

COMMONWEALTH OF AUSTRALIA

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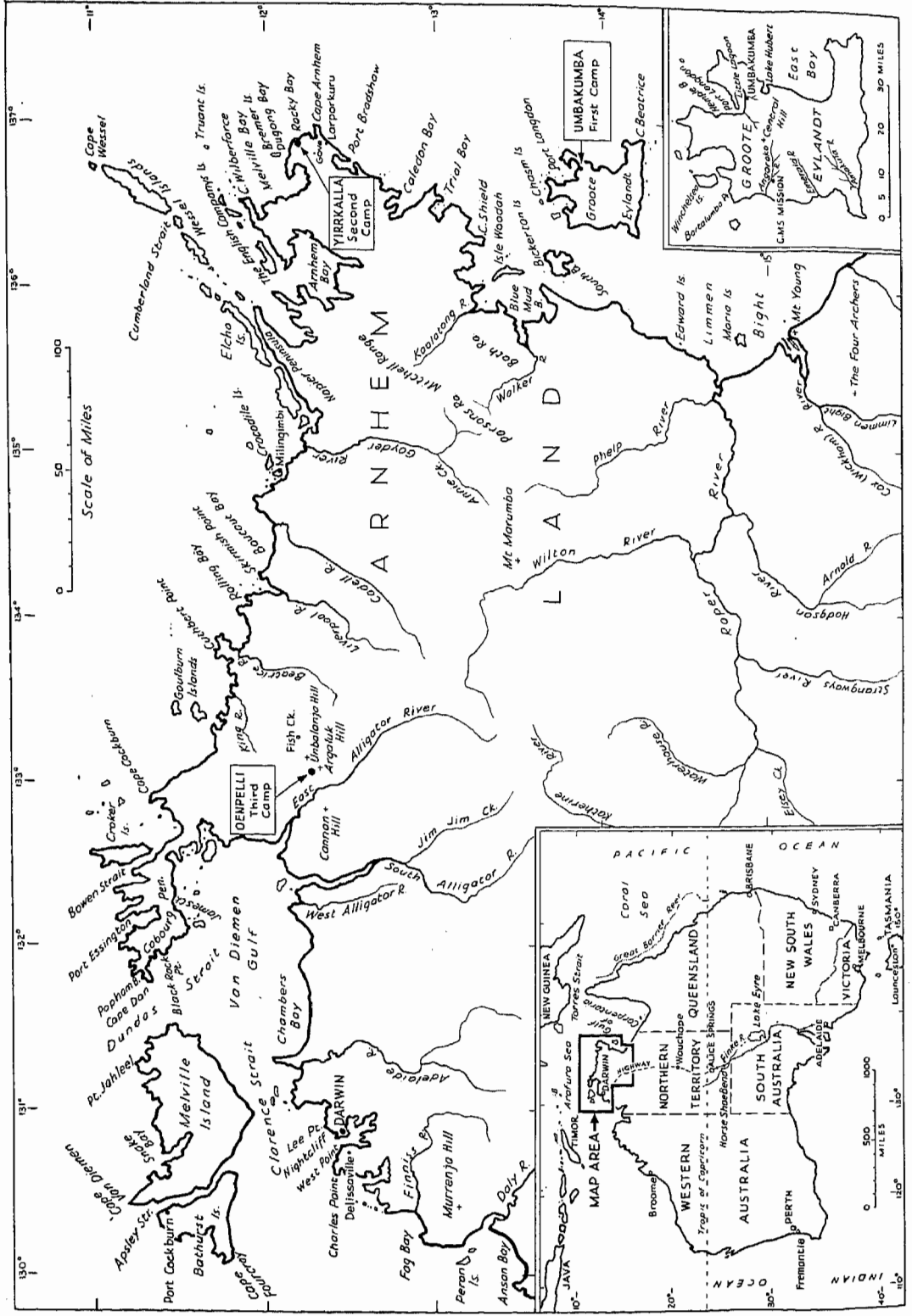
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Arnhem Land, showing expedition camps and collecting localities

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MARINE ALGAE FROM ARNHEM LAND, NORTH AUSTRALIA

by H. B. S. WOMERSLEY*

DURING the 1948 expedition to Arnhem Land, Northern Australia, under the joint sponsorship of the National Geographic Society, the Smithsonian Institution, and the Commonwealth of Australia, the botanist on the expedition, Dr Ray L. Specht, collected marine algae at a number of localities on the coast near where the expedition camped. He also made ecological notes, at the various localities, which are incorporated in this paper. These give some idea of the habitat and zonation of marine algae on tropical Australian shores. His collection numbers are shown thus: A1.

Although the collection is not a large one (some fifty-nine species were found) it is the first from this part of Australia. Previous papers on tropical Australian algae are few, and almost entirely from the north-east coast of Queensland. Some of the earliest records from tropical Australia are those of Montagne¹ from tiny Toud Island in Torres Strait. There seems reason to doubt a few of these records, however. Another early and still the most important paper is that of Sonder;² these and additional records were given again by Sonder.³ The genus *Sargassum* was monographed by J. Agardh⁴ and by Grunow.⁵ Many of Grunow's varieties and species, however, appear to need careful checking in relation to large ranges of specimens and with a background of field knowledge. Okamura⁶ contributed records from Torres Strait and Moreton Bay, while more recently papers by Lucas,⁷ May⁸ and Levring⁹ have appeared.

The marine algae of tropical seas of the Indian and Pacific Oceans are moderately well known from a number of papers. In particular the Siboga Monographs¹⁰ give a comprehensive account of the marine algae of the East Indian region.

The marine algae of Arnhem Land are very largely typical tropical and subtropical species which are widely distributed in most warm waters of the world. A smaller group appears to be restricted to tropical Australia, but these species probably occur from north-west Australia around to the eastern Queens-

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1. Montagne (1842-5).	2. Sonder (1871).	3. Sonder (1880).
4. J. Agardh (1889).	5. Grunow (1915, 1916).	6. Okamura (1904).
7. Lucas (1931).	8. May (1948, 1951a, 1951b).	9. Levring (1953).
10. Barton (1901); A. & E. S. Gepp (1911); W. van Bosse (1904, 1913, 1921, 1923, 1928).		

land coast, and very likely would be found in the islands north of Australia. This group includes *Anadyomene brownii*, *Avrainvillea erecta*, *Dictyota bifurca*, *Padina australis*, *Cystophyllum muricatum*, *Sargassum fissifolium*, *S. flavicans*, *S. fragile*, *S. godeffroyi*, *S. peronii*, *Scinaia moretonensis* and *Hypnea divaricata*.

The collection months and ecological notes are given under each locality, followed by the systematic list. The first set of specimens is deposited in the Algal Herbarium of the University of Adelaide. Duplicate sets, as far as possible, have been deposited in the following herbaria: Botany Department, University of Queensland; Smithsonian Institution, Washington; Rijksherbarium, Leiden; University of California, Berkeley; British Museum (N.H.), London.

The collection localities are shown on the map, frontispiece.

ECOLOGICAL NOTES ON THE LOCALITIES

LITTLE LAGOON, GROOTE EYLANDT

April 1948

Little Lagoon is a sandy bay, some 4 miles by 3 miles, with an entrance about $\frac{3}{4}$ mile wide, on the south-east side of Port Langdon. On the south side of the entrance is a lateritic reef, the surface of which has numerous hollows and pools. This reef is some 30 yards across and outcrops for only 30-50 yards along the shore. Most of the nearby coastline is sandy, with fairly shallow water off-shore. The area is well protected from winds. Wave action is slight. The tidal rise is probably 3-5 ft. A cross section of the reef is shown in Fig. 1.

THE LITTORAL. The upper part of the littoral is bare of algal growth. In fact the only obvious growth between low and high tide levels is in depressions at a lower littoral level, which tend to retain water at low tide. Here *Lyngbya confervoides* forms a greenish brown coating on pebbles.

THE SUBLITTORAL. On the edge of the reef in the sublittoral fringe, *Sargassum baccularia* is dominant, with *Jania rubens* forming a mat on the rock and also frequently epiphytic on the *Sargassum*. In nearby areas, just above or below low tide level, sand, shells, and lateritic nodules had collected, giving a suitable substratum for dense growth of the marine angiosperm *Halophila ovalis*. *Halimeda macroloba* was plentiful in the same area, and occasional plants of *Laurencia papillosa* occurred on shells or sponges.

On the flat tops of rocks, from low tide level down for several feet, *Padina commersonii* was plentiful.

Most of Little Lagoon has a sandy bottom, and near the shore but below low tide level are small areas of *Halimeda macroloba*, together with patches of *Halophila ovalis*, *Caulerpa sertularioides*, and *Caulerpa racemosa* var. *clavifera*. Other species growing irregularly on shells, stones, etc., over the lagoon are *Griffithsia tenuis*, *Acanthophora spicifera*, *Hypnea hamulosa*, *Spyridia filamentosa* and *Avrainvillea erecta*. *Hormophysa triquetra* was also found in the drift.

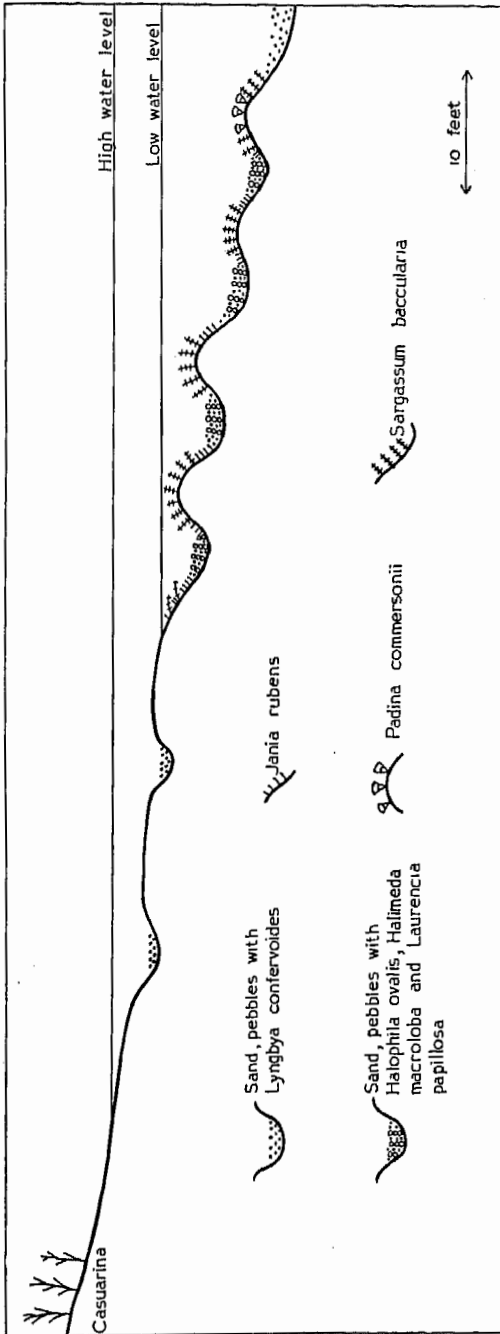


FIG. 1. Cross section of the reef at Little Lagoon, Grootte Eylandt

ARNHEM LAND: BOTANY AND PLANT ECOLOGY

HEMPLE BAY, GROOTE EYLANDT

May 1948

Hemple Bay is on the west side of Port Langdon, opposite Little Lagoon. Scattered along the shore near the middle of the bay are boulders of consolidated grit, containing shells and lateritic gravel. These boulders may present a substratum within the littoral or sublittoral zone, or sometimes from well below low tide level to above all algal growth. The water just offshore is deeper than at Little Lagoon, and the locality less protected from the wind. Hence wave action is slight to moderate.

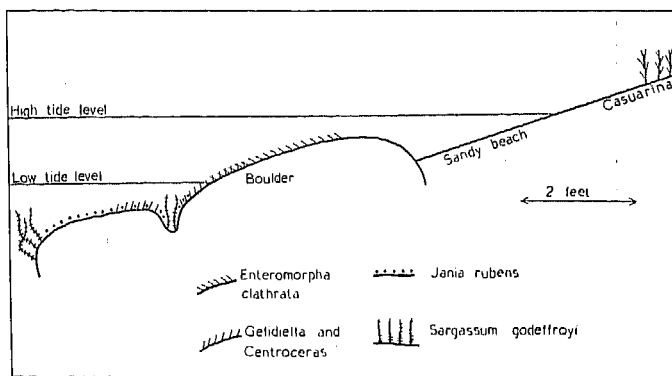


FIG. 2. Cross section showing zonation on boulders at Hemple Bay, Groote Eylandt

Algal growth on these boulders is shown in Fig. 2, which represents a typical sectional view.

THE LITTORAL. The only algal growth above low tide level is mats of *Enteromorpha clathrata*, forming a green covering up to 3 or 4 cm. high on the rocks.

THE SUBLITTORAL. From just above low tide level to 2 feet or so below is a mat of a *Gelidiella* (A12) mixed with *Centroceras clavulatum*. At one foot or more below low tide level, this is mixed with *Jania rubens*, and slightly deeper the *Jania* is purer. Growing in hollows between the boulders and slightly deeper was *Sargassum godeffroyi*, with the fronds almost reaching the surface at low tide. *Gelidiella acerosa*, *Padina commersonii* and occasional plants of *Halimeda macroloba* also occurred in the uppermost sublittoral.

SOUTH BAY, BICKERTON ISLAND

June 1948

As the name implies, South Bay is on the southern side of Bickerton Island. In the north-east corner of the bay is a large mass of laterite near the shore, where it is nearly submerged at high tide. This reef is formed of irregularly sloping lateritic masses covered with fine mud and silt, deposited from a creek which

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runs through mangroves just south-east of the reef. The southern extremity of the reef is below low tide level, but most is exposed during low tide. Wave action on the reef is slight, and the tidal rise about 3-5 feet.

THE LITTORAL. A few small trees of the mangrove *Rhizophora mucronata* occur on the upper parts of the reef, but this area is bare of obvious algal growth. In the lower littoral tufts and mats of *Enteromorpha clathrata* and *Gladophora fascicularis* are plentiful, with occasional plants of *Dictyosphaeria cavernosa*. Often a stunted mat of *Hypnea*, *Polysiphonia* and *Enteromorpha* occurs, with a film of *Lyngbya confervoides* on top of the rocks.

In areas of mud between stones, a sea grass was dominant, with small patches of *Halimeda maculosa*. These latter extend below low tide level.

THE SUBLITTORAL. On rocks just at or under the water level at low tide grew a mass of algae, comprising *Acanthophora spicifera*, *Sarconema furcellatum*, *Dictyota pardalis*, *Hypnea cornuta*, *Tolyptocladia glomerulata* and *Padina comersonii*. *Spyridia filamentosa* was common in the muddiest places.

In slightly deeper water (1-4 or more feet below low water level) *Padina australis*, *Jania rubens* and *Sargassum baccharia* occurred.

PORT BRADSHAW

July 1948

Port Bradshaw is in a well protected bay, and nearly all the specimens collected were in the drift. They probably came from rocky outcrops below low tide level.

On some boulders and oysters exposed at low tide *Enteromorpha clathrata*, *Pocockiella variegata* and *Sphacelaria furcigera* were collected.

The drift material comprised: *Halimeda cuneata*, *Caulerpa racemosa* var. *laetevirens*, *Dictyota bifurca*, *D. ciliolata* var. *lata*, *Padina australis*, *Colpomenia sinuosa*, *Sargassum fragile*, *Chondrococcus harveyi*, *Hypnea cornuta* and *Acanthophora spicifera*.

YIRRKALLA

August 1948

The area examined at Yirrkalla extends from the end of a sandy beach, where a stream flows out through mangroves, to a point formed of granite boulders. Between the beach and point is a lateritic reef, mostly covered at high tide, with an area of coral at about the centre. The area is shown in Fig. 3. The tidal rise is about 4-6 feet, with deep water off shore. Wave conditions on the point are severe, becoming somewhat calmer further towards the beach as the reef then lies in the same direction as the waves. A heavy surf often occurs in the bay.

THE LITTORAL. The algae are—as in most of the other localities—restricted to the lower part of the littoral zone.

At the end of the lateritic reef near the stream *Enteromorpha clathrata* is plentiful, doubtless due to the dilution effect of the fresh water.

ARNHEM LAND: BOTANY AND PLANT ECOLOGY

On lateritic rocks and extending into tidal pools and to the edge of the coral area is a mixture of mat-like and encrusting algae, comprising *Isactis plana*, *Chaetomorpha* sp. (A61c), *Ralfsia* sp. (A61b) lithothamnia and *Polysiphonia sphaerocarpa*. At a very low littoral level (probably extending into the sublittoral) *Anadyomene brownii* occurs. Between the granite point and the coral area, *Laurencia obtusa*, *L. papillosa* (better developed below low tide level), *Chondrococcus harveyi* and *Hydrocoleum lyngbyaceum* were abundant.

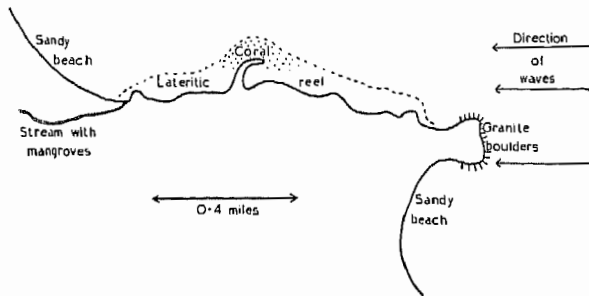


FIG. 3. Sketch map of the area studied at Yirrkalla

The point consists of an irregular mass of granite boulders, subject to heavy wave action and largely exposed at low tide. Here a comparatively large number of species was found on the sides and in the hollows between the rocks, where water tends to remain at low tide. In the hollows between the boulders *Jania rubens* (with *Centroceras clavulatum*), *Gelidiella* sp. (A64 and A68), *Polysiphonia sphaerocarpa* and *Gelidiella acerosa* occurred, while on the tops and upper sides of the rocks there were tufts of *Enteromorpha clathrata*, *Chaetomorpha media* and *C. aerea*, together with some *Hydrocoleum lyngbyaceum*.

THE SUBLITTORAL. It was not possible to collect extensively in this zone due to severe wave conditions, but *Turbinaria ornata* and *Scinaia moretonensis* occur at the edge of the coral reef, while *Chondrococcus harveyi* and *Laurencia papillosa* are best developed below low tide level.

The following list of species collected from the drift indicates the deeper sublittoral flora: *Anadyomene brownii*, *Dictyota ciliolata* var. *lata*, *Padina australis*, *Colpomenia sinuosa*, *Cystophyllum muricatum*, *Sargassum fissifolium*, *S. flavicans*, *S. fragile*, *S. peronii*, *Asparagopsis taxiformis*, *Chondrococcus harveyi*, *Hypnea divaricata*, *Laurencia obtusa*.

NIGHTCLIFF, DARWIN March and September 1948

Little collecting was done here. Algae were not obvious in the littoral zone on the cliffs or on the extensive shale reefs or a coral reef at East Point. An exception was *Rhizoclonium lubricum* which occurred in crevices of the shale

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cliff at about high tide level. *Amphiroa anceps* was also found in the lower littoral. The tidal rise at Nightcliff is very considerable—probably about 20 ft.

The following were collected in the drift: *Sargassum baccularia*, *S. flavicans*, and *Leveillea jungermannioides*.

MYXOPHYTA

NOSTACALES

OSCILLATORIACEAE

Lyngbya confervoides C. Agardh. Gomont (1892) pt. II: 136, pl. 3, f. 5-6. Tilden (1910): 119; pl. 5, f. 39. Rabenhorst (1932): 1061, f. 672b.

Little Lagoon, Groote Eylandt (on lateritic pebbles in littoral pools): A1;
South Bay, Bickerton Island (on rocks on a reef, lower littoral): A45.

Cosmopolitan.

Hydrocoleum lyngbyaceum Kützing (1849): 259. Gomont (1892) pt. I: 337, pl. 12, f. 8-10. Tilden (1910): 135, pl. 5, f. 58. Rabenhorst (1932): 1150, f. 757.

Yirrkalla (littoral on a lateritic reef): A73a. Forming small tufts or patches on the rock.

Cosmopolitan.

RIVULARIACEAE

Isactis plana (Harvey) Thuret. Bornet and Flahault (1886) pt. II: 343. Setchell and Gardner (1919): 104, pl. 1, f. 8-9. Womersley (1946): 128, f. 1A.

Yirrkalla (on rocks on a reef): A61a.

This material is unusual in that the filaments are frequently reflexed at the base, and intercalary heterocysts are relatively plentiful. This is possibly due to filaments growing downwards from above a heterocyst, becoming reflexed at the rock surface, and then growing upwards again. Form, filament width and cell structure appear typical of *I. plana*.

Cosmopolitan.

CHLOROPHYTA

ULVALES

ULVACEAE

Enteromorpha clathrata (Roth) Greville. Bliding (1944): 331. Doty (1947): 16. Kylin (1949): 28.

Hemple Bay, Groote Eylandt (on sandstone rocks, lower littoral): A11; South Bay, Bickerton Island (on a flat lateritic reef, lower littoral): A31; Port Bradshaw (on oysters, lower littoral): A59a; Yirrkalla (on steep granite rocks, littoral): A67b, A69; Yirrkalla (on a flat lateritic reef at a stream mouth, littoral): A79.

Several forms, all falling within Bliding's concept of this species as far as can be seen from dried material.

Cosmopolitan.

CLADOPHORALES

CLADOPHORACEAE

Cladophora fascicularis (Mertens) Kützing (1843): 268, Børgesen (1946): 21.
South Bay, Bickerton Island (on a flat lateritic reef, lower littoral): A32.
Cosmopolitan.

Chaetomorpha aerea (Dillwyn) Kützing (1849): 379; (1853): t. 59. Smith (1944): 56. Taylor (1937): 80.

Yirrkalla (on granite rocks exposed at low tide): A67a. This is a stunted and slender form, only 1-2 cm. high, with the filaments reaching a width of 200 μ .
Cosmopolitan.

Chaetomorpha media (C. Agardh) Kützing (1849): 380. Børgesen (1925): 37, f. 9-10; (1936): 64. Taylor (1942): 22.

Conferva media C. Agardh (1824): 100.

Yirrkalla (on top of steep granite rocks, littoral): A70.

Considerable discussion (Howe (1914): 37; Børgesen (1913): 16; (1925): 37; (1936): 64; Taylor (1945): 52) has taken place over whether *C. media* and *C. antennina* (Bory) Kützing are distinct species or not. Suggested differences involve the length of the basal cell, position of rhizoids, diameter of the filaments and the length and width of the upper cells. In Herbarium Agardh (Lund) there are two specimens, with C. Agardh's writing, placed under *C. media*, but without this name on them. One is a slender plant, approaching *C. aerea*. The other is identical with the Arnhem Land plants, and is almost certainly the basis of Agardh's original description. In this type (from the western Indian Ocean) and in the Arnhem Land specimens, the basal cell is up to 12 mm. long, rhizoids occur only at the base of the basal cell, and the cells in the upper parts are distinctly longer (2-4 (-8) times) than broad. *C. antennina* Bory was described from Reunion Island, and the probable original specimen (and all others of the Bory Herbarium) in the Herbarium Thuret-Bornet, Paris Museum, has basal cells 10 mm. or more long, but the upper cells are only about as long as broad ($\frac{2}{3}$ -1 $\frac{1}{2}$ times as long as broad). This difference in the upper cells appears to give a ready distinction between *C. media* and *C. antennina* in the vast majority of specimens, and for the present it seems more satisfactory to retain both species, as done by Taylor. In any case the Arnhem Land specimens agree well with the type of *C. media*.

Caribbean; Bermuda; Canary Islands; India; northern Australia.

Chaetomorpha sp.

Yirrkalla (on rocks on a reef): A61c.

Many rocks at a low littoral level were covered by a green felt up to $\frac{1}{2}$ cm. high, consisting of a *Chaetomorpha* (plus fragments of *Cladophora*) with distinct basal cells and upper cells 35-65 μ wide, 1-3 times as long as broad, and relatively thick walled. As this material may be rather stunted, and in view of the multiplicity of previously described and very poorly known species of *Chaetomorpha*, it has not been possible to identify it with any certainty.

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Rhizoclonium lubricum Setchell and Gardner (1920): 185, pl. 9, f. 5.

Nightcliff, Darwin (upper littoral on steep shale cliff): A105, A113.

This material, which was abundant, has filaments about 40 μ thick, long and flaccid, with thin walled cells 3.5 times as long as broad. Rhizoids are frequent, but consist usually only of short out-growths from the ends of cells. It agrees very well with an authentic specimen of *R. lubricum* from Oakland, California, except that the rhizoids are more numerous in the Darwin material. Pacific coast, U.S.A.; Darwin.

SIPHONOCLEDALES

VALONIACEAE

Dictyosphaeria cavernosa (Forsskal) Børgesen (1932): 2. Egerod (1952): 350.

D. favulosa (C. Agardh) Decaisne. Børgesen (1913): 33.

South Bay, Bickerton Island (on lateritic boulders, lower littoral): A35;
Yirrkalla (on granite rocks, low littoral): A63b.

Cosmopolitan within tropical and subtropical regions.

Anadyomene brownii (Gray) J. Agardh (1887): 127.

Calonema brownii Gray (1866): 46, t. 44, f. 3.

Anadyomene muelleri Sonder (1871): 63, t. 6, f. 1-4.

Yirrkalla (on a lateritic reef, littoral; stunted plants): A62; Yirrkalla (drift): A92.
Northern Australia; Timor, and other islands north of Australia.

SIPHONALES

CODIACEAE

Halimeda cuneata Hering. Barton (1901): 15.

Port Bradshaw (drift): A50.

Tropical and subtropical parts of the Indian Ocean; northern Australia.

Halimeda macroloba Decaisne. Barton (1901): 24.

Little Lagoon, Groote Eylandt (upper sublittoral in sand at the edge of a lateritic reef): A4; Hemple Bay, Groote Eylandt (upper sublittoral on hard sandstone rocks): A16; South Bay, Bickerton Island (in mud between lateritic rocks, low littoral): A42; Little Lagoon, Groote Eylandt (drift): A115.

Tropical and subtropical parts of the Indian Ocean and western Pacific; northern Australia.

Avrainvillea erecta (Berkeley) A. & E. S. Gepp (1911): 29.

Little Lagoon, Groote Eylandt (sublittoral): A26.

The specimens consist of little except the brown basal mass of rootlets, buried in sand, but one specimen has an upper part about 1 cm. high, which agrees well in appearance and filament structure with the Gepps' description.

East Indian region; northern Australia.

CAULERPACEAE

Caulerpa racemosa (Forsskal) J. Agardh.

var. *clavifera* (Turner) W. v. Bosse (1898): 361.

Fucus claviferus Turner (1808): pl. 57.

Little Lagoon, Groote Eylandt (upper sublittoral in sand): A9, A114.

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var. *laetevirens* (Montagne) W. v. Bosse (1898): 366.

Port Bradshaw (drift): A52.

Most tropical and subtropical seas.

Caulerpa sertularioides (Gmelin) Howe. W. v. Bosse (1898): 294.

Little Lagoon, Groote Eylandt (upper sublittoral in sandy hollows at edge of a lateritic reef): A8.

Cosmopolitan in tropical and subtropical seas.

PHAEOPHYTA
ECTOCARPALES
RALFSIACEAE

Ralfsia sp.

Yirkalla (on rocks of lateritic reef, littoral): A61b, A73a.

This material is scanty and sterile. Possibly it is *R. expansa* J. Agardh. (See Børgesen (1914): 189, W. v. Bosse (1913): 146.)

SPHACELARIALES
SPHACELARIACEAE

Sphacelaria furcigera Kützing (1855): t. 90. Sauvageau (1914): 145.

Port Bradshaw (littoral, on *Pyura*): A59c.

Cosmopolitan.

DICTYOTALES
DICTYOTACEAE

Dictyota bifurca J. Agardh (1894): 79.

Port Bradshaw (drift): A54.

The type locality of *D. bifurca* is Port Denison, Queensland, although Agardh also referred to it some Port Phillip (Victoria) specimens. The Port Bradshaw specimens agree well with the type, but have more numerous marginal proliferations, and also a tendency to spirality of the thallus.

Northern Australia, possibly also southern Australia.

Dictyota ciliolata Kützing (1859): 12, t. 27. Taylor (1928): 119.

D. ciliata J. Agardh (1882): 94; (1894): 75. Harvey (1852): 110. Vickers (1908): 39, pl. 17.

var. *lata* var. nov. (Pl. 1).

D. ciliolata affinitas, sed thallus 5-15 mm. latus, cilia sparsa, ciliis inferioribus in phylla minuta spathulata evolutis.

Characters as for the species, with occasional but distinct marginal teeth or cilia, but thallus width 5-15 mm., with occasional marginal proliferations below.

Yirkalla (drift): A76, A103; Port Bradshaw (drift): A55.

The type of var. *lata* is A76, shown in Pl. 1.

D. ciliolata is clearly a variable species in the thallus width, but normally much narrower than in the Arnhem Land specimens. J. Agardh (1894: 76) refers

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to specimens with a broad thallus from Ceylon, and classed these as *D. ciliata ceylonensis* in his herbarium. They are the same as var. *lata*, but the varietal name *ceylonensis* was apparently never published. The type of *D. ciliolata* is in the Sonder Herbarium, now incorporated in Melbourne National

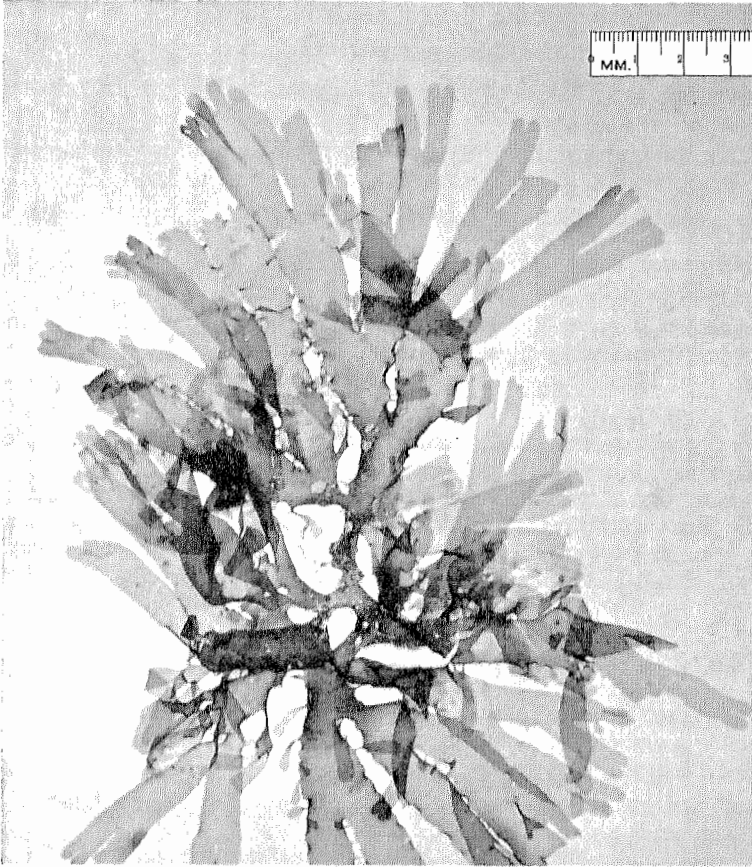


PLATE I. The type specimen of *Dictyota ciliolata* var. *lata*

Herbarium. The type locality is La Guayra, Venezuela. The species was previously better known as *D. ciliata*, but this name had been earlier used for another plant by Lamouroux, and is now relegated to the synonymy of *Taonia atomaria*. The type of *D. ciliolata* Kützing is the same as an isotype specimen of *D. ciliata* J. Agardh (from Vera Cruz) in Melbourne National Herbarium.

D. ciliata recorded by Harvey (Alg. Aus. Exs. no. 68a) from Fremantle, Western Australia, agrees fairly well with the type of *D. ciliolata*.

The species is widely distributed in tropical and subtropical waters; the var. *lata* from Arnhem Land and Ceylon.

Dictyota pardalis Kützing (1859): 16, t. 39. J. Agardh (1894): 68.

South Bay, Bickerton Island (upper sublittoral on muddy lateritic rocks): A38.

These specimens agree well in form with Kützing's figure and with the only specimen in Herbarium Kützing (from Senegambia, though Kützing gave the West Indies in his original description). As both the Arnhem Land and type specimens are sterile, determination is not certain.

Senegambia; West Indies; Malay Archipelago; Bickerton Island.

Padina gymnospora (Kützing) Vickers. Børgesen (1930): 170.

Padina australis Hauck. W. v. Bosse (1913): 180.

South Bay, Bickerton Island (upper sublittoral on muddy lateritic rocks) A41;
Port Bradshaw (drift): A58; Yirrkalla (drift): A88, A89.

Northern Australia; East Indies; West Indies.

Padina commersonii Bory (1828): 144-5, pl. 21, f. 2. J. Agardh (1882): 119. W. v. Bosse (1913): 178.

Little Lagoon, Groote Eylandt (upper sublittoral on flat lateritic reef): A7;
Hemple Bay, Groote Eylandt (upper sublittoral on hard sandstone): A17;
South Bay, Bickerton Island (upper sublittoral on muddy lateritic rocks): A40.

P. commersonii was described from 'l'île aux Tonneliers, pres de l'île de France' (Mauritius) where it was collected by the Coquille expedition between 1822 and 1825. The three specimens figured by Bory are mounted on a single sheet in the Bory Herbarium, Paris Museum, and there can be no doubt that these are the type of *P. commersonii*. Bory gave as synonyms *P. tenuis* (Bory 1827: 590) and *P. pavonia* var. *tenuis* C. Agardh (1824: 264). Bory based *P. tenuis* on Agardh's var. *tenuis*, quoting no other material, but J. Agardh (1880: 119) showed this to be a *Zonaria*. Bory, however, may well have had the Mauritius specimens before him when describing *P. tenuis*, for although there is nothing in print to show this, faint (erased) pencil writing on the type sheet of *P. commersonii* may refer to 'tenuis'. It appears that Bory's name '*commersonii*' can best be retained owing to the uncertainty of application of his specific name '*tenuis*'.

Tropical and subtropical parts of the Indian and western Pacific Oceans; northern and eastern Australia.

Pocockiella variegata (Lamouroux) Papenfuss (1943): 467, f. 1-14.

Gymnosorus variegatus (Lamx.) J. Agardh (1894): 11, pl. 1, f. 1-2.

Port Bradshaw (littoral): A59b.

Cosmopolitan in tropical to warm temperate seas.

DICTYOSIPHONALES

PUNCTARIACEAE

Colpomenia sinuosa (Roth) Derbes and Solier. Setchell and Gardner (1925): 539, pl. 45, f. 82-6. Smith (1944): 128, pl. 20, f. 1.

Port Bradshaw (drift): A49; Yirrkalla (drift): A83.

Cosmopolitan.

MARINE ALGAE
FUCALES
CYSTOSEIRACEAE

Cystophyllum muricatum (Turner) J. Agardh (1848): 231. Lucas (1936): 74.
Fucus muricatus Turner (1809): pl. 112.

Yirrkalla (drift): A74, A100.

East Indies, Australia.

Hormophysa triquetra (L.) Kützing (1860): 22, t. 60, f. 1.

Fucus triquetra L. Turner (1808): pl. 34.

Little Lagoon, Groote Eylandt (drift): A116.

Tropical and subtropical parts of the Indian Ocean; East Indies; northern Australia.

SARGASSACEAE

Sargassum baccularia (Mertens) J. Agardh (1848): 307; (1889): 119, t. XXI, f. 4.

Little Lagoon, Groote Eylandt (upper sublittoral on a flat lateritic reef): A2;

South Bay, Bickerton Island (upper sublittoral on a flat lateritic reef):
A43; Nightcliff, Darwin (drift): A106.

These three numbers comprise excellent fertile specimens which agree well with specimens of *S. baccularia* in Paris Museum and an isotype of Mertens in Herbarium Agardh, Lund. The actual type could not be located in Paris Museum.

Tropical parts of the Indian Ocean; East Indies; northern Australia.

Sargassum fissifolium (Mertens) J. Agardh (1889): 83, t. XXV, f. 4.

Fucus fissifolius Mertens (1819): 180.

Yirrkalla (drift): A77, A97.

Two sterile plants which have the branched leaves characteristic of this species, and agree well with an isotype fragment of Mertens in Herbarium Agardh, Lund. No type could be located in the Paris Museum.

Tropical Australia.

Sargassum flavicans (Mertens) C. Agardh. J. Agardh (1889): 82, t. XXV, f. 3.

Fucus flavicans Mertens (1819): 179.

Yirrkalla (drift): A98, A99; Nightcliff, Darwin (drift): A106.

A98 is somewhat stouter and more robust than A99, but they agree well in all essential features. A99 agrees well with probable isotype fragments of *S. flavicans* in Herbarium Agardh, and with specimens in the Paris Museum.

The actual type could not be located.

Tropical Australia.

Sargassum fragile J. Agardh (1889): 121, t. XXXI, f. 3.

Port Bradshaw (drift): A53; Yirrkalla (drift): A95.

The latter specimen is well developed and fertile. It agrees well with the type in Herbarium Agardh, though the receptacles are slightly shorter and more slender (probably younger) in A95.

Tropical and subtropical Australia.

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Sargassum godeffroyi Grunow (1916): 46.

Hemple Bay, Groote Eylandt (upper sublittoral at edge of hard sandstone rocks): A18. (Pl. 2.)

Several good specimens which agree well with an authentic (isotype?) specimen of Grunow (Mackay, Queensland, leg. A. Dietrich) in the Rijksherbarium, Leiden.

Arnhem Land, N.T., and Qld.

Sargassum ilicifolium (Turner) C. Agardh. J. Agardh (1848): 318; (1889): 94.
Fucus ilicifolius Turner (1808); pl. 51.

Yirkalla (drift): A47. Agrees well with the type in Herbarium Kew.

Tropical Indian Ocean; East Indies; northern Australia.

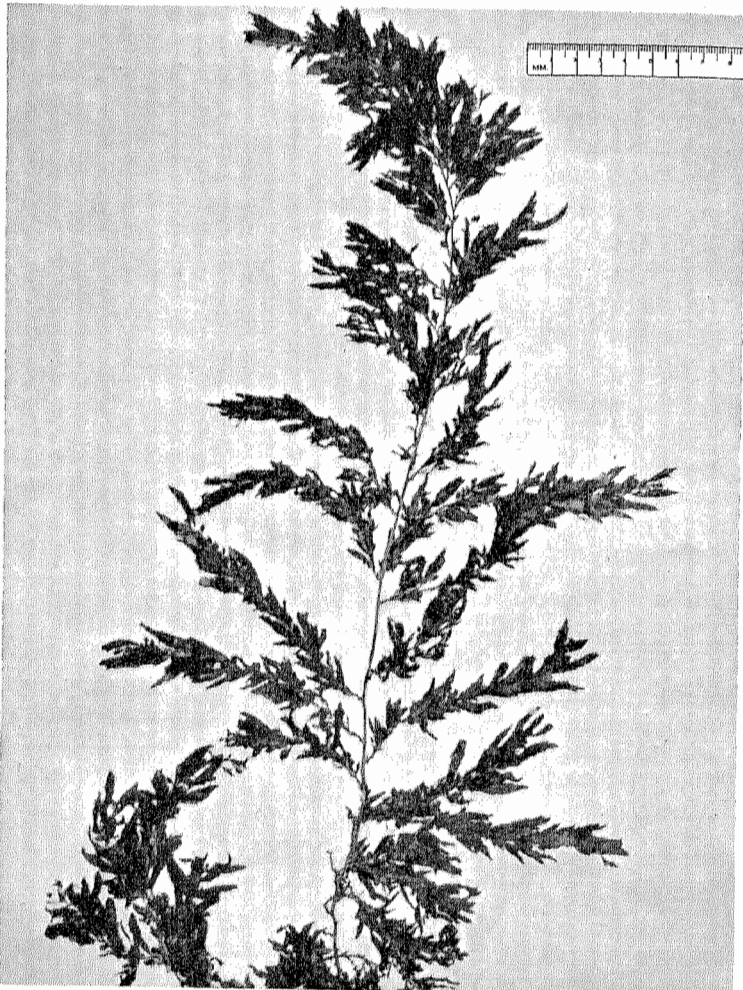


PLATE 2. *Sargassum godeffroyi*

MARINE ALGAE

- Sargassum peronii* (Mertens) C. Agardh. J. Agardh (1889): 47, t. XV, f. 1.
S. boryi C. Agardh (1824): 308. J. Agardh (1889): 47, t. III.
Fucus peronii Mertens (1819): 4, t. I, f. 13. Turner (1819): pl. 247.
Yirrkalla (drift): A101.
The identity of *S. boryi* and *C. peronii* is discussed in a separate paper on Australian Sargassums.
Tropical and subtropical Australia; East Indies.
- Turbinaria ornata* (Turner) J. Agardh (1848): 266. Barton (1891): 219. Taylor (1950): 101, pl. 53.
Yirrkalla (upper sublittoral on a coral reef): A78.
Tropical Indian and Pacific Oceans; East Indies; northern Australia.

RHODOPHYTA NEMALIONALES CHAETANGIACEAE

- Scinia moretonensis* Levring (1953): 509, f. 39, 40.
Yirrkalla (upper sublittoral at edge of a coral reef): A96.
This collection agrees perfectly with Levring's type specimen.
Moreton Bay, Qld., and Yirrkalla, N.T.
- Galaxaura rugosa* (Ellis and Solander) Lamouroux. Børgesen (1916): 100, f. 105-7. Svedelius (1945): 10; (1953): 18-23, f. 14-17.
Yirrkalla (drift): A117.
Cosmopolitan in tropical regions.

BONNEMAISONIACEAE

- Asparagopsis taxiformis* (Delile) Collins and Hervey. Børgesen (1919): 352.
J. & G. Feldmann (1942): 81.
Yirrkalla (drift): A87.
Cosmopolitan in tropical regions.

GELIDIALES

GELIDIACEAE

- Gelidium pusillum* (Stackhouse) Le Jolis. L. Newton (1931): 263. May (1949): 197.
Yirrkalla (fragments on rocks (with lithothamnium) on lateritic reef): A73.
Cosmopolitan.
- Gelidiella acerosa* (Forsskal) Feldmann & Hamel (1934): 6.
Gelidiopsis rigida (Vahl) W. v. Bosse. Børgesen (1920): 370, f. 362.
Hemple Bay, Groote Eylandt (uppermost sublittoral on hard sandstone rocks): A14, A15; Yirrkalla (on granite rocks, low littoral): A66.
Most of these specimens are small (1-2 cm. high) and stunted.
Widespread in tropical regions.

Gelidiella sp.

Yirrkalla (littoral in holes in steep granite rocks): A61, A68.

This material does not fit any described species very well, but as it may be stunted and atypical, it is left unnamed. It forms dense tufts 1-1½ cm. high, composed of numerous erect, mostly simple, and strongly flattened branches about 1 mm. wide from basal rhizomatous parts. A few subhorizontal branches, which may develop tetraspores, often occur near the apices. The apical growing cell and lack of medullary rhizoids are typical of *Gelidiella*. No good fertile material was seen.

Gelidiella sp.

Hemple Bay, Groote Eylandt (lowest littoral and uppermost sublittoral, on hard sandstone rocks): A12.

This material also is sterile and since it does not agree with any described species, it is therefore left unnamed. It forms low densely entangled mats ½-1 cm. high, branches terete, 60-130 μ thick, irregularly and sparingly (except at the base) branched. The cortical cells are in fairly distinct rows, and there is a single apical cell.

CRYPTONEMIALES

CORALLINACEAE

Amphiroa anceps (Lamarck) Decaisne. Harvey (1847): 98, pl. 37. W. v. Bosse (1904): 93, p. 16, f. 6-8.

Nightcliff, Darwin (low littoral on a coral reef): A118.

Widespread in tropical to warm temperate regions.

Jania rubens (L.) Lamouroux. Harvey (1871): pl. 252. Taylor (1950): 133.

Corallina rubens L. L. Newton (1931): 314, f. 191.

Little Lagoon, Groote Eylandt (on a flat lateritic reef and on *Sargassum baccularia*, upper sublittoral): A3; Hemple Bay, Groote Eylandt (on hard sandstone rocks, littoral): A13; Yirrkalla (on granite rocks, low littoral): A63a.

None of these specimens are fertile, but they agree well with specimens of *J. rubens* in the Linnaean Herbarium. Apparently this is a common alga on Groote Eylandt, and probably on much of the Arnhem Land coast.

Probably cosmopolitan, at least very widely distributed.

Melobesia coronata Rosanoff (1866): 64, pl. iv, f. 9. Foslie (1904): 56.

South Bay, Bickerton Island (on *Padina australis*, upper sublittoral): A41a.

This coralline densely encrusted many specimens of *Padina australis*, and although similar to *M. coronata* there are slight differences in cell size and tetrasporic conceptacles. W. v. Bosse also doubtfully refers specimens on *Padina* in Borneo to this species.

Southern Australia; Bickerton Island; and Borneo?

Lithothamnieae

Crustose lithothamnia were common on the reef at Yirrkalla, and almost certainly are plentiful all around the Arnhem Land coast. The material collected, however, is inadequate for determination.

MARINE ALGAE

RHIZOPHYLLIDACEAE

Chondrococcus harveyi (J. Agardh) De Toni (1905): 1676.

Desmia harveyi J. Agardh (1876): 356.

Yirkalla (drift): A46 and A82; Port Bradshaw (drift): A51; Yirkalla (littoral (rare) on a coral reel): A60.

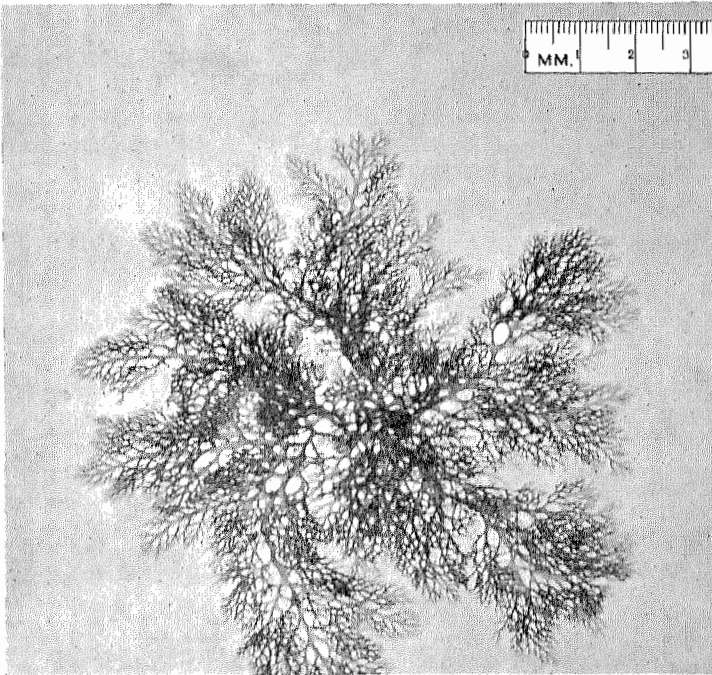


PLATE 3. *Chondrococcus harveyi*

Silva (1952, 304) gives reasons for the retention of the name *Chondrococcus* rather than *Desmia* Lyngbye. Whether *C. harveyi* is really distinct from *C. hornemanii* (Lyngb.) Schmitz or other species of the genus is doubtful. The Arnhem Land specimens (Pl. 3) match those in Herbarium Agardh of *C. harveyi* quite well, and are smaller, slenderer and more densely branched than most South African specimens of *C. hornemanii*. Field studies would very likely result in reduction of species of this genus.

Friendly Islands; northern Australia.

GIGARTINALES

SOLIERIACEAE

Sarconema furcellatum Zanardini. Kylin (1932): 21. Børgesen (1939): 111-12.
L. M. Newton (1953): 408-9.

South Bay, Bickerton Island (upper sublittoral, on muddy lateritic rocks): A33.
These specimens agree well with the type of *S. indicum* in Herbarium Agardh, Lund, but are clearly rather poor and stunted plants. Both Børgesen and

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L. M. Newton consider that *S. indicum* and *S. montagnei* are only ecological forms of *S. furcellatum*.

Tropical parts of the Indian Ocean and nearby seas.

HYPNEACEAE

Hypnea cornuta (Lamouroux) J. Agardh (1852): 449; (1876): 563. Bergesen (1920): 382, f. 367-8. Tanaka (1941): 242, f. 14.

South Bay, Bickerton Island (on muddy lateritic rocks, upper sublittoral): A34; Port Bradshaw (drift): A56.

A34 comprises small stunted plants 3-5 cm. high, while A56 (presumably from deeper water) are loosely branched and up to 20 cm. high. All show the characteristic stellate processes on the branches.

Cosmopolitan within tropical regions.

Hypnea divaricata (Turner) Greville (1830): lix. Kützing (1849): 759; (1868): t. 25?

Fucus divaricatus Turner (1811): pl. 181.

Yirrkalla (drift): A86.

This species is represented by only a single specimen, shown in Pl. 4. It agrees fairly well with Turner's figure. The type came from the Australian coast, and the species has been much confused in the literature. (cf. De Toni

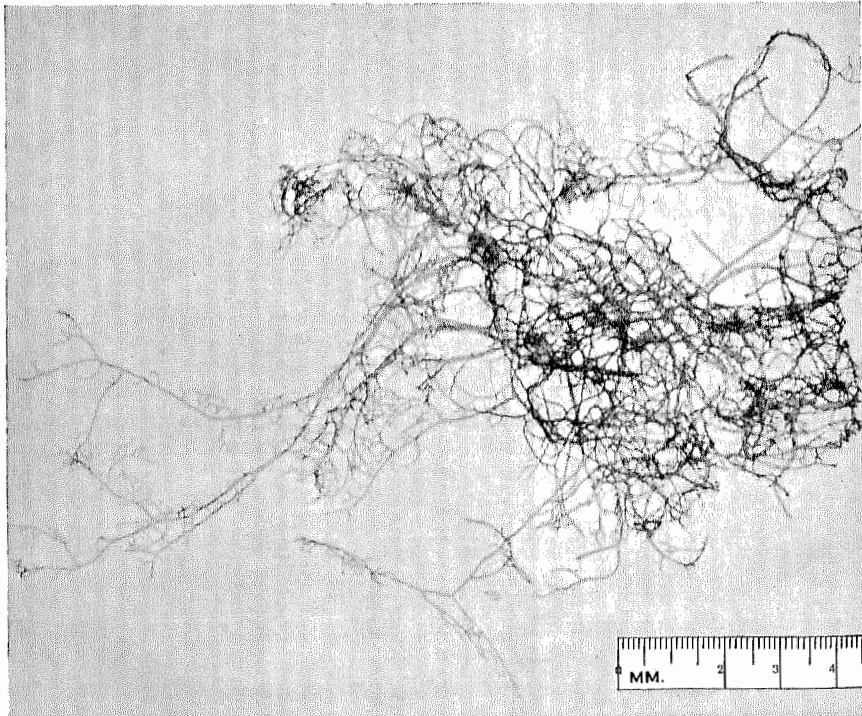


PLATE 4. *Hypnea divaricata*

MARINE ALGAE

1900: 478.) Kützing's figure (1868: t. 26) of *H. esperi* appears very similar to A86, but this is now ranked as a variety of *H. musciformis*.

Northern Australia.

Hypnea hamulosa (Esper) Montagne. J. Agardh (1852): 447; (1876): 563. Tanaka (1941): 245, f. 17.

Fucus hamulosus Esper. Turner (1809): pl. 79.

Little Lagoon, Groote Eylandt (on shells, etc. on a sandy sea-floor, upper sublittoral): A24.

Widely distributed in tropical and subtropical regions.

CERAMIALES

CERAMIACEAE

Griffithsia tenuis C. Agardh. J. Agardh (1876): 70. Børgesen (1920): 462, f. 423.

Little Lagoon, Groote Eylandt (on shells, etc. upper sublittoral): A22.

Cosmopolitan in tropical and subtropical regions.

Spyridia filamentosa (Wulfen) Harvey (1871): pl. 46. Børgesen (1917): 233, f. 222-6. Taylor (1937): 343; pl. 44, f. 2; pl. 46, f. 2-5.

Little Lagoon, Groote Eylandt (on shells, etc. on sandy sea-floor, upper sublittoral): A25; South Bay, Bickerton Island (on muddy lateritic rocks, very low littoral): A39.

Under *S. filamentosa* must be included *S. breviarticulata* J. Agardh (1876: 268). I have examined the type from Whitsunday Island, Queensland (in Herbarium Agardh) and consider it as only a form of the widely distributed *S. filamentosa*.

Cosmopolitan in tropical to temperate regions.

Centroceras clavulatum (C. Agardh) Montagne. J. Agardh (1876): 108. Smith (1944): 328; pl. 84, f. 5-6.

Hemple Bay, Groote Eylandt (with *Gelidiella*, littoral): A12; Yirrkalla (with *Jania rubens*, littoral): A63a.

Cosmopolitan.

RHODOMELACEAE

Polysiphonia sphaerocarpa Børgesen (1918): 271, f. 267-71?

Yirrkalla (on granite rocks, low littoral): A61e, A65.

These specimens agree well with Børgesen's figures, and description, although cystocarpic plants were not seen. They formed dense tufts 1-2 cm. high.

West Indies; Yirrkalla, N.T.

Tolypiocladia glomerulata (C. Agardh) Schmitz. Falkenberg (1901): 177, t. 21, f. 27-9.

Roschera glomerulata (Ag.) W. v. Bosse (1923): 359.

South Bay, Bickerton Island (on muddy lateritic rocks, upper sublittoral): A36.

Tropical parts of the Indian and Pacific Oceans; East Indies; northern Australia.

Acanthophora spicifera (Vahl) Boergesen (1918): 259, f. 253-8. W. v. Bosse (1923): 347, f. 131-2.

Little Lagoon, Groote Eylandt (on shells on a sandy sea-floor, upper sublittoral): A23; South Bay, Bickerton Island (on muddy lateritic rocks, upper sublittoral): A37; Port Bradshaw (drift): A57; Little Lagoon, Groote Eylandt (drift): A119.

Tropical Indian Ocean; East and West Indies; northern Australia.

Laurencia obtusa (Hudson) Lamouroux. Falkenberg (1901): 246, t. 23, f. 11-18. Yamada (1931): 222; pl. 16-17. Boergesen (1918): 247, f. 237.

Yirrkalla (abundant on lateritic rocks, lower littoral): A71; Yirrkalla (drift): A84, A85, A90, A91, A93, A94, A104.

These numbers include a variety of forms, all referable to *L. obtusa*. Reef forms (A71) are usually small dense plants while those from deeper water are larger and more loosely branched. A85 is probably referable to var. *majuscula* Harvey.

Cosmopolitan in tropical to temperate regions.

Laurencia papillosa (Forsskal) Greville. Kützing (1865): t. 62. Yamada (1931): 190, pl. 1 a, b. Boergesen (1918): 246, f. 236.

Little Lagoon, Groote Eylandt (in sandy hollows, on shells, at the edge of a lateritic reef, upper sublittoral): A6; Yirrkalla (on rocks on lateritic-coral reef, littoral): A72; Little Lagoon, Groote Eylandt (drift): A119.

Cosmopolitan in the tropics.

Leveillea jungermannioides (Mertens & Hering) Harvey. Falkenberg (1901): 392, t. 6, f. 1-13, t. 14, f. 18-27.

L. schimperi, Harvey (1860): pl. 161. Kützing (1865), t. 7.

Nightcliff, Darwin (drift (with *Hypnea*) on base of *Sargassum baccularia*): A107.

The type specimens of *L. comosa*, *L. gracilis* and *L. schimperi* (all Decaisne species) in the Paris Museum are only forms of *L. jungermannioides*.

Tropical parts of the Indian Ocean; East Indies; Japan; northern Australia.

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