

STUDIES ON BANGIOPHYCEAE (RHODOPHYTA) FROM THE COAST OF KARACHI

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Abstract

The present study records the seaweeds belonging to Bangiophyceae (Rhodophyta) collected during 1974-84 from the coast of Karachi and the adjacent areas in Pakistan. It treats a taxonomic description and ecological notes of 7 species including 6 new records from the coast of Pakistan, embracing 3 species belonging to Porphyridiales, 2 species to Erythropeltidales and 2 to Bangiales. Order Rhodochaetales was found to be absent. *Bangia fuscopurpurea* (Dillw.) Lyngb., *Bangiopsis subsimplex* (Mont.) Schmitz and *Porphyra vietnamensis* Tanaka *et* Ho are new records from the Arabian Sea.

Introduction

The knowledge about the systematics of Bangiophyceae Melchior 1954 is in a rudimentary stage, since many fundamental problems pertaining morphology, reproduction and life-history of these algae are yet to be solved. The only published account about the taxonomy of this group from the coastline of Pakistan is about *Erythrocladia subintegra* (Anand, 1943). Apart from a reference on the occurrence of *Porphyra* C. Ag. (Michanek, 1975) and a note about Bangiophyceae (Shameel & Moazzam, 1982) from this region no taxonomic description is available. A taxonomic evaluation of these algae is therefore presented.

Materials and Methods

The specimens were collected from different localities along 40 km coastline from Manora to Cape Monze (Fig. 1), near Karachi during 1974-84. The algae were preserved in 4% formaline neutralized with hexamethylene tetramine. To study the anatomical features the sections and pieces of thin fronds were stained with 1% methylene blue, acidified with a drop of dil. HCl and mounted in 70% glucose solution.

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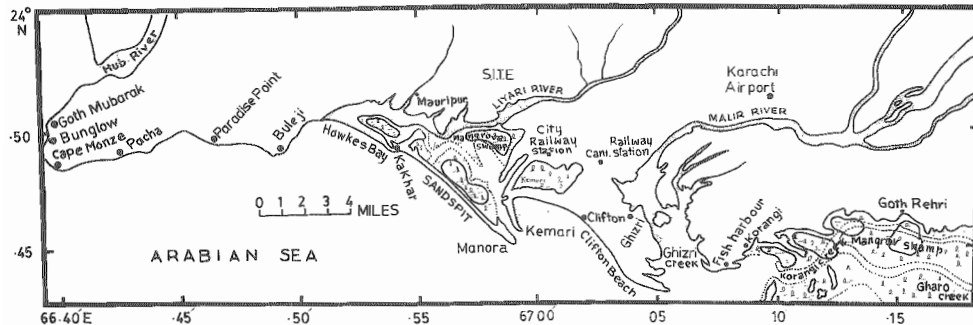


Fig. 1. Map showing the area surveyed with various localities of collection.

Results and Discussion

Seven species of red algae having filamentous or simple thalli, showing a diffuse growth and composed of cells without pit-connections with stellate chloroplasts could be collected. A dichotomous key to distinguish them is as follows:

- | | | | | | |
|----|---|---|---|---|----------------------------------|
| 1. | Thalli filamentous, filiform | — | — | — | 2 |
| | Thalli expanded, flattened | — | — | — | 3 |
| 2. | Filaments verrucose with proliferations | — | — | — | <i>Bangiopsis subsimplex</i> |
| | Filaments smooth without proliferations | — | — | — | 4 |
| 3. | Fronds disc shaped, prostrate | — | — | — | <i>Erythrocladia irregularis</i> |
| | Fronds oblong lanceolate, erect | — | — | — | <i>Porphyra vietnamensis</i> |
| 4. | Filaments simple, unbranched | — | — | — | 5 |
| | Filaments variably branched | — | — | — | 6 |
| 5. | Rhizoids arising from lower cells of the filament | | | | <i>Bangia fuscopurpurea</i> |
| | Rhizoids not arising from lower cells of the filament | | | | <i>Erythrotrichia carnea</i> |
| 6. | Cells upto 5 μm in diam. | — | — | — | <i>Chroodactylon ornatum</i> |
| | Cells 7 – 13 μm in diam. | — | — | — | <i>Goniotrichum alsidii</i> |

With the exception of *Erythrocladia irregularis*, which was described by Anand (1943) as *E. subintegra*, all the species are new records from the coast of Pakistan, while *Bangia fuscopurpurea*, *Bangiopsis subsimplex* and *Porphyra vietnamensis* are new records from the Arabian Sea. Usually the algae occur as an epiphyte or as an epizoon inhabiting the fronds of larger seaweeds or the hydrothecae of hydroids. However, the habitat of *P. vietnamensis* is uncertain, it could only be collected as drift specimens. For the taxonomic enumeration of these seaweeds the classification of Garbary *et al.* (1980 a) has been adopted:

A. PORPHYRIDIALES Kylin 1937

1. *Bangiopsis subsimplex* (Mont.) Schmitz 1897.

Basionym: *Compsopogon subsimplex* Montagne 1850.

References: Børgesen, 1915: 10; Taylor, 1960: 289.

Diagnosis: Thallus filamentous, erect, flexuous, verrucose, subsimple, sometimes proliferous (Fig. 2); younger filaments uniseriate, older ones multiseriate, proliferations uniseriate; basal cell forming holdfast; rhizoids absent; cells about 35 μm broad; chloroplasts stellate, violet red, with a single pyrenoid.

Habitat: Epiphytic on the older filaments of *Petalonia fascia* (Müller) Kuntze.

Local distribution: Buleji, Paradise Point and Paçha.

Distribution: Guyana and Pakistan.

Remarks: Usually found at Karachi in September and sometimes also in July. This alga has not previously been reported from the Arabian Sea.

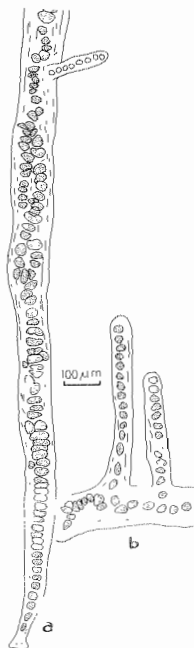


Fig. 2. *Bangiopsis subsimplex* (Mont.) Schmitz: a. old filament with holdfast, b. young filament with proliferations.

2. *Goniotrichum alsidii* (Zan.) Howe 1914.

Basionym: *Bangia alsidii* Zanardini 1839.

Synonym: *Bangia elegans* Chauvin 1842, *Goniotrichum elegans* (Chauv.) Zanardini 1847, *Porphyra elegans* Crouan et Crouan 1867.

References: Børgesen, 1915: 4; Dawson *et al.*, 1964: 30 (both as *G. elegans*); Taylor, 1960: 288; Dangeard, 1968: 5; Chapman, 1969: 4; Abbott & Hollenberg, 1976: 280; Kornmann & Sahling, 1977: 256; Rueness, 1977: 96; Garbary *et al.*, 1980 b: 144.

Diagnosis: Thallus filamentous, erect, irregularly branched, uniseriate (Fig. 3); cells at the base of the frond comparatively thicker; cells barrel shaped or cylindrical, 7 – 13 μm in diam., 5 – 13 μm in length; outer cell wall thick; chloroplasts stellate, violet red.

Habitat: Epiphytic on the fronds of *Plocamium telfairiae* Harv. and *Gracilaria corticata* J. Ag.; epizoic on the hydrothecae of *Sertularia* spp. and also epilithic.

Type locality: Adreatic Sea.

Local distribution: Manora, Sandspit, Paradise Point and Cape Monze.

Distribution: Virtually cosmopolitan: North Sea, Atlantic coast of Europe and America, Mediterranean Sea, Arabian Sea, Peru, Morocco and New Zealand.

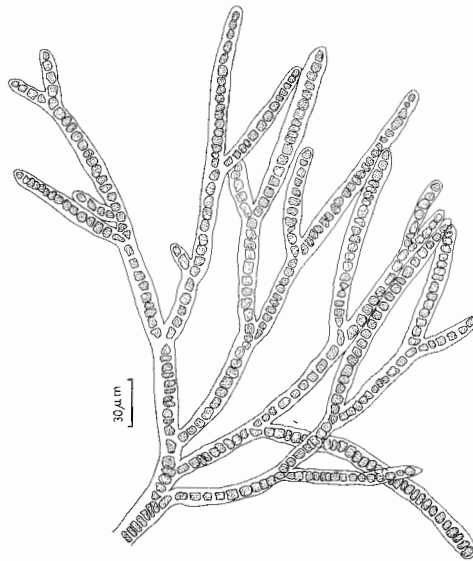


Fig. 3. *Goniotrichum alsidii* (Zan.) Howe.

Remarks: Our specimens are similar with those described by Taylor (1960), Chapman (1969) and Garbary *et al.* (1980 b), but slightly differ from them in cell shape, being occasionally barrel shaped. The cells are also slightly smaller in diameter than the algae collected from Peru (Dawson *et al.*, 1964). This species commonly occurs in Arabian Sea and has been reported from Dwarka, Tutikorin and Okha Port in India (Børgesen, 1933, 1934).

3. *Chroodactylon ornatum* (C. Ag.) Basson 1979

Basionym: *Conferva ornata* C. Agardh 1824.

Synonym: *Hormospora ramosa* Thwaites in Harvey 1846 – 51, *Chroodactylon wolleanum* Hansg. 1885, *Goniotrichum ramosum* (Thwaites in Harv.) Hauck 1885, *Asterocystis ramosa* (Thwaites in Harv.) Hauck 1879, *A. ornata* (C. Ag.) Hamel 1924.

References: Børgesen, 1939: 102; Tanaka, 1952: 11; Pankow, 1971: 215; Jaasund, 1976: 59 (all as *A. ornata*); Taylor, 1960: 287 (as *A. ramosa*); Basson, 1979: 67.

Diagnosis: Thallus filamentous, erect, pseudodichotomously branched (Fig. 4); filaments uniseriate, 12–22 μm wide, length variable upto 900 μm ; cells almost quadrate, 5 μm in diam.; chloroplasts single, with a pyrenoid, purple red.

Habitat: Epiphytic on *Chaetomorpha* spp. and other filamentous algae.

Local distribution: Buleji and Paradise Point.

Distribution. North Atlantic and Arabian Sea.

Remarks: It is found mostly in December and January.

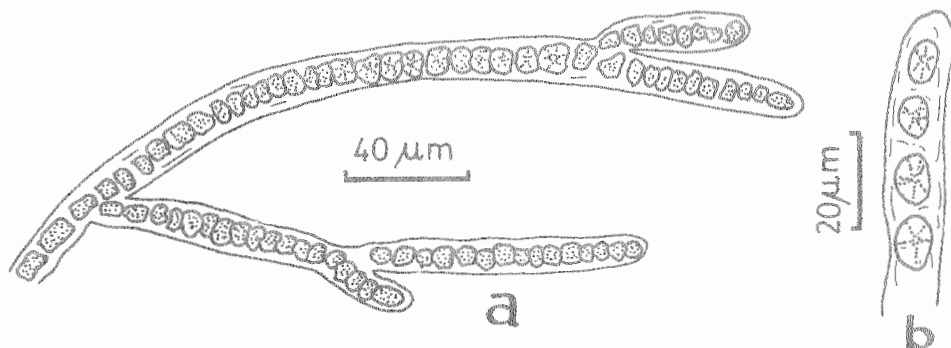


Fig. 4. *Chroodactylon ornatum* (C. Ag.) Basson: a. filaments with pseudodichotomous branching, b. tip of a filament enlarged.

B. ERYTHROPELTIDALES Garb., Hans. *et* Scagel 1980

4. *Erythrocladia irregularis* Rosenvinge 1909.

Synonym: *Erythrocladia subintegra* Rosenvinge 1909, *E. polystromatica* Dangeard 1932, *E. ectozoica* Dawson 1953.

References: Børgesen, 1939: 102; Anand, 1943: 5; Smith, 1951: 166; Taylor, 1960: 290; Chapman, 1969: 10; Nizamuddin & Gessner, 1970: 8 (all as *E. subintegra*); Jaasund, 1965: 116; Heerebout, 1968: 141; Chapman, 1969: 8; Pankow, 1971: 216; Abbott & Hollenberg, 1976: 284; Rueness, 1977: 96; Basson, 1979: 67; John *et al.*, 1979: 73; Garbary *et al.*, 1980 b: 154.

Diagnosis: Thallus disc shaped, with rounded margin, flattened, monostromatic, prostrate (Fig. 5); discs upto 100 μm in diam.; cells 3–6 μm in diam., 3–12 μm in length, peripheral cells usually bifurcated; monospores globose.

Habitat: Epiphytic on a large number of green and red algae, e.g. *Bryopsis pennata* Lamour., *Chaetomorpha antennina* (Bory) Kütz., *Cladophora* spp., *Champia parvula* (Ag.) Harvey etc.; epizoic on the hydrothecae of *Sertularia* sp. and *Clytia* sp.

Type locality: Møllegrund off Hirschals, Denmark.

Local distribution: Manora, Buleji, Paradise Point and Cape Monze.

Distribution: Cosmopolitan in temperate and tropical waters.



Fig. 5. *Erythrocladia irregularis* Rosenvinge.

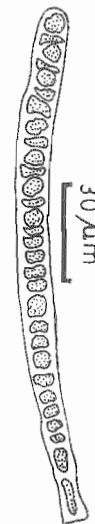


Fig. 6. *Erythrotrichia carnea* (Dillw.) J. Ag.

Remarks: This species has already been reported from Manora coast, near Karachi by Anand (1943) as *E. subintegra*. Heerebout (1968) has placed *E. subintegra* in synonymy with *E. irregularis*. It was also found in the areas other than Manora. It occurs in such a large number on *Chaetomorpha antennina* that the colour of the latter appears to be red. Karachi specimens agree in dimensions with those described from British Columbia (Garbary *et al.*, 1980 b).

5. *Erythrotrichia carnea* (Dillw.) J. Ag. 1883.

Basionym: *Conferva carnea* Dillwyn 1802–1809.

Synonym: *Conferva ceramicola* Lyngb. 1919, *Ceramium ceramicola* (Lyngb.) C. Ag. 1828. *Erythrotrichia ceramicola* (Lyngb.) Aresch. 1850, *Bangia reflexa* Crouan *et* Crouan 1852. *Prophyra ceramicola* (Lyngb.) Crouan *et* Crouan 1867.

References: Børgesen, 1935: 41, 1939: 101; Nasr, 1947: 90; Taylor, 1960: 292; Chapman, 1969: 11; Pankow, 1971: 217; Abbott & Holenberg, 1976: 286; Kornmann & Sahling, 1977: 258; Rueness, 1977: 97; Basson, 1979: 67; John *et al.*, 1979: 74; Garbary *et al.*, 1980 b: 156.

Diagnosis: Thallus filamentous, erect, unbranched (Fig. 6); filaments uniseriate, 12–26 μm in diam., attached by a basal disc; cells 16–32 μm long, 15 μm in diam., chloroplasts central, stellate with a single pyrenoid; monosporangia found on the older filaments, usually cut off by an oblique wall near distal end of the cell.

Habitat: Epiphytic on various green and red algae; epizoic on the hydrothecae of *Sertularia* sp. and other hydroids.

Type locality: Wales, U.K.

Local distribution: Buleji, Pacha, Paradise Point and Cape Monze.

Distribution: Virtually cosmopolitan. Atlantic Ocean, Mediterranean Sea, Pacific coast of America, Indian Ocean: Persian Gulf and North Arabian Sea.

Remarks: The Karachi specimens resemble those occurring at the eastern coast of America (Taylor, 1960) as well as British Columbia (Garbary *et al.*, 1980 b), with a slight difference in the cell dimensions.

C. RHODOCHAETALES

The only species included in this order, *Rhodochaete parvula* Thuret *in* Bornet was found to be absent from this region.

D. BANGIALES Schmitz *in* Engler 1892

6. *Bangia fuscopurpurea* (Dillw.) Lyngbye 1819.

Basionym: *Conferva fuscopurpurea* Dillwyn 1802–1809.

Synonym: *Conferva atropurpurea* Roth 1806, *Bangia crispa* Lyngb. 1819, *B. atropurpurea* (Roth) C. Ag. 1824, *B. bidentata* Kütz. 1845–69, *B. pallida* Kütz. 1845–69, *B. versicolor* Kütz. 1845–69, *B. pumila* Aresch. 1875.

References: Taylor, 1960: 293; Jaasund, 1965: 115; Chapman, 1969: 17; Pankow, 1971: 217; Abbott & Hollenberg, 1976: 294; Kormmann & Sahling, 1977: 262; Ruess, 1977: 98; Garbary *et al.*, 1980 b: 167.

Diagnosis: Thallus filamentous, unbranched, occurring in aggregates, attached through a basal disc (Fig. 7), filaments upto 10 cm long, young parts uniseriate and older ones multiseriate, rhizoids arising from the lower cells of the filament; cells from 2.5–3.0 μm in diam.; chloroplasts radially lobed, purple violet; monospores formed by the direct transformation of vegetative cells.

Habitat: Generally epizoid on the shells of the limpet *Cellana radiata*, found in the upper littoral zone along the rocky shores, occasionally epilithic in small tufts at the same tidal height.

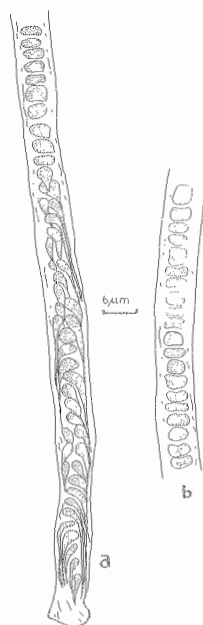


Fig. 7. *Bangia fuscopurpurea* (Dillw.) Lyngb.: a. old filament showing rhizoids and holdfast, b. young filament exhibiting uniseriate arrangement.

Type locality: Bremen, F.R. Germany.

Local distribution: Paradise Point.

Distribution: Virtually cosmopolitan in marine habitats.

Remarks: This species was always found in small tufts. The young filaments appear in the early June, reach upto a height of 10 cm during middle of June and disappear by the end of the month. This species has not previously been reported from Arabian Sea. The Karachi specimens resemble those described from New Zealand waters (Chapman, 1969) as well as from Baltic Sea (Pankow, 1971), but are much smaller in length. The specimens from Baltic Sea are 1–16 cm long, while those from New Zealand are upto 20 cm. The short life-span and small height of Karachi specimens may be due to their habitat in strong wave action.

7. *Porphyra vietnamensis* Tanaka et Ho 1962

Reference: Tanaka & Ho, 1962: 34.

Diagnosis: Thallus oblong, lanceolate, membranous, flattened, monostromatic, erect (Fig. 8); margins undulate; frond 18–24 μm thick 1–2 cm broad and 4–10 cm long;

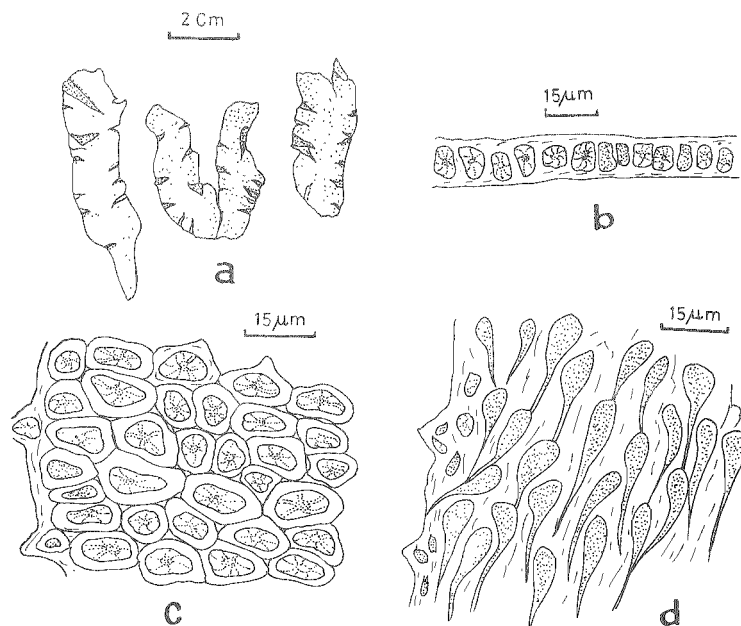


Fig. 8. *Porphyra vietnamensis* Tanaka et Ho: a. lanceolate thalli with undulate margins, b. T. S. of the thallus, c. marginal portion of the thallus exhibiting spinulate processes, d. lower most cells of the thallus showing rhizoidal filaments.

cells about 6 μm in diam., ellipsoidal in surface view, irregularly arranged; lower cells of the frond projecting rhizoidal filaments; chloroplasts sub-stellate, with a central pyrenoid, purplish red; sporocarp having 8 carpospores.

Habitat: Drift algae, beached on the sandy shore.

Type locality: Vung Tau (Cap. St. Jacques), Viet-Nam.

Local distribution: Paradise Point.

Distribution: Viet-Nam, Thailand, east cost of India, Pakistan.

Remarks: This species has not previously been reported from Arabian Sea. It could not be collected in attached condition, all the specimens were found in drifted condition indicating their sublittoral origin. However, the type specimens were from the upper littoral zone. Tanaka & Ho (1962) have described two forms of this species, one with oblong lanceolate blades and the other with lacerate fronds emerging from a common base. The specimens from Karachi appear to belong to the first form. Only female plants could be collected.

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