

NEW RECORDS OF MARINE ALGAE ON ARTIFICIAL STRUCTURES AND INTERTIDAL FLATS IN COASTAL WATERS OF SINGAPORE

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ABSTRACT. – A total of 40 algal records for Singapore are reported here, encompassing 26 species of Rhodophyceae, four species of Phaeophyceae and 10 species of Chlorophyceae. These algae were primarily collected from navigation buoys in Singapore waters and other artificial structures, either floating or fixed, from the Singapore coastline. All of the species presented in this report are considered new records for Singapore, except *Gracilaria changii*, *Halymenia maculata*, *Dictyopteris repens*, *Cladophoropsis vaucheriaeformis* and *Parvocaulis parvulus*. The records of 10 species listed here (*Acrochaetium hypneae*, *Asparagopsis taxiformis*, *Ceramium flaccidum*, *Dictyopteris delicatula*, *Botryocladia skottsbergi*, *Coelothrix irregularis*, *Chondria simpliciuscula*, *G. rhodymenioides*, *G. corticata* and *Chrysomenia procumbens*), provide an extension of the previously known biogeographic distribution for these species. Although not in any way complete, these records are an important addition to the knowledge of algal diversity and distribution in Southeast Asia and demonstrate the high biodiversity of artificial habitats.

KEY WORDS. – Algae, biodiversity, marine flora, seaweeds, Singapore.

INTRODUCTION

Numerous studies have been conducted on marine flora in the Indo-Pacific region over the last three decades. Checklists and floristic studies are available for several countries, including Malaysia (Phang & Wee, 1991; Ismail, 1995; Masuda et al., 1999, 2000a, b, 2002a, b; Terada et al., 2000; Phang et al., 2007), Thailand (Lewmanomont, 1994; Lewmanomont & Ogawa, 1995), Vietnam (Pham, 1969; Tseng & Xia, 1999), Indonesia (Coppejans & Prud'homme van Reine, 1992; Verheij & Prud'homme van Reine, 1993; Liao et al., 2004) and the Philippines (Abbott, 1985; Silva et al., 1987; Kraft et al., 1999).

In marked contrast, the marine flora of Singapore and its outlying islands is relatively unknown. Records of Singapore marine flora are from only a few locations

(Purchon & Enoch, 1954; Lee, 1966; Chuang, 1977; Chou & Wong, 1987; Phang & Wee 1991) and collections were made primarily as a result of an overall assemblage survey of the area of interest. From these studies, only 16 species of Chlorophyceae, nine species of Phaeophyceae, 11 species of Rhodophyceae, three seagrasses and two species of Cyanophyceae were identified. The only other study that examined a larger amount of material was one by Teo & Wee (1983); however, a large part of their collection is unidentified and vouchers cannot be located. Phang et al. (2007) recently published a checklist of Malaysian marine algae, which included a collection from Singapore shores. In this checklist, a total of 107 algae taxa were reported, which included eight taxa of blue green algae, 29 taxa of red algae, 30 brown algae species and 40 species of green algae. Aside from these studies, the more recent publications include a floristic checklist of the seaweeds of the Indian

Ocean which included Singapore as its easternmost point (see Silva et al., 1996) and examinations of specific groups of algae (e.g. Phang, 1994; Zuccarello & West, 2006).

In this present paper, 40 records for Singapore are presented, encompassing 26 species of Rhodophyceae, four species of Phaeophyceae and 10 species of Chlorophyceae. All of the species presented in this report are considered new records for Singapore, except *Gracilaria changii*, which was reported in Phang (1994), *Halymenia maculata* (see Abbott, 1999), *Dictyopeteris repens* (Phang et al., 2007), *Cladophoropsis vaucheriaeformis* and *Parvocaulis parvulus*. The two latter species were listed in Silva et al. (1996). However, the list represented here is not comprehensive as it does not include members of Cyanophyta or the seagrasses. A checklist of algae species previously reported for Singapore is also included here (see Table 1). Also included in this list is the occurrence of previously recorded algae that were observed in the course of present study.

MATERIAL AND METHODS

The material examined was collected between Apr.2002 and Jun.2004 from several locations along the coast of Singapore, primarily from intertidal reef flats, artificial structures (seawalls and breakwater) and from floating navigation buoys located in various waterways. The geographical coordinates of collection sites and their associated waterways are provided in Table 2. Samples were fixed in 10% formalin in seawater and also dried as voucher specimens. Where necessary, hand sections were made using a razor blade, stained with aniline blue and mounted in 50% glycerol-seawater. Whole mounts of some algae were also made in Aquamount®.

TAXONOMY

RHODOPHYTA

ACROCHAETIACEAE

Acrochaetium hypneae (Børgesen) Børgesen, 1915 (Fig. 1a)

Basionym. – *Chantransia hypneae* Børgesen 1909.

Synonyms. – *Acrochaetium seriatum* Børgesen, 1915; *Audouinella seriata* (Børgesen) Garbary, 1979; *Audouinella hypneae* (Børgesen) G. Lawson & D. M. John, 1982; *Colaonema seriatum* (Børgesen) Stegenga, 1985.

Type locality. – St. Croix, U. S. Virgin Islands.

Material examined. – Paku Buoy, fouling community on floating navigational buoy, 15 May 2002.

Description. – Microscopic, filamentous, mostly epiphytic. Possesses irregular branching, erect portions arising from multicellular base. Monosporangia carried singly but appear

in short series on the inner sides of branchlets.

Remarks. – This sample, collected from a navigational buoy, was found growing on a string that was entangled in the fouling on the buoy.

BONNEMAISONIACEAE

Asparagopsis taxiformis (Delile) Trevisan de Saint Léon 1845

Basionym. – *Fucus taxiformis* Delile, 1813.

Synonyms. – *Asparagopsis delilei* Montagne, 1841; *Dasya delilei* Montagne, 1841; *Lictoria taxiformis* (Delile) J. Agardh, 1841; *Asparagopsis sandfordiana* Harvey, 1855; *Polysiphonia hillebrandii* Bornet, 1883; *Falkenbergia hillebrandii* (Bornet) Falkenberg, 1901.

Type locality. – Alexandria, Egypt

Material examined. – South-western coast on St John's Island, found at the base of seawall, Apr.2002; Pulau Tekukor, on intertidal reef edge, 3 Dec.2002; North Pandan Buoy, fouling community on floating navigational buoy, 11 Apr.2002.

Description. – Plants with creeping stolons, giving rise to erect, plumose fronds. Erect axes are naked towards lower portion. Tetrasporangial phase resembling *Polysiphonia*-like structure.

Remarks. – *Asparagopsis taxiformis* is common along the coast of Singapore. However, the gametophytes appear to be highly seasonal. The tetrasporangial phase (commonly referred to as *Falkenbergia hillebrandii*) occurs throughout the year forming small bright red amorphous clumps, at the bases of seawalls in the low intertidal area.

GALAXAURACEAE

Tricleocarpa cylindrica (Ellis & Solander) Huisman & Borowitzka, 1990 (Fig. 1c)

Basionym. – *Corallina cylindrica* Ellis & Solander, 1786.

Synonyms. – *Galaxaura cylindrica* (Ellis & Solander) Lamouroux, 1821; *Galaxaura fastigiata* Decaisne, 1842.

Type locality. – West Indies.

Material examined. – Tanjung Hakim, St John's Island, on intertidal reef flat, attached to rocks, 14 Jun.2002 and 8 Jun.2004.

Description. – Plants heavily calcified, 4 cm high, dichotomously branched. Branches terete. Internally composed of medulla of elongated filaments giving rise to radiating, dichotomously branched filaments forming the cortex. Cortex composed of 3–4 layers of rounded inflated cells, outer cortical cells distinctly smaller than inner. In

surface view, outer cortical cells five or six sided. Bright red in colour when wet, dries to a greyish-pink.

Remarks. – For a long time recognized as a species of *Galaxaura*, this species has been transferred to *Tricleocarpa* due to its unique life history (see Huisman & Borowitzka, 1990).

***Pterocladia capillacea* (Gmelin) Santelices & Hommersand, 1997**
(Fig. 1d, e)

Basionym. – *Fucus capillacea* Gmelin, 1768.

Synonyms. – *Pterocladia capillacea* (Gmelin) Bornet & Thuret, 1876.

Type locality. – Mediterranean.

GELIDIACEAE

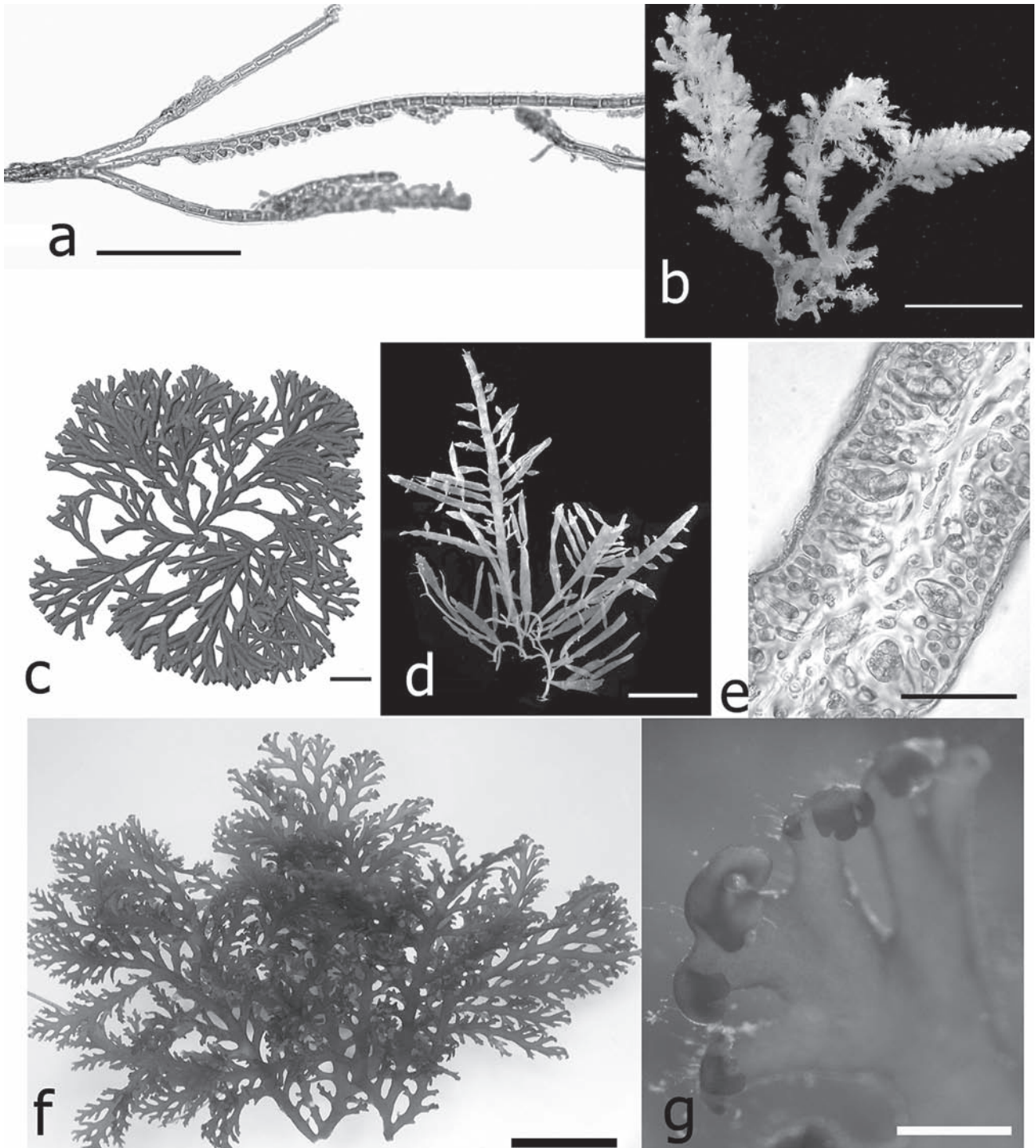


Fig. 1. Marine algae from Singapore waters. *Acrochaetium hypnea*: a, whole mount, showing monosporangia carried singly on inner sides of branchlets; *Asparagopsis taxiformis*: b, wet habit of preserved material; *Tricleocarpa cylindrica*: c, habit of dry pressed specimen; *Pterocladia capillacea*: d, wet habit; e, cross section of thallus; *Portieria hornemannii*: f, wet habit; g, close up of branch tips, showing in curling of tips. Scale bars: a = 100 µm; b–d, f = 1 cm; e = 50 µm; g = 200 µm.

Material examined. – Tanjung Hakim, St John's Island, on intertidal reef flat, usually attached to recessed surfaces of rocks, 8 Jun.2004.

Description. – Plants are small and cartilaginous, dark purplish red in colour, up to 4 cm high. Occurs in clumps of compressed to flattened fronds, usually ~2 mm wide, distichous branching, often regular and pinnate or bipinnate. Fronds often taper at ends, with distinctive basal constrictions. Horizontal axes slightly more cylindrical than erect axes.

Remarks. – This species was recently recognized to belong to a new segregate genus because of its unique reproductive morphology different from the typical form found in *Pterocladia* under which it has been recognized for many years (see Santelices & Hommersand, 1997). This species is harvested for agar in localities where they grow abundantly. Most records of this species indicate that this is a fairly large plant, reaching a height in excess of 20 cm. The specimen obtained here is likely to be a young plant as observed from the small size of the plant and the absence of reproductive structures.

RHIZOPHYLLIDACEAE

Portieria hornemannii (Lyngbye) Silva, 1987

(Fig. 1f, g)

Basionym. – *Desmia hornemannii* Lyngbye, 1819.

Synonyms. – *Chondrococcus hornemannii* (Lyngbye) Schmitz, 1895.

Type locality. – Red Sea.

Material examined. – South-western coast on St John's Island, found at the base of seawall, Apr.2002

Description. – Plants are small, up to 5 cm tall, erect, vermilion to red in colour, consisting of compressed to flattened branches. Branching alternate-irregularly pinnate in one plane, distal portion of branches pointed and curled, with in-rolling tips.

Remarks. – Usually occurs in areas of higher wave exposure. This species has been the subject of much bioprospecting due to its cytotoxic secondary metabolite, halomon, reported to be a human tumour cell suppressant (Fuller et al., 1994).

GRACILARIACEAE

Gracilaria rhodymenioides Millar, 1997

(Fig. 2a–d)

Type locality. – Muttonbird Island, Coffs Harbour, New South Wales, Australia.

Material examined. – intertidal reef flat, north of Pulau Tekong,

East Johore Straits, 30 May 2002, 7 Jun.2004; Tanjung Hakim, St John's Island on intertidal reef flat, 8 Jun.2004.

Description. – Plants erect to horizontally spreading, in loose tufts, up to 5 cm high. Plants borne on short, prominent and terete stipe. Cross-section of stipe has central medulla surrounded by radiating cortical cells. Blades flattened, cartilaginous, widely spreading from stipe, with regularly dichotomous branching, older portions of plant with irregularly divided fronds. Blade margins usually entire, unless damaged, which produced various branched shoots. Cystocarps present along blade margin.

Remarks. – Blade on older portion of plant more elongate, younger portions appear more digitate.

Gracilaria changii (Xia & Abbott) Abbott, Zhang & Xia, 1991

Basionym. – *Polycavernosa changii* Xia & Abbott, 1987.

Synonym. – *Hydropuntia changii* (Xia & Abbott) Wynne, 1989.

Type locality. – Penang, Malaysia.

Material examined. – intertidal reef flat, north of Pulau Tekong, East Johore Straits, 7 Jun.2004.

Description. – Plant erect, purplish-brown in colour, erect axes and branches cylindrical, branching irregular-alternate, sometimes secund, conspicuous constrictions present at base of axes, stipe slender with distal swelling, branches tapering towards tips.

Remarks. – This specimen is similar to *Gracilaria cylindrica* Børgesen in that both species show conspicuous constrictions at branches and branchlets. However, the swollen distal end of the stipe with the gradual tapering distinguishes this species from *G. cylindrica*

Gracilaria corticata (J. Agardh) J. Agardh, 1852

(Fig. 2e, f)

Basionym. – *Rhodymenia corticata* J. Agardh, 1841.

Synonym. – *Sphaerococcus corticatus* (J. Agardh) Kützinger, 1849.

Type locality. – Sri Lanka

Material examined. – Kuala Buoy, fouling community on floating navigational buoy, 9 May 2002; St John's Island, on floating pontoon, 14 Jun.2004.

Description. – Plant erect, deep red to purplish-red in colour, thallus broad (2–5 mm) and flattened; branching is dichotomous, with older segments of plants having marginal projections, arranged pinnately.

Remarks. – Easily recognized in the field because of its

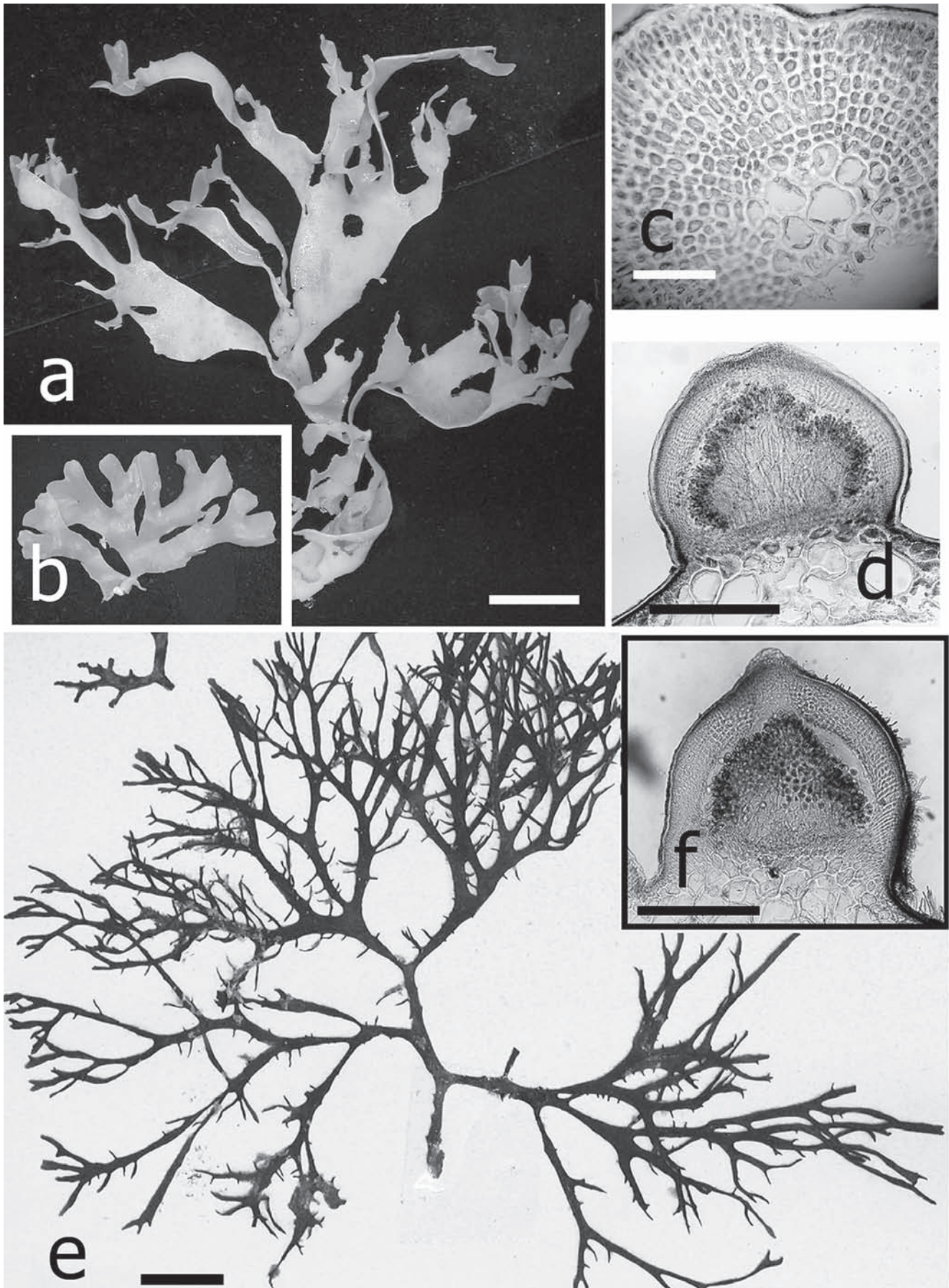


Fig. 2. Marine algae from Singapore waters. *Gracilaria rhodymenioides*: a, wet habit showing proliferations; b, wet habit of younger portion of thallus, showing digitate appearance; c, cross section through distal end of stipe; d, transverse section through mature cystocarp; *G. corticata*: e, habit of dry pressed specimen; f, transverse section through mature cystocarp. Scale bars: a, b, e = 1 cm; c, d, f = 500 µm.

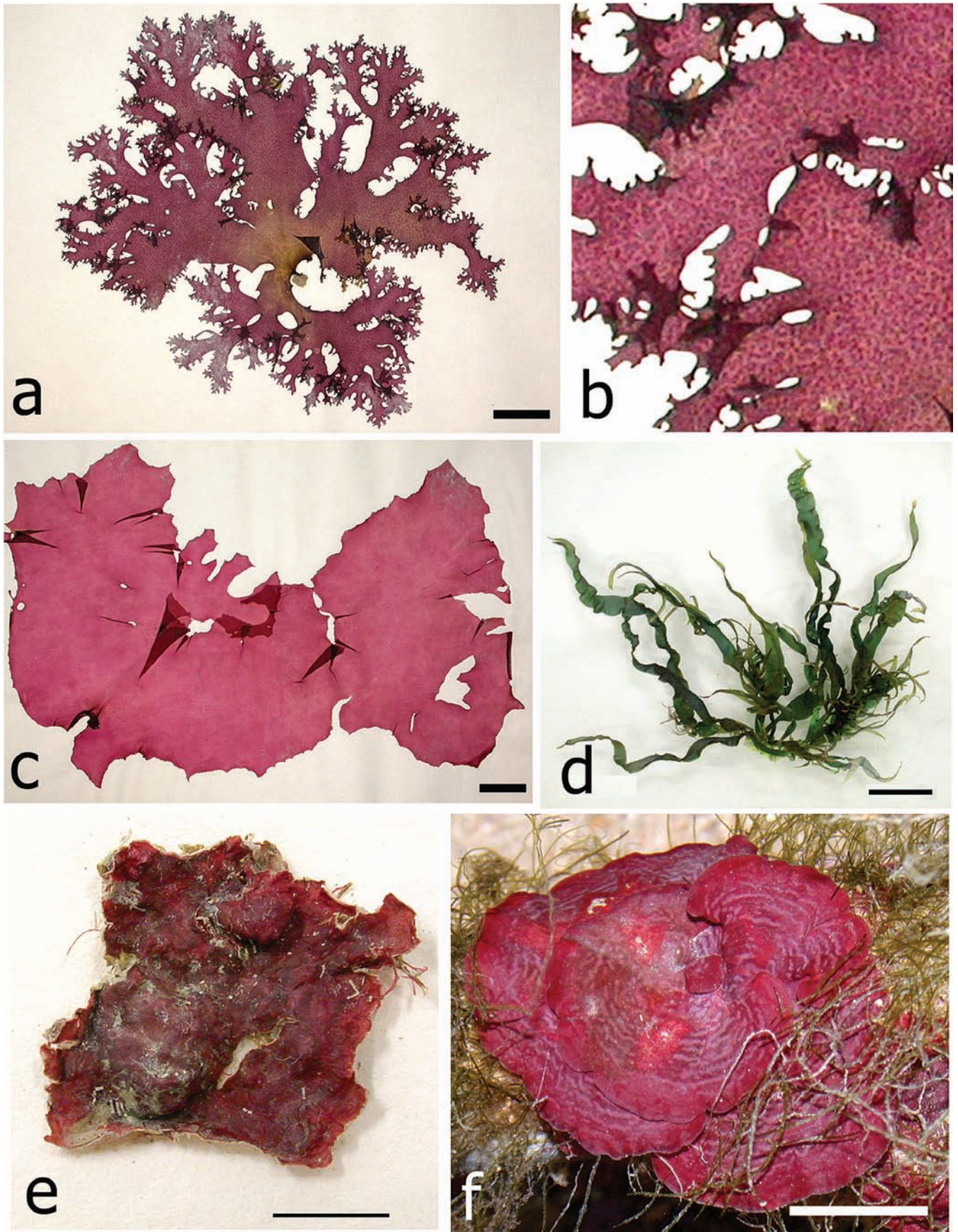


Fig. 3. Marine algae from Singapore waters. *Halymenia maculata*: a, habit of dry pressed specimen; b, close up of thallus showing characteristic blotchy appearance; *H. dilatata*: c, habit of dry pressed specimen; *Grateloupia filicina*: d, wet habit; *Peysonnelia rubra*: e, wet habit showing thick crustose appearance; *P. inamoena*: f, wet habit showing free margins. Scale bars: a, d = 2 cm; b is not to scale; c, e = 5 cm; f = 1 cm.

distinctive flattened morphology and cartilaginous texture, growing quite abundantly when in season.

HALYMENIACEAE

Halymenia maculata J. Agardh, 1885 (Fig. 3b)

Synonym. – *Sebdenia maculata* (J. Agardh) De Toni, 1900.

Type locality. – Mauritius.

Material examined. – intertidal reef flat, north of Pulau Tekong, East Johore Straits, 30 Jun.2003, 7 Jun.2004.

Description. – Plants up to 12 cm tall, dark red to purplish red in colour, somewhat carnose in texture. Blades irregularly foliose and sinuate, with distinct maculation, giving rise to a blotchy appearance. Cortex of 7–10 cells thick, with outer most cells elongate, resulting in rabbit ear appearance. Medulla of dense filaments, oriented periclinally.

Remarks. – *Halymenia maculata* is easily identifiable from the blotchy surface appearance and the thick and slightly stiffer feel to the blade as compared to other *Halymenia* species.

Halymenia dilatata Zanardini, 1851 (Fig. 3c)

Synonyms. – *Sebdenia dilatata* (Zanardini) De Toni, 1900.

Type locality. – Red Sea.

Material examined. – Berkas Buoy, fouling community on floating navigational buoy, 19 Jun.2002; intertidal reef flat, north of Pulau Tekong, East Johore Straits, 30 Jun.2003, 7 Jun.2004

Description. – Plants are fragile, soft and gelatinous, bright red to pink in colour, reaching up to 15 cm tall. Blades are broad to rounded, with blade margins entire, sinuate or slightly crenulate. Cortex 4–6 cells thick; medulla consisting of filaments running perpendicularly from cortex to cortex.

Remarks. – Plant feels slightly soft and jelly-like.

Grateloupia filicina (Lamouroux) C. Agardh, 1822 (Fig. 3d)

Basionym. – *Delesseria filicina* Lamouroux, 1813.

Type locality. – Trieste, Italy.

Material examined. – CAAS (Changi) Buoy, fouling community on floating navigational buoy; 23 Apr.2002; Kuala Buoy, 9 May 2002

Description. – Plants dark red to dark green in colour, gelatinous and slimy, usually with a single percurrent axis,

ranging between 5 and 10 cm tall. Branches compressed, distichously branched. Branches bearing 2 order lateral branching.

Remarks. – These specimens occurred in a broad band on the navigational buoy, spanning from the water line to about 50 cm below water surface. The specimens collected at the water line were usually green in colour while those that were more subjected to subtidal conditions were usually dark red in colour.

PEYSSONNELIACEAE

Peyssonnelia rubra (Greville) J. Agardh, 1851 (Fig. 3e)

Basionym. – *Zonaria rubra* Greville, 1827.

Type locality. – Ionian Islands, Adriatic Sea.

Material examined. – Pulau Satumu, base of artificial seawall, 9 Oct.2002, 4 Jul.2003; Pulau Tekukor, low intertidal reef flat, 3 Dec.2002.

Description. – Plants usually crustose, calcified especially at the lower surface, flat to flabellate, forming thin dark red crust, adhering to substrata across entire ventral surface by multiple unicellular rhizoids. Upper surface sometimes with faint concentric bands.

Remarks. – Thallus more tightly adhering to substratum than other *Peyssonnelia* species, sometimes conforming to the contours of substratum, rendering them more binding at the bases.

Peyssonnelia inamoena Pilger, 1911 (Fig. 3f)

Synonyms. – None.

Type locality. – Cameroon, West Africa.

Material examined. – Intertidal reef flat, north of Pulau Tekong, East Johore Straits, 7 Jun.2004

Description. – Plant crustose, membranous at edges, only lightly calcified, tightly adhering to substrata at central portion, margins free and easily loosens from substrata.

Remarks. – Similar in appearance to *P. rubra* except that the attachment to substratum is limited to the central portion of the plant and the margins are free. *P. inamoena* is usually much easier to detach from the substratum than *P. rubra*.

LOMENTARIACEAE

Gelidiopsis intricata (C. Agardh) Vickers, 1905 (Fig. 4a)

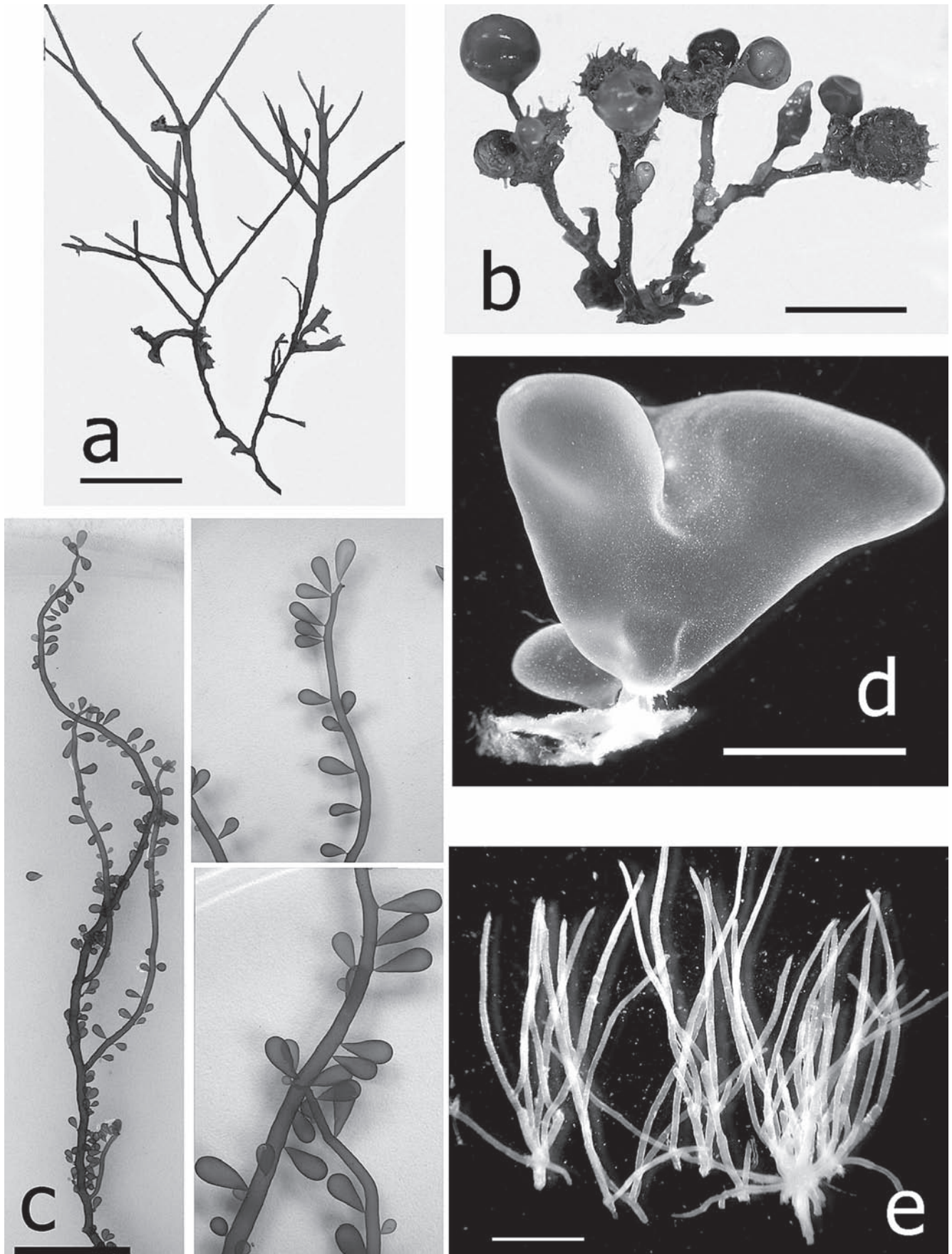


Fig. 4. Marine algae from Singapore waters. *Gelidiopsis intricata*: a, whole mount of preserved specimen; *Botryocladia skottsbergii*: b, wet habit showing spherical vesicles and irregular branching; *B. leptopoda*: c, wet habit of thallus, showing numerous vesicles borne laterally along branch with close-up of branch showing oval vesicles; *Chrysomenia procumbens*: d, wet habit of preserved material showing sac like appearance; *Coelothrix irregularis*: e, wet habit of preserved material. Scale bars: a = 5 mm; b, c = 2 cm; d = 1 cm; e = 1 mm.

Basionym. – *Sphaerococcus intricatus* C. Agardh, 1822.

Synonyms. – *Gelidium intricatum* (C. Agardh) Kützinger, 1849; *Acrocarpus intricatus* (C. Agardh) Kützinger, 1868; *Ceratodictyon intricatum* (C. Agardh) R. E. Norris, 1987.

Type locality. – Unknown

Material examined. – Tanjung Hakim, St John's Island, on intertidal reef flat, 8 Jun.2004.

Description. – Plants erect, wiry, thallus cylindrical to slightly compressed with slightly pointed tips and unsegmented branching, small, up to 3 cm tall. Often occurring in clumps or tufts, often entangled with other algae. Branching irregularly alternate, appearing di-trichotomous.

Remarks. – Plants are composed of very fine filaments which are bound together forming tufts, and which help prevent substrata erosion, often confused with other similarly finely filamentous species of the Gelidiaceae.

RHODYMENIACEAE

Botryocladia skottsbergii (Børgesen) Levring, 1941 (Fig. 4b)

Basionym. – *Chrysomenia skottsbergii* Børgesen, 1924.

Synonyms. – *Chrysomenia kuckuckii* Weber-van Bosse, 1928; *Botryocladia kuckuckii* (Weber-van Bosse) Yamada and Tanaka, 1938.

Type locality. – Easter Island.

Material examined. – Berkas Buoy, 19 Jun.2002; Tanjung Hakim, St John's Island on intertidal reef flat, 8 Jun.2004

Description. – Plants generally occurring in clusters, to 3 cm high, stipe irregularly branched. Each branched ending in a single mucilage-filled vesicle that is nearly spherical in shape.

Remarks. – This species is characterized by having vesicles subtended by stipes that arise directly from the substratum.

Botryocladia leptopoda (J. Agardh) Kylin, 1931 (Fig. 4c)

Basionym. – *Chrysomenia uvaria* var. *leptopoda* J. Agardh, 1876.

Synonym. – *Chrysomenia leptopoda* (J. Agardh) Weber-van Bosse, 1928.

Type locality. – Moreton Bay, Queensland, Australia.

Material examined. – St John's Island, 10 Jun.2004.

Description. – Plants are tall, up to 20 cm high, bright pinkish-red in colour, especially at tips, base of branches

slightly greener. Stipe irregularly branched, each branch bearing multiple vesicles borne laterally along branch and clustering at distal end.

Remarks. – This species is usually gregarious, consisting of branched axes densely beset with vesicles.

Chrysomenia procumbens Weber-van Bosse, 1928 (Fig. 4d)

Synonyms. – None known.

Type locality. – Borneo Bank.

Material examined. – St John's Island, 10 Jun.2004.

Description. – Plants are small, usually 1–2 cm high, pinkish-red in colour. Asymmetric blade sac-like, borne on a short stipe (not more than 3 mm), with cushion-like appearance.

Remarks. – A species not frequently encountered, it is usually a hollow sac which ruptures as it ages.

Coelothrix irregularis (Harvey) Børgesen, 1920 (Fig. 4e)

Synonyms. – *Cordylecladia irregularis* Harvey, 1853.

Type locality. – Key West, Florida.

Material examined. – Tanjung Hakim, St John's Island, on intertidal reef flat, 8 Jun.2004

Description. – Plants erect, wiry, growing in clumps up to 2 cm high. Branching irregular, branches attaching and reattaching to one another and to substrata, giving rise to a much entangled appearance.

Remarks. – Sometimes mistaken for *Gelidiopsis* species, this plant is usually wiry and clumpy and does not bind sediments unlike the latter.

CERAMIACEAE

Ceramium flaccidum (Harvey ex Kützinger) Ardissone, 1871

Basionym. – *Hormoceras flaccidum* Kützinger, 1862.

Synonyms. – *Ceramium byssoideum* Harvey 1853; *Hormoceras flaccidum* Kützinger 1862; *Gongroceras subtile* Kützinger 1863; *Ceramium gracillimum* f. *intermedium* Fosløe, 1893; *Ceramium transversale* F. S. Collins & Harvey, 1917; Mazoyer 1938, *Ceramium masonii* E. Y. Dawson 1950.

Type locality. – County Clare, Ireland.

Material examined. – Marina South, mouth of Marina Bay,

Singapore; on revetment of artificial seawall, 11 Sep.2002, 5 Jun.2003.

Description. – Plants filamentous, erect portion arising from a prostrate base, filaments composed of areas alternating zones of corticated and non-corticated bands, attachment to substratum by rhizoids originating from cortical bands. Corticated nodes often wider than internodal region. Internodal regions are normally longer than corticated nodes, especially on lower portions of filaments. Corticated areas of 6–8 periaxial cells, basipetal row of 1–3 transversely elongated cells. Branching is pseudodichotomous.

Remarks. – usually epiphytic, commonly occurring with other turf-forming algal assemblages.

Centroceras clavulatum (C. Agardh) Montagne, 1846

Basionym. – *Ceramium clavulatum* C. Agardh, 1822.

Type locality. – Callao, Peru.

Material examined. – North Pandan Buoy 11 Apr.2002; CAAS (Changi) Buoy 23 Apr.2002.

Description. – Plants filamentous, bright red, up to 3 cm tall, occur in large clumps. Often found occurring with other turf-forming algal communities. Branches often unbranched or sub-dichotomously branched, apices slightly forcipate, cortication evident throughout, with 14 periaxial cells.

Remarks. – Among species from the tropics, this is often easily identified by its forcipate tips and uniform cortication throughout.

Griffithsia cf. *ovalis* Harvey, 1855

Synonyms. – None.

Type locality. – King George Sound, Australia.

Material examined. – Lower Shoal Buoy, fouling community on floating navigational buoy, 21 Jun.2002.

Description. – Plants mostly epiphytic, bright red in colour, small, up to 5 mm tall, cells are subcylindrical, almost twice as long as wide, numerous rhizoidal attachments to substrata as well as to itself.

Remarks. – This specimen was observed attached among other turf-forming algae. No obvious branching patterns or reproductive structure was observed. As such, the identification made here is only tentative.

Spyridia filamentosa (Wulfen) Harvey, 1833 (Fig. 5a)

Basionym. – *Fucus filamentosa* Wulfen, 1803.

Type locality. – Adriatic Sea.

Material examined. – St John's Island, on floating pontoon, 14 Jun.2004.

Description. – Plants erect, up to 6 cm tall, attached to substrata by small discoidal holdfast, Branches tapered to fine points, branching irregular to alternate, making plants appear plumose. Main axes are completely corticated. Ramelli are short, simple and curved towards apices, appearing to be regularly segmented due to the alternation of corticated and uncorticated zones, with acute cell tips.

Remarks. – Plants are rather common when in season; the characteristic hairy filaments often lead to its misidentification as a species of *Hypnea*.

DASYACEAE

Heterosiphonia crispella (C. Agardh) Wynne, 1985

Basionym. – *Callithamnion crispellum* C. Agardh, 1828.

Synonym. – *Dasya wurdemannii* J. Bailey ex Harvey, 1853, *Heterosiphonia wurdemannii* (Bailey ex Harvey) Falkenberg var. *laxa* Børgesen, 1915–1920.

Type locality. – Cádiz, Spain.

Material examined. – Labrador Park, natural rocky shore, 9 Jun.2004.

Description. – Plants epiphytic and small, usually less than 1 cm, prostrate or decumbent. Branching alternate, lateral branches uniseriate and dichotomously branched, appearing plumose.

Remarks. – usually associated with turf-forming algal assemblages and with other sediment binding species.

RHODOMELACEAE

Chondria simpliciuscula Weber-van Bosse, 1913 (Fig. 5b)

Synonyms. – None.

Type locality. – Aldabra Island, Indian Ocean.

Material examined. – Labrador Park, natural rocky shore, 9 Jun.2004.

Description. – Plants up to 2 cm tall, procumbent, consisting of creeping axes that gives rise to erect lateral branches. Erect branches occurring singly, simple, mostly cylindrical with truncate or slightly tapered and rounded tips. Surface cells of axes are characteristically ellipsoidal to subspherical in shape.

Remarks. – Oftentimes there is an apical pit or depression at the branch tips.

Type locality. – Mokha, Yemen.

Material examined. – St John's Island, on floating pontoon, 14 Jun.2004.

***Chondrophycus papillosus* (C. Agardh) Garbary & Harper, 1998**
(Fig. 5c)

Basionym. – *Chondria papillosa* C. Agardh, 1822.

Synonyms. – *Fucus tenerrimus* Clemente, 1807; *Laurencia papillosa* (C. Agardh) Greville, 1830; *Laurencia tenerrima* (Clemente) Cremades, 1990.

Description. – Plant tall, up to 7 cm high, forming dense clusters, greenish-purple to dark purple in colour. Branching alternate to irregular. Tips of branches are densely covered by short and knobbier branchlets, lower portion usually devoid of branchlets.

Remarks. – Almost reminiscent of corn on a cob.

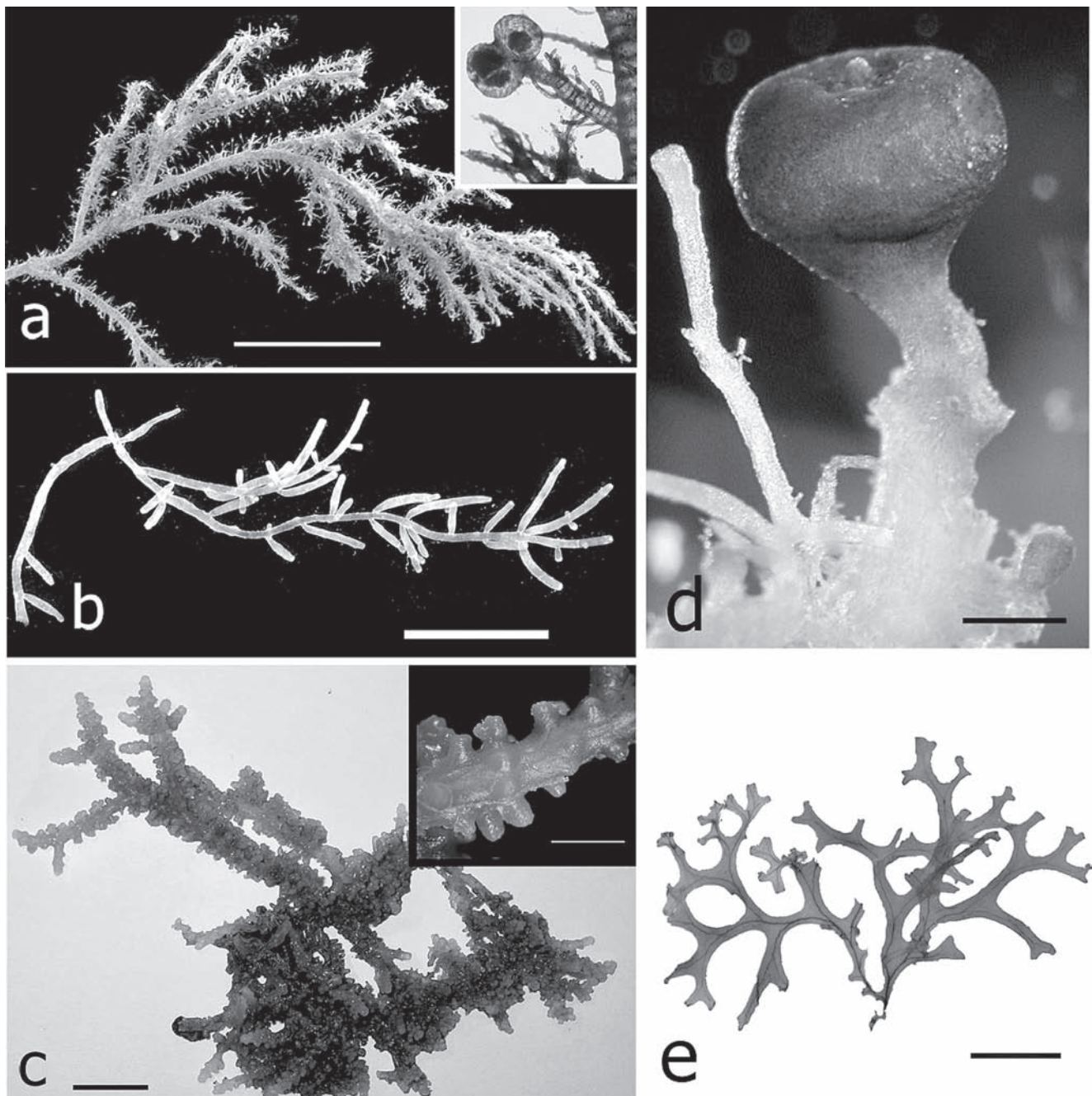


Fig. 5. Marine algae from Singapore waters. *Spyridia filamentosa*: a, wet habit of preserved material; *Chondria simpliciuscula*: b, wet habit of preserved specimen; *Chondrophycus papillosus*: c, wet habit of preserved specimen, with a close-up of thallus, showing short knobbier branchlets; *Acrocystis nana*: d, wet habit showing apical cell in terminal depression; *Dictyopteris repens*: e, habit of dry pressed material, with obvious mid-rib. Scale bars: a, c, d = 1 cm; b = 5 mm; e = 1 mm.

***Acrocystis nana* Zanardini, 1872**
(Fig. 5d)

Synonyms. – None known.

Type locality. – Tanjong Datu (Cape Datu), boundary between Sarawak (East Malaysia) and West Kalimantan (Indonesia).

Material examined. – Tanjung Hakim and Tanjung Lokos, St John's Island, high intertidal areas; on floating pontoon, St John's Island, 14 Jun.2004.

Description. – Plants small, up to 6.4 mm tall, forming loose aggregations. Branches are upright, terminating in hollow vesicle with apical cell in a terminal depression. Vesicles are light to dark brown in colour while branches are usually much paler.

Remarks. – Often confused with some species of *Botryocladia* for its vesiculate construction. This species is always simple and very rarely branching, with an apical depression of the vesicle as a reliable marker. Abundant amongst *Bostrychia* spp. in shaded rocks and boulders in the high intertidal areas.

PHAEOPHYTA

DICTYOTACEAE

***Dictyopteris repens* (Okamura) Børgesen, 1924**
(Fig. 5e)

Basionym. – *Haliseris repens* Okamura, 1916.

Synonym. – *Neurocarpus repens* (Okamura) Okamura, 1936.

Type locality. – Chuuk (Truk), Caroline Islands.

Material examined. – North Pandan Buoy, 11 Apr.2002; North-East Corridor Buoy, 4 Jul.2002; Tanjung Hakim, St John's Island, on intertidal reef flat, 8 Jun.2004.

Description. – Plants small, prostrate, entangled with other algae, sometimes bushy in appearance. Branches membranous, strap-shaped, with obvious midribs. Branching irregularly dichotomous.

Remarks – Similar in appearance to *D. delicatula* except in the broader branches and obvious creeping habit.

***Dictyopteris delicatula* Lamouroux, 1809: 332,**
(Fig. 2B, Pl. 6)

Synonyms. – *Haliseris delicatula* (Lamouroux) C. Agardh, 1820; *Dictyopteris hauckianus* Möbius, 1889.

Type locality. – Antilles, West Indies.

Material examined. – North Pandan Buoy, 11 Apr.2002; North-East Corridor Buoy, 4 Jul.2002; Tanjung Hakim, St John's Island,

on intertidal reef flat, 8 Jun.2004

Description. – Plants erect, small up to 5 cm tall, sometimes assurgent. Branches attaching to substratum or to each other at several points. Branching dichotomous to irregular, segments 0.5–5 mm broad, membranes 2 cells thick. Sori in single rows on either side of midrib.

Remarks. – This species shows greater internodal branch length than the preceding species.

***Lobophora variegata* (Lamouroux) Womersley**
ex Oliveira, 1977
(Fig. 6a)

Basionym. – *Dictyota variegata* Lamouroux, 1809.

Synonyms. – *Zonaria variegata* (Lamouroux) C. Agardh, 1817; *Zonaria nigrescens* Sonder, 1845; *Spatoglossum nigrescens* (Sonder) Kützinger, 1849; *Orthosorus nigrescens* (Sonder) Trevisan, 1849; *Zonaria latissima* Sonder ex Kützinger, 1859; *Pocockiella variegata* (J. V. Lamouroux) Papenfuss, 1943; *Pocockiella nigrescens* (Sonder) Papenfuss, 1943.

Type locality. – Antilles, West Indies.

Material examined. – Pulau Tekukor, at base of artificial seawall, 3 Dec.2002; South-western coast on St John's Island, found at the base of artificial seawall, Apr.2002; Pulau Satumu, low intertidal, on reef flat, 9 Oct.2002, 10 Nov.2003; Labrador Park, base of seawall and on boulders on natural shore, 23 Sep.2002.

Description. – Plant encrusting, orange brown to dark brown in colour, tightly adhering to substrata, bearing a very leathery feel. Sometimes may appear as fan-shaped blades, flabellate or as crusts. Thalli with an outermost layer of cortical cells, rectangular in transverse section, overlying the larger internal medullary cells. Usually two cortical cells overlying each medullary cell.

Remarks. – Plants found on the higher intertidal tend to feel much harder and crisper than those found lower on the shore.

SARGASSACEAE

***Turbinaria decurrens* Bory de Saint-Vincent, 1828**
(Fig. 6 b, c)

Synonyms. – *Turbinaria vulgaris* var. *decurrens* (Bory de Saint-Vincent) J. Agardh, 1848.

Type locality. – In the sea between Tahiti and New Guinea.

Material examined. – Pulau Tekukor, at base of artificial seawall, 3 Dec.2002; South-western coast on St John's Island, found at the base of artificial seawall, Apr.2002; Pulau Satumu, low intertidal, on reef flat, 9 Oct.2002

Description. – Plant erect, yellow to dark brown in colour,

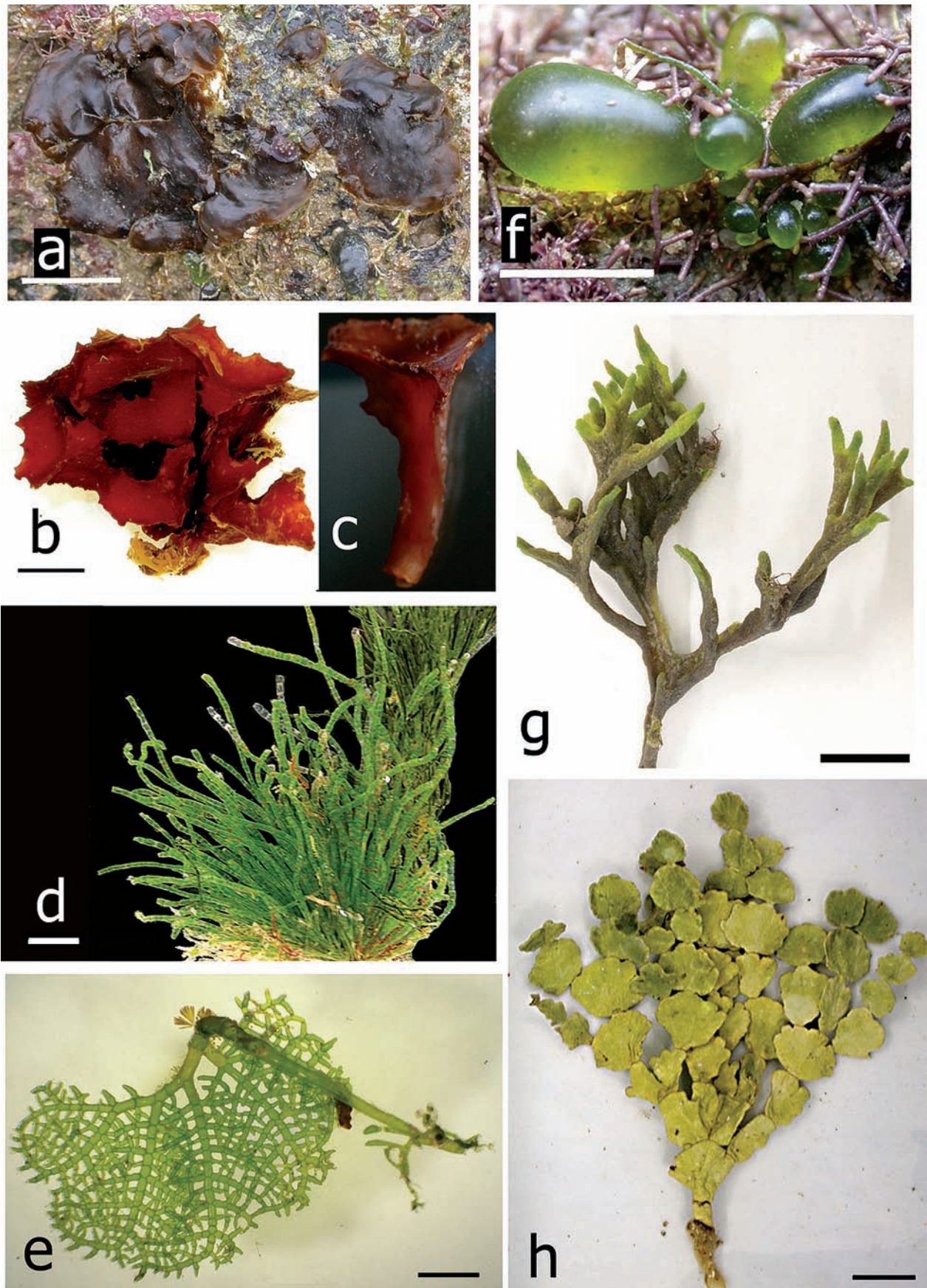


Fig. 6. Marine algae from Singapore waters. *Lobophora variegata*: a, habit of plant showing leathery encrusting appearance; *Turbinaria decurrens*: b, wet habit of plant, c, close up of single thallus; *Chaetomorpha antennina*: d, wet habit of plant with tufted appearance; *Phyllocladon anastomosans*: e, wet habit showing blade formed from an intricate network of filaments; *Boergesenia forbesii*: f, wet habit; *Cladophoropsis vaucheriaeformis*: g, wet habit; *Halimeda macroloba*: h, wet habit of plant showing distinct holdfast. Scale bars: a, f = 1 cm, b, d, e = 5 mm; c not to scale; g, h = 2 cm.

arising from single holdfast. Leaves are pyramidal in cross section, triangular in surface view, with concave surface.

Remarks. – One of the easiest species of the family Sargassaceae to identify. The obpyramidal leafy parts are distinctive for this species.

CHLOROPHYTA

CLADOPHORACEAE

***Chaetomorpha antennina* (Bory de Saint-Vincent)
Kützinger, 1847
(Fig. 6d)**

Basionym. – *Conferva antennina* Bory de Saint-Vincent, 1804.

Synonyms. – *Conferva media* C. Agardh, 1824; *Chaetomorpha media* (C. Agardh) Kützinger, 1849.

Type locality. – Reunion Island.

Material examined. – North-East Corridor Buoy, 4 Jul.2002.

Description. – Plants small, filamentous, unbranched, forms tufts. Attached to substrata by rhizoidal filaments. Consist of small cylindrical cells, between 400–600 microns long and between 200–300 microns in diameter.

Remarks. – Unlike other *Chaetomorpha* spp. found in Singapore, which commonly forms loose amorphous coils, *C. antennina* is usually present in tufts.

BOODLEACEAE

***Boodlea composita* (Harvey) F. Brand, 1904**

Basionym. – *Conferva composita* Harvey, 1834.

Synonyms. – *Cladophora composita* (Harvey) Kützinger, 1849; *Aegagropila composita* (Harvey) Kützinger, 1854; *Boodlea siamensis* Reinbold, 1901; *Boodlea kaeneana* Brand, 1904.

Type locality. – Mauritius.

Material examined. – Marina South, mouth of Marina Bay, on revetment of artificial seawall, 19 Mar.2003.

Description. – Plant spongiouse in form, consisting of richly branching uniseriate filaments. Branching pinnate to irregular in portions where branches anastomose with each other, resulting in a matted appearance.

Remarks. – Plant bears a slightly crispy feel.

***Phyllocladon anastomosans* (Harvey) Kraft & Wynne,
1996
(Fig. 6e)**

Basionym. – *Cladophora anastomosans* Harvey, 1859.

Synonyms. – *Struvea delicatula* Kützinger, 1866; *Pterodictyon anastomosans* (Harvey) Gray, 1866; *Struvea anastomosans* (Harvey) Piccone & Grunow ex Piccone, 1884.

Type locality. – Fremantle, Western Australia.

Material examined. – Tanjung Hakim, St John's Island, on intertidal reef flat, epilithic, 8 Jun.2004.

Description. – Plant small, < 1 cm high, dark green in colour, forming dense entangled clumps, sometimes amorphous. Attached to substrata via a stoloniferous base bearing multiple rhizoids. Blades mesh-like, bearing a network of branchlet filaments, frequently attaching and reattaching to itself and to other filaments.

Remarks. – The leafy blade is characteristic for this species.

Family Siphonocladaceae

***Boergesenia forbesii* (Harvey) Feldmann, 1938
(Fig. 6f)**

Basionym. – *Valonia forbesii* Harvey, 1860.

Synonym. – *Pseudovalonia forbesii* (Harvey) Iyengar, 1938.

Type locality. – Sri Lanka.

Material examined. – Tanjung Hakim, St John's Island, on intertidal reef flat, epilithic, 8 Jun.2004.

Description. – Plants made up of fluid-filled vesicles, up to 3 cm tall, solitary or forming colonies. Vesicles may be pear- or club-shaped, bright green in colour, smooth and shiny when fresh. Attached to substratum by short stalk at the basal portion, forming a disc-like holdfast.

Remarks. – A highly seasonal species, easily identified by its distinctive club-shaped, liquid-filled branches.

***Cladophoropsis vaucheriaeformis* (J. E. Areschoug)
Papenfuss, 1958
(Fig. 6g)**

Basionym. – *Spongocladia vaucheriaeformis* J.E. Areschoug, 1854.

Synonyms. – *Spongodendron dichotomum* Zanardini, 1878; *Spongodendron crassum* Zanardini, 1878; *Spongocladia dichotoma* (Zanardini) Murray & Boodle, 1888; *Spongocladia neocaledonica* Grunow ex G. Murray & Boodle, 1888; *Cladophoropsis dichotoma* (Zanardini) Papenfuss, 1958; *Cladophoropsis neocaledonica* (Grunow ex G. Murray & Boodle) Papenfuss, 1958.

Type locality. – Mauritius.

Material examined. – Pulau Hantu Besar, lagoon in the north-

western side of island, 17 Jun.2002.

Description. – Plant tall, up to 15 cm high, composed of interwoven filaments that are held together in an organic matrix. Filaments are irregularly branched, without cross walls separating branchlets from main axes. Plants commonly occurring with a sponge symbiont, *Halichondria cartilaginia* (Halichondridae).

Remarks. – Plant often confused with a sponge due to the amount of sponge material present. Not to be confused with *Certaodictyon* sp., that also has a sponge symbiont (*Haliclona* sp.). The appearance of *Ceratodictyon* sp. is marked by the superficial appearance of ostioles that is not observed in *Cladophoropsis vaucheriaeformis*.

VALONIACEAE

Valonia aegagropila C. Agardh, 1823

Synonyms. – None known.

Type locality. – Venice, Italy.

Material examined. – St John's Island, on floating pontoon, 14 Jun.2004.

Description. – Plant small, bright green to dark green in colour, small, forming tight clumps. Plant composed of vesicular club-shaped segments that are arranged in tiers.

Remarks. – This species form tightly adhering clumps that are often lodged securely into the substratum.

HALIMEDACEAE

Halimeda fragilis Taylor, 1950

Synonyms. – None known.

Type locality. – Elugelab Island, Eniwetok Atoll, Marshall Islands.

Material examined. – Pulau Tekukor, on intertidal reef edge, 2002.

Description. – Plants erect, up to 4 cm tall, heavily calcified. Branching occurs in more than one plane, resulting in compact appearance. Basal segment cylindrical to reniform, sometimes inconspicuous. Branch segments mostly reniform in shape, two or more segments may arise from a single segment.

Remarks. – Among the *Halimeda* species encountered in this study, this species has an inconspicuous holdfast.

Halimeda macroloba Decaisne, 1841

(Fig. 6h)

Synonym. – *Halimeda macroloba* var. *ecalcareia* Weber-van Bosse, 1926.

Type locality. – Red Sea.

Material examined. – intertidal reef flat, north of Pulau Tekong, East Johore Straits, 30 May 2002; Tanjung Hakim, St John's Island, on intertidal reef flat, epilithic, 8 Jun.2004.

Description. – Plant erect, up to 12.5 cm tall, moderately to heavily calcified. Branching occurring only in one plane. Holdfast bulbous, basal segment rectangular, other segments larger (up to 27 mm wide and 17 mm high) and compressed, commonly flabellate.

Remarks. – Thickly calcified segments and a large, bulbous holdfast coated with sand characterize this species.

POLYPHYSACEAE

Parvocaulis parvulus (Solms-Laubach) S. Berger, U. Fettweiss, S. Gleissberg, L. B. Liddle, U. Richter, H. Sawitsky, H. & G. C. Zuccarello, 2003 (Fig. 7a, b)

Synonyms. – *Acetabularia parvula* Solms-Laubach, 1895; *Acetabularia moebii* Solms-Laubach, 1895.

Type locality. – Sulawesi, Indonesia.

Material examined. – Tanjung Hakim, St John's Island, on intertidal reef flat, epilithic, 8 Jun.2004.

Description. – Plants small, up to 10 mm tall, composed of slightly calcified stalk and a flat to shallow saucer-shaped cap. Each cap consisting of 14 to 19 gametangial rays, each ray attached with the adjacent rays by calcium carbonate. Rays appear slightly club-shaped, widest at the rounded tip.

Remarks. – A minute species that is easily overlooked in the field, however due to its small size and the arrangement of the rays, it is also easily recognisable from the other similar species found in the region. These include *Acetabularia dentata*, *A. major*, *A. ryukyuensis*, *A. toxasii*, *Parvocaulis polyphysoides*, *P. clavatus* and *A. calyculus* that have been recorded from Philippines (Silva et al., 1987). The latter two species were also recorded Vietnam (Pham, 1969; Tsuitsui et al., 2005), while *A. dentata*, *A. major*, *P. clavatus* and *P. polyphysoides* were also recorded from Indonesia.

ANADYOMENACEAE

Anadyomene sp. (Fig. 7c, d)

Material examined. – Tanjung Hakim, St John's Island, on intertidal reef flat, epilithic, 8 Jun.2004.

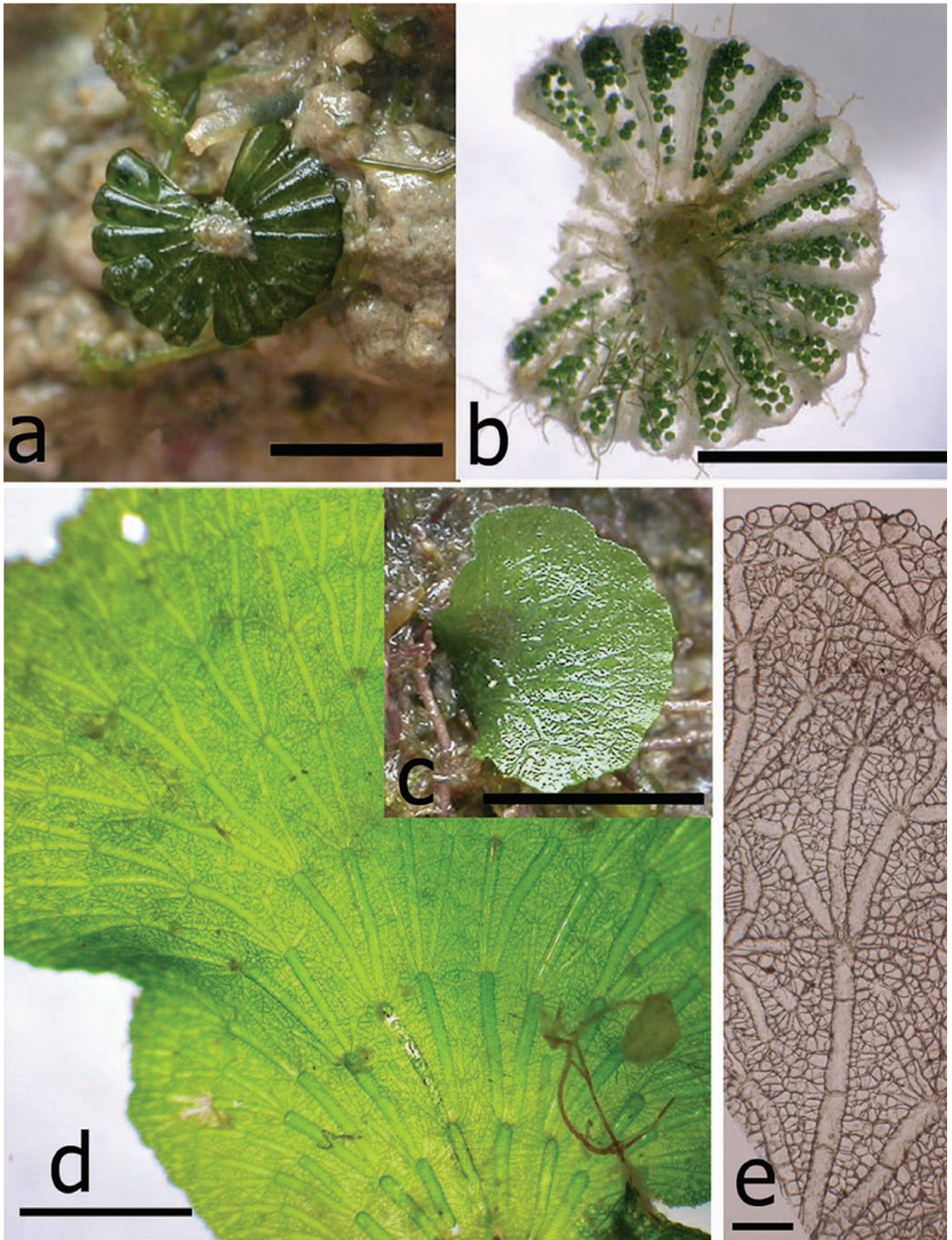


Fig. 7. Marine algae from Singapore waters. *Parvocaulis parvulus*: a, plant attached to rocks; b, showing gametangial rays; *Anadyomene* sp.: c, plant attached to rocks; d, whole mount of blade; e, close up of blade showing branching pattern. Scale bars = a, b, d = 5 mm; c = 500 μ m; e = 200 μ m.

Description. – Plants small, up to 2 cm high, bright green in colour. Blades fan shaped, corticated, consisting of two layers of cell, eperforate, main veins composed of single uniseriate chains of cells, elongate in appearance, branching polychotomously especially at base, interstitial cells randomly arranged, oval shape in cross section, outer margin formed by small ellipsoidal cells.

Remarks. – A seemingly rare species, it has a few congeners in Southeast Asia that likewise require further study. The present specimen is not given a specific name pending examination of comparative material.

DISCUSSION

This present collection represents a significant addition to the existing list of marine algae recorded from Singapore waters. Out of the 42 records presented here, all but four are new. The list presented here is by no means comprehensive as members of the benthic Cyanophyobacteria and the seagrass as well as any records of *Sargassum* are excluded. In addition, the collection of the material has been limited to intertidal areas and artificial floating structures. Numerous reef-associated species present in Singapore were not included in this list. However, of the 41 records of algae presented in this list, a total of nine genera are new records for Singapore. This is likely an indication of the high seaweed biodiversity characteristic for the Indo-Pacific region including Singapore (Silva et al., 1996). The occurrence of many of these species in Singaporean waters, including some reported in this report, is subject to much speculation. The introduction of exotic marine algae may be variously attributable to aquarium trade, aquaculture and/or shipping vectors. Being one of the world's busiest international sea ports, the waters around Singapore without doubt play host to introduced marine species including seaweeds, whose spores or propagules have been brought in together with ship ballast waters or through hull fouling. This phenomenon has been documented in many regions around the world wherein exotic and invasive seaweed species have established with certainty (Shaffelke et al., 2006).

Some of these recently recorded species from Singapore may have the potential to become invasive in the near future and could have serious ecological consequences (Casas et al., 2004). However, there is no easy way to determine which species are recently introduced, due to the paucity of earlier records in Singaporean waters. Information on the aggressiveness and invasive potentials of some of these species will need to be gleaned from plant demographic reports from other areas, or subjected to ecological experiments testing the effects of different environmental parameters on their growth and reproduction. Most of the studies on invasive seaweeds have focused on temperate species, while documentation of invasive tropical species is poor or non-existent. The few reports from the tropics are limited to economic species deliberately introduced to tropical locales for aquaculture purposes (Shaffelke et al., 2006). It would therefore be interesting to document

potentially invasive species in Singapore waters where shipping as a vector plays an important role. The data presented in this paper represent an initial step towards that direction.

In terms of biogeography, the occurrence of 11 of the species presented here provides an extension to the previously known biogeographic distribution. *Acrochaetium hypneae*, *Asparagopsis taxiformis*, *Ceramium flaccidum* and *Dictyopteris delicatula* were previously recorded from the Philippines (Silva et al., 1987) and Vietnam (Pham, 1969; Abbott et al., 2002); *Botryocladia skottsbergii* and *Coelothrix irregularis* were recorded only from the Philippines (Silva et al., 1987; Kraft et al. 1999); while *Chondria simpliciuscula* and *Gracilaria fisheri* were recorded from Vietnam (Pham, 1969; Ohno et al., 1999; Abbott et al., 2002). The latter species was also recorded from Thailand, along with *G. rhodymenioides* (Lewmanomont & Chirapart, 2004); while *C. flaccidum* was also recorded from Myanmar (Silva et al., 1996). The occurrence of these species in Singapore increases the range of these species to the southern region of the Indo-Malaysian Archipelago. Prior to this collection, both *G. corticata* and *Chrysomenia procumbens* have not been previously recorded from the South-East Asia region. Distribution of *G. corticata* was previously limited to the African continent and the Indian Ocean (e.g. Børgesen, 1943; Silva et al., 1996) while *C. procumbens* was recorded from China (Xia & Zhang, 1999), Hawaii (Abbott, 1999) and Solomon Islands (Littler & Littler, 2003).

Land reclamation is commonplace around Singapore except in the northern shore bordering the Straits of Johore. In the mangrove areas there, the rich macro algal flora is well developed due to the availability of suitable, relatively undisturbed substrata for algal colonization and yielding recent new records (West, 1991). It is well known that land reclamation impacts benthic communities including marine algae by addition of new land fillings, obliterating bottom attachment surfaces and reducing light penetration. Therefore the availability of artificial port structures like buoys and other floating navigational aids as well as seawalls associated with land reclamation provides additional habitats on which marine algae and other organisms can colonize. These artificial structures may well host certain species with selective substratum preferences not otherwise found in natural substratum in Singaporean waters, although this requires further study and monitoring.

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Table 1. Checklist of marine algae reported from the coasts of Singapore, with sources provided. New records are indicated with double asterisks (**) and previous records that are included in this report is marked with a single asterisk (*). Species that were previously recorded and that were also recorded in the course of this study are marked with a tick mark (✓).

Taxa		Source
Cyanophyta		
Family Mastigocladales		
✓ <i>Brachytrichia quoyi</i> (C. Agardh) Bornet & Flahault		M
<i>Mastigocladus Cohn</i>		S
Family Nostocaceae		
<i>Anabaena licheniformis</i> Bory de Saint-Vincent		E, M, S
<i>Nostoc commune</i> Vaucher ex Bornet & Flahault		E, M, S
Family Rivulariaceae		
<i>Gardnerula spongiosa</i> (Zanardini) Tsedng & Hua		M
Family Microcystaceae		
<i>Microcystis zanardinii</i> (Hauck) P. Silva		M
<i>Microcystis zanardinii</i> (Hauck) P. Silva [Syn: <i>Anacystis aeruginosa</i> (Zanardini) Drouet & Daily]		E, S
Family Entophysalidaceae		
<i>Entophysalis</i> Kützinger		S
Family Oscillatoriaceae		
<i>Lyngbya noronhae</i> Dickie ex Forti [Syn: <i>Lyngbya noronhae</i> Dickie]		E
<i>Oscillatoria lutea</i> C. Agardh		S
Family Phormidiaceae		
<i>Porphyrosiphon luteus</i> (Gomont) Anagnostidis & Komárek [Syn: <i>Lyngbya lutea</i> (C. Agardh) Areschoug]		M
<i>Porphyrosiphon luteus</i> (Gomont) Anagnostidis & Komárek [Syn: <i>Oscillatoria lutea</i> C. Agardh]		E
Family Merismopediaceae		
<i>Merismopedia thermalis</i> Kützinger		M, S
Family Microsporaceae		
<i>Microspora stagnorum</i> (Kützinger) Lagerheim		J

	Taxa	Source
	Family Schizotrichaceae	
	<i>Schizothrix arenaria</i> (Berkeley) Gomont	E, M, S
	<i>Schizothrix calcicola</i> (C. Agardh) Gomont ex Gomont	E, M, S
	<i>Schizothrix mexicana</i> Gomont	E, M, S
	Family Scytonemataceae	
	<i>Scytonema hofmann-bangii</i> C. Agardh ex P.C. Silva	M, S
	Family Pseudanabaenaceae	
	<i>Spirulina subsalsa</i> Ørsted	E
	Rhodophyta	
	Family Erythrotrichiaceae	
	<i>Erythrotrichia carnea</i> (Dillwyn) J. Agardh	E, M, S
	<i>Sahlingia subintegra</i> (Rosenvinge) Kornmann	M
**	Family Acrochaetiaceae	
	<i>Acrochaetium hypneae</i> (Børgesen) Børgesen	
**	Family Bonnemaisoniaceae	
	<i>Asparagopsis taxiformis</i> (Delile) Trevisan de Saint Léon	
**	Family Galaxauraceae	
	<i>Tricleocarpa cylindrica</i> (Ellis & Solander) Huisman & Borowitzka	
	<i>Galaxaura rugosa</i> (Ellis & Solander) Lamouroux	M
**	Family Gelidiaceae	
	<i>Pterocladia capillacea</i> (Gmelin) Santelices & Hommersand	
	<i>Gelidium amansii</i> (Lamouroux) Lamouroux	M
	<i>Gelidium pusillum</i> (Stackhouse) Le Jolis	M
✓	Family Gelidiellaceae	
	<i>Gelidiella acerosa</i> (Forsskål) Feldmann & G. Hamel	M

	Taxa	Source
Family Rhizophyllidaceae		
**	<i>Portieria hornemannii</i> (Lyngbye) Silva	
Family Gracilariaceae		
	<i>Gracilaria blodgettii</i> Harvey	E, M
	<i>Gracilaria bursa-pastoris</i> (S.G. Gmelin) P.C. Silva	M
	<i>Gracilaria canaliculata</i> Sonder	M
	<i>Gracilaria canaliculata</i> Sonder [Syn: <i>Gracilaria crassa</i> Harvey ex J. Agardh]	E
*	<i>Gracilaria changii</i> (Xia & Abbott) Abbott, Zhang & Xia	I
**	<i>Gracilaria corticata</i> (J. Agardh) J. Agardh	
	<i>Gracilaria cacialia</i> (J. Agardh) Dawson	S
	<i>Gracilaria coronapifolia</i> J. Agardh	I M, S
✓	<i>Gracilaria crassa</i> Harvey ex J. Agardh	S
✓	<i>Gracilaria gracilis</i> (Stackhouse) M. Steentoft, L.M. Irvine & W.F. Farnham [Syn: <i>Gracilaria verrucosa</i> (Hudson) Papenfuss]	M
**	<i>Gracilaria rhodomenioides</i> Millar	
✓	<i>Gracilaria salicornia</i> (C. Agardh) E.Y. Dawson	I M
	<i>Gracilaria salicornia</i> (D.Adgardi) E.Y. Dawson [Syn: <i>Gracilaria cacialia</i> (J. Agardh) E.Y. Dawson]	E
	<i>Gracilaria urvellei</i> (Montagne) Abbott, Zhang et Xia	I M, S
✓	<i>Hydropuntia edulis</i> (S.G. Gmelin) Gurgel & Fredericq [Syn: <i>Gracilaria edulis</i> (S.G. Gmelin) P.C. Silva]	I, M, S
	<i>Hydropuntia edulis</i> (S.G. Gmelin) Gurgel & Fredericq [Syn: <i>Gracilaria lichenoides</i> f. <i>taenioides</i> (J. Agardh) V. May]	M
	<i>Hydropuntia edulis</i> (S.G. Gmelin) Gurgel & Fredericq [Syn: <i>Gracilaria lichenoides</i> Greville]	E
Family Haymeniaceae		
✓	<i>Halymenia durvillei</i> Bory de Saint-Vincent	A, M, N
**	<i>Halymenia dilatata</i> Zanardini	
	<i>Halymenia floresia</i> (Clemente y Rubio) C. Agardh	E, M, S
	<i>Halymenia formosa</i> Harvey ex Kützinger	M, S
*	<i>Halymenia maculata</i> J. Agardh	N
	<i>Halymenia microcarpa</i> (Montagne) P.C. Silva	M
	<i>Halymenia microcarpa</i> (Montagne) P. Silva [Syn: <i>Halymenia durvillei</i> Bory de Saint-Vincent var. <i>ceylanica</i> Kützinger (Harvey ex Kützinger)]	E, S
**	<i>Halymenia formosa</i> Harvey ex Kützinger [Syn: <i>Halymenia durvillei</i> var. <i>formosa</i> (Harvey ex Kützinger) Reinbold]	M
	<i>Grateloupia filicina</i> (Lamouroux) C. Agardh	
Family Peyssonneliaceae		
**	<i>Peyssonnelia rubra</i> (Greville) J. Agardh	

	Taxa	Source
**	<i>Peyssonnelia inamoena</i> Pilger	
	Family Corallinales	
✓	<i>Amphiroa anceps</i> (Lamarck) Descaisne	M
✓	<i>Amphiroa foliacea</i> var. <i>erecta</i> Weber-van Bosse	M
✓	<i>Amphiroa fragilissima</i> (Linnaeus) Lamouroux	C, E, M, S
✓	<i>Amphiroa rigida</i> Lamouroux	E, M, S
	<i>Jania verrucosa</i> Lamouroux	M
	Family Hapalidiaceae	
	<i>Melobesia membranacea</i> (Esper) Lamouroux	M
	<i>Mesophyllum erubescens</i> (Foslie) Lemoine	M
	<i>Mesophyllum erubescens</i> (Foslie) Lemoine [Syn: <i>Lithothamnion erubescens</i> Foslie]	A
	Family Caulacanthaceae	
	<i>Catenella caespitosa</i> (Withering) Irvine	M
	<i>Catenella impudica</i> (Montagne) J. Agardh	M, S
	<i>Catenella nipae</i> Zanardini	M, S
	<i>Caulacanthus ustulatus</i> (Mertens ex Turner) Kützinger	M
	Family Hypneaceae	
✓	<i>Hypnea esperi</i> Bory de Saint-Vincent	E, M, S
	<i>Hypnea musciformis</i> (Wulfen) Lamouroux	M
✓	<i>Hypnea spinella</i> (C. Agardh) Kützinger	E, S
	Family Solieriaceae	
	<i>Eucheuma arnoldii</i> Weber-van Bosse	M
	<i>Eucheuma arnoldii</i> Weber-van Bosse [Syn: <i>Eucheuma cupressoideum</i> Weber-van Bosse]	C, S
	<i>Eucheuma crassum</i> Zanardini	M
	<i>Eucheuma denticulatum</i> (N.L. Burman) F.S. Collins & Hervey	M
	<i>Eucheuma denticulatum</i> (N.L. Burman) F.S. Collins & Hervey [Syn: <i>Eucheuma muricatum</i> (S.G. Gmelin) Weber-van Bosse]	A
	<i>Eucheuma edule</i> (Kützinger) Weber-van Bosse	A, M
	<i>Eucheuma horridum</i> J. Agardh	M
	<i>Kappaphycus striatum</i> (F. Schmitz) Doty ex P.C. Silva	A, M
✓	<i>Solieria robusta</i> (Greville) Kylin	E, M, S

	Taxa	Source
	Family Lomentariaceae	
**	<i>Gelidiopsis intricata</i> (C. Agardh) Vickers	
	<i>Ceratodictyon spongiosum</i> Zanardini	M
	Family Rhodymeniaceae	
**	<i>Botryocladia skottsbergii</i> (Børgesen) Levring	
**	<i>Botryocladia leptopoda</i> (J. Agardh) Kylin	
**	<i>Chrysmenia procumbens</i> Weber-van Bosse	
**	<i>Coelothrix irregularis</i> (Harvey) Børgesen	
	Family Delesseriaceae	
	<i>Caloglossa adhaerens</i> R.J. King & Puttock	M
	<i>Caloglossa angustalata</i> J.A. West	M
	<i>Caloglossa beccarii</i> (Zanardini) De Toni	M
	<i>Caloglossa bengalensis</i> (G. Martens) King & Puttock	M
	<i>Caloglossa lepreurii</i> (Montagne) G. Martens	M, P
	<i>Caloglossa ogasawaraensis</i> Okamura	M
	<i>Caloglossa saigonensis</i> Tanaka & Hô [Syn: <i>Caloglossa monosticha</i> Kamiya]	P
	<i>Caloglossa stipitata</i> Post	M
	<i>Caloglossa vieillardii</i> (Kützinger) Setchell [Syn: <i>Caloglossa lepreurii</i> var. <i>hookeri</i> Post]	M
	Family Sebdeniaceae	
	<i>Sebdenia amoena</i> (Bory) E. Soler-Onís [Syn: <i>Halymenia amoena</i> Bory de Saint-Vincent]	M
	Family Ceramiaceae	
**	<i>Ceramium flaccidum</i> (Harvey ex Kützinger) Ardisson	
**	<i>Centroceras clavulatum</i> (C. Agardh) Montagne	
	<i>Corallophila huysmansii</i> (Weber-van Bosse) R. Norris	
	<i>Corallophila huysmansii</i> (Weber-van Bosse) R. Norris [Syn: <i>Ceramium huysmansii</i> Weber-van Bosse]	M
**	<i>Griffithsia</i> cf. <i>ovalis</i> Harvey	E, S
**	<i>Spyridia filamentosa</i> (Wulfen) Harvey	
	Family Dasyaceae	
**	<i>Heterosiphonia crispella</i> (C. Agardh) Wynne	

	Taxa	Source
Family Rhodomelaceae		
✓	<i>Acanthophora muscoides</i> (Linnaeus) Bory de Saint-Vincent	E, M, S
✓	<i>Acanthophora spicifera</i> (Vahl) Børgesen	A, C, E, M, S
	<i>Acanthophora spicifera</i> (Vahl) Børgesen [Syn: <i>Acanthophora orientalis</i> J. Agardh]	E, S
	<i>Bostrychia calliptera</i> (Montagne) Montagne	M, R.
	<i>Bostrychia calliptera</i> (Montagne) Montagne [Syn: <i>Bostrychia pinnata</i> J. Tanaka & Chihara]	M
	<i>Bostrychia kelanensis</i> Grunow [Syn: <i>Stictosiphonia kelanensis</i> (Grunow ex Post) King & Puttock]	M
	<i>Bostrychia moriziana</i> (Sonder ex Kützinger) J. Agardh	M, S
	<i>Bostrychia radicans</i> (Montagne) Montagne	M
	<i>Bostrychia simpliciuscula</i> Harvey ex J. Agardh	M, R.
✓	<i>Bostrychia tenella</i> (Lamouroux) J. Agardh	M
	<i>Bostrychia tenella</i> (Lamouroux) J. Agardh [Syn: <i>Bostrychia binderi</i> Harvey]	E, S
**	<i>Chondria simpliciuscula</i> Weber-van Bosse	
	<i>Chondria riparia</i> (J. Agardh) De Toni	M
	<i>Laurencia microcladia</i> Kützinger	S
	<i>Laurencia botryoides</i> (C. Agardh) Gaillon	M
	<i>Laurencia microcladia</i> Kützinger	M
	<i>Laurencia nsis</i> Zanardini ex De Toni & Levi	M
✓	<i>Leveillea jungermanniodes</i> (Herling & G. Martens) Harvey	E, M, S
	<i>Neosiphonia ferulacea</i> (Suhr ex J. Agardh) Guimaraes & Fujii [Syn: <i>Polysiphonia ferulacea</i> Suhr ex J. Agardh]	E, M, S
	<i>Polysiphonia howei</i> Hollenberg	M
	<i>Polysiphonia platycarpa</i> Børgesen	E, M, S
	<i>Herposiphonia parca</i> Setchell	M
	<i>Herposiphonia secunda</i> f. <i>tenella</i> (C. Agardh) M.J. Wynne	M
**	<i>Chondrophycus papillosus</i> (C. Agardh) Garbary & Harper	
**	<i>Acrocystis nana</i> Zanardini	
	<i>Murrayella pericladus</i> (C. Agardh) Schmitz	M
Phaeophyta		
Family Dictyotaceae		
✓	<i>Canistrocarpus cervicornis</i> (Kützinger) De Paula & De Clerk [Syn: <i>Dictyota cervicornis</i> Kützinger]	E, M, S
	<i>Dictyota bartayresiana</i> Lamouroux	E, M, S
	<i>Dictyota ciliolata</i> Sonder ex Kützinger	E, M, S
	<i>Dictyota ciliolata</i> Sonder ex Kützinger [Syn: <i>Dictyota beccariana</i> Zanardini]	M

	Taxa	Source
	<i>Dictyota lata</i> Lamouroux	M
	<i>Dictyotopsis propagulifera</i> Troll	M
*	<i>Dictyopteris repens</i> (Okamura) Børgesen	S
**	<i>Dictyopteris delicatula</i> Lamouroux	
	<i>Dictyopteris woodwardia</i> (Brown ex Turner) C. Agardh	M
**	<i>Lobophora variegata</i> (Lamouroux) Womersley ex Oliveira	
	<i>Padina antillarum</i> (Kützinger) Piccone	M
	<i>Padina antillarum</i> (Kützinger) Piccone [Syn: <i>Padina tetrastromatica</i> Hauck]	E, M, S
	<i>Padina boryana</i> Thivy	M
	<i>Padina boryana</i> Thivy [Syn: <i>Padina tenuis</i> Bory de Saint-Vincent]	E, F
	<i>Padina boryana</i> Thivy [Syn: <i>Padina commersonii</i> Bory de Saint-Vincent]	A, B, C, D, S
	<i>Padina gymnospora</i> (Kützinger) Sonder	E, M S
	<i>Styopodium zonale</i> (Lamouroux) Papenfuss	E, M, S
	Family Scytosiphonaceae	
✓	<i>Colpomenia sinuosa</i> (Mertens ex Roth) Derbès & Solier	A, C, D, M
	<i>Hydroclathrus clathratus</i> (C. Agardh) M.A. Howe	M
	<i>Hydroclathrus clathratus</i> (C. Agardh) M.A. Howe [Syn: <i>Hydroclathrus cancellatus</i> Bory de Saint-Vincent]	A
	Family Acinetosporaceae	
	<i>Feldmannia indica</i> (Sonder) Womersley & A. Bailey	M
	Family Sphacelariaceae	
	<i>Sphacelaria casespitula</i> Lyngbye	M, S
	<i>Sphacelaria indica</i> Reinke	M
	<i>Sphacelaria tribuloides</i> Meneghini	M
	Family Chordariaceae	
	<i>Trichocladia nostocoides</i> Zanardini	M
	Family Cystoseiraceae	
	<i>Hormophysa cuneiformis</i> (J. Gmelin) P.C. Silva	M
	<i>Hormophysa cuneiformis</i> (J. Gmelin) P. Silva [Syn: <i>Cystoseira prolifera</i> J. Agardh]	D, S
	<i>Hormophysa cuneiformis</i> (J. Gmelin) P. Silva [Syn: <i>Cystoseira triquetra</i> C. Agardh]	S

Taxa	Source
Family Sargassaceae	
<i>Sargassum angustifolium</i> D.Agardh	M, S
<i>Sargassum aquifolium</i> (Turner) D.Agardh	M, S
<i>Sargassum asperifolium</i> Hering & G. Martens ex J.Agardh	E, M, L, S
<i>Sargassum assimile</i> Harvey	M
<i>Sargassum baccharia</i> (Mertens) C. Agardh	H, L, M, O.
<i>Sargassum baccharia</i> var. <i>subcompressum</i> Grunow	M
<i>Sargassum belangeri</i> Bory de Saint-Vincent	M
<i>Sargassum biserrula</i> J. Agardh	H
<i>Sargassum biserrula</i> var. <i>singapoorensis</i> Grunow	M
<i>Sargassum brevifolium</i> var. <i>pergracile</i> Grunow	M
<i>Sargassum cervicorne</i> Greville	M
<i>Sargassum cinereum</i> J.Agardh	E, M, L, S
<i>Sargassum cristaeifolium</i> C. Agardh	M
<i>Sargassum cristaeifolium</i> C. Agardh [Syn: <i>Sargassum duplicatum</i> (J. Agardh) J. Agardh]	E, S
<i>Sargassum cristaeifolium</i> C. Agardh [Syn: <i>Sargassum duplicatum</i> Bory de Saint-Vincent]	L.
<i>Sargassum echinocarpum</i> J. Agardh	M
<i>Sargassum filifolium</i> C. Agardh	M
<i>Sargassum gaudichaudii</i> Montagne	M
<i>Sargassum glaucescens</i> J. Agardh	M
<i>Sargassum glaucescens</i> var. <i>ivanii</i> (Montagne) Grunow	M
<i>Sargassum gracile</i> J. Agardh	M
<i>Sargassum granuliferum</i> C. Agardh	M
<i>Sargassum granuliferum</i> var. <i>dubiosum</i> Grunow	M
<i>Sargassum ilicifolium</i> (Turner) C. Agardh	E, M, L, S
<i>Sargassum ilicifolium</i> var. <i>pseudospinosum</i> Grunow	M
<i>Sargassum ilicifolium</i> var. <i>venustum</i> Grunow	M
<i>Sargassum latifolium</i> (Turner) C. Agardh	M
<i>Sargassum myriocystum</i> J.Agardh	M, L S
<i>Sargassum microcystum</i> f. <i>dilatatum</i> Grunow	M
<i>Sargassum myriocystum</i> var. <i>grandifolium</i> Grunow	M
<i>Sargassum microphyllum</i> C. Agardh	M
<i>Sargassum obtusifolium</i> var. <i>reichelii</i> Grunow	M
<i>Sargassum odontocarpum</i> Sonder	M
<i>Sargassum oligocystum</i> Montagne	M, O.

	Taxa	Source
	<i>Sargassum oligocystum</i> Montagne [Syn: <i>Sargassum binderi</i> Sonder]	O.
	<i>Sargassum oocyste</i> var. <i>chierchii</i> Grunow	M
	<i>Sargassum parvifolium</i> (Turner) C. Agardh [Syn: <i>Carpacanthus parvifolius</i> (Turner) Kützinger]	H
	<i>Sargassum plagiophyllum</i> C. Agardh	M
	<i>Sargassum plagiophyllum</i> var. <i>hebetatum</i> Grunow	M
	<i>Sargassum plagiophyllum</i> var. <i>singapoorensis</i> Grunow	E, M, L O, S
✓	<i>Sargassum polycystum</i> C. Agardh	M
	<i>Sargassum parvifolium</i> (Turner) C. Agardh	M
	<i>Sargassum pseudocystocarpum</i> Grunow	M
	<i>Sargassum pulchellum</i> Grunow	M
	<i>Sargassum siliculosum</i> J. Agardh	A, C, H, K, M, O, S
	<i>Sargassum spathulaefolium</i> J. Agardh	E, M, L S.
	<i>Sargassum squarrosus</i> Greville	M, H
	<i>Sargassum subspatulatum</i> (Grunow) Grunow	M
	<i>Sargassum torvum</i> J. Agardh	E, M, S
	<i>Sargassum virgatum</i> D. Agardh	M, S
✓	<i>Turbinaria conoides</i> (J. Agardh) Kützinger	E, M, S
	<i>Turbinaria conoides</i> f. <i>laticuspidata</i> W.R. Taylor	M
	<i>Turbinaria conoides</i> f. <i>retroflexa</i> W.R. Taylor	M
**	<i>Turbinaria decurrens</i> Bory de Saint-Vincent	
	<i>Turbinaria murrayana</i> Barton	M
	<i>Turbinaria ornata</i> (Turner) J. Agardh	A, C, D, F, M, S
	<i>Turbinaria ornata</i> (Turner) J. Agardh var. <i>serrata</i> Jaassund	E, M, S
	<i>Turbinaria trialata</i> (J. Agardh) Kützinger	M
Chlorophyta		
Family Ulvaceae		
	<i>Enteromorpha ovata</i> Thivy & Visalaksmi ex H. Joshi & V. Krishnamurthy	E, M, S
	<i>Ulva beytensis</i> Thivy & Sharma	E, M, S
	<i>Ulva clathrata</i> (Roth) C. Agardh [Syn: <i>Enteromorpha clathrata</i> (Roth) Greville]	E, F, M, S
	<i>Ulva clathrata</i> (Roth) C. Agardh [Syn: <i>Enteromorpha muscoides</i> (Clemente y Rubio) Cremades]	M
	<i>Ulva fasciata</i> Delile	E, M, S
✓	<i>Ulva flexuosa</i> Wulfen [Syn: <i>Enteromorpha flexuosa</i> (Wulfen) J. Agardh]	M, S
	<i>Ulva flexuosa</i> Wulfen [Syn: <i>Enteromorpha lingulata</i> J. Agardh]	M
	<i>Ulva flexuosa</i> Wulfen [Syn: <i>Enteromorpha tubulosa</i> (Kützinger) Kützinger]	E

Taxa		Source
	<i>Ulva flexuosa</i> subsp. <i>paradoxa</i> (D.Agardh) M.J., Wynne [Syn: <i>Enteromorpha flexuosa</i> subsp. <i>paradoxa</i> (C. Agardh) Bliding]	M, S
✓	<i>Ulva flexuosa</i> subsp. <i>paradoxa</i> (C. Agardh) M.J. Wynne [Syn: <i>Enteromorpha plumosa</i> Kützinger]	E
✓	<i>Ulva intestinalis</i> Linnaeus [Syn: <i>Enteromorpha intestinalis</i> (Linnaeus) Nees]	E, M
	<i>Ulva lactuca</i> Linnaeus	E, M, S
✓	<i>Ulva lactuca</i> Linnaeus [Syn: <i>Ulva fenestrata</i> Postels & Ruprecht]	M.
✓	<i>Ulva pertusa</i> Kjellman	E, M, S
✓	<i>Ulva reticulata</i> Forsskål	B, C, E, F, M, S
Family Sphaeropleaceae		
	<i>Sphaeroplea</i> C. Agardh	S
Family Trentepoliaceae		
	<i>Trentepohlia rigidula</i> (J. Müller) Hariot	G
Family Dasycladaceae		
✓	<i>Bornetella oligospora</i> Solms-Laubach	M
✓	<i>Bornetella sphaerica</i> (Zanardini) Solms-Laubach	M
	<i>Neomeris annulata</i> Dickie	C, M
	<i>Neomeris bilimbata</i> J.T. Koster	M
	<i>Neomeris dumetosa</i> Lamouroux	M
	<i>Neomeris stipitata</i> Howe	M
	<i>Neomeris vanbosseae</i> Howe	M
Family Cladophoraceae		
**	<i>Chaetomorpha antennina</i> (Bory de Saint-Vincent) Kützinger	M, S
✓	<i>Chaetomorpha crassa</i> (C.Agardh) Kützinger	E, M, S
✓	<i>Chaetomorpha gracilis</i> Kützinger	E, M, S
✓	<i>Chaetomorpha linum</i> (Muller) Kützinger	M
	<i>Chaetomorpha ligustica</i> (Kützinger) Kützinger [Syn: <i>Rhizoclonium tortuosum</i> (Dillwyn) Kützinger]	E, M, S
	<i>Cladophora patentiramea</i> (Montagne) Kützinger	M
	<i>Cladophora sericea</i> (Hudson) Kützinger	E, M, S
	<i>Cladophora vagabunda</i> (Linnaeus) Hoek	M
	<i>Cladophora vagabunda</i> (Linnaeus) Hoek [Syn: <i>Cladophora mauritiana</i> Kützinger]	M
	<i>Cladophora viridifusca</i> (Montagne) Montagne	E
	<i>Rhizoclonium africanum</i> Kützinger	M

	Taxa	Source
	<i>Rhizoclonium grande</i> Børgesen	E,
	Family Boodleaceae	
**	<i>Boodlea composita</i> (Harvey) F. Brand	M, S
	<i>Boodlea montagnei</i> (Harvey ex J. Gray) Egerod	E
	<i>Boodlea montagnei</i> (Harvey ex J. Gray) Egerod [Syn: <i>Microdictyon montagnei</i> Harvey ex J. Gray]	
**	<i>Phyllocladon anastomosans</i> (Harvey) Kraft & Wynne	
	Family Codiaceae	
✓	<i>Codium arabicum</i> Kützting	E, C, M, S
	<i>Codium effusum</i> (Rafinesque) Chiaje	M
✓	<i>Codium geppiorum</i> O. Schmidt	E, M, S
	<i>Codium tomentosum</i> Stackhouse	M
	Family Siphonocladaceae	
**	<i>Boergesenia forbesii</i> (Harvey) Feldmann	M
	<i>Cladophoropsis herpestica</i> (Montagne) Kützting [Syn: <i>Cladophoropsis javanica</i> (Kützting) P.C. Silva]	E
	<i>Cladophoropsis herpestica</i> (Montagne) Kützting [Syn: <i>Cladophoropsis zollingerii</i> (Kützting) Reinbold]	S
	<i>Cladophoropsis javanica</i> (Kützting) P.Silva	E, M, S
	<i>Cladophoropsis membranaceae</i> (Hofman Bang ex C. Agardh) Børgesen	E, M, S
	<i>Cladophoropsis sundaensis</i> Reinbold	M, Q
*	<i>Cladophoropsis vaucheriaeformis</i> (J.E. Areschoug) Papenfuss	M
	<i>Cladophoropsis vaucheriaeformis</i> (J.E. Areschoug) Papenfuss [Syn: <i>Spongocladia vaucheriaeformis</i> Areschoug]	E, M, S
✓	<i>Dictyosphaeria cavernosa</i> (Forsskål) Børgesen	A, D,
	<i>Dictyosphaeria cavernosa</i> (Forsskål) Børgesen [Syn: <i>Dictyosphaeria favulosa</i> C. Agardh]	
	Family Valoniaceae	
**	<i>Valonia aegagropila</i> C. Agardh	M
	<i>Valonia fastigiata</i> Harvey ex J. Agardh	
	Family Bryopsidaceae	
✓	<i>Bryopsis corymbosa</i> J. Agardh	E, M, S
	<i>Bryopsis indica</i> A. Gepp & E.S. Gepp	E, M S
	<i>Bryopsis pennata</i> Lamouroux var. <i>lepreurii</i> (Kützting) Collins & Harvey	E, M, S
	<i>Bryopsis pennata</i> Lamouroux var. <i>secumda</i> (Harvey) Collins & Harvey	E, M, S

Taxa			Source
✓	<i>Bryopsis plumosa</i> (Hudson) C. Agardh <i>Derbesia fastigiata</i> W.R. Taylor		A, C, M, S S
Family Derbesiaceae			
	<i>Derbesia fastigiata</i> W.R. Taylor		M
Family Udoteaceae			
	<i>Boodleopsis carolinensis</i> Trono		M
✓	<i>Avrainvillea erecta</i> (Berkeley) A. Gepp & E. Gepp <i>Avrainvillea amadelpha</i> (Montagne) A. Gepp & E. Gepp		A, C, D, S M
✓	<i>Avrainvillea lacerata</i> Harvey ex J. Agardh <i>Avrainvillea obscura</i> (C. Agardh) J. Agardh		M M
✓	<i>Rhipidosiphon javensis</i> Montagne <i>Rhipidosiphon javensis</i> Montagne [Syn: <i>Udotea javensis</i> (Montagne) A. Gepp & E. Gepp		M E, S
	<i>Udotea argentea</i> Zanardini <i>Udotea flabellum</i> (J. Ellis & Solander) M.A. Howe <i>Udotea glaucescens</i> Harvey ex J. Agardh		M M M
Family Caulerpaceae			
✓	<i>Caulerpa lentilifera</i> J. Agardh		E, M, S
✓	<i>Caulerpa macrophysa</i> (Sonder ex Kützting) Murray [Syn: <i>Caulerpa racemosa</i> var. <i>macrophysa</i> (Sonder ex Kützting) Taylor]		M
✓	<i>Caulerpa mexicana</i> Sonder ex Kützting		M
✓	<i>Caulerpa peltata</i> Lamouroux		E, M, S
	<i>Caulerpa peltata</i> var. <i>macrodisca</i> (Decaisne) Weber-van Bosse		A, M
✓	<i>Caulerpa racemosa</i> (Forsskål) J. Agardh <i>Caulerpa racemosa</i> Forsskål J. Agardh [Syn: <i>Caulerpa racemosa</i> var. <i>clavifera</i> (C. Agardh) Weber-van Bosse]		A, C, M, S E
✓	<i>Caulerpa racemosa</i> (Forsskål) J. Agardh var. <i>turbinata</i> (J. Agardh) Eubank <i>Caulerpa serrulata</i> (Forsskål) J. Agardh		E, M, S E, M, S
✓	<i>Caulerpa serrulata</i> (Forsskål) J. Agardh [Syn: <i>Caulerpa freycinetii</i> C. Agardh]		A,
✓	<i>Caulerpa sertularioides</i> (S. Gmelin) Howe <i>Caulerpa taxifolia</i> (Vahl) C. Agardh <i>Caulerpa verticillata</i> J. Agardh		E, F, M, S A, E, M, S E, M, S
Family Halimedaceae			
	<i>Halimeda discoidea</i> Decaisne		M

	Taxa	Source
**	<i>Halimeda fragilis</i> Taylor	
	<i>Halimeda gracilis</i> Harvey ex J. Agardh	
**	<i>Halimeda macroloba</i> Decaisne	M
✓	<i>Halimeda opuntia</i> (Linnaeus) Lamouroux	
	<i>Halimeda opuntia</i> (Linnaeus) Lamouroux var. <i>minor</i> Vickers	A, C, E, F, M, S
	<i>Halimeda papyracea</i> Zanardini	S
✓	<i>Halimeda tuna</i> (Ellis & Solander) Lamouroux	M
		A, M, S
	Family Polyphysaceae	
	<i>Acetabularia parvula</i> Solms-Laubach	M
*	<i>Parvocaulis parvulus</i> (Solms-Laubach) S. Berger, U. Fottweiss, S. Gleissberg, L. B. Liddle, U. Richter, H. Sawitsky, H. & G. D. Zuccarello	M
	Family Anadyomenaceae	
**	<i>Anadyomene</i> Lamouroux.	
Mognoliophyta		
	Family Hydrocharitaceae	
	<i>Halophila ovalis</i> (Brown) Hooker	B, D
	<i>Enhalus</i> sp.	B, D
	Family Cymodoceaceae	
	<i>Cymodocea rotundata</i> Ehrenberg & Hemprich ex Ascherson	B, D, F,

Sources:

- A, Purchon & Enoch, 1954
 B, Chuang, 1961
 C, Lee, 1966
 D, Chuang, 1977
 E, Teo & Wee, 1983
 F, Chou & Wong, 1984
 G, Sarma, 1986
 H, Tseng & Lu, 1992a, b
 I, Phang, 1994
 J, Ettl & Gärtner, 1995
 K, Phang et al., 1995
 L, Phillips, 1995
 M, Silva et al., 1996
 N, Abbott, 1999
 O, Ajisaka, 2002
 P, Kamiya et al., 2003
 Q, Leliaert & Coppejans, 2006
 R, Zuccarello & West, 2006
 S, Phang et al., 2007

Table 2. List of the collection areas, associated waterways and the geographical coordinates for the material examined.

Type	Site Name	Area/ waterway	Coordinates
Buoy	North Pandan	East Jurong Fairway	1°15.780'N 103°45.185'E
	Kuala	Kallang Basin Approach	1°16.679'N 103°52.630'E
	Paku	Johore Straits eastern approach	1°60.142'N 103°23.539'E,
	Berkas	Raffles Reserve anchorage	1°44.671'N 103°44.348'E
	Lower Shoal	East Keppel Fairway	1°14.679'N 103°52.180'E
	North-East Corridor	Eastern Roads	1°15.429'N 103°53.814'E
	CAAS (Changi)	Johore Straits eastern approach	1°23.676'N 103°59.596'E
Intertidal/ Artificial seawall	St John's Island	Tanjung Hakim, Sisters' Fairway	1°13.405'N 103°50.729'E
	St John's Island	South-western coast, Sisters' Fairway	1°12.933'N 103°50.930'E
	Pulau Tekukor	Sisters' Fairway	1°13.732'N 103°50.338'E
	Pulau Hantu	Selat Pauh	1°13.505'N 103°44.807'E
	Pulau Satumu	Main Strait	1°09.652'N 103°44.478'E
	Pulau Tekong	Mouth of Sungai Johor	1°16.186'N 104°02.848'E
	Marina South	Marina Channel	1°16.853'N 103°52.255'E