, fig. 42.



Bombay: Santa Cruz, BOERGESEN no. 5081 (type).

The plant (Plate 1) forms about 10 cm. high, roundish tufts composed of the irregularly ramified and much interwoven filaments. The main filaments are about 100—200  $\mu$  thick and the length of the cells up to ten times as long or even more. The filaments are irregularly branched,

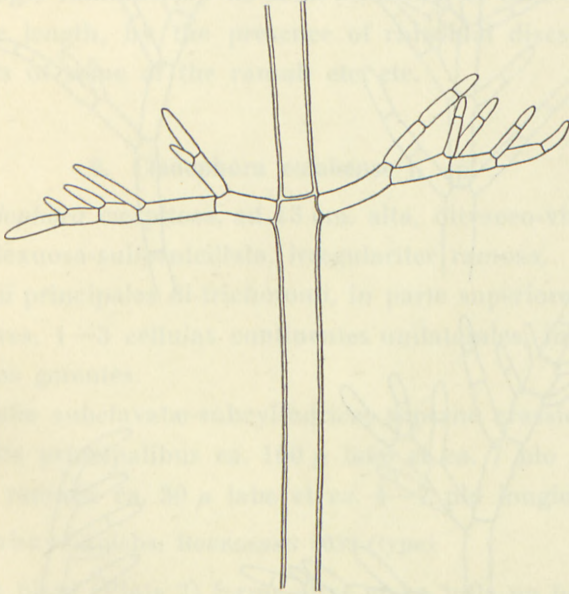


Fig. 7. *Cladophora saracenicum* Boergs. Part of a main filament with opposite branches. ( $\times 30$ ).

branches being issued to all sides. A few of these occasionally grow out to main filaments; but by far the greater part of the branches remain short with definite growth. These short branch-systems (Figs. 7, 8) are given off sometimes from each cell in the main branch, sometimes with intervals of bare cells, and sometimes only one branch is, given off or two oppositely placed. The short shoots are richly ramified. In some of these 2—3 pairs of ramuli are

issued from the main axis in the basal part, whereas higher up a single ramulus is given out from each joint. But in most of the short shoots the ramuli are unilaterally placed

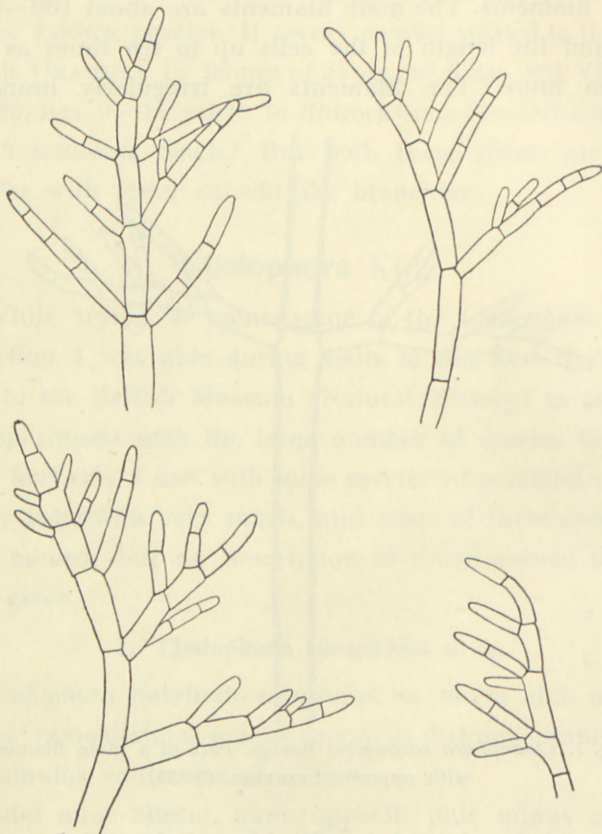


Fig. 8. *Cladophora saracenica* Boergs. Branches with ramuli.  
( $\times 30$ ).

on the convex side of the more or less curved main axis. In some cases two ramuli grow out from each joint on the convex side of the main axis. This is about  $100 \mu$  thick near the base tapering slowly upwards to about half this measure. Near the summit the ramuli are about  $50-30 \mu$

thick. The apices are obtuse. The cell wall is 10—15  $\mu$  thick in the main filaments, in the ramuli it is thin.

This species seems to come rather near to *Cladophora boodleoides* Boergs. from the Canary Islands; but this plant differs from the Indian one by its more irregular ramification, by the fact that the short shoots are often reduced to a single ramulus, by its somewhat shorter cells of more variable length, by the presence of rhizoidal discs in the summits of some of the ramuli etc. etc.

## 2. *Cladophora colabense* n. sp.

*Cladophora* caespitosa, ad 13 cm. alta, olivaceo-viridis in sicco, flexuosa-subpenicillata, irregulariter ramosa.

Rami principales di-trichotomi, in parte superiore ramulos breves, 1—3 cellulas continentis unilaterales, interdum oppositos gerentes.

Cellulae subclavatae-subcylindricae superne crassiores in filamentis principalibus ca. 100  $\mu$  latae et ca. 7 plo longiores, in ramulis ca. 30  $\mu$  latae et ca. 4—7 plo longiores.

Bombay: Kolaba, BOERGESEN 5059 (type).

This plant (Plate 2) forms olive green tufts up to about 13 cm. high. The plant is rather irregularly ramified. The main filaments are divided at shorter or longer intervals, giving off a single or sometimes two branches from the same joint (Fig. 9). In the upper part of the thallus the filaments carry long rows of ramuli issued as a rule unilaterally one from each joint (Fig. 10); sometimes, but rarely, two opposite ramuli are given off. The ramuli are short, consisting only of 1—3 cells. In the main filament the cells are about 100  $\mu$  broad and up to about 7 times as long; upwards the breadth decreases to 40—50  $\mu$  or less. The

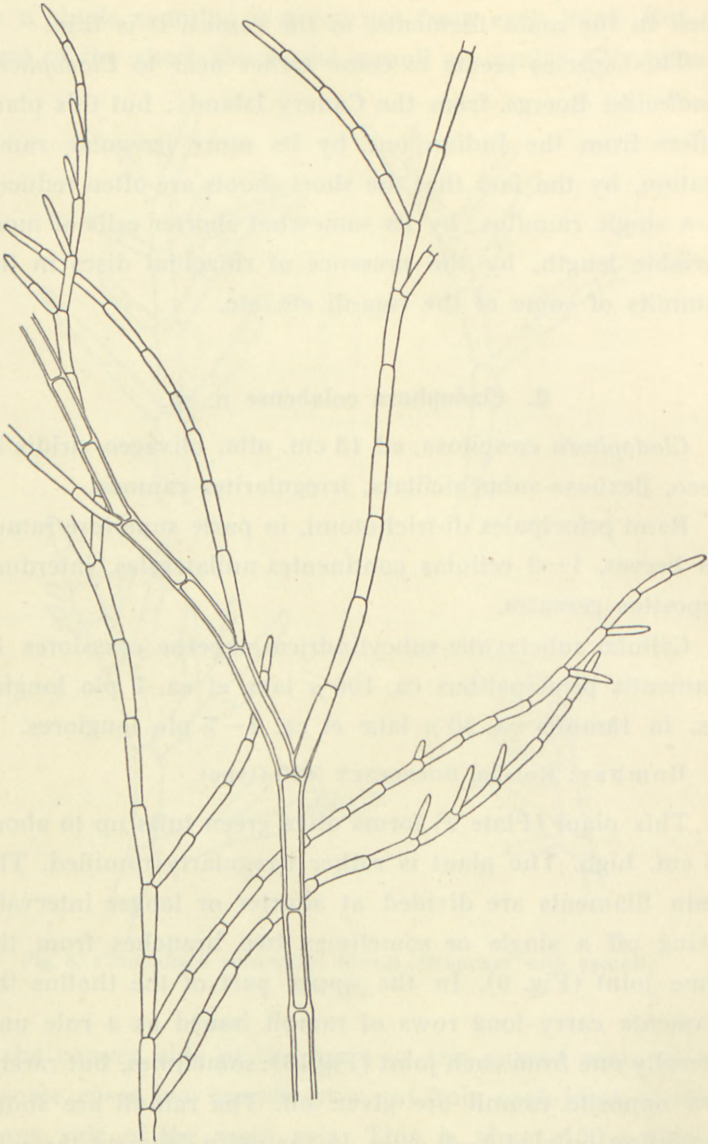


Fig. 9. *Cladophora colabense* n. sp. Parts of the thallus. ( $\times 30$ ).

ramuli are about  $30\ \mu$  thick. The apices of the ramuli are obtuse but often protruding somewhat uppermost, where they have very thick walls (Fig. 10 c). The cells are subclavate cylindrical and thickest at their upper ends except

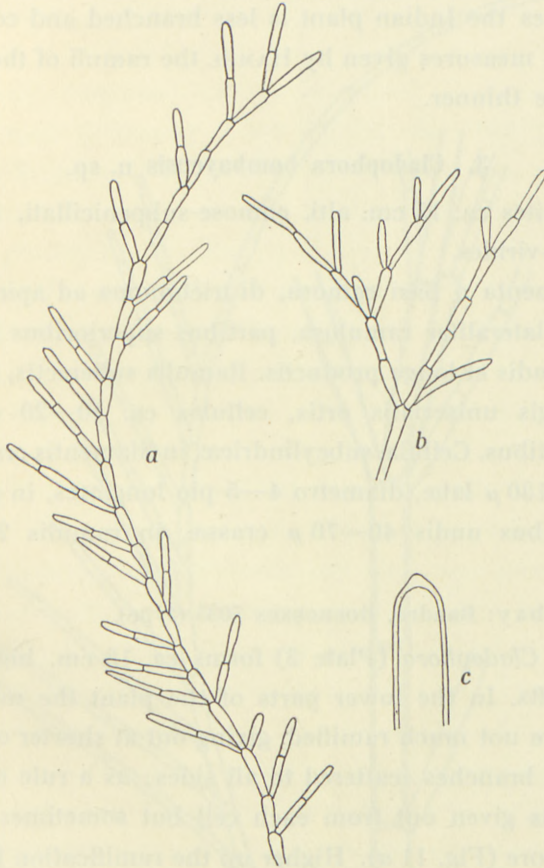


Fig. 10. *Cladophora colabense* n. sp. a—b. Upper ends of filaments with ramuli. ( $\times 45$ ); c, upper end of ramulus with thick-walled apex. ( $\times 220$ ).

in the ramuli where the cells are almost cylindrical. In the main filaments the cell wall is up to about  $12\ \mu$  thick and clearly stratified; in the ramuli the wall is thin with the exception mentioned above.

This plant might perhaps be compared with *Cladophora flexuosa* (Griff.) Kütz.; see for instance HARVEY'S figure in *Phycologia Britannica*, pl. 353 and G. HAMEL, *Chlorophycées des côtes françaises*, p. 20, fig. 16 c. But to mention other differences the Indian plant is less branched and compared with the measures given by HAMEL the ramuli of the Indian plant are thinner.

### 3. *Cladophora bombayensis* n. sp.

Cæspites ca. 15 cm. alti, comose-subpenicillati, in sicco olivaceo-virides.

Filamenta a basi ramosa, di-trichotoma ad apicem versus unilateraliter ramulosa, partibus superioribus filamentorum nudis et longe productis. Ramulis suberectis, in seriebus longis uniseriatis ortis, cellulas ca. 10—20 et ultra continentibus. Cellulæ subcylindricæ, in filamentis crassioribus ca. 130  $\mu$  latæ, diametro 4—5 plo longiores, in partibus superioribus nudis 40—70  $\mu$  crassæ, in ramulis 20—50  $\mu$  crassæ.

Bombay: Bandra, BØRGESEN 5035 (type).

This *Cladophora* (Plate 3) forms ca. 15 cm. high, dark green tufts. In the lower parts of the plant the main filaments are not much ramified, giving out at shorter or longer intervals branches scattered to all sides; as a rule only one branch is given out from each cell but sometimes two or rarely more (Fig. 11 a). Higher up the ramification becomes unilateral or almost so, long unbranched ramuli being issued pectinately often in long rows from nearly every joint (Fig. 11 b). At the upper ends the main branches are destitute of ramuli, running out into often rather long naked filaments; it is characteristic of these naked filaments that they do not taper upwards.

The ramuli consist of a rather large number of cells 10—20 or more and 2—4 times as long as broad. Near the base the main filaments are about  $130\ \mu$  thick and the

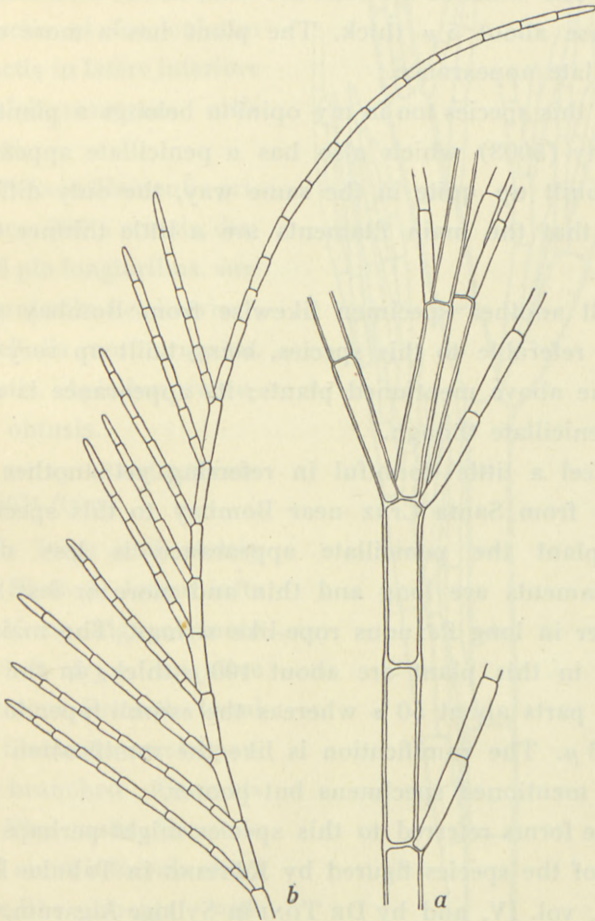


Fig. 11. *Cladophora bombayensis* n. sp. *a.* Part of main filament. ( $\times 110$ ).  
*b.* Upper end of a filament with ramuli. ( $\times 30$ ).

length of the cells about 4—5 times the breadth, they decrease slowly upwards so that the naked upper ends are about  $40\text{--}70\ \mu$  broad. Below the ramuli are about  $40\text{--}50\ \mu$

thick, tapering upwards, their upper ends reaching only a breadth of about 20—35  $\mu$ . The upper ends of the ramuli are obtuse. The cells are almost cylindrical in the whole plant. The walls of the cells are thin, in the filaments near the base about 5  $\mu$  thick. The plant has a more or less penicillate appearance.

To this species too in my opinion belongs a plant from Bombay (5008) which also has a penicillate appearance; it is built up quite in the same way, the only difference being that the main filaments are a little thinner (about 100  $\mu$ ).

Still another specimen likewise from Bombay (5001) seems referable to this species, being built up very much like the above mentioned plants; its appearance is a little less penicillate though.

I feel a little doubtful in referring yet another plant (5078) from Santa Cruz near Bombay to this species. In this plant the penicillate appearance is less distinct the filaments are long and thin and more or less woven together in long flexuous rope-like strings. The main filaments in this plant are about 100  $\mu$  thick, in the upper naked parts about 50  $\mu$  whereas the ramuli taper to about 25—33  $\mu$ . The ramification is like the ramification of the above mentioned specimens but poorer.

The forms referred to this species might perhaps recall some of the species figured by KÜTZING in *Tabulæ Phycologicae*, vol. IV, and by DE TONI in *Sylloge Algarum*, vol. I, p. 320 referred to *Cladophora nitida* Kütz.

#### 4. *Cladophora monumentalis* n. sp.

*Cladophora* permagna, caespites ad 35 cm altos formans. Filamenta primaria setacea, elongata cylindrica, alterne aut



irregulariter ramosa. Rami breves, erecti, sub angulo acutissimo egredientes, ramuliferi ramulis subsecundis erectis et fasciculatim conjunctis in latere interiore (ventrale) ramorum ortis instructi.

Cellulis in filamentis primariis ca. 300  $\mu$  crassis, diametro 6 plo longioribus, sursum tenuioribus et brevioribus; cellulis ramulorum ca. 40  $\mu$  latis. Apicibus ramulorum obtusis.

Bombay: Bandra, BOERGESEN 5034 (type).

This large and stately plant (Plate 4) forms tufts up to 35 cm. high or more and when dry of an olive green colour. From the basal felted filaments erect sparingly branched filaments arise. The main filaments bear at short intervals short fascicle-like shoots with densely pectinately placed branchlets (Fig. 12); besides the short shoots still another but smaller branch-system is sometimes given

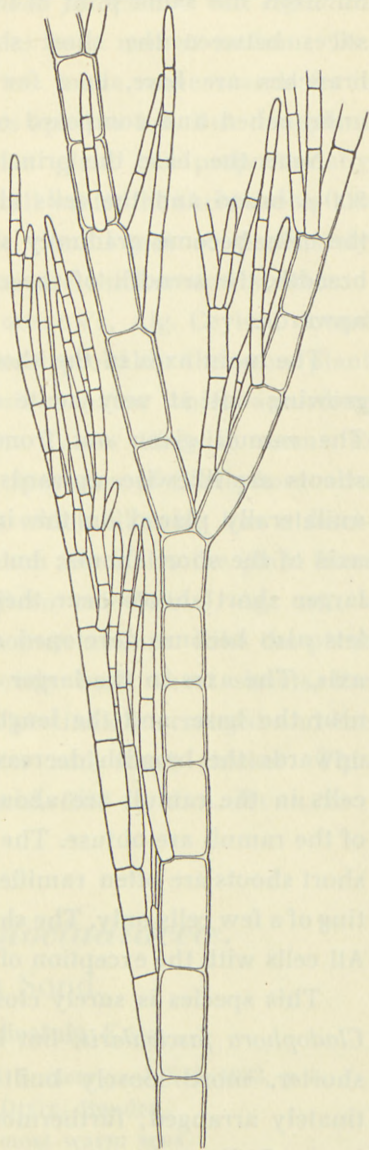


Fig. 12. *Cladophora monumentalis* n. sp. Part of a principal filament with short branchlets. ( $\times 30$ ).

off from the same joint of the main branches. In the interstices between the short shoots the main stems of the branches are bare, or a few quite small branchlets, often unbranched and composed of a few cells only, issue.

Near the base the principal filaments are up to about  $300 \mu$  broad and the cells about 6 times as long; upwards the cells become gradually shorter to about 2—3 times the breadth, the breadth of the cells likewise slowly decreasing upwards.

The main axes in the short shoots are straight and erect, growing out at very acute angles from the main shoots. The ramuli given out from the main axes of the short shoots are likewise upwards directed; they are as a rule unilaterally placed on the inner ventral side of the main axis of the short shoots; but it happens especially in the larger short shoots near their upper end that some branchlets also become developed on the dorsal side of the main axis. The axes in the larger shoots are about  $170 \mu$  thick near the base, and the length of the cells is about  $400 \mu$ ; upwards the breadth decreases slowly and the uppermost cells in the ramuli are about  $40 \mu$  broad only. The apices of the ramuli are obtuse. The lowermost branchlets in the short shoots are often ramified, the upper ones not, consisting of a few cells only. The short shoots are about  $\frac{1}{2}$  cm. long. All cells with the exception of the apical ones are cylindrical.

This species is surely closely related to the West Indian *Cladophora fascicularis*, but in this species the fascicles are shorter, more loosely built and the ramuli not so pectinately arranged; furthermore the ramuli are thicker than in the Indian plant.

As to its outer appearance this plant resembles very much a specimen in the British Museum (FERGUSSON, Alg.

Ceylon, no. 18) called *Cladophora fascicularis* var. *ceylanica* Grun., a name which seems to be a nomen nudum; Dr. G. TANDY, who most kindly has made some search for it in the British Museum, is of this opinion too. But this plant when compared with the Indian plant has proportionally much longer cells and thicker cell walls; the short shoots are shorter and broader and the ramuli not so pectinately arranged and the cells of these are thicker and shorter.

Another specimen of FERGUSSON'S, Alg. Ceylon, found in the Kew Herbarium and most probably the same plant is named *Cladophora Thwaitesii*, a name which according to kind information from Dr. TANDY likewise seems to be a nomen nudum. Another specimen of *Cladophora* also found in the Kew Herbarium which likewise has a fasciculate appearance and very much resembles the plant from Ceylon is determined as *Conferva orientalis* J. Ag. ms., a name which surely also is a nomen nudum. Like the plant from Ceylon it has more loosely built short shoots, the ramuli are not so densely and pectinately arranged and the cells in the ramuli are shorter and much thicker. This plant was gathered near Karachi, 6/83 by J. A. MURRAY.

### Fam. 3. *Siphonocladaceæ*.

#### *Struvea* Sond.

##### 1. *Struvea delicatula* Kütz.

BOERGENSEN in Journ. Ind. Bot. Society, vol. XII, 1933, p. 3.

Bombay: Kolaba, leg. S. C. DIXIT; Bandra.

Geogr. Distrib.: Found in most warm seas.

## III. Siphonales.

Fam. 1. *Bryopsidaceæ*.*Pseudobryopsis* Berth.1. *Pseudobryopsis mucronata* Boergs.

BOERGENSEN, in Journ. Indian Bot. Soc., vol. IX, 1930, p. 163, fig. 7.

Some time after I had described this interesting new species of this hitherto monotypic genus Dr. JEAN FELDMANN, Algeria, wrote to me that he had found near Banyuls in France a *Pseudobryopsis* which had mucronate gametangia in shape very much like those found by me in the Indian species, and he asked me if I could send him some material of the Indian plant with which to compare his specimens. After having made this comparison Dr. FELDMANN most kindly let me know that he found the shape of the sporangia in both plants to be very alike, but nevertheless the Indian plant differed essentially from his, the chromatophores being much larger in the Indian plant. Having omitted to mention this interesting fact in my description of the Indian plant (Fig.

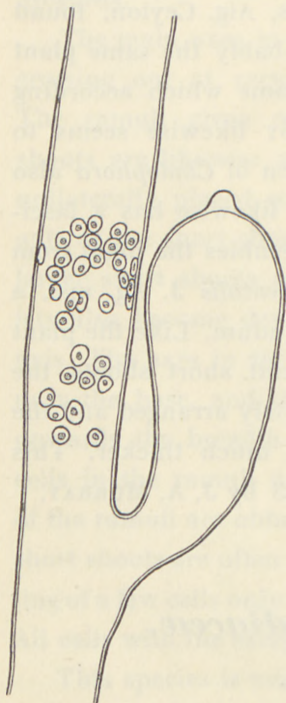


Fig. 13. *Pseudobryopsis mucronata* Boergs. Piece a filament with chromatophores and a gametangium. ( $\times 330$ ).

13) I wish to communicate this fact here. The chromatophores in the Indian plant are like large roundish discs from 5—12  $\mu$  broad and in the middle they contain a large pyrenoid. In a specimen from Banyuls which Dr. FELDMANN was so kind as to send

to me the chromatophores are rarely  $4\ \mu$  broad, as a rule only  $2-3\ \mu$ . In this plant the numerous small chromatophores were roundish of shape; in a specimen from the Canary Islands the chromatophores, having about the same size, were often a little more oval of shape.

## *Fam. 2. Caulerpaceæ.*

### **Caulerpa Lamour.**

#### 1. *Caulerpa fastigiata* Mont.

Journ. Indian Bot. Soc., vol. XI, 1932, p. 55.

Bombay in various localities.

Geogr. Distrib: West Indies, Brazil, India, Pacific etc.

#### 2. *Caulerpa scalpelliformis* (R. Br.) Web. v. Bosse.

var. *intermedia* Web. v. Bosse.

WEBER VAN BOSSE, A., Monographie des Caulerpes, p. 287, pl. 23, figs. 5-7.

In the herbarium of the British Museum (Nat. Hist.), London a somewhat incomplete specimen is found, consisting of four assimilators but no stolon. The assimilators are rather slender only 7-9 mm. broad.

Bombay, leg. Major HOBSON.

Geogr. Distrib.: South India, Mauritius, Red Sea.

#### 3. *Caulerpa sertularioides* (Gmel.) Howe.

Journ. Indian Bot. Soc., vol. XI, 1932, p. 59.

Bombay: Kolaba.

Geogr. Distrib: Most tropical seas.

#### 4. *Caulerpa racemosa* (Forssk.) Web. v. Bosse.

Journ. Indian Bot. Soc., vol. XI, 1932, p. 59.

Bombay, leg. Prof. HATE.

Geogr. Distrib: Most tropical seas.

**5. Caulerpa peltata Lamour.**

Journ. Indian Bot. Soc., vol. XI, 1932, p. 62, fig. 5.

Bombay, leg. Prof. HATE; Major HOBSON according to a specimen in the Herbarium of the Brit. Museum.

Geogr. Distrib: Canary Island, West Indies, Pacific and Indian Ocean.

# PHÆOPHYCEÆ

## I. Ectocarpales.

### *Ectocarpus* Lyngb.

#### 1. *Ectocarpus coniger* Boergs. spec. nov.

Frons cæspitosa, ca. 7—10 cm. alta, quoquoversum irregulariter ramosa, ramis sparsis rarius secundis munita, in parte basali longioribus ad apicem brevioribus et sursum tenuioribus. Filamenta crassiora ca.  $30\mu$  lata, minora  $15\mu$  vel minus, e cellulis diametro fere æqualibus vel duplo majoribus, in summis ramorum 3—4 plo longioribus, per divisionem intercalarem divisis composita.

Sporangia plurilocularia sparsa, sessilia aut interdum pedicellata, anguste ovato-ellipsoidea aut conico-elongata, magnitudine variabili, 22— $28\mu$  lata et 50— $80\mu$

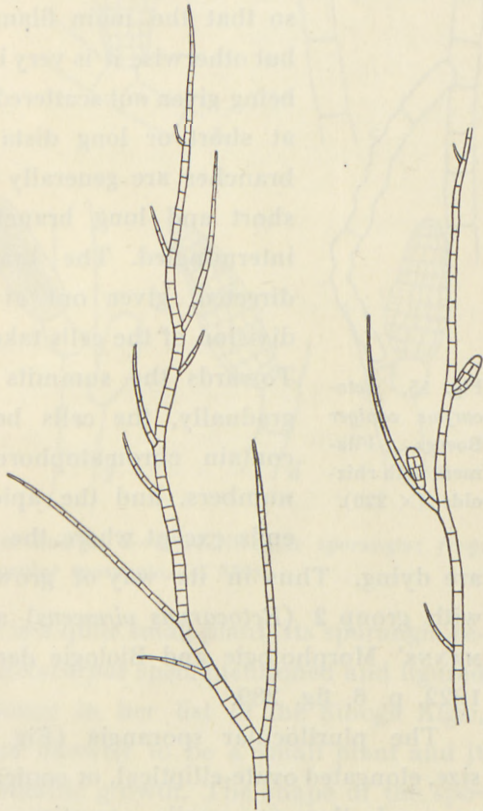


Fig. 14. *Ectocarpus coniger* Boergs. Parts of filaments. ( $\times 75$ ).

longa. Sporangia unilocularia sessilia aut pedicellata, oblonge-subcylindrica, ad basem et apicem late rotundata, ca.  $20\mu$  lata et  $52\mu$  longa.

Bombay: Back Bay, BØRGESEN 5030 (type).

The plant (Fig. 14) forms dense tufts up to about 7—10 cm. Its colour is brownish when living, olive-green when dried. It is fastened by means of rhizoids growing out from the basal part of the filaments (Fig. 15). The ramification is monopodial so that the main filaments are easily seen, but otherwise it is very irregular, the branches being given out scattered or sometimes secund at short or long distances; the lowermost branches are generally the longer ones, but short and long branches are often found intermingled. The branches are upwards directed, given out at acute angles. The division of the cells takes place intercalarily.

Fig. 15. *Ectocarpus coniger* Boergs. Filament with rhizoids. ( $\times 220$ ).

Towards the summits the branches taper gradually, the cells become longer but all contain chromatophores even if in scarce numbers, and the apical cells have obtuse ends except where the ends of the branches are dying. Thus in its way of growing the plant agrees with group 2 (*Ectocarpus virescens*) as described in OLT-MANN'S' Morphologie and Biologie der Algen, II Bd., Jena 1922, p. 6, fig. 289.

The plurilocular sporangia (Fig. 16) are of variable size, elongated ovate-elliptical, or conical rarely subfusiform; as a rule they are sessile, sometimes also placed upon an unicellular pedicell. Of unilocular sporangia (Fig. 16) I



have seen only a few; they are almost cylindrical with broadly rounded apices and bases.

The shape of the sporangia in this plant may remind one of *Ectocarpus arabicus* Kütz., Tab. Phyc. V, pl. 72, from

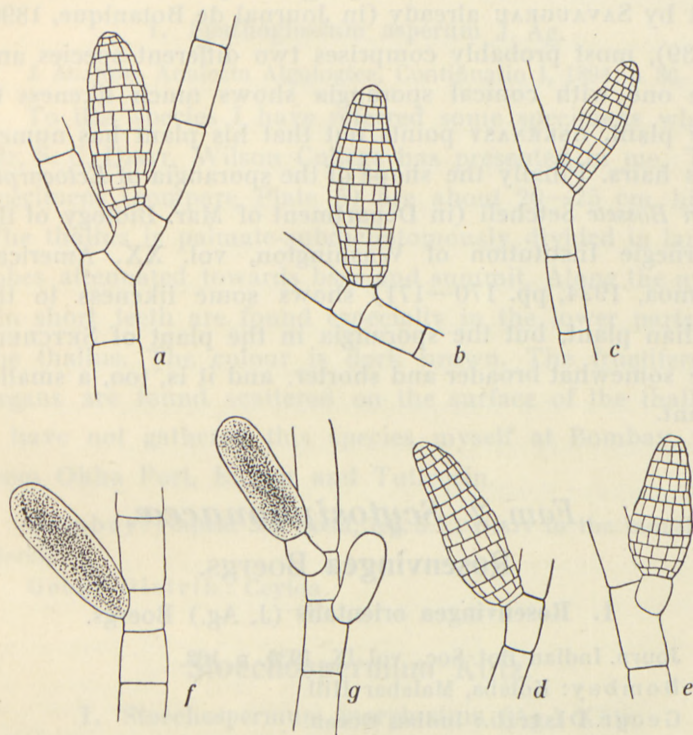


Fig. 16. *Ectocarpus coniger* Boergs. a—e. plurilocular sporangia; f—g. unilocular sporangia. ( $\times 330$ ).

the Red Sea, but this is a quite small plant. Its sporangia remind one, too, of the *Ectocarpus* spec. mentioned and figured by M<sup>me</sup> WEBER v. BOSSE in her list of the Siboga Algæ, p. 131, but this seems likewise to be a small plant and it has hairs with trichothallic growth. The shape of the sporangia in this plant seems furthermore to be rather like the conical shaped sporangia which ASKENASY (Flora, 1894,

p. 9) says he has found together with cylindrical, plurilocular sporangia, broadly rounded at both ends, in the plant he presumes to be like the much discussed *Ectocarpus indicus* Sonder. Even if ASKENASY's plant, as pointed out by SAVAUGEAU already (in *Journal de Botanique*, 1896, p. 39), most probably comprises two different species and the one with conical sporangia shows much likeness to my plant, ASKENASY points out that his plant has numerous hairs. Finally the shape of the sporangia of *Ectocarpus van Bosseæ* Setchell (in *Department of Mar. Biology of the Carnegie Institution of Washington*, vol. XX. American Samoa, 1924, pp. 170—171) shows some likeness to the Indian plant, but the sporangia in the plant of SETCHELL are somewhat broader and shorter, and it is, too, a smaller plant.

## Fam. 2. *Scytosiphonaceæ*.

### Roseningea Boergs.

#### 1. *Roseningea orientalis* (J. Ag.) Boergs.

*Journ. Indian Bot. Soc.*, vol. IX, 1930, p. 168.

Bombay: Kolaba, Malabar Hill.

Geogr. Distrib.: Indian Ocean.

## Fam. 3. *Encoeliaceæ*.

### *Colpomenia* Derb. et Sol.

#### 1. *Colpomenia sinuosa* (Roth) Derb. et Sol.

India: Bombay.

Geogr. Distrib.: Widely spread in warmer seas.

## II. Dictyotales.

### Fam. 1. Dictyotaceæ.

#### *Spathoglossum* Kütz.

##### 1. *Spathoglossum asperum* J. Ag.

J. AGARDH, *Analecta Algologica*, Continuatio I, 1894, p. 36.

To this species I have referred some specimens which Mr. S. C. DIXIT, Wilson College has presented to me. The specimens (compare Plate 5) are about 20—25 cm. high. The thallus is palmate-subdichotomously divided in larger lobes attenuated towards base and summit. Along the margin short teeth are found especially in the lower parts of the thallus. The colour is dark brown. The fructiferous organs are found scattered on the surface of the thallus. I have not gathered this species myself at Bombay, but from Okha Port, Karvar and Tuticorin.

Bombay: Napear Sea Road, leg. S. C. DIXIT in the month of March.

Geogr. Distrib.: Ceylon.

#### *Stoechospermum* Kütz.

##### 1. *Stoechospermum marginatum* (Ag.) Kütz.

Journ. Indian Bot. Soc., vol. XI, 1932, p. 67, fig. 8.

Bombay: Malabar Hill, where besides by myself it has been gathered by Mr. S. C. DIXIT.

Geogr. Distrib.: Red Sea, Ceylon.

#### *Padina* Adans.

##### 1. *Padina tetrastromatica* Hauck.

Journ. Indian Bot. Soc., vol. IX, 1930, p. 172, fig. 10, pl. II.

Bombay: Kolaba, Back Bay, Malabar Hill, Bandra.

Geogr. Distrib.: Malayan Archipelago, Somaliland.

## Dictyopteris Lamour.

### 1. *Dictyopteris acrostichoïdes* (J. Ag.).

*Haliseris acrostichoïdes* J. Ag., Till Algernes Systematik, V Dictyoteae, p. 133.

A few rather incomplete specimens most probably washed ashore might perhaps be referred to this species. I have been able to compare the specimens with a specimen in the Kew Herbarium referred to this species, and I have found that they agreed rather well with the exception that the fructifying stripes were much broader in the plant from the Kew Herbarium. In the specimens from Bombay the fructiferous stripes form a very narrow belt on both sides of the midrib only about 1 mm. broad. The thallus is about  $\frac{3}{4}$ —1 cm. broad. The edges of the thallus are even and entire and only very seldom split.

Bombay: Kolaba, leg. Mr. S. C. DIXIT.

Geogr. Distrib.: Australia.

## Dictyota Lamx.

### 1. *Dictyota Bartayresiana* Lamour.

LAMOUREUX, Exposition des caractères . . . *Dictyota* (Journ. de Bot., t. II, 1809, p. 43). J. AGARDH, Spec. Alg., vol. I, p. 94; Till Algernes Systematik, V, p. 97. HARVEY, Nereis Bor.-Am., p. 110, pl. VIII. C.

I feel rather doubtful in referring some sterile specimens to this species. The specimens are rather like HARVEY's figure quoted above, but the ramification is not quite so much divaricate and the thallus is rather thin and sticks to the paper.

Some of the specimens from a sheltered locality in Back Bay were distinguished by the presence of numerous long thin proliferations growing out from the lower part

of the thallus; most probably they were specimens lying loose.

Bombay: Malabar Hill, Back Bay.

Geogr. Distrib.: West Indies, Indian Ocean, tropical Australia.

## 2. *Dietyota dumosa* nov. spec.

Frons cæspitosa, ca. 12 cm. alta in parte basali ex filamentis decumbentibus, repentibus, rhizoideis substrato adfixis composita. Thallus erectus repetite dichotomus e segmentis late-linearibus, subcuneatis in parte basali latioribus, ca.  $\frac{3}{4}$ — $1\frac{1}{2}$  cm. latis, sursum sensim attenuatis, in superiori parte 3—4 mm. latis compositus. Segmenta erecta, margine intergerrima, apicibus rotundatis, subparallela, sinibus rotundatis angustioribus discreta. Organis fructiferis per totam superficiem thalli sparsis.

India: Bombay in several localities: Back Bay, Bandra Seaface, Malabar Hill. BOERGESSEN 5103 (type).

The plant (Plate 6) grows in dense tufts which are about 12 cm. high. The base consists of decumbent, creeping, subterete or somewhat flattened filaments from which rhizoids are formed. From these filaments erect shoots occasionally are developed. These are divided dichotomously several times, the distance between the dichotomies being about 2—3 cm. The lobes are broad linear-lingulate and quickly reach their greatest breadth near the base and then slowly taper towards the summits. In the lower part of the thallus just below the dichotomy the breadth is from  $\frac{3}{4}$ — $1\frac{1}{2}$  cm.; the uppermost parts of the lobes are about 3—4 mm. broad. The apices are obtuse. The sinus between the lobes is rounded and the margin of the lobes is even; only seldom have I seen a few proliferations. The lower part of the thallus is dark brown and rather thick, higher up it

becomes thinner and becomes light olive-green of colour. It adheres fairly well to paper.

The fructiferous organs are found scattered over the surface of the thallus. In some of the specimens the spores had germinated in great numbers, giving the thallus a ciliate appearance.

As regards its whole habit this plant rather recalls *Dictyota ligulata* as I know it from the Canary Islands, but it differs by its much broader thallus and by the fact that the fructiferous organs are scattered over the whole surface of the thallus, whereas in *Dictyota ligulata* these are found in a belt along the middle of the thallus, leaving the margins free. In some respects our plant too shows some likeness to *Dictyota Bartayresiana* var. *denticulata* Kütz. mentioned and figured by M<sup>me</sup> WEBER in "Algues Siboga" p. 183, pl. III, fig. 4. But judging from M<sup>me</sup> WEBER's figure (I have not seen any specimen of it) the thallus in her plant is less broad in the basal part, reaching its greatest breadth near the middle of the thallus. Another difference is the sinus between the lobes being more narrow in the Indian plant and more divaricate in the Malayan plant.

### 3. *Dictyota maxima* Zan.

ZANARDINI, *Phycearum indicarum* pugillus, p. 4, no. 12, pl. 1, figs. 1—3.

Two young specimens are perhaps referable to this species. The thallus is dichotomously divided with rather broad lobes up to 12 m.; the fructiferous organs are scattered over the whole surface of the thallus. The specimens from Bombay are olive green of colour whereas some larger and better developed specimens gathered by me at Karvar are

more brown. The Indian specimens have no proliferations but these are found in ZANARDINI'S figure.

I have compared my specimens with some of this species found in the Herbarium of the British Museum, London, and found that my specimens agree quite well with these.

Bombay: Bandra Causeway.

Geogr. Distrib.: Sarawak.

#### 4. *Dictyota Atomaria* Hauck.

Journ. Indian Bot. Soc., vol. XI, 1932, p. 69, figs. 9, 10, pl. II.

Bombay: Malabar Hill, Back Bay.

Geogr. Distrib.: Bombay.

#### 5. *Dictyota pinnatifida* Kütz.

KÜTZING, Tab. Phyc., IX, p. 16, pl. 39, fig. 1. J. AGARDH, Till Alpernes Systematik, V. p. 100.

In the Herbarium of the British Museum, London, a specimen is found which seems to agree quite well with KÜTZING'S description and figure. The specimen is rather large, but sterile. M<sup>me</sup> WEBER in Algues Siboga, p. 184 mentions this species from several localities in the Malay Archipelago. KÜTZING based his description upon a specimen from the West Indies.

Bombay: Major HOBSON.

Geogr. Distrib.: West Indies, Malayan Archipelago.

### *Dilophus* J. Ag.

#### 1. *Dilophus Fasciola* (Roth) Howe.

HOWE, M. A., in Memoirs Torr. Bot. Club. 15, 1914, p. 72. BOERGESSEN, Alg. Canary Islands in Biol. Medd. 6, 1926, p. 82. *Fucus Fasciola* Roth, Cat. Bot. I, p. 146, pl. 7, fig. 1. *Dictyota repens* J. Ag., Alg. Medit. p. 38. KÜTZING, Tab. Phyc., vol. 9, pl. 9, fig. 1. *Dilophus repens* J. Ag., Till Alpernes System. 2. afd. p. 106.

The genus *Dilophus* differs from *Dictyota*, its thallus at any rate in parts consisting of two layers of large cells besides the surrounding layer.

Only a few specimens were gathered by me. Furthermore I have seen a specimen in the Herbarium of the British Museum, London.

Bombay: Major HOBSON, Kolaba (!).

Geogr. Distrib.: Mediterranean Sea, Red Sea, Canary Islands, Malayan Archipelago.

### III. Fucales.

#### Fam. 1. *Fucaceæ*.

#### *Sargassum* Ag.

##### 1. *Sargassum tenerrimum* J. Ag.

Journ. Indian Bot. Soc., vol. XII, 1933, p. 10, fig. 6, plate II.

As mentioned in the above quoted Journal, I owe to Professor W. A. SETCHELL, Berkeley, the determination of my material of *Sargassum*.

Bombay: Malabar Hill.

Geogr. Distrib.: Arabian Sea along the Indian Coast.

##### 2. *Sargassum ilicifolium* (Turn.) C. Ag. forma.

Journ. Indian Bot. Soc., vol. XII, 1933, p. 14.

Bombay: Bandra Seaface.

Geogr. Distrib.: Indian Ocean, Red Sea.



## RHODOPHYCEÆ

### A. Protoflorideæ.

#### I. Bangiales.

##### *Fam. 1. Bangiaceæ.*

##### *Erythrotrichia* Aresch.

##### 1. *Erythrotrichia carnea* J. Ag.

Kew Bulletin, 1932, no 3, p. 113.

Bombay: Santa Cruz.

Georg. Distrib.: Atlantic Ocean, Mediterranean Sea, Malayan Archipelago, Pacific coast of America.

### B. Florideæ.

#### I. Nemalionales.

##### *Fam. 1. Chantransiaceæ.*

##### *Acrochætium* Nägl.

##### 1. *Acrochætium sargassicolum* Boergs.

Kew Bulletin, 1932, no. 3, p. 115, figs. 3—5.

Bombay: Back Bay, growing socially on *Sargassum tenerrium* J. Ag.

## II. Gelidiales.

### Fam. 1. Gelidiaceæ.

#### Gelidium Lamour.

##### 1. *Gelidium pusillum* (Stackh.) Le Jolis.

Kew Bulletin, 1933, no. 3, p. 114.

Bombay: Malabar Hill.

Geogr. Distrib.: West coast of Europe, Mediterranean Sea, Red Sea, Malayan Archipelago, Japan etc.

##### 2. *Gelidium pulvinatum* (Kütz.) Thur.

THURET in BORNET, Algues de Schousboe, p. 268. *Acrocarpus pulvinatus* Kütz., Spec. Alg., p. 762; Tabulæ Phycologicæ, vol. 18, tab. 37.

##### f. *parvissima* n. f.

This small plant (Fig. 17) in all respects resembles KÜTZING's above quoted figure with the difference only that it is much smaller, only reaching a height of 1—2 mm. The plant has almost terete rhizome-like creeping filaments

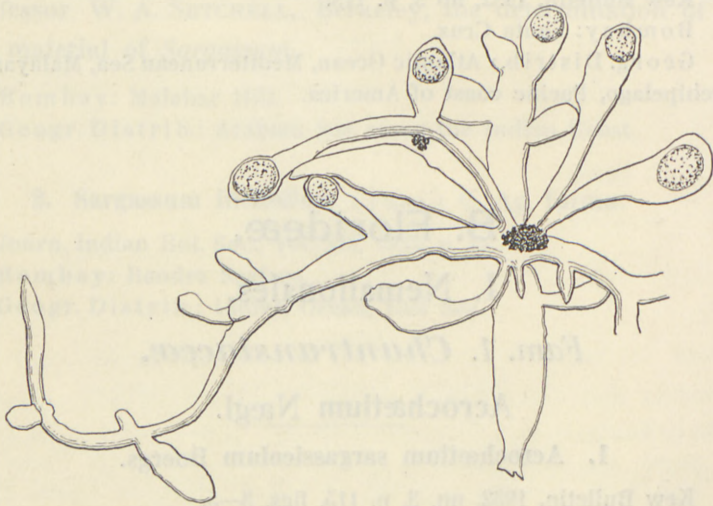


Fig. 17. *Gelidium pulvinatum* (Kütz.) Thur. forma *parvissima* n. f.

A small tuft. (× 30).

fixed by means of groups of rhizoids to the substratum. From these filaments the erect somewhat flattened parts of the thallus arise; along the margin of these short, scattered or sometimes nearly opposite, flattened branchlets are given out. The tetrasporangia are found in roundish groups near the upper broad ends of the erect parts of the thallus.

This little plant is most probably closely related to *G. pusillum* var. *conchicola* Picc. et Grun. forma *minuscula* Web. v. B. (Algues de Siboga, p. 226) but as the plant found by me in all respects seems to be a small copy of *G. pulvinatum* I prefer to refer it to this species. It was found in the littoral zone growing together with *Caloglossa Leprieurii* upon shells and stones.

Bombay: Bandra.

Geogr. Distrib.: Atlantic coast of France and Portugal.

### 3. *Gelidium heteroplatos* Boergs.

Kew Bulletin, 1934, no. 1, p. 3, fig. 3, pl. I.

Bombay: Malabar Hill, in the littoral zone on rocks facing the Arabian Sea.

### 4. *Gelidium corneum* (Huds.) Lamour.

Kew Bulletin, 1934, no. 1, p. 5.

Bombay: Malabar Hill, Back Bay.

Geogr. Distrib.: Widely spread.

## *Gelidiopsis* Schmitz.

### 1. *Gelidiopsis variabilis* (Grev.) Schmitz.

SCHMITZ in ENGLER'S Bot. Jahrb. vol. 21, 1895/6, p. 148. FELDMANN, J. in Recueil de Travaux Cryptogamiques dédiés à LOUIS MANGIN, Paris 1931, p. 156. *Gelidium variabile* (Grev.) J. Ag., Spec. Alg. II, p. 468. KÜTZING, Tab. Phycol., vol. 19, tab. 23 c, d. *Gigartina variabile* Grev. mscr.

The specimens found by me are a little smaller than KÜTZING's figures but otherwise they agree quite well. The thallus is about  $350\ \mu$  thick and the tufts 4—5 cm. high.

Bombay: Back Bay, Kolaba, Worli Seaface, Bandra.

Geogr. Distrib.: Indian Ocean.

### **Gelidiella** Feldm. et Hamel.

(= *Echinocaulon* (Kütz.) Feldm. emend., non Spach).

FELDMANN, G. and G. HAMEL in *Revue Générale*, t. 46, 1934, p. 529.

#### 1. **Gelidiella myrioclada** (Boergs.) Feldm. et Hamel.

FELDMANN et HAMEL, l. c., p. 533. *Echinocaulon myriocladum* Boergs., in *Kew Bulletin*, 1934, no. 1, p. 5, figs. 4, 5.

Bombay: Malabar Hill, on rocks in exposed places near high water mark.

### **Caulacanthus** Kütz.

#### 1. **Caulacanthus ustulatus** (Mert.) Kütz.

*Kew Bulletin*, 1933, no. 3, p. 115.

Bombay: Malabar Hill, Back Bay, Kolaba.

Geogr. Distrib.: Atlantic Ocean, Mediterranean Sea, Cape, Malayan Archipelago.

## III. Cryptonemiales.

### *Fam. 1. Squamariaceæ.*

#### **Peyssonnelia** Decaisne.

#### 1. **Peyssonnelia obscura** Web. v. Bosse.

WEBER v. BOSSE, *Algues Siboga*, p. 274—5, fig. 92.

#### Var. **bombayensis** nov. spec.

A var. typica var. *bombayensis* præcipue differt cellulis superioribus perithalli paulo majoribus, crassitudine nematheciorum paulo minore et colore thalli obscure rubro.

Bombay: Malabar Hill on stones in rock pools in exposed locality facing the Arabian Sea. BOERGESEN no. 5211 pro parte (type).

This plant seems to come so near to *P. obscura* according to the the description of it that I consider it a variety only of this species. The thallus adheres with all its under side to the substratum, stones, rocks, with the exception of the edge which in dried specimens is free and somewhat upward turned. The colour of the dried thallus is a dirty red with a little brownish and violet tinge. The shape of the thallus is orbicular with more or less lobed edges. The surface is dull or sometimes a little shining. Concentric belts are not present, radial stripes in places are well developed, in others not.

The cells of the hypothallium are arranged in long parallel rows; the cells are about 35 (30—38)  $\mu$  long and about 15—19  $\mu$  broad; a transverse section shows that they are about 25—30  $\mu$  high (Fig. 18). The arch-shaped upward

directed, dichotomously divided, short filaments issue from the cells of the hypothallium and, forming together the perithallium, are below composed of large cells having about the same size and shape as those in the hypothallium, being about 32—34  $\mu$  long and 17—22  $\mu$  high. The following cells in the filaments are divided and therefore longer than broad, namely about 14—23  $\mu$  long and 9—13  $\mu$  broad;

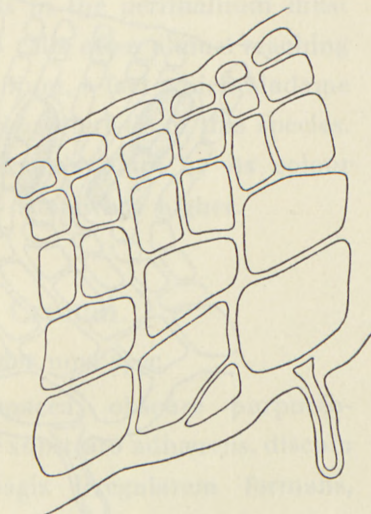


Fig. 18. *Peyssonnelia obscura* Web. v. Bosse var. *bombayensis* Boergs. Radial transverse section of sterile thallus ( $\times 500$ ).

above these 2—3 cells, rarely more, are found in each filament; the cells become shorter upwards, the uppermost being only 4—8  $\mu$  high. When seen from above the surface cells are arranged in long straight rows consisting of roundish-polygonal almost isodiametric cells about 12  $\mu$  broad. The under side of the thallus is covered by a layer of chalk about as thick as the numerous rhizoids growing out from

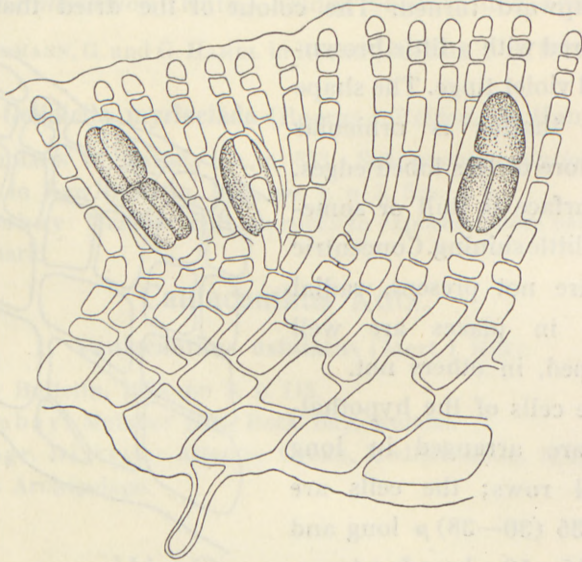


Fig. 19. *Peyssonnelia obscura* Web. v. Bosse var. *bombayensis* Boergs. Transverse section of thallus with tetrasporic nemathecium ( $\times 330$ ).

the cells of the hypothallium are long; their tips are often just protruding from the chalk.

Nemathecium with tetraspores (Fig. 19) and cystocarps were found. They form low roundish irregular elevations scattered over the surface of the thallus. A transverse section of the thallus with a tetrasporic nemathecium is about 200  $\mu$  thick, the nemathecium alone about 90—110  $\mu$ . The cells of the paraphyses in the middle are about double as long

as broad with shorter cells above and below. The tetrasporangia are cruciately divided, about  $50-70\ \mu$  long and  $25-30\ \mu$  broad. The female nemathecium has almost the same size; the carpospores are ball shaped or somewhat more irregularly formed; their diameter is about  $30-35\ \mu$ .

It is evident from this description and the accompanying figures that the Indian plant must be said to be closely related to Madame WEBER's plant. In this connection the large size of the lowermost cells in the perithallium must especially be pointed out, these cells often almost reaching the size of those in the hypothallium, a fact which Madame WEBER shows to be especially characteristic of this species. But it differs from Madame WEBER's plant by its colour and the nemathecium which is somewhat higher.

### **Crouoriella Crouan.**

#### **1. *Crouoriella bicolor* nov. spec.**

Frons orbiculata, membranacea, obscure purpureo-violacea, tota superficie inferiore substrato adhærens, discum primo rotundatum, postea magis irregularem formans, margine plus minus sinuato aut lobato, lobis interdum superositer instructa.

Hypothallium e cellulis ca.  $20-25\ \mu$  longis, ca.  $8-12\ \mu$  latis et ca.  $20\ \mu$  altis compositum est. Perithallium e filamentis arcuatis adscendentibus, dichotomis compositum; cellulis filamentorum ad basin majoribus, ca.  $16\ \mu$  longis et  $7-8\ \mu$  latis sursum longioribus cellulis supremis brevioribus.

Nemathecia verrucas humiles sparsas, irregulariter maculæformes clarius purpurascens formantia.

Paranemata nematheciorum e cellulis  $6-8$  iunctis, basi

latioribus, in media parte tenuioribus, superioribus ca.  $8\mu$  latis composita.

Tetrasporangia irregulariter cruciatim divisa, ca.  $32-45\mu$  lata et  $50-84\mu$  longa. Carposporæ subsphaericæ aut magis irregulares, ca.  $40\mu$  diametro.

Thallus sterilis ca.  $50-130\mu$  altus, stratum fructiferum ca.  $80\mu$  altum.

Bombay: Malabar Hill on stones in rock pools in exposed locality. BØRGESEN no. 5211 pro parte (type).

When dry the thallus is of a dark purplish violet colour, only the edge is not so dark; when moistened with fresh water the colour of the thallus becomes lighter reddish violet. The plant adheres strongly to the substratum. The surface is shining and without concentric or radial stripes but rather uneven, shaping itself according to the substratum. The young thallus forms circular discs, the older ones have a more irregular circumference forming up to  $5-6$  cm. broad discs which are often enlarged coalescing with neighbouring discs.

The nemathecium are scattered over the surface of the thallus. The female ones form small irregularly shaped  $\frac{1}{2}-1$  mm. broad elevations of a light reddish violet colour contrasting clearly with the much darker sterile thallus; the tetrasporic nemathecium are larger and of various extension forming irregularly shaped cushions which often coalesce with neighbouring nemathecium; their colour too is somewhat lighter reddish violet.

The height of the sterile thallus varies from about  $50\mu$ — $130\mu$ . The nemathecium are up to about  $80\mu$  and the fertile thallus up to about  $200\mu$  thick. In the thin thallus (Fig. 20) besides the hypothallium the erect filaments in the perithallium were composed of about 5 cells only, whereas in



the thick thallus the rows had 13—14 cells. A transverse section of the thallus shows furthermore that it is composed of two layers of rather different colour; the lowermost layer is bluish violet, the uppermost reddish purple. In the above-mentioned thin part of the thallus the bluish violet layer comprehended the hypothallium and two layers of the perithallium, whereas in the thick part of the thallus besides the hypothallium 5—6 layers of the perithallium belonged to the bluish violet part and the remaining upper parts of the perithallium to the reddish purple part. The colour of the nemathecium in transverse sections is rosy red and the reddish purple part most probably becomes gradually fertile.

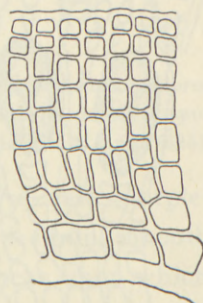


Fig. 20. *Cruoriella bicolor* Boergs. Radial section of sterile thallus. ( $\times 400$ ).

The cells of the hypothallium are about 20—25  $\mu$  long, 8—10—12  $\mu$  broad and about 20  $\mu$  high. In radial sections (Fig. 20) they are seen to be irregularly rectangular, somewhat longer than high. In transverse sections they are about double as high as broad. When the thallus is seen from underneath it is noticed that the hypothallium is composed of more or less curved, ramified and coalescing filaments forming the fanshaped figures which are characteristic of *Cruoriella*. On the under side from the cells of the hypothallium short unicellular rhizoids grow out here and there, often several together, whereas other parts of the thallus are destitute of these. The rhizoids are immersed in a layer of chalk.

The lowermost cells of the perithallium very much resemble those of the hypothallium, but they are smaller. Above this layer the filaments are divided; they are about

7—8  $\mu$  thick, keeping this size throughout their length, while the cells upwards becomes gradually shorter. The top cells are roundish or a little broader than long, 7—8  $\mu$  thick. When seen from above these cells form a layer of densely placed cells arranged in rows often forming fanlike parts.

The cells of the paraphyses in the nemathecia are thin,

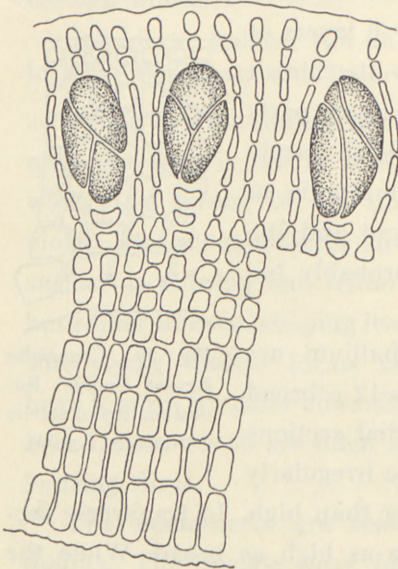


Fig. 21. *Cruoriella bicolor* Boergs. Transverse section of thallus with tetrasporic nemathecium. ( $\times 375$ ).

those in the middle of the filaments reaching only a breadth of about 2—3  $\mu$ ; towards the summits they increase to almost the same size as of those in the vegetative thallus, namely about 8  $\mu$  (Fig. 21). The sporangia are cruciately divided, though often rather irregularly, their size also varying rather, for instance one was 50  $\mu$  long and 32  $\mu$  broad, another one 64  $\mu$  long and 38  $\mu$  broad and a third one 57  $\mu$  long and 45  $\mu$  broad.

The carospores too vary much as to size and shape, their diameter being about 40  $\mu$ .

## Fam. 2. *Hildenbrandiaceæ*.

### *Hildenbrandia* Nardo.

#### 1. *Hildenbrandia prototypus* Nardo.

NARDO, De novo genere Algarum cui nomen est *Hildbrandtia prototypus*. OKEN'S *Isis* 1843, p. 675. HAUCK, *Meeresalgen*, p. 38.

ROSENVINGE, L. KOLDERUP, The Marine Algae of Denmark, Rhodophyceæ II, p. 202—07, figs. 121—124, where more literature is quoted.

The Indian specimens agree very well with ROSENVINGE'S minute description and good figures. The vertical rows of cells in the crust are about 4—6  $\mu$  thick; the lowermost cells in the filaments are about as long as broad, the uppermost about double as long as broad. The shape and size of the sporangia vary much (Fig. 22). The sporangia are divided by oblique walls.

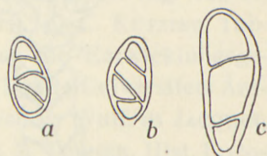


Fig. 22. *Hildenbrandia prototypus* Nardo. Tetrasporangia. ( $\times 375$  and  $525$ ).

In Back Bay the plant forms extensive dark purple-violet coverings upon horizontal or slightly declining smooth rocks. During low tide the nearly black rocks upon which the alga is found become burning hot from the sun.

Bombay: Back Bay, Bandra.

Geogr. Distrib.: Cosmopolitan, occurs both in cold and warm seas.

### Fam. 3. *Corallinaceæ*.

#### *Amphiroa* Lamour.

##### 1. *Amphiroa fragilissima* (L.) Lamour.

Kew Bulletin, 1934, no. 1, p. 7.

Bombay: Kolaba, Back Bay.

Geogr. Distrib.: West Indies, Mediterranean Sea, Indian Ocean, Malay Archipelago, Pacific Ocean.

#### *Cheilosporum* Aresch.

##### 1. *Cheilosporum spectabile* Harv.

HARVEY, Friendly Island Algæ no. 31 (nomen nudum). WEBER VAN BOSSE, A. and M. FOSLIE, The Corallinaceæ of the Siboga-Expedition, p. 106.

The Indian form is a small one, the thallus reaching only a breadth of  $1\frac{1}{2}$ —2 mm. The specimens (Fig. 23) are



Fig. 23. *Cheilosporum spectabile* Harv. Part of a tuft. ( $\times 6$ ).

rather like a specimen No. 1203 collected by SETCHELL at Tutuila Island (1924, p. 152) which he was so kind as to send to me, but the Indian form is smaller.

Bombay: Bandra Seaface, forming tufts on the rocks in the littoral zone often intermingled with *Amphiroa fragilissima*.

Geogr. Distrib.: Malayan Archipelago, Polynesia.

## Jania Lamour.

### 1. *Jania rubens* (L.) Lamour.

LAMOUREUX, Hist. Polyp. Corallig. Flex., p. 272 (1816). ARE-SCHOUGH, in J. AGARDH, Spec. Alg. II, p. 557. KÜTZING, Tab. Phycol. vol. VIII, tab. 84.

Only a few specimens were found which seem referable to this species; the thallus was  $150\ \mu$  thick.

Bombay: Bandra Seaface.

Geogr. Distrib.: Atlantic Ocean, Mediterranean Sea, Red Sea, Natal, Malay Archipelago, Australia, Polynesia.

*Fam. 4. Grateloupiaceæ.**Grateloupia* C. Ag.1. *Grateloupia filicina* (Wulf.) Ag.

AGARDH, C., Spec. Alg., p. 223. J. AGARDH, Spec. Alg. vol. II, p. 180; Epicrisis, p. 153. HARVEY, Phycol. Brit., pl. C. KÜTZING, Tab. Phycol., vol. XVII, pl. 22. KYLIN, H., Ueber die Entwicklungsgeschichte der Florideen, p. 19, figs. 10, 11. (Lunds Universitets Årsskrift, N. F., Avd. 2, Bd. 26, 1930). *Fucus filicinus* Wulf. in JACQUIN, Collectanea, vol. III, 1789, p. 157, tab. 5, fig. 2. TURNER, Hist. Fuco-  
rum, pl. 150.

The appearance of this plant varies much according to the external conditions influencing it, some of the forms being so heterogeneous that KÜTZING considered them independent species. Also at the shores of Bombay the habit of this species varies much, which may be seen from the specimens shown on plates 7—9. Plate 7 shows a form from a very exposed coast. The plant grows here in dense tufts on declining rocks between tide marks. The thallus is flat, up to  $\frac{1}{2}$  cm broad, and up along the margins numerous unilaterally and densely placed proliferations are issued. This form seems to be like *Gr. horrida* Kütz. (Tabulæ Phycologicae, 17, pl. 29) from the Mediterranean Sea and may be called forma *horrida*.

Another form (pl. 8) from a more sheltered coast has a much more narrow thallus, only up to about 1 mm broad, and numerous narrow almost linear flat proliferations given off from the edges of the thallus. Therefore this form gets a pectinate appearance and may be called forma *pectinata*.

Finally a third form is pictured upon plate 9. This plant was found in a quite sheltered locality; it is distinguishable by its very irregular ramification with numerous proliferous branches and branchlets growing out from the

main filaments. An especially interesting feature was that many of the branchlets ended in tendrils and consequently this form may be called f. *cirrhosa*.

The anatomical structure of the thallus is quite the same in all three forms. As described by KYLIN (l. c.) the growth of the thallus is developed in the way of the fountain type (Springbrunnentypus). Near the periphery the flat thallus consists of a cortical layer of densely placed cells inwards slowly increasing in size, and in the middle there is a tissue composed of stellate cells with very long arms between which rhizoids are running; compare KYLIN'S figure 9 C and my figure 136 in *Marine Algae of the Danish West Indies*, vol. II, p. 127 of similar cells found in *Grateloupia cuneifolia* J. Ag. The tetrasporangia are formed in the cortical tissue scattered over the whole thallus and are cruciately divided. Sexual plants were not observed.

Bombay: Back Bay, Kolaba, Malabar Hill, Bandra.  
Geogr. Distrib.: Seems to occur in all warm seas.

#### IV. Gigartinales.

##### *Fam. 1. Solieriaceæ.*

##### *Solieria* J. Ag.

##### 1. *Solieria robusta* (Grev.) Kylin.

Kew Bulletin, 1934, no. 1, p. 10.

Several specimens of this species are found in the herbarium of the British Museum (Nat. Hist.) London; they are referable to the var. *Wightii*.

Bombay: Major HOBSON.  
Geogr. Distrib.: Australia, Japan, Malayan Archipelago.

## **Sarconema Zanard.**

### **1. Sarconema filiforme (Sond.) Kylin.**

Kew Bulletin, 1934, no. 1, p. 11, fig. 7.

Bombay: Back Bay, Malabar Hill.

Geogr. Distrib.: West Australia, Arabian Sea.

## **Fam. 2. Rhabdoniaceæ.**

### **Catenella Grev.**

#### **1. Catenella repens (Lightf.) Batt.**

Kew Bulletin, 1933, no. 3, p. 116.

Bombay: Malabar Hill.

Geogr. Distrib.: Most warm seas.

## **Fam. 3. Hypneaceæ.**

### **Hypnea Lamour.**

#### **1. Hypnea Valentiaë (Turn.) Mont.**

Kew Bulletin, 1934, p. 17.

Bombay: Back Bay, Malabar Hill, Bandra, Santa Cruz.

Geogr. Distrib.: Most warm seas.

#### **2. Hypnea musciformis (Wulf.) Lamour.**

Kew Bulletin, 1934, p. 17.

Bombay: Back Bay.

Geogr. Distrib.: Most warm seas.

## **Fam. 4. Gracilariaceæ.**

### **Gracilaria Grev.**

#### **1. Graciliara foliifera (Forssk.) Boergs**

Kew Bulletin, 1933, no. 3, p. 124.

Bombay: Kolaba, leg. S. C. Dixit.

Geogr. Distrib.: Warmer Atlantic coast of Europe and America, Mediterranean Sea, Red Sea, Indian Ocean etc.

2. *Gracilaria corticata* J. Ag.var. *ramalinoides* J. Ag.

Kew Bulletin, 1933, no. 3, p. 124.

Bombay: Malabar Hill, Kolaba, Back Bay, Bandra.

Geogr. Distrib.: Indian Ocean, Red Sea.

*Fam. 5. Gigartinaceæ.**Gigartina* Stackh.1. *Gigartina acicularis* (Wulff.) Lamour.

LAMOUREUX, Essai Thalassiphytes, 1813, p. 48. J. AGARDH, Spec. Alg., vol. II, p. 263; Epicr., p. 190. KÜTZING, Tab. Phycol. Vol. XVIII, tab. 1. *Fucus acicularis* Wulf., Crypt. aquat. 1803, p. 63, no. 50. TURNER, Hist. Fucorum, tab. 126. For more literature compare DE TONI, Syll. Alg., vol. IV, Florideæ, p. 198.

Only a few sterile specimens were found.

Bombay: Bandra Seaface.

Geogr. Distrib.: Seems to occur in most warm seas.

## V. Rhodymeniales.

*Fam. 1. Rhodymeniaceæ.**Rhodymenia* Grev.1. *Rhodymenia australis* Sond.

SONDER in Bot. Zeitung 1845, p. 56. HARVEY Phycologia Australica, tab. 146. *Acropeltis australis* Kütz., Tab. Phycol., vol. 19, tab. 34. BØRGESEN, Algae . . . Arabian Sea in Biologiske Meddelelser, XI, 6, København 1934, p. 41.

I think a few sterile specimens presented to me by Mr. S. C. DIXIT are referable to this species.

Bombay: Kolaba, S. C. DIXIT.

Geogr. Distrib: West Australia.



## VI. Ceramiales.

### *Fam. 1. Ceramiaceæ.*

#### **Monospora Solier.**

##### **1. Monospora indica Boergs.**

Kew Bulletin, 1931, no. 1, p. 12, fig. 8.

Bombay: Kolaba, leg. K. GOPAL AYENGAR.

#### **Spyridia Harv.**

##### **1. Spyridia filamentosa (Wulf.) Harv.**

Kew Bulletin, 1931, no. 1, p. 14.

Bombay: Back Bay, Kolaba.

Geogr. Distrib.: Most warm seas.

#### **Centroceras Kütz.**

##### **1. Centroceras clavulatum (Ag.) Mont.**

Kew Bulletin, 1934, n. 1, p. 18.

Bombay: Back Bay, Malabar Hill, Bandra.

Geogr. Distrib.: All warm seas.

### *Fam. 2. Delesseriaceæ.*

#### **Myriogramme Kylin.**

##### **1. Myriogramme bombayensis Boergs.**

Kew Bulletin, 1931, no. 1, p. 23, fig. 15, pl. II, fig. 4.

Reexamining my material of this plant, I found some tetrasporic specimens. The tetrasporangia are developed in the proliferations, forming roundish groups containing numerous sporangia. If a nerve is present in the fertile proliferation the tetrasporangial group is found on both sides of the nerve, but as a rule the proliferations are destitute of nerves. Fig. 24 shows part of a tuft with

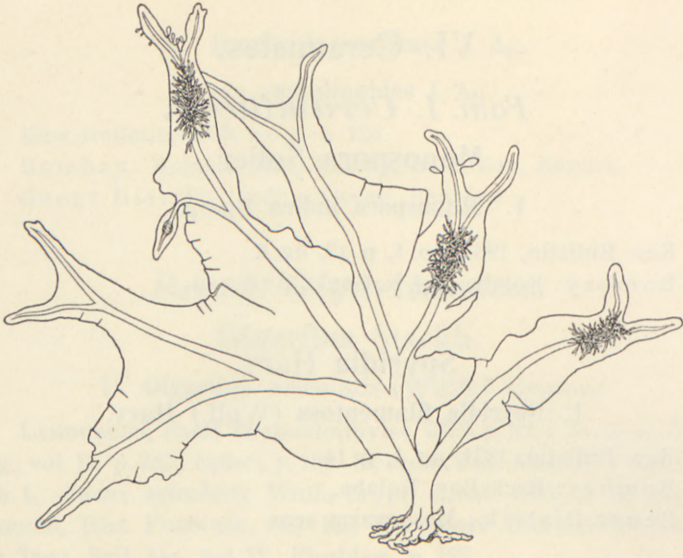


Fig. 24. *Myriogramme bombayensis* Boergs. Part of the thallus. ( $\times 3$ ).

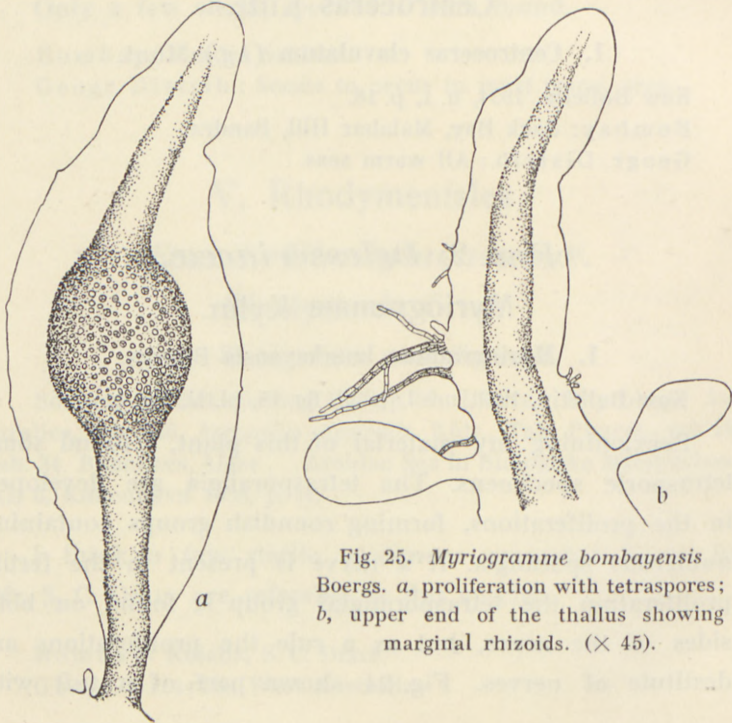


Fig. 25. *Myriogramme bombayensis* Boergs. *a*, proliferation with tetraspores; *b*, upper end of the thallus showing marginal rhizoids. ( $\times 45$ ).

groups of rhizoids growing out from the nerves; when these become fixed to the rocks they are able to give rise to new tufts. Along the margin of the figure several proliferations are seen, one of which with a group of tetrasporangia. Magnified still more this sporangial group is shown in fig. 25 a; and fig. 25 b shows a part of the upper end of the lacinulate thallus with proliferations and rhizoids growing out from the margin.

Bombay: Malabar Hill, on rocks facing the open sea.

### **Caloglossa J. Ag.**

#### **1. Caloglossa Leprieurii (Mont.) J. Ag.**

Kew Bulletin, 1933, no. 3, p. 127.

Bombay: Malabar Hill.

Geogr. Distrib.: Widely distributed in warmer seas.

#### **2. Caloglossa bombayensis Boergs.**

Kew Bulletin, 1933, no. 3, p. 127, figs. 10, 11, 12.

Bombay: Malabar Hill.

### **Fam. 3. Rhodomelaceæ.**

#### **Laurencia Lamour.**

##### **1. Laurencia papillosa (Forssk.) Grev.**

Kew Bulletin, 1933, no. 3, p. 134.

Bombay: Malabar Hill, Kolaba.

Geogr. Distrib.: Most warm seas.

#### **Chondria (C. Ag.) Harv.**

##### **1. Chondria dasyphylla (Woodw.) Ag.**

AGARDH, C., Sp. Alg., p. 350. *Fucus dasyphyllus* Woodw. in Transact. Linn. Soc. II, p. 239, pl. 23, figs. 1—3. For more literature compare DE TONI, Syll. Alg. vol. IV, p. 842.

Tetrasporic specimens were collected in the month of January.

Bombay: Bandra Seaface.

Geogr. Distrib.: Seems to occur in most warm seas.

## 2. *Chondria cornuta* Boergs.

Kew Bulletin, 1932, no. 3, p. 130, figs. 15, 16.

Bombay: Malabar Hill, Santa Cruz.

## *Acanthophora* Lamx.

### 1. *Acanthophora Delilei* Lamx.

Kew Bulletin, 1933, no. 3, p. 134.

On referring my material of *Acanthophora* from Bombay (compare Plate 10) to this species, I wish to point out that my specimens are not quite typically developed, and the material being sterile, the determination of it was not quite satisfactory.

My specimens are very like a specimen of FERGUSSON'S Ceylon Algae no. 29 found in the herbarium of the British Museum, London and determined as *Acanthophora Delilei*.

Bombay: Bandra Seaface, Malabar Hill in various places, Kolaba.

Geogr. Distrib.: Mediterranean and Black Sea, Red Sea, shores of Samoli.

## *Polysiphonia* Grev.

### 1. *Polysiphonia platycarpa* Boergs.

Kew Bulletin, no. 1, 1934, p. 23, figs. 15, 16, 17.

Referring the reader to my description and figures of the plant I wish to point out that after a visit to London in the spring 1934 where in the Kew Herbarium I have been able to compare my plant with authentic cystocarpic

material of HARVEY'S *Polysiphonia mollis* (HARVEY'S Alg. austr. no. 168 A, Fremantle, West Australia) I have come to the conclusion that my plant seems to be very closely related to this species. And the Indian plant too seems to resemble very much the plant which ASKENASY in Flora, 1894, p. 13, pl. 3, fig. 13, has referred to *Polysiphonia mollis*, that is, with a ? after the specific name. As pointed out in my description, the branches in the Indian plant appear in the places of the trichoblasts and according to ASKENASY'S description this seems to be the case too in the Australian plant. As to the length of the cells it was in my specimens from about  $1\frac{1}{2}$ —3 which seems to agree rather well with ASKENASY'S statement and with the measures found by YENDO (in Botanical Magazine, vol. 30, Tokyo 1916, p. 261) and by M<sup>me</sup> WEBER (in "Algues du Siboga", p. 356) respectively in plants from Japan and the Malayan Archipelago. Both these investigators point out that their plants have shorter cells than *P. mollis*. Therefore these two authors, just as ASKENASY, place a ? after the specific name.

Cystocarpic specimens have not been found by the last mentioned investigators. According to my observations the size of the cystocarps in the Indian plant varies rather much, those I have figured in the figures quoted above being respectively 250 and 320  $\mu$  long and 280 and 340  $\mu$  broad. The measures given by ASKENASY for the size of the cystocarps are 250  $\mu$  for the length and 260  $\mu$  for the breadth. In the original description of *Polysiphonia mollis* Hook. and Harv. in "Nereis Australis", p. 43, the cystocarps are described in this way: "Ceramidia very numerous, minute, shortly stalked, ovate, acute". This cannot be said to correspond very well with the Indian plant nor with the

Australian one examined by me, a cystocarp of this plant in the Kew Herbarium measured by me reaching a length of 420  $\mu$  and a breadth of 460  $\mu$ , thus it is a good deal larger than those found in the Indian plant. According to these various observations it seems to be a very heterogeneous number of forms which are referred (and generally with doubt) to *Polysiphonia mollis*, and therefore I think it most preferable until further examination of fruiting material has been made to consider the Indian plant a proper species.

The plant seems to be common in rather sheltered places by the shores near Bombay.

Bombay: Back Bay, Kolaba, Bandra Seaface, Bandra.

### 1. *Polysiphonia variegata* (C. Ag.) Zan.

Kew Bulletin, 1934, no. 1, p. 26, fig. 18.

In the collection of the British Museum two small specimens from Bombay are present. The specimens have about 6 pericentral cells which are about as long as the breadth of the segments. From the material I was not able to see whether the branches are found at the base of the trichoblast or not; compare my figure quoted above.

Bombay: Major HOBSON.

Geogr. Distrib.: Mediterranean Sea, warmer Atlantic coasts of Europe and America, West Indies.

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*Cladophora saracenica* Boergs.



*Cladophora colabense* Boergs.



*Cladophora bombayensis* Boergs.



*Cladophora monumentalis* Boergs.



*Spathoglossum asperum* J. Ag.



*Dictyota dimosa* Boergs.



*Grateloupia filicina* (Wulf.) Ag. forma *horrida* (Kütz.).

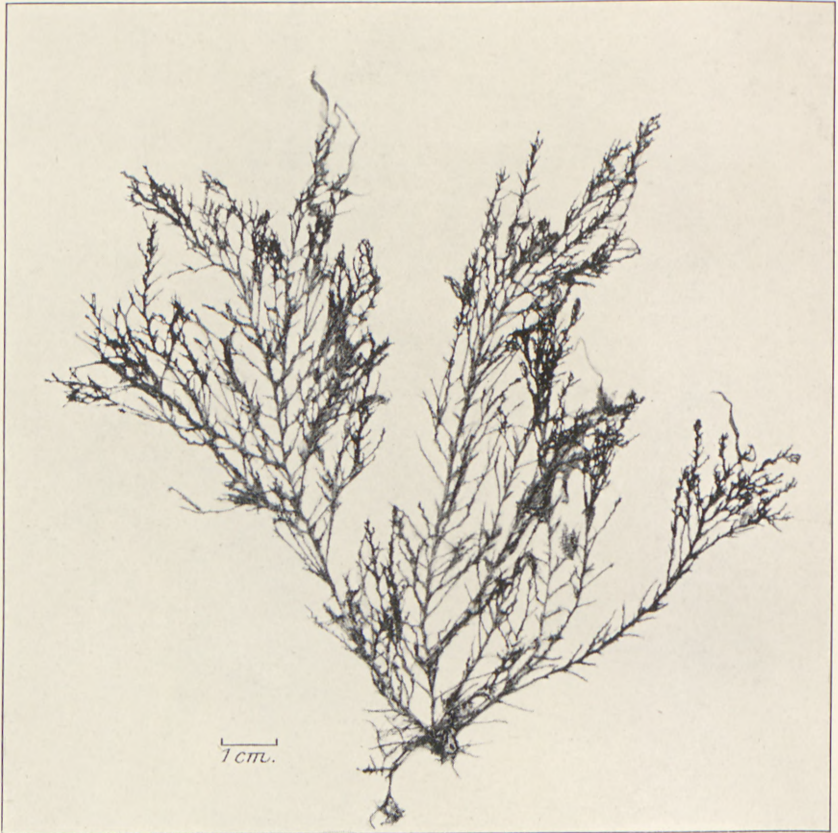


*Grateloupia flicina* (Wulf.) Ag. forma *pectinata*.





*Grateloupia filicina* (Wulf.) Ag. forma *cirrhosa*.



*Acanthophora Delilei* Lamx.