

DISTRIBUTION OF AND SOME ECOLOGICAL NOTES OF PHAEOPHYTA FROM THE COAST OF KARACHI

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Abstract

During taxonomical and ecological survey of Phaeophyta from the coast of Karachi, 17 genera and 48 species including 10 genera and 29 species as new records were found in Ectocarpales, Dictyotales, Punctariales and Fucales. Members of Dictyotales were predominant

Introduction

The coast of Karachi, Pakistan is densely populated by seaweeds, mainly the brown algae which can be exploited for food, fodder, fertilizer and stuffing agents in industries. Except for the accounts by Boergesen (1934), Nizamuddin & Saifullah (1967), Nizamuddin & Farooqui (1968), Saifullah (1973), Nizamuddin & Begum (1978) and Nizamuddin & Perveen (1986), an account of the systematics of brown algae has not been made. During a 5 year (1982-1986) survey of the Karachi coast a list of brown algae was prepared with some ecological notes indicating the local distribution, tide-level and habitat of each species. The results are discussed in relation to seasonal and ecological variations.

Materials and Methods

Material either living or as drift at low tide was collected at monthly interval from Manora, Hawkes Bay, Buleji and Paradise Point and ecological conditions noted. Herbarium sheets were made and kept in the Phycology section, Department of Botany, University of Karachi. Specimens were fixed in 4% formalin-sea water for morpho-anatomical studies. The identification of specimens is based on morpho-anatomical observations of 5-20 plants from each collection and 5-15 section were cut from lower, middle and upper part of each thallus and 5-15 cells were measured from each section.

ECTOCARPALES ECTOCARPACEAE

I. *Ectocarpus* Lyngbye

1. *E. cylindricus* Saunders

Drift at Hawkes Bay (Leg. M. Begum & N. Khatoon, 31.3.1982). Buleji (Leg. M. Begum & N. Khatoon, 26.1.1983).

Geog. Distr. Pacific Grove: California.

II. *Hincksia* Gray

1. *H. granulosa* (J.E. Smith) Silva
Syn. *Conferva granulosa* J.E. Smith

Ectocarpus granulosis (J.E. Smith) Agardh

Grows on flat sandy and rocky area at mid water mark at Manora (Leg. N. Khatoon, 11.2.1984).

Geog. Distr. Puget Sound to Southern California (Sanpedro), England, Karachi (Pakistan).

2. *H. mitchelliae* (Harvey) Silva
Syn. *Ectocarpus mitchelliae* Harvey

Grows on flat sandy and rocky area at mid water mark at Hawkes Bay (Leg. M. Begum & N. Khatoon, 31.3.1983); Buleji (Leg. M. Begum & N. Khatoon, 26.1.1983).

Geog. Distr. Arabian Sea: Karachi (Pakistan), Persian Gulf; West Indies, Atlantic coast of N. America.

3. *H. rallsiae* (Vickers) Silva
Syn. *E. rallsiae* Vickers

Drift at Manora (Leg. M. Begum & N. Khatoon, 19.12.1982).

Geog. Distr. West Indies.

SPERMATOCHNACEAE

III. *Nemacystus* Derbes et Solier

1. *Nemacystus decipiens* (Sur.) Kuckuck

Drift at Hawkes Bay (Leg. M. Begum & N. Khatoon, 4.4.1985); Manora (Leg. N. Khatoon, 11.2.1984).

Geog. Distr. Arabian Sea: Mauritius, Persian Gulf, Karachi (Pakistan); Pacific Ocean: Japan.

DICTYOTALES
DICTYOTACEAE

IV. *Dictyopteris* Lamourous

- *1. *D. acrostichoides* (J.Ag.) Boergesen
(Nizamuddin & Saifullah, 1967).

Grows in the East of Cape Monze (Leg. M. Nizamuddin, 21.11.1984); Hawkes Bay (Leg. M. Nizamuddin, 16.5.1985).

Geog. Distr. Arabian Sea: India, Karachi (Pakistan). Pacific Ocean: Australia, New Caledonia.

- **2. *D. australis* Sonder in Askenasy f. *Karachiensis* Nizam et Saif.

Grows in deep rocky pools at low water marks but mostly collected as drift at Manora (Leg. M. Nizamuddin, 3.2.1954; M. Begum & N. Khatoon; 1.11.1982); Sands Pit (Leg. M. Nizamuddin, 1.1.1963); Hawkes Bay (Leg. M. Nizamuddin, 12.2.1956; M. Begum & N. Khatoon, 31.3.1982); Buleji (Leg. M. Nizamuddin, 21.1.1963); Paradise Point (Leg. M. Nizamuddin 7.1.1962).

Geog. Distr. West coast of India and Pakistan; Pacific Ocean: Australia, New Caledonia, Lord Howe Island.

- *3. *D. delicatula* Lamouroux
(Nizamuddin & Saifullah, 1967).

Drift at Cape Monze (Leg. M. Nizamuddin, 16.3.1986).

Geog. Distr. Arabian Sea: Ceylon, Malayan Archipelago, Karachi (Pakistan); Pacific Ocean: Costa Rica, Mexico, Atlantic Ocean: Trinidad, Venezuela, Puerto Rico, Jamaica, Cuba, Tobago, Barbados, Bermuda, Florida, Brazil.

- *4. *D. divaricata* (Okamura) Okamura
(Nizamuddin & Saifullah, 1967).

* Previously reported only.

** Reported previously as well.

Drift at Manora (Leg. M. Nizamuddin, 2.12.1963).

Geog. Distr. Karachi (Pakistan), Japan.

5. *D. membranacea* (Stackhouse) Batters

Attached on rocks at Manora (Leg. M. Begum & N. Khatoon, 7.4.1984); Hawkes Bay (Leg. N. Khatoon, 31.3.1982).

Geog. Distr. Atlantic Ocean: Sid Mouth Devon West Promontory; Mediterranean Sea: African as well as European coast, Karachi (Pakistan).

6. *D. polypodioides* Lamouroux

Drift at Manora (Leg. N. Khatoon, 7.4.1984).

Geog. Distr. Arabian Sea: Ceylon, West coast of India and Pakistan; Atlantic Ocean: England, Portugal, Canary Island; Mediterranean Sea: Malorca, France, Italy, Sicily, Libya, Tunisia; Southern Ocean.

7. *D. repens* (Okamura) Boergesen
(Nizamuddin & Saifullah, 1967).

Cape Monze (Leg. M. Nizamuddin, 28.12.1963).

Geog. Distr. Pacific Ocean: Pacific coast of Central America and Salvador, Hachidyo Island (Yoshi-Kawa), Island of Yonakuni, Southern Marshall Island; Karachi (Pakistan).

8. *D. tripolitana* Nizamuddin

Drift at Manora (Leg. M. Begum & N. Khatoon, 7.4.1984); Hawkes Bay (Leg. M. Begum & N. Khatoon, 31.3.1982).

Geog. Distr. Mediterranean Sea: Mallorca – Magaluf; Cerete; Italy – Barcola; Sicily – Arenella; Yugoslavia – Ragusa; Greece; Libya – Tripoli; Tunisia; Algeria. Atlantic Ocean: England - Sadrame Bay, Karachi (Pakistan).

V. *Dictyota* Lamouroux

1. *D. bartayresiana* Lamouroux

Drift at Buleji (Leg. N. Khatoon, 22.10.1983).

Geog. Distr. Arabian Sea: Ceylon, East and West Coast of India, Pakistan; Red Sea; Pacific Ocean: New Zealand, Tropical Australia, Mexico, California, Japan; Atlantic Ocean; West Indies.

2. *D. cervicornis* Kuetzing

This species grows on sandy covered rocks and sandy bottom pools at lower water mark at Clifton (Leg. M. Nizamuddin, 21.3.1963); Manora (Leg. M. Begum & N. Khatoon, 21.3.1982; M. Nizamuddin, 8.12.1963); Gote Manjar (Leg. M. Nizamuddin, 29.9.1963).

Geog. Distr. Arabian Sea: India, Karachi (Pakistan); Pacific Ocean: Mexico; Atlantic Ocean: Columbia, Venezuela, West Indies, Panama; Mediterranean Sea: Portugal.

3. *D. ciliata* J.G. Agardh

It grows in sheltered pools, with sandy bottom and sand covered rocks at mid to lower water mark at Manora (Leg. M. Nizamuddin, 6.12.1961; N. Khatoon, 12.12.1982); Buleji (Leg. M. Begum & N. Khatoon, 22.10.1983); Cape Monze (Leg. M. Nizamuddin, 21.11.1964); Gote Manjar (Leg. M. Nizamuddin, 29.9.1963).

Geog. Distr. Arabian Sea: Ceylon, Karachi (Pakistan); Red Sea; Atlantic Ocean: Veracruz, West Indies.

4. *D. ceylanica* Kuetzing

Drift at Buleji (Leg. N. Khatoon 22.10.1983); Cape Monze (Leg. M. Nizamuddin, 28.12.1963).

Geog. Distr. Arabian Sea: Ceylon, India, Malaya, Karachi (Pakistan); Pacific Ocean: Japan.

5. *D. dichotoma* (Hudson) Lamouroux

Grows on sandy covered rocks and rocky pools at lower water mark at Manora (Leg. Arshad, 6.11.1973. M. Begum & N. Khatoon, 1.11.1982; M. Khan, 23.3.1966; M. Nizamuddin, 30.10.1963; S. Bilgrami, 28.12.1961); Buleji (Leg. M. Begum & N. Khatoon, 19.12.1984); Paradise Point (Leg. M. Nizamuddin 7.1.1962); Cape Monze (Leg. M. Nizamuddin, 30.12.1964).

Geog. Distr. Arabian Sea: Ceylon, Tuticorin, West coast of India and Pakistan; Pacific Ocean: Japan; Atlantic Ocean: West Indies, England, Heligoland; Mediterranean Sea: Spain, France, Italy, Sicily, Yugoslavia, Greece, Libya, Tunisia, Morocco.

6. *D. dichotoma* (Hudson) Lamouroux var. *intricata* (C. Agardh) Greville

Grows on sandy bottom pools from middle to lower water marks at Manora (Leg. M. Nizamuddin, 23.3.1966); Hawkes Bay (Leg. M. Nizamuddin, 13.12.1964); Buleji (Leg. M. Begum & N. Khatoon, 26.1.1983).

Geog. Distr. Mediterranean Sea: France, Italy, Sicily, Yugoslavia, Greece, Libya; Atlantic Ocean: England; Karachi (Pakistan)

7. *D. divaricata* Lamouroux

Mostly grows on sand covered rocks at Cape Monze (Leg. M. Nizamuddin, 30.12.1964).

Geog. Distr. Arabian Sea: Persian Gulf, West coast of India and Pakistan; Pacific Ocean: Japan, Eastern tropical and sub-tropical coast of America; Atlantic Ocean: El-Salvador, West Indies.

8. *D. dumosa* Boergessen

Drift at Hawkes Bay (Leg. M. Nizamuddin, 13.12.1964).

Geog. Distr. India, Karachi (Pakistan).

9. *D. hauckiana* Nizamuddin.

This species grows on sandy covered rocks and sandy bottom pools at lower water mark at Manora (Leg. M. Begum & N. Khatoon, 28.12.1985; M. Nizamuddin, 28.8.1968); Sands Pit (Leg. M. Nizamuddin, 1.1.1963); Hawkes Bay (Leg. M. Begum & N. Khatoon, 31.3.1982; N. Khatoon, 9.4.1982, M. Begum, 21.11.1986); Buleji (Leg. M. Begum & N. Khatoon, 26.1.1983); Paradise Point (Leg. M. Nizamuddin, 7.1.1962; N. Khatoon, 9.4.1982).

Geog. Distr. Endemic to eastern and northern coast of Arabian Sea (Pakistan and India).

10. *D. indica* Sonder

This species grows in sandy bottom pools and sand covered rocks at lower water mark at Manora (Leg. N. Khatoon, 5.3.1983); Hawkes Bay (Leg. M. Begum & N. Khatoon, 31.3.1982); Buleji (Leg. N. Khatoon, 31.3.1982); Naugaza Mazar (Leg. M. Rukh, 13.2.1967); Cape Monze (Leg. M. Nizamuddin, 21.11.1964).

Geog. Distr. Arabian Sea: Ceylon, India, Karachi (Pakistan), Malaya; Pacific Ocean: Virgin Island; Atlantic Ocean: Cuba, West Indies, Florida.

11. *D. maxima* Zanardini

Drift at Sands Pit (Leg. M. Nizamuddin, 1.1.1963).

Geog. Distr. Arabian Sea: Ceylon, India, Karachi (Pakistan).

VI. *Dilophus* J. Agardh1. *D. fasciola* (Roth) Howe var. *repens* (J.Ag.) Feldmann

Grows on sand covered rocks and flat sand area from middle to lower water mark at Manora (Leg. N. Khatoon, 2.6.1984); Buleji (Leg. M. Begum & N. Khatoon, 26.1.1983).

Geog. Distr. Mediterranean Sea: Morocco, France, Libya; Karachi (Pakistan).

VII. *Padina* Adanson1. *Padina boergesenii* Allender and Kraft

Drift at Hawkes Bay (Leg. M. Begum & N. Khatoon, 31.3.1982).

Geog. Distr. Howds, Australia, Karachi (Pakistan).

2. *P. pavonia* (L.) Lamouroux

The species is widely spread along the coast from high to low water mark and grows in various habitats i.e., sandy bottom rocks, pools, flat rocky platforms at Manora (Leg. M. Begum & N. Khatoon, 31.3.1985); Buleji (Leg. M. Begum & N. Khatoon, 31.3.1983); Paradise Point (Leg. N. Khatoon, 9.4.1982).

Geog. Distr. Cosmopolitan, Karachi (Pakistan).

3. *P. sancte-crucis* Boergesen

Drift at Hawkes Bay (Leg. M. Begum & N. Khatoon, 31.3.1982); Buleji (Leg. M. Begum & N. Khatoon, 31.3.1983).

Geog. Distr. West Indies, Karachi (Pakistan).

4. *P. tenuis* Bory

This species grows in sandy bottom pools, sand covered rocks, flat sandy and stony area from high to low water marks at Manora (Leg. M. Begum & N. Khatoon, 2.6.1984); Buleji (Leg. N. Khatoon, 26.1.1983).

Geog. Distr. Mediterranean Sea: Spain, France, Italy, Sicily, Yugoslavia, Greece, Crete, Libya, Tunisia; Karachi (Pakistan).

5. *P. tetrastromatica* Hauck

This species is spread all over the coast and grows in all habitats being intermixed with *P. pavonia* population at Manora (Leg. M. Begum & N. Khatoon, 31.3.1982); Hawkes Bay (Leg. M. Begum & N. Khatoon, 21.11.1986); Buleji (Leg. M. Begum & N. Khatoon, 26.1.1983); Paradise Point (Leg. N. Khatoon, 9.4.1982).

Geog. Distr. Arabian Sea: Ceylon, West coast of India and Pakistan, Somalia; Pacific Ocean: New Zealand, Australia.

VIII. *Spatoglossum* Kuetzing

**1. *S. aspermum* J. Agardh
(Nizamuddin & Perveen, 1986).

This species only grows on sand covered rocks at low water mark at Manora (Leg. M. Begum & N. Khatoon, 21.3.1985); Hawkes Bay (Leg. M. Begum & N. Khatoon, 31.3.1982); Buleji (Leg. M. Begum & N. Khatoon, 26.1.1983); Cape Monze (Leg. M. Nizamuddin, 23.3.1965); Gote Manjar (Leg. M. Nizamuddin, 28.12.1963).

Geog. Distr. Arabian Sea: Ceylon, Mauritius, Karachi (Pakistan).

2. *S. schroederi* (C. Agardh) Kuetzing

Drift at Manora (Leg. N. Khatoon, 31.3.1982); Sands Pit (Leg. M. Nizamuddin, 1.1.1964); Paradise Point (Leg. N. Khatoon, 9.4.1982); Cape Monze (Leg. M. Nizamuddin, 28.12.1963).

Geog. Distr. Atlantic Ocean: Gulf of Mexico, Tampa Bay, Florida, North Carolina, Bermuda, Bahamas, South of Brazil; Karachi (Pakistan).

**3. *S. variabile* Figari et De Notaris
(Nizamuddin & Perveen 1986).

This species grows on sand covered rocks at low water marks at Manora (Leg. M. Begum & N. Khatoon, 21.3.1985); Hawkes Bay (Leg. M. Begum & N. Khatoon, 9.4.1982; M. Begum, 21.11.1986); Buleji (Leg. M. Begum & N. Khatoon, 26.1.1983); Paradise Point (Leg. N. Khatoon, 9.4.1982); Cape Monze (Leg. M. Nizamuddin, 28.12.1963); Gote Manjar (Leg. M. Nizamuddin, 29.9.1963).

Geog. Distr. Arabian Sea: Malayan Archipelago, Karachi (Pakistan); Red Sea.

IX. *Stoechospermum* Kuetzing.**1. *Stoechospermum marginatum* C. Agardh
(Nizamuddin & Perveen, 1986).

It grows on flat sand area and sand covered rocks from mid to lower water mark at Manora (Leg. S. Perveen, 17.1.1964; M. Begum & N. Khatoon, 12.5.1982); Hawkes Bay (Leg. M. Begum, 12.5.1982); Buleji (Leg. M. Begum, 26.1.1983); Paradise Point (Leg. N. Khatoon, 9.4.1982); Cape Monze (Leg. Aftab, 26.12.1964; M. Nizamuddin, 28.12.1963; S. Perveen, 23.10.1970); Gote Mubarak (Leg. M. Nizamuddin, 3.4.1965); Gote Manjar (Leg. M. Nizamuddin, 29.9.1963) Sonmiani Beach (Leg. U. Ghani, 4.12.1964).

Geog. Distr. Arabian Sea: Ceylon, West coast of India and Pakistan, Red Sea, Atlantic Ocean: Madeira.

X. *Styopodium* Kuetzing1. *Styopodium zonale* (Lamx.) Papenfuss
(Nizamuddin & Perveen, 1986).

Drift at Manora (Leg. N. Khatoon, 7.4.1984).

Geog. Distr. Arabian Sea: Ceylon, West coast of India and Pakistan, South African coast; Pacific Ocean: Japan, Galapagos Island; Atlantic Ocean: Venezuela, West Indies, Bermuda, Bahamas, Florida, Brazil, Canary Island.

PUNCTARIALES PUNCTARIACEAE

XI. *Colpomenia* Derbes et Solier

1. *C. ecuticulata* Parson

This species grows on sand covered rocks and flat sandy area from high to mid water mark at Manora (Leg. N. Khatoon, 5.2.1983); Buleji (Leg. M. Begum, 31.3.1982).

Geog. Distr. New Zealand, Karachi (Pakistan).

**2. *C. sinuosa* (Roth) Derbe's et Solier (Nizamuddin & Begum, 1978).

This species widely spreads on all coasts and grows in all habitats from high to lower water marks at Manora (Leg. M. Begum & N. Khatoon, 21.3.1985); Hawkes Bay (Leg. M. Begum & N. Khatoon, 31.3.1982; N. Khatoon, 9.4.1982; M. Begum, 21.11.1986); Buleji (Leg. M. Begum & N. Khatoon, 31.3.1982); Paradise Point (Leg. M. Khatoon, 9.4.1982).

Geog. Distr. Arabian Sea: Mauritius, Persian Gulf, Karachi (Pakistan), Red Sea; Pacific Ocean: New Zealand, Monterey Peninsula, Southern California, Australia; Mediterranean Sea: Europe as well as African Coast.

XII. *Hydroclathrus* Bory

*1. *Hydroclathrus clathratus* (Bory) Howe (Nizamuddin & Begum, 1978).

Deep water plant at Manora.

Geog. Distr. Mauritius Islands, Karachi (Pakistan), South Australia, Victoria, Eastern part of North America and Brazil.

XIII. *Iyengaria* Boergesen.

- *1. *Iyengaria stellata* (Boergesen) Boergesen
(Nizamuddin & Begum, 1978).

Widely spread in all locations and in all ecological condition at Manora (Leg. M. Begum & N. Khatoon, 31.3.1982); Hawkes Bay (Leg. M. Begum & N. Khatoon, 31.3.1982; N. Khatoon, 9.4.1982; M. Begum, 21.11.1986); Buleji (Leg. M. Begum & N. Khatoon, 31.3.1982); Paradise Point (Leg. N. Khatoon, 9.4.1982); Cape Monze (Leg. M. Nizamuddin, 20.11.1964).

Geog. Distr. Arabian Sea: Dwarka (India), Karachi (Pakistan), Persian Gulf, False Bay, Messel Bay, Port Alfred.

XIV. *Rosenvingea* Boergesen.

- **1. *R. fastigiata* (Zanardini) Boergesen
(Nizamuddin & Begum, 1978).

This species grows on flat sandy area and conglomerate rocks of mid low water mark at Manora (Leg. M. Begum & N. Khatoon, 11.2.1984); Buleji (Leg. M. Begum, 26.1.1983).

Geog. Distr. Northern part of Arabian Sea, Karachi (Pakistan); Red Sea.

- **2. *R. orientalis* (J. Agardh) Boergesen
(Nizamuddin & Begum, 1978).

This species mostly grows in sub-littoral zone as well as in the mid-littoral pools in association with *Padina pavonia*, at Paradise Point (Leg. M. Begum & N. Khatoon, 3.5.1982); Manora (Leg. Fatima, 24.1.1970; M. Nizamuddin, 29.1.1962).

Geog. Distr. Arabian Sea: India-Bombay, Kalaba Shores, Malabar Hills, Karachi (Pakistan); Atlantic Ocean: West Indies.

FUCALES FUCACEAE

XV. *Stockeyi* Thivy et Doshi

1. *S. indica* Thivy et Doshi.

Widely spread on rocky coasts, in pools at Manora (Leg. M. Begum & N. Khatoon, 31.3.1982); Hawkes Bay (Leg. M. Begum & N. Khatoon, 21.3.1985; M. Begum,

21.11.1986); Buleji (Leg. M. Begum & N. Khatoon, 31.3.1982); Paradise Point (Leg. N. Khatoon, 9.4.1982).

Geog. Distr. Arabian Sea.

XVI. *Sargassum* C. Agardh.

1. *S. crassifolium* J. Agardh.

It grows in sandy bottom pools, sand covered rocks and stony area at Manora (Leg. M. Begum & N. Khatoon, 5.10.1983); Buleji (Leg. M. Begum, 20.12.1983).

Geog. Distr. Arabian Sea: East African coast, Ceylon, West Indian and Pakistani coast; Pacific Ocean: Australia, Japan.

2. *S. curvicone* Greville

Drift at Manora (Leg. M. Begum & N. Khatoon, 1.12.1982).

Geog. Distr. Arabian Sea: Ceylon-Hambantota, Karachi (Pakistan).

3. *S. swartzii* (Turner) Agardh

Drift at Manora (Leg. N. Khatoon, 9.4.1982); Paradise Point (Leg. N. Khatoon, 9.4.1982).

Geog. Distr. Arabian Sea: West coast of India and Karachi (Pakistan), Hongkong, Japan.

4. *S. tenerrimum* J. Agardh.

Drift at Manora (Leg. N. Khatoon, 2.6.1984); Hawkes Bay (Leg. M. Begum & N. Khatoon, 31.3.1982; N. Khatoon, 9.4.1982); Paradise Point (Leg. N. Khatoon, 9.4.1982).

Geog. Distr. Arabian Sea: Ceylon, India, Karachi (Pakistan). Australia, Hongkong.

5. *S. wightii* (Grev.) var. *sublinearis* Grunow

Grows on sand covered rocks at low water mark at Manora (Leg. M. Begum & N. Khatoon, 11.2.1984); Hawkes Bay (Leg. M. Begum & N. Khatoon, 31.3.1982; M. Begum, 21.1.1986).

Geog. Distr. Arabian Sea: West Coast of India and Karachi (Pakistan).

XVII. *Hormophysa* Kuetzing 1843

1. *H. cuniformis* (Gmelin) Silva
Syn. *H. triquetra* (C.Ag.) Kuetzing

Drift at Buleji (Leg. M. Nizamuddin, 2.1.1970).

Geog. Distr. Philippines, Red Sea, East African coast, India and Pakistan.

Discussion

The taxonomical and ecological survey of brown algae showed the distribution of 48 species in Dictyotales (7 genera and 30 species), Ectocarpales (3 genera and 5 species) Punctariales (4 genera and 6 species) and Fucales (3 genera and 7 species). The members of Phaeophyta varied seasonally and ecologically in their occurrence, growth and fertility. The maximum number of plants were collected during February to March and minimum in October. Benz *et al.*, (1979) observed the highest number of seaweeds in May and September and the lowest in October from India. The large size and well developed plants were collected during winter months (December-January). The maximum fertility period was in April and minimum during December-January which relate to the spring and winter season, respectively, indicating that the reproductive rates increase with an increase in temperature (Edward, 1969). Plants deteriorated in April-May after having discharged their gametes and tetraspores. The poor growth of plants in April was also reported by Anand (1940) on Manora coast.

The brown algal flora also varied ecologically. The most common genera and species abundantly collected throughout the season and from all localities and ecological conditions mentioned in the text were *Dictyota haukiana*, *Padina pavonia*, *P. tetrastromatica*, *Spatoglossum variabile*, *Colpomenia sinuosa*, *Iyengaria stellata*, *Stockeyi indica* and *Sargassum tenerrimum*.

Comparative floristic study of Manora, Buleji, Hawkes Bay and Paradise Point indicated that the coast of Manora was highly populated than all other coasts, since this coast has a wide littoral region at N. Western side with various types of habitats which afford favourable conditions for a large number of algal communities. Few species were restricted to a particular locality, e.g., *Hincksia granulosa*, *H. rallsiae*, *Dictyopteris divaricata*, *Dictyota divaricata*, *D. flabellata*, *D. linearis*, *Stypopodium zonale*, *Sargassum curvicone* on Manora coast, *Padina boergesenii* and *Dictyota dumosa* on Hawkes Bay, *Dictyota dichotoma* var. *intricata* and *D. bartayresiana* on Buleji and *Rosenvingia orientalis* in Paradise Point, *Dictyota maxima* in Sands Pit and *D. divaricata* was found only from Cape Monze.

Dictyota haukiana, *Spatoglossum aspernum*, *S. variable* and *Sargassum wightii* was found to grow on sand covered rocks at lower water mark, *Hinckesia granulosa* and *H. mitchelliae* on flat sandy area at mid water mark and *Dictyota dichotoma* on sandy bottom pool from mid to low water mark. The present study would suggest that the most suitable habitat for the growth of brown algal population is sandy bottom pools and sand covered rocks at mid to low water mark with Manora coast as the best locality.

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