

Marine Algal Flora of French Polynesia II. Chlorophyceae (green algae)

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Abstract – This second paper in a monographic series on the marine algae of French Polynesia gives a detailed coverage of the species of Chlorophyceae occurring in these islands. A total of 81 taxa are presented; of these, 23 represent new records for the local flora, 1 (*Halimeda heteromorpha*) is a new species and 2 (*Microdictyon* sp. and *Struveopsis* sp.) are newly discovered taxa. The benthic marine green algal flora has most affinities with the neighbouring Cook Islands (Sørensen Index of 0.43) but only with 44% of shared species with that archipelago, while 69 and 64% of species are shared with the Fijian and Micronesian islands, respectively. About 75% of the flora is shared with the Indian and Pacific Ocean in general; 3 species (or about 4% of the total flora) seem restricted to French Polynesia.

algae / biogeography / distribution / floristics / French Polynesia / Chlorophyceae / new records / taxonomy

Résumé – **Flore des algues marines de la Polynésie française. II. Chlorophyta (algues vertes).** Cette deuxième publication dans une série monographique sur la flore marine de la Polynésie française donne une distribution détaillée des espèces de Chlorophycées qui sont présentes dans ces îles. Un total de 81 taxons sont présentés, dont 23 sont nouveaux pour la Polynésie française, 1 (*Halimeda heteromorpha*) représente une nouvelle espèce et 2 (*Microdictyon* sp. et *Struveopsis* sp.) représentent de nouveaux taxons. La flore a le plus d'affinités avec l'archipel voisin des îles Cook (Index de Sørensen de 0.43), mais seulement avec 44 % des espèces en commun avec ce groupe d'îles, tandis que 69 et 64 % des espèces sont en commun avec les îles Fidji et la Micronésie, respectivement. Environ 75 % de la flore est en commun avec l'Océan Indien et l'Océan Pacifique en général ; 3 espèces (ou environ 4 % de la flore) semblent restreintes à la Polynésie française.

algues / biogéographie / distribution / floristique / Polynésie française / Chlorophyceae / nouveaux reports / taxonomie

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INTRODUCTION

This study gives a detailed overview of the species of Chlorophyceae occurring in French Polynesia and supplements and revises the taxa previously reported in Setchell (1926), Meinesz *et al.* (1981), Payri & Meinesz (1985b), Payri & N'Yeurt (1997), Payri *et al.* (2000), and Conte & Payri (2002, 2006). The history of early phycological collecting in French Polynesia was treated in N'Yeurt & Payri (2006). The earlier works covered some 96 taxa of Chlorophyta, but this number could not be confirmed. The present paper documents the distribution of Chlorophyta within French Polynesia and compares the similarity of the benthic marine green algal flora of French Polynesia to other Pacific areas and discusses the biogeographical patterns encountered.

MATERIALS AND METHODS

Material was collected using SCUBA, snorkelling or reef-walking. Herbarium specimens were pressed using standard techniques, and representative parts of thalli and turf algae stored in 4% buffered formalin in sealed plastic bags packed in a light-proof container for shipment and later anatomical examination in the laboratory. Herbarium specimens were photographed using a bench-mounted digital camera (NIKON Coolpix 995). Photomicrographs were obtained using an OLYMPUS C-4040 digital camera fitted on an OLYMPUS BH2 microscope. Voucher specimens are housed at the Phycological Herbarium of the Université de Polynésie française in Tahiti (UPF), with "S" referring to slide collections. These collections are accessible online at the following address: <http://biodiv.upf.pf/base/>. "IFR" refers to holdings in the herbarium of the French Institute of Research on Coral Reef Environment (IFRECOR) in Bora Bora, French Polynesia (curated by Mr. Denis Schneider). Where necessary, available French Polynesian herbarium records in UPF have been re-verified in the light of new taxonomic information, and some of Setchell & Parks and other early collections in BM (British Museum, London), PC (Museum National d'Histoire Naturelle, Paris), SAP (Hokkaido University, Sapporo) and UC (University of California, Berkeley) examined either on site or on loan. Unfortunately, some voucher specimens of species from Moorea listed in Payri (1987), which contain some taxa not held at UPF, could not be located and are presumed lost. Consequently, only those records which could be confirmed on the basis of existing collections have been included in this study. The taxonomy generally follows that of Silva *et al.* (1987; 1996), De Reviere (2003), and is updated with other sources where necessary as stated in the text. For each taxon, basionym and type locality information is provided, followed by relevant synonyms and selected bibliographic references. Asterisks (*) indicate new published records or species for French Polynesia.

RESULTS AND OBSERVATIONS**Key to genera of French Polynesian Chlorophyta**

- 1a. Thallus calcified or partly calcified. 2
- 1b. Thallus totally uncalcified 5
 - 2a. Thallus cylindrical (club-shaped) and unsegmented, or a flabellate blade 3
 - 2b. Thallus flattened or circular, segmented, straight or slightly arcuate 4
- 3a. Thallus club-shaped, unbranched, slightly arcuate. *Neomeris*
- 3b. Thallus fan-shaped, dichotomously branched, monostromatic *Rhipidosiphon*
 - 4a. Segments clavate, fused into a circular stipitate disc *Parvocaulis*
 - 4b. Segments flattened, in branched chains, not fused into a disk *Halimeda*
- 5a. Thallus as a solitary ovoid vesicle, to 5 cm high *Ventricaria*
- 5b. Thallus not ovoid, usually gregarious 6
 - 6a. Thallus blade-like, compressed or tubular, or of branches forming a fused network. 7
 - 6b. Thallus vesicular, filamentous or plumose, not forming a network 11
- 7a. Thallus three-dimensional, forming spongy crispy masses *Boodlea*
- 7b. Thallus in a single plane, not a spongy mass 8
 - 8a. Thallus thick and gelatinous, composed of a mass of non-organized microscopic cells less than 10 μm in diameter, with sickle-shaped chloroplasts *Verdigellas*
 - 8b. Thallus thin, not gelatinous, cells more than 10 μm in diameter, chloroplasts not sickle-shaped. 9
- 9a. Thallus monostromatic, mesh-like and composed of fused branches, not membranous. 10
- 9b. Thallus distromatic, hollow tubular, compressed or membranous, not mesh-like or composed of fused components *Ulva*
 - 10a. Thallus broadly lanceolate, with a long stipe; tenacular cells predominantly consisting of small, modified, distally crenellated (type-3) cells on terminal segments. *Phyllodictyon*
 - 10b. Thallus forming rosettes or blunt paddle-shaped, attached via short rhizoids, tenacular cells (type-1) consisting solely of unmodified segments with a distal crenellated or smooth thickened pad *Microdictyon*
- 11a. Thallus filamentous or tuft-like. 12
- 11b. Thallus not filamentous 21
 - 12a. Filaments regularly separated by cross-walls (septate) or lacking cross-walls at the base of at least some lateral branches 13
 - 12b. Filaments coenocytic, or with few partitions if any. 14
- 13a. Thallus branched. 16
- 13b. Thallus unbranched. 17
 - 14a. Axes sparsely branched, constrictions absent or rare. *Derbesia*
 - 14b. Axes profusely branched, constrictions abundant. 15
- 15a. Thallus with radial, siphonous vesicles about an erect axis; cell division segregative (presence of globular lateral branch precursors in axes). *Siphonocladus*
- 15b. Thallus with dichotomous, pinnate or secund branching; cell division not segregative 18
 - 16a. Thallus lacking cross-walls at the base of at least some lateral branches 19
 - 16b. Thallus with cross walls at the base of all lateral branches. . . *Cladophora*

- 17a. Thallus forming fleecy masses; filament diameter less than 70 μm ; basal cell absent or unmodified *Rhizoclonium*
- 17b. Thallus erect or in clumps; filament diameter more than 70 μm ; modified basal cell often present *Chaetomorpha*
- 18a. Thallus plumose, with pinnate or secund branching *Bryopsis*
- 18b. Thallus tuft-like, filaments dichotomous 20
- 19a. Thallus flaccid or in clumps, lacking a percurrent main axis *Cladophoropsis*
- 19b. Thallus tufted, with a stratified percurrent main axis *Struveopsis*
- 20a. Thallus tufted, filaments not adhering except at the base *Chlorodesmis*
- 20b. Thallus blade-like, filaments interwoven throughout *Avrainvillea*
- 21a. Thallus bubble-like, or of loosely-adhering, clavate or cylindrical vesicles 22
- 21b. Thallus otherwise 24
- 22a. Thallus bubble-like, composed of small closely-adhering hexagonal cells *Dictyosphaeria*
- 22b. Thallus consisting of large clavate or cylindrical vesicles 23
- 23a. Vesicles irregular or clavate; thallus loosely aggregated, not prostrate *Valonia*
- 23b. Vesicles cylindrical, sometimes arcuate; thallus prostrate or forming balls .. *Valoniopsis*
- 24b. Thallus with a creeping stolon bearing uprights of various shapes *Caulerpa*
- 24a. Thallus without a creeping stolon, spongiose; habit globular, upright or convoluted, internal filaments with terminal inflated utricles.. *Codium*

Division **CHLOROPHYTA** T. Cavalier-Smith

Order **Tetrasporales** Lemmermann

Family **Palmellopsidaceae** Korshikov

Genus ***Verdigellas*** Ballantine *et J. Norris*

****Verdigellas peltata*** Ballantine *et J. Norris*, 1994: 369, figs 5-7 (type locality: Mona Island, Puerto Rico). Brazil: Bravin *et al.*, 1999: 124, figs 6-8; Fiji: Littler & Littler, 2003: 194 (as *Verdigellas* sp.). **(Figs 1-2)**

Misapplied name: *Palmogloea protuberans* (Smith *et Sowerby*) Kützing, 1843: 176.

French Polynesia: Payri *et al.*, 2000: 62.

Material examined: Hiti, 10 Nov. 1996, *leg. J. Orempuller*, UPF 129; Marokau, 22 Nov. 1996, *leg. J. Orempuller*, UPF 127, 128; Nengo Nengo, Jun. 1996, *leg. J. M. Zanini*, UPF 698.

Thallus to 10 cm high and up to 2 mm thick, dark green and turgid, attached to the substratum via small, discrete basal holdfasts. Habit irregularly lobed, erect (Fig. 1). The surface of the thallus is smooth and gelatinous, with usually ruffled, thickened margins. Internally, structure consists of a mass of non-organized, microscopic spherical cells 6-9 μm in diameter, with characteristic sickle-shaped chloroplasts (Fig. 2).

Remarks: Growing as isolated thalli, *Verdigellas peltata* has been recorded from 30 to 60 m deep, in atolls of the Tuamotu archipelago. This jelly-like alga of grass-green colour appears to be relatively common in deepwater and low-light habitats in tropical regions, from the Caribbean to the South Atlantic (Bravin *et al.*, 1999) and the South Pacific (Littler & Littler, 2003; this study). The nearest related genus to *Verdigellas* is *Palmophyllum* Kützing (1846), but species in that genus have a gelatinous stalk, are leathery in texture (as opposed to soft and jelly-like in *Verdigellas*) and the species closest to *V. peltata*, *Palmophyllum crassum* (Naccari) Rabenhorst (1868) differs in having concentrically zoned lobes (Ballantine &

Norris, 1994: 371; Feldmann, 1937: 176). *Palmophyllum umbracola* (Nelson & Ryan, 1986) from New Zealand could be mistaken for *V. peltata*, but the former has a leathery texture unlike the soft, slippery consistency of *V. peltata* (Ballantine & Norris, 1994: 371). The French Polynesian material is broadly peltate, forming gelatinous unbranched cushions 1-2 mm thick attached to the substratum by several discrete stipe-like holdfasts. It hence differs from *V. fimbriata* (Ballantine & J. Norris, 1994: 369) and *V. nektongammaea* (Ballantine & Aponte, 1996) which are erect with marginal branches, or lobed with cavities in transverse sections, respectively. In French Polynesia it has been previously misidentified as *Palmogloea protuberans* (Smith *et* Sowerby) Kützing, a superficially similar freshwater species (Payri *et al.*, 2000).

Order **Ulvales** Blackman *et* Tansley

Family **Ulvaceae** J.V. Lamouroux

Genus ***Ulva*** Linnaeus

Recent molecular studies (Hayden *et al.*, 2003; Shimada *et al.*, 2003) have confirmed previous vegetative and reproductive indications (Bonneau, 1977; Provasoli & Pintner, 1980; Kraft, 2000) that *Ulva* and *Enteromorpha* are not distinct genera. The artificial separation of *Ulva* into distromatic (“*Ulva*”) and tubular (“*Enteromorpha*”) forms (Link, 1820) had been done for purposes of convenience, and retained since. French Polynesian records of *Enteromorpha* are hence transferred to *Ulva* based on the new combinations proposed by Hayden *et al.* (2003: 288, table 4). Five species of the genus are represented in collections from French Polynesia in UPF. Since most of the South Pacific species of *Ulva* have been identified in the past using European names, this taxonomy may not be applicable to tropical populations (G.T. Kraft, pers. com.).

Key to the French Polynesian species of *Ulva*

- 1a. Thallus usually flabellate, sheet-like 2
- 1b. Thallus usually tubular to compressed 3
 - 2a. Cells in cross-section rectilinear, arranged in distinct palisade layers ...
..... *U. rigida*
 - 2b. Cells in cross-section rectangular, not in distinct palisade layers
..... *U. lactuca*
- 3a. Thallus cylindrical, sparsely branched with uniseriate laterals ... *U. flexuosa*
- 3b. Thallus compressed, uniseriate laterals absent. 4
 - 4a. Laterals radially arranged, at a narrow angle. *U. clathrata*
 - 4b. Laterals not radially arranged, at wide angles. *U. compressa*

**Ulva clathrata* (Roth) C. Agardh, 1811: 23

(Fig. 3)

Basionym: *Conferva clathrata* Roth, 1806: 175-178 (type locality: Fehmarn, southwestern Baltic, according to Berger *et al.*, 2003: 288).

Homotypic synonym (given by Hayden *et al.*, 2003): *Enteromorpha clathrata* (Roth) Greville, 1830: lxvi, 181. Viêt Nam: Dawson, (1954: 384, fig. 6d-e); Thailand: Egerod, 1974: 134, fig. 4; Indian Ocean: Silva *et al.*, 1996: 729; Lord Howe Island: Kraft, 2000: 525, fig. 8; Fiji: N’Yeurt, 2001: 693, figs 2, 3a-b; Samoa: Skelton & South, 2002a: 160, fig. 22A-B; 2002b: 8, pl. 5 figs 29-33, pl. 6 fig. 34; Hawaiian Islands: Abbott & Huisman, 2004: 46, fig. 5A-C.

Material examined: Tarakoi islet, Rapa Island, Australs, 5 Nov. 2002, leg. C. E. Payri, UPF 2018, 2019.

Thallus irregularly branched and proliferous, forming entangled masses. Filaments of main axis 280-300 µm in diameter, lateral branchlets 40-100 µm in diameter, issued distichously to radially at a narrow angle. Ultimate branchlets and distal portions of axes multiseriate, 20-40 µm in diameter, with characteristic bulbous expansions. Cells angular and mostly regularly arranged in surface view, 11-17 µm in diameter. 1-4 pyrenoids per cell (usually 2-3).

Remarks: *Ulva clathrata* is readily distinguished by multiseriate laterals ending in bulbous expansions.

Ulva compressa Linnaeus, 1753: pl. 2: 1163 (type locality: Baltic Sea) **(Figs 4-5)**

Homotypic synonym (given by Hayden *et al.*, 2003): *Enteromorpha compressa* (Linnaeus) Greville, 1830: 180. Marshall Islands: Dawson, 1956: 27, fig. 1; Europe: Bliding, 1963: 132, fig. 82a-f, 83a-d, 84a-f; Indian Ocean: Silva *et al.*, 1996: 729; Blomster *et al.*, 1998: 325, figs 4-6, 35-41; Lord Howe Island: Kraft, 2000: 521, fig. 5A-F; Fiji: N'Yeurt, 2001: 695.

Material examined: Opunohu, Moorea, 1 Jul. 1997, *leg. A. D. R. N'Yeurt*, UPF 81; Faa'a, Tahiti, *leg. A. D. R. N'Yeurt*, 13 Apr. 1997, UPF 83-84, 7 May 1997, UPF 82; Taharaa, Tahiti, 22 Apr. 1998, *leg. C. E. Payri*, UPF 714.

Thallus simple to repeatedly branched, 16-25 mm high, composed of compressed, upwardly broadened axes 2-5 mm in diameter. Cells polygonal to rounded, about 14 × 23 µm, densely arranged and appearing compressed in surface view.

Remarks: *Ulva compressa* is distinct from *U. intestinalis*, and *Enteromorpha usneoides* Bonnemaison ex. J. Agardh (1883: 159) appears to be an ecotype of *U. compressa* (Blomster *et al.*, 1998, Hayden *et al.*, 2003). *Ulva compressa* is morphologically differentiated from *U. intestinalis* by the lack of branching in the latter. It is a cosmopolitan biofouling species, with extreme morphological plasticity varying from low tubular fronds to flattened blades to 120 mm across (Kraft, 2000: 521). The latter observation of morphological plasticity is in support of the accumulating molecular evidence for merging of *Enteromorpha* into *Ulva*.

Ulva flexuosa Wulfen, 1803: 1

(Fig. 6)

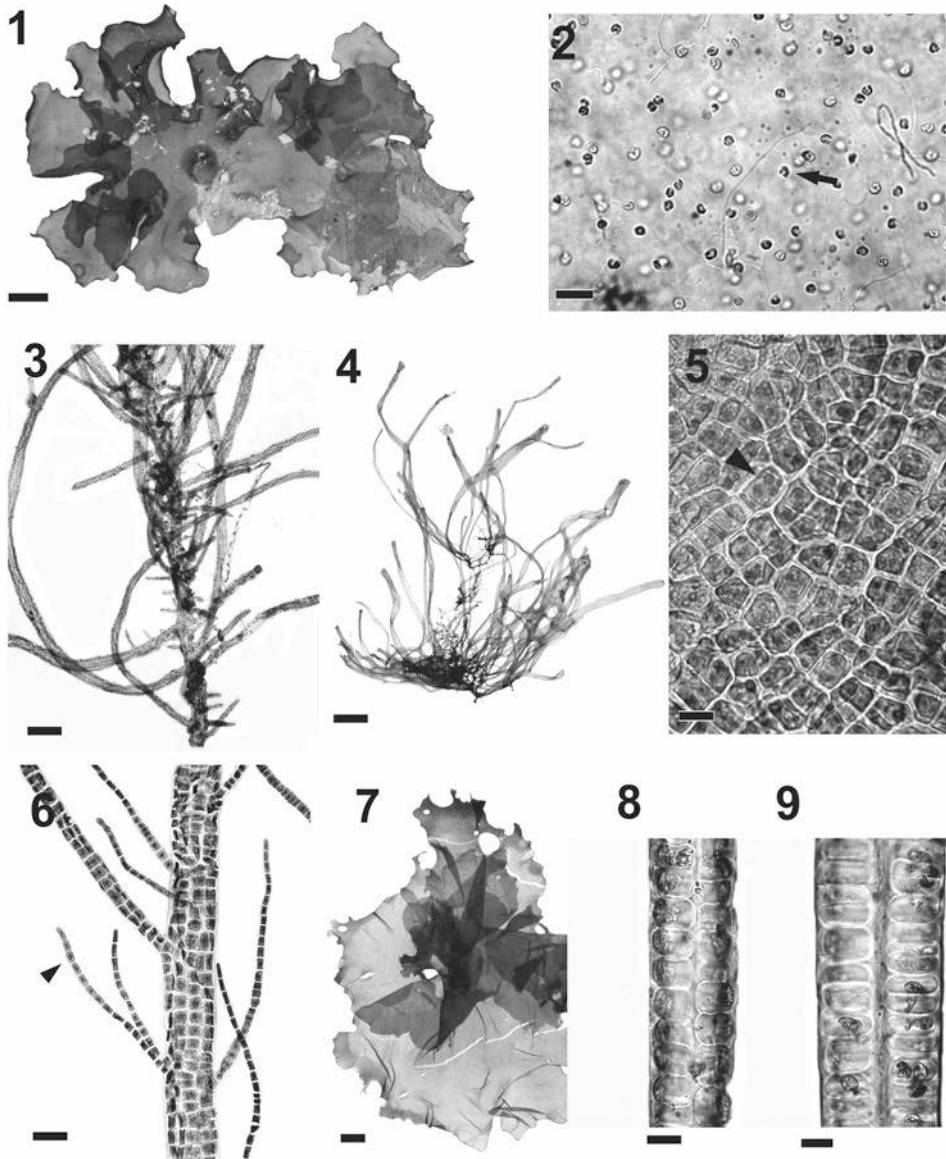
Basionym: *Conferva flexuosa* Roth, 1800: 188, *nom. illeg.* (type locality: Duino, near Trieste, Adriatic Sea).

Homotypic synonym (given by Hayden *et al.*, 2003): *Enteromorpha flexuosa* (Wulfen) J. Agardh, 1883: 126 (incl. subsp. *flexuosa*). French Polynesia: Payri & N'Yeurt, 1997: 879, Payri *et al.*, 2000: 62, Conte & Payri, 2002: 166, fig. 1; Europe: Bliding, 1963: 73, figs 38-40; Indian Ocean: Silva *et al.*, 1996: 733; Lord Howe Island: Kraft, 2000: 523, fig. 7 A-E; Namibia: Lluch, 2002: 179, figs 199, 200A-D.

Heterotypic synonym (given by Hayden *et al.*, 2003): *Enteromorpha tubulosa* (Kützing) Kützing, 1856: 11. French Polynesia: Setchell, 1926: 68.

Material Examined: Ua Huka, Marquesas, Aug. 1999, *leg. E. Conte & C. E. Payri*, UPF 801, 819; Opunohu, Moorea, 1 Jul. 1997, *leg. A. D. R. N'Yeurt*, UPF 81; Faa'a, Tahiti, 13 Apr. 1997, *leg. A. D. R. N'Yeurt*, UPF 83, 84, 7 May 1997, UPF 82; Taharaa, Tahiti, 22 Apr. 1998, *leg. C. E. Payri*, UPF 714.

Plants light-green and fleecy, tubular in cross-section, 150-155 µm in diameter and up to 20 cm long; sparsely to profusely branched with a flexuous basal portion. Lateral branches often uniseriate, 25-30 µm in diameter. In surface view cells subrectangular, up to 25 by 35 µm, arranged in distinct brick-like longitudinal rows; 3-6 (usually 3) pyrenoids per cell.



Figs 1-9. **1.** *Verdigellas peltata*. Habit of dried plant (UPF 698). Scale = 10 mm. **2.** *Verdigellas peltata*. Cellular matrix, with sickle-shaped chloroplast (arrow) (UPF 698). Scale = 20 μ m. **3.** *Ulva clathrata* (UPF 2018); habit. Scale = 200 μ m. **4.** *Ulva compressa* (UPF 81); habit. Scale = 10 mm. **5.** *Ulva compressa* (UPF 82). View of surface cells, showing pyrenoids (arrowhead). Scale = 20 μ m. **6.** *Ulva flexuosa* (UPF WSS228). Habit showing uniseriate lateral branchlet (arrowhead). Scale = 100 μ m. **7.** *Ulva lactuca* (UPF 136). Habit. Scale = 10 mm. **8.** *Ulva lactuca* (UPF 2715). Transverse section of thallus, showing squarish double row of cells. Scale = 20 μ m. **9.** *Ulva rigida* (UPF RPS 184). Transverse section of thallus, showing rows of rectilinear cells. Scale = 30 μ m.

Remarks: This species, which is one of the commonest of the genus in the tropical Pacific, includes at least one subspecies, subsp. *paradoxa* (Dillwyn) Bliding, (1963: 79), characterized by abundant uniseriate laterals and less regular arrangement of cell rows.

Ulva lactuca Linnaeus, 1753: 1163 (type locality: "in Oceano"). French Polynesia: Setchell, 1926: 69, pl. 7 figs 1-4 (as f. *lacunculata*), Payri *et al.*, 2000: 64, Conte & Payri, 2002: 167, fig. 5; South Australia: Womersley, 1984: 141, figs 44 A, 45 A-C; Indian Ocean: Silva *et al.*, 1996: 745; Lord Howe Island: Kraft, 2000: 531, fig. 10. **(Figs 7-8)**
Material examined: Trou du souffleur, Tahiti, 18 Nov. 1995, *leg. A. D. R. N'Yeurt*, UPF 137; Hotel Beachcomber, Faa'a, Tahiti, 13 Apr. 1997, *leg. A. D. R. N'Yeurt*, UPF 135, 139; 7 May 1997, UPF 136; Taharara, Tahiti, 14 Apr. 1997, *leg. A. D. R. N'Yeurt*, UPF 138; Arue, Tahiti, 6 Apr. 1998, *leg. C. E. Payri*, UPF 699; Ua Huka, Marquesas, Aug. 1999, *leg. E. Conte & C. E. Payri*, UPF 818; Motu Togegie, Gambier, 22 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 810, 811; Rapa Iti, 4 Nov. 2002, *leg. C. E. Payri*, UPF 1941, 2689; Pt. Komire, Rapa, 13 Nov. 2002, *leg. J. L. Menou*, UPF 2198.

Thallus to 10 cm broad, flat and simple, membranous and irregularly lacerate with small holes, attached by a small rhizoidal holdfast (Fig. 7). Blade distromatic; cells squarish, 20-23 μm long and 20-21 μm tall, subrectangular and adherent (Fig. 8), with a single outer chloroplast. Pyrenoids 1-2 per cell.

Remarks: The commonest *Ulva* species reported in the literature, *U. lactuca* is a poorly defined and documented species. Some authors (e.g. Abbott & Huisman, 2004) do not venture using the name for tropical species. We follow the description of Kraft (2000) for the French Polynesian specimens, which have squarish cells and are distinct from *U. rigida* (described below) which has rectilinear cells. Setchell (1926: 69) reports this edible species as being consumed by Tahitians at the time, but recently in French Polynesia it is only being used as food in the Marquesas (Conte & Payri, 2002, 2006).

Ulva rigida C. Agardh, 1823: 410 (type locality: Cádiz, Spain). French Polynesia: Taylor, 1973: 38 (Makatea); Netherlands: Koeman & van den Hoek, 1980: 37, figs 78-107; Indian Ocean: Silva *et al.*, 1996: 750; Belize: Littler & Littler, 1997: 87, fig. 114; Lord Howe Island: Kraft, 2000: 532, fig. 11; Namibia: Lluch, 2002: 185, figs 210, 211A-B. **(Fig. 9)**

Material examined: Tarakoi Islet, Rapa Island, Australs, 5 Nov. 2002, *leg. C. E. Payri*, UPF 2687, RPS 182, 183, 184.

Thallus 25-30 mm broad and 88-100 μm thick, sparsely perforate, with a coarser basal portion. Cell rectilinear, 45-50 μm long and 13-18 μm broad, arranged in distinct double palisade layers.

Remarks: This species is distinguished by its rectilinear cells arranged in palisade layers, and the coarseness of the lower portions of the thallus (Kraft, 2000). So far in French Polynesia, only reported from Makatea (Tuamotu) and in the cooler waters of the southern Australs (Rapa Island).

Order **Cladophorales** Haeckel
 Family **Anadyomenaceae** Kützing
 Genus ***Microdictyon*** Decaisne

With some 20 tropical to subtropical species, the most comprehensive monographic treatment of *Microdictyon* to date remains the work of Setchell (1929). In French Polynesia, *Microdictyon* occurs in atolls of the Tuamotu

Archipelago, the Gambier, Society and Rapa in the Australs. Covers of *Microdictyon* in typical rosettes among coral debris are typical of the algal flora of the lagoons in atolls of the Tuamotu Archipelago. Payri & N'Yeurt (1997) report four species of the genus in French Polynesia, but only three have been found, some growing together in the same habitats. Reports of *M. agardhianum* and *M. setchellianum* need verification as both these names are taxonomically questionable (see Silva *et al.*, 1996: 758, 934).

Key to the French Polynesian species of *Microdictyon*

- 1a. Thallus firm, leaf-like, with clear basal umbilicate rhizoidal holdfast. . . . *M. sp.*
- 1b. Thallus flaccid, forming expanded blades without clear basal holdfast. . . . 2
 - 2a. Main filaments below 250 µm in diameter, attachment pads smooth *M. umbilicatum*
 - 2b. Main filaments above 350 µm in diameter, attachment pads crenellated *M. okamurae*

Microdictyon okamurae Setchell, 1925: 107; 1929: 553, figs 76-84 (type locality: Ryukyu-retto, Japan). French Polynesia: Taylor, 1973: 38 (Tikehau); Payri & N'Yeurt, 1997: 880; Payri *et al.*, 2000: 66; Indian Ocean: Silva *et al.*, 1996: 757. (Figs 10-12)

Material examined: Reitoru, 25 Sep. 1992, *leg. R. Galzin*, UPF 120; Marokau, 22 Sep. 1996, *leg. J. Orempuller*, UPF 113; Tekokota, 26 Sep. 1996, *leg. J. Orempuller*, UPF 122; Hiti, 12 Nov. 1996, *leg. J. Orempuller*, UPF 123; Haraiki, 15 Nov. 1996, *leg. J. Orempuller*, UPF 112, 117; Hikueru, 16 Nov. 1996, *leg. J. Orempuller*, UPF 116; Hiti, 12 Nov. 1996, *leg. J. Orempuller*, UPF 118; Marokau, 22 Nov. 1996, *leg. J. Orempuller*, UPF 119.

Thallus light yellow-green (remaining so when dried), consisting of a monostromatic, delicate reticulate blade up to 5 by 12 cm, forming a meshwork with veins (Fig. 10). Main filaments 400-500 µm in diameter, terminal cells 180-200 µm in diameter, slightly tapered. Branching mostly opposite. Branch anastomosis frequent, taking place by means of crenulated attachments pads formed on the tip of unmodified terminal cells (type-1 tenacular cells in Leliaert, 2004: 104; Figs 11-12).

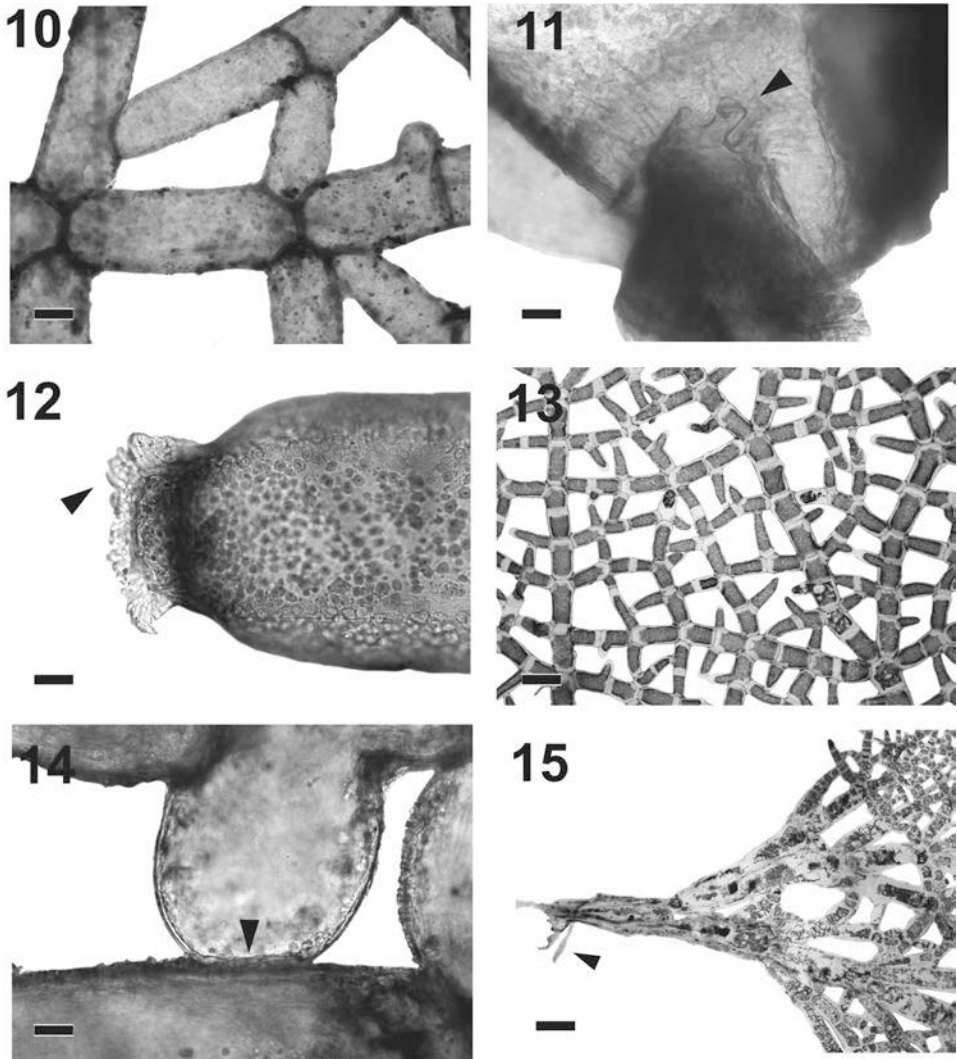
Remarks: A common and often dominant component of the atoll marine flora, forming extensive rosettes on coralline formations and other hard substrata in the lagoons. This coarser species in French Polynesia appears to be restricted to atoll habitats, unlike *M. umbilicatum* which occurs as far south as the high islands of Rapa in the Australs, and east to the Gambier.

Microdictyon umbilicatum (Velle) Zanardini, 1862: 461. French Polynesia: Payri & N'Yeurt, 1997: 880, Payri *et al.*, 2000: 66; Setchell, 1929: 503, figs 21-27; South Australia: Womersley, 1984: 217, fig. 72; Indian Ocean: Silva *et al.*, 1996: 758; Lord Howe Island: Kraft, 2000: 570, fig. 24 D-F; Hawaiian Islands: Egerod, 1952: 363, pl. 32b figs 5, 6b; Abbott & Huisman, 2004: 62, fig. 15B. (Figs 13-14)

Basionym: *Conferva umbilicata* Velle, 1800: 169, pl. 7 (type locality: New South Wales, Australia).

Heterotypic synonym (according to Abbott & Huisman, 2004): *Microdictyon japonicum* Setchell, 1925: 107. Fiji: N'Yeurt, 2001: 699, fig. 27; Samoa: Skelton & South, 2002a: 161, fig. 22C.

Material examined: Reitoru, 25 Sep. 1992, *leg. R. Galzin*, UPF 121; Nengo Nengo, Jun. 1996, *leg. J. M. Zanini*, UPF 614; Papeari, Tahiti, 24 Apr. 1997, *leg. A. D. R. N'Yeurt*, UPF 133; Akamaru, Gambier, 17 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 894; Marotiri, Australs, 6 Nov. 2002, *leg. IRD*, UPF 2109; Rapa Island, Australs: Karapoo, 1 Nov. 2002, *leg. J. L. Menou*, UPF 1873; Ha'urei, 11 Nov. 2002, *leg. J. L. Menou*, UPF 2141, 13 Nov. 2002, UPF 2172, 2182;



Figs 10-15. **10.** *Microdictyon okamuriae* (UPF 2697). Habit of mesh-like thallus. Scale = 300 μ m. **11.** *Microdictyon okamuriae* (UPF 123). Detail of crenulate attachment pad making contact with another part of the thallus (arrowhead). Scale = 40 μ m. **12.** *Microdictyon okamuriae* (UPF 2697). Branchlet with crenulate attachment pad (arrowhead). Scale = 40 μ m. **13.** *Microdictyon umbilicatum* (UPF RPS 217). Habit of mesh-like thallus. Scale = 400 μ m. **14.** *Microdictyon umbilicatum* (UPF 2698). Detail of smooth, circular attachment pad (arrowhead). Scale = 40 μ m. **15.** *Microdictyon* sp. (UPF RPS 33). Detail of stipe, showing a basal rhizoid (arrowhead). Scale = 200 μ m.

Rarapai, 12 Nov. 2002, leg. J. L. Menou, UPF 2153, 30 Nov. 2002, UPF 2442; Komire Pt., 13 Nov. 2002, leg. J. L. Menou, UPF 2200; east oceanic slope, 23 Nov. 2002, leg. J. L. Menou, UPF 2329; Tarakoi, 6 Nov. 2002, leg. C. E. Payri, UPF 2038; Anakaturinako Bay, 8 Nov. 2002, leg. C. E. Payri, UPF 2074; Tauna islet, 27 Nov. 2002, leg. C. E. Payri, UPF 2369, 2370.

Thallus dark green and rigid (turning blackish when dry), consisting of a monostromatic, delicate reticulate blade up to 5 by 12 cm, forming a mesh with prominent veins (Fig. 13). Attachment to the substratum via an umbilicate stipe. Main filaments (120) – 200-220 μm in diameter, terminal cells 40-52 μm in diameter, gradually tapered with a blunt tip. Branching irregularly alternate or opposite to stellate, with up to 4 branches per mother cells. Branch anastomosis frequent, taking place by means of smooth, rounded attachments pads formed on the tip of unmodified terminal cells (Fig. 14).

Remarks: By far the commonest *Microdictyon* species encountered in French Polynesia, to date reported from all archipelagos except the Marquesas, it can be distinguished from *M. okamurae* by its finer mesh texture and generally darker green colour, usually turning black when dried. Plants from Tahiti, Gambier and Marotiri (UPF 133, 894, 2109) have smaller main filament diameters (120-130 μm) and do not turn black on drying, and would have previously been placed under *M. japonicum* Setchell. Kraft (2000) and Abbott & Huisman (2004), after comparing respective type specimens, have placed *M. japonicum* in synonymy with *M. umbilicatum*.

****Microdictyon* sp.**

(Fig. 15)

Material examined: Marotiri, Australs, 6 Nov. 2002, *leg. IRD*, UPF 2110; Northern plateau, Rapa Island, 25 Nov. 2002, *leg. J. L. Menou*, UPF RPS 33.

Thallus grass-green, rigid and orbicular, rugose, 5-10 mm high and 4 to 20 mm broad, with an umbilicate stipe 1-2 mm long, attached via long blunt-tipped rhizoids issued from basal segments. Branching acropetal and fan-shaped, becoming stellate, with secondary branchlets attaching perpendicularly to other primary segments via smooth attachment pads. Cells of mid-thallus 80-110 μm in diameter, broader above than below; ultimate segments blunt-ended, 40-30 μm in diameter. Edge of thallus irregularly open, without lateral cohesion between ultimate cells.

Remarks: Growing at 40 to 52 m depth, in French Polynesia so far only reported from the southern Australs (Rapa, Marotiri). This diminutive, stiped *Microdictyon* species bears some resemblance to *M. calodictyon* (Montagne) Kützing, from the Canary Islands, and to an undescribed species from New Caledonia. As pointed out by Børgesen (1925: 35), *M. calodictyon* is similar, especially as regards the basal portion, to *Rhipidiphyllon reticulatum* (Askenasy) Heydrich, reported from Easter Island by Børgesen (1924: 251, figs 3-4), and from the Marshall Islands by Dawson (1956: 32, fig. 10). *Rhipidiphyllon*, however, differs from the French Polynesian plants by its more lax branching, smaller stature (no more than 5 mm broad) and does not form a network as in even young plants of *M. calodictyon*. It is not ruled out, however, that both species could be related or represented different ecomorphs or growth stages of the same entity. Studies in progress (Payri *et al.*, in prep) should elucidate the affinities of the South Pacific plants in the near future.

Family Cladophoraceae Wille

Genus *Chaetomorpha* Kützing

Of the two species of *Chaetomorpha* accredited to Tahiti by Setchell (1926: 72), none have been recollected since, although a further two species described below are reported in collections.

Key to the French Polynesian species of *Chaetomorpha*

- 1a. Mature filaments straight and basally attached, 200-250 µm in diameter
 *C. antennina*
- 1b. Mature filaments bent or coiled, free or creeping, entangled 2
- 2a. Filaments 80-200 µm in diameter *C. fibrosa*
- 2b. Filaments 300-600 µm in diameter 3
- 3a. Basal cells absent, cells of uniform diameter throughout, rhizoids absent. . . .
 *C. linum*
- 3b. Basal cells curved, cells deflexed and creeping with abundant rhizoids.
 *C. basiretrorsa*

Chaetomorpha antennina (Bory de Saint-Vincent) Kützing, 1847: 166. French Polynesia: Payri *et al.*, 2000: 68; Indian Ocean: Silva *et al.*, 1996: 759; Lord Howe Island: Kraft, 2000: 538, fig. 13 A-C. **(Fig. 16)**

Basionym: *Conferva antennina* Bory de Saint-Vincent, 1804: 381 (type locality: La Réunion).

Material examined: Taharaa, Tahiti, 18 May 1996, *leg. C. E. Payri*, UPF 687; 14 Apr. 1997, *leg. C. E. Payri & A. D. R. N'Yeurt*, UPF 57; 30 Mar. 1998, *leg. A. D. R. N'Yeurt*, UPF 680; Karapoo, Rapa, 1 Nov. 2002, *leg. C. E. Payri*, UPF 1857; Akatamiro Bay, Rapa, 2 Dec. 2002, *leg. J. L. Menou*, UPF 2451.

Thallus to 30 mm high and 15 mm broad, light yellowish-green, consisting of tufts of stiff, unbranched, segmented filaments to 250 µm in diameter. Basal cells straight, erect and permanent, 1.5-3 mm in length (Fig. 16b). Individual segments are barrel-shaped, with a thick cell wall (Fig. 16a).

Remarks: Forming tufts on the reefs rim and in areas exposed to surf. The Tahitian and Rapa plants grow attached in dense tufts and have straight basal cells 1.5-3 mm in length, and thus conform to *C. antennina* and not to *C. basiretrorsa* Setchell (1926: 72, pl. 8 figs 4-6), a new species described from Punaruu, Tahiti. This leaves the question as to why the presently common *C. antennina* (a species familiar to Setchell, who had found it earlier in American Samoa) was absent from the reefs when Setchell visited Tahiti in 1922, and especially from the Tahara'a site from where he had made an extensive collection of algae.

Chaetomorpha basiretrorsa Setchell, 1926: 72, pl. 8 figs 4-6 (type locality: Punaruu Pass, Tahiti). **(Fig. 17)**

Heterotypic synonyms: *Chaetomorpha prostrata* P. Anand, 1940: 5, figs 5A-B, 6 (type locality: Manora, Karachi, Pakistan). Pakistan: Nizamuddin & Begum, 1973: 16, figs 67-68. — *Rhizoclonium grande* Børgesen, 1935: 14, figs 5-6 (type locality: Bombay, India). Pakistan: Nizamuddin & Begum, 1973: 16, fig. 69; Thailand: Egerod, 1975: 43, figs. 1-4; Tanzania: Jaasund, 1976: 5, fig. 12; Somalia: Sartoni, 1986: 361, fig. 3D; Seychelles: Wynne, 1995: 328, fig. 87; Rotuma: N'Yeurt, 1996: 368, figs 9, 20; Hawaiian Islands: Gilbert, 1965: 486, fig. 4E; Abbott & Huisman, 2004: 82, fig. 25B. — *Rhizoclonium robustum* Setchell *et* Gardner, 1937: 73, pl. 5 fig. 11 (type locality: North Seymour Island, Galapagos).

Misapplied name: *Cladophoropsis javanica* (Kützing) P. Silva in Silva *et al.*, 1996: 792 (Indian Ocean).

Material examined: Punaruu Pass, Tahiti, 12 Jul. 1922, *leg. W. A. Setchell & H. E. Parks*, UC 261301 (type).

Thallus caespitose, creeping, 400-600 µm in diameter, with thick stratified cell walls. Rhizoids abundant, up to 100 mm thick at the base, arising from nearly

every cell. Individual cells 2-3 diameters long, deflexed. Basal cell up to 2 mm long, distinctly bent.

Remarks: Growing in deep pools under *Sargassum*. This species has not been recollected in Tahiti since Setchell's report. The conspecificity of *C. basiretrorsa* and *Rhizoclonium grande* was first suggested by H. Ohba, in an unpublished annotation on the holotype herbarium sheet dated 11 February 1998. This observation was confirmed by our own examination of Setchell's material and comparison with *R. grande* from other Pacific Islands (e.g. N'Yeurt 1996, Rotuma). According to Silva *et al.* (1996: 793) and based on the authority of Dixit (1968: 13), *R. grande* and *Chaetomorpha prostrata* are synonyms of *Cladophoropsis javanica* (Kützing) P. Silva; however Hanyuda *et al.* (2003: 568, fig. 1) have shown from analysis of 18S rRNA sequences that *R. grande* is closely allied to *Chaetomorpha*. This is also confirmed by 28S rDNA sequences (unpublished data, F. Leliaert, pers. com.) where "*R. grande*" from the East African coast is closely related to *Chaetomorpha crassa* and *C. spiralis* Okamura. Leliaert (2004) also provides arguments for the distinction between *Rhizoclonium* and *Cladophoropsis*, on morphological grounds. As Setchell's name is the earlier one, it takes precedence over Børgesen's name for this entity (Article 11, Section 3 of the International Code of Botanical Nomenclature; Greuter *et al.*, 2000) and *R. grande* is treated as a later synonym. The synonymy of *Rhizoclonium profundum* and *R. grande* was suggested by Dawson (1959: 7), and an examination of Setchell & Gardner's illustrations and description of the Galapagos material would seem to confirm this.

Chaetomorpha fibrosa Kützing, 1849: 377 (type locality: Baltic Sea). French Polynesia: Setchell, 1926: 72, pl. 8 figs 7-8.

Material examined: Tongatapu, Tonga, Jul. 1874, *leg. H. Moseley*, BM 841401; Maraa, Tahiti, 28 Sep. 1928, *leg. C. Crossland*, BM 841379.

Thallus forming crisp entangled masses over larger fixed algae. Segments 80-110 µm in diameter and 70-240 µm long. Cell walls stratified, about 12 µm thick.

Remarks: This alga is little-reported in the literature, and of uncertain taxonomic status (Furnari *et al.*, 1999). It mainly differs from *C. linum* by its smaller filament diameter. The French Polynesian material agrees with plants from Tonga in BM.

****Chaetomorpha linum*** (O. F. Müller) Kützing, 1845: 204. India: Børgesen, 1935: 12, fig. 3; Pakistan: Nizamuddin & Begum, 1973: 15, fig. 62; Thailand: Egerod, 1974: 135, fig. 9; South Australia: Womersley, 1984: 176, pl. 13, fig. 2, figs 54D, 57A; Indian Ocean: Silva *et al.*, 1996: 765; Belize: Littler & Littler, 1997: 93, fig. 126; Papua New Guinea: Littler & Littler, 2003: 198. **(Figs 18-19)**

Basionym: *Conferva linum* O. F. Müller, 1778: 7, pl. 771(2) (type locality: Denmark).

Misapplied name: *Chaetomorpha basiretrorsa* Setchell. French Polynesia: Setchell, 1926: 72.

Material examined: Tahiti, Oct. 1909, *leg. J. E. Tilden* South Pacific Algae Nr. 21, BM 841428 (as *Chaetomorpha antennina* (Bory) Kützing).

Thallus forming entangled, coiled unattached masses to 40 mm across (Fig. 18). Filaments 320-400 µm in diameter, of uniform thickness throughout, composed of cells 430-950 µm long, slightly incised at cross-walls (Fig. 19). Cell walls thin, 10 µm thick. Basal cells absent.

Remarks: This species was not recollected since, and possibly interpreted by Setchell (1926) as a free, entangled form of *C. basiretrorsa*. However, the Tahitian

material in BM agrees well with *C. linum* from other regional localities such as the Mariana Islands (Guam, BM 841419) or Tonga (BM 841384). Usually associated with high nutrient or polluted areas (Littler & Littler, 2003), a shift in habitat composition might explain this alga's current disappearance. It mainly differs from the widespread *Chaetomorpha crassa* (C. Agardh) Kützing by its thinner cells walls, and rectangular cells never exceeding 500 µm in diameter in French Polynesian specimens. *Chaetomorpha crassa* usually attains diameters of up to 1000 µm, and has almost quadrate barrel-shaped cells (Littler & Littler, 2000: 314).

Genus *Rhizoclonium* Kützing

It has been proposed (Nienhuis, 1975; Kraft, 2000: 543) that there is only a single, continuously variable and widely distributed species, *R. riparium* (Roth) Harvey (1849). Furthermore, the only distinguishing character at present between *Chaetomorpha* and *Rhizoclonium* is the occasional production of morphologically distinct short laterals in the latter genus, and both genera could be congeneric, with *Rhizoclonium* being the earlier name. Moreover, Hanyuda *et al.* (2003: 570) and recent studies (F. Leliaert, pers. com.) have shown *Rhizoclonium* to be polyphyletic, forming a clade with *Chaetomorpha* and *Cladophora* species, and suggesting plural independent evolution of the genus morphology within the Cladophorales. For the time being, traditional taxonomic characters have been used to identify the two French Polynesian species of *Rhizoclonium*.

Key to the French Polynesian species of *Rhizoclonium*

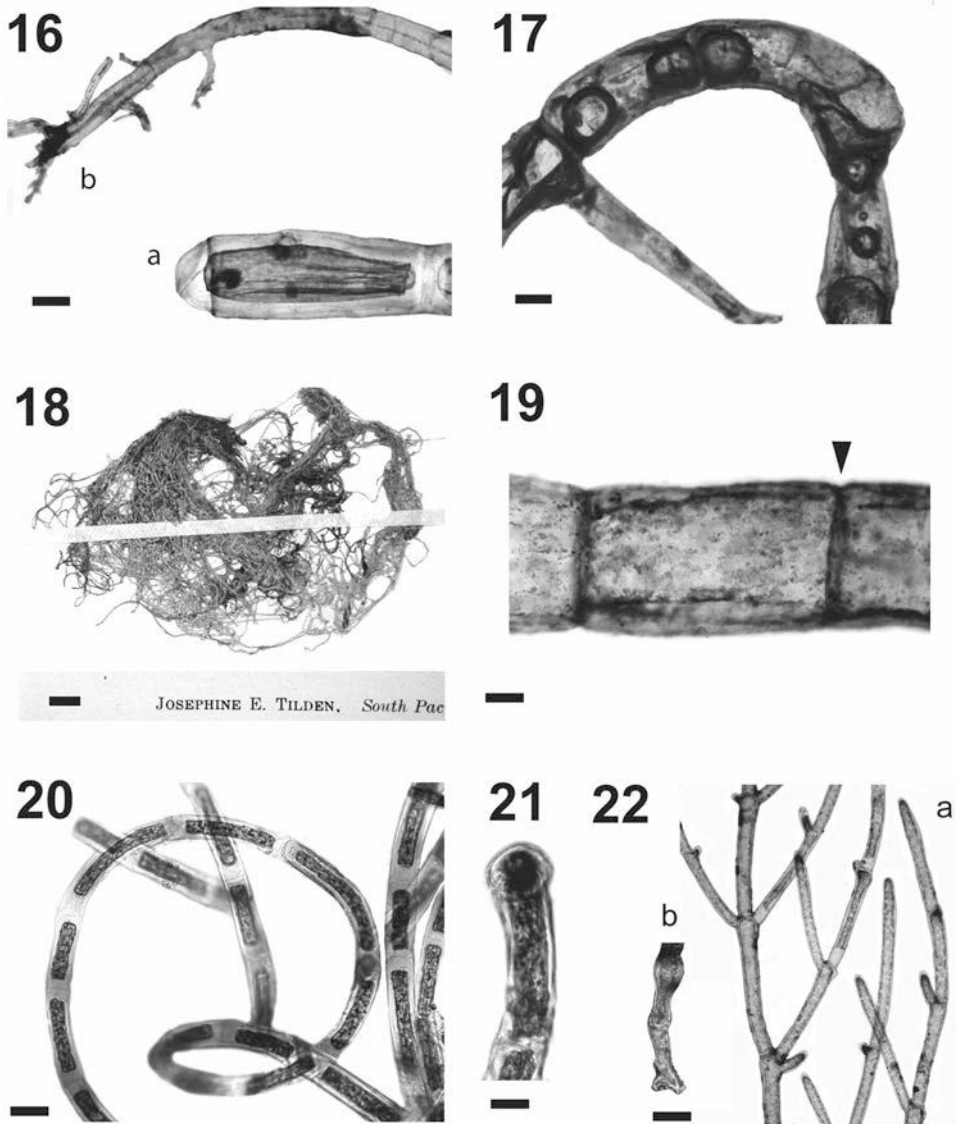
- 1a. Filament diameter 25-30 µm, often curled, apical cell swollen, found in estuaries. *R. riparium*
 1b. Filament diameter 40-60 µm, not curled, apical cell not swollen, found in uppermost littoral *R. africanum*

Rhizoclonium africanum Kützing, 1853: 21, pl. 67 fig. 2 (type locality: Senegambia, Africa). French Polynesia: Payri & N'Yeurt, 1997: 880, Payri *et al.*, 2000: 70; Indian Ocean: Silva *et al.*, 1996: 784; Lord Howe Island: Kraft, 2000: 542; Samoa: Skelton & South, 2002b: 10, pl. 7 figs 44-46.

Material examined: Maraa, Tahiti, Sep. 1928, *leg. C. Crossland*, BM 840828; Taharaa, Tahiti, on cliff walls, 30 Mar. 1998, *leg. A. D. R. N'Yeurt*, UPF 703; Atituiti, Mangareva, Gambier, base of cliffs, 18 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 920; Rikitea, Mangareva, Gambier, on breakwater, 20 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 892.

Thallus light green and filamentous, to 10 cm long, forming entangled fleecy masses composed of straight, coarse filaments 45-60 µm in diameter. Individual cells rectangular, with thick cell walls. Apical cells of same diameter as main filaments. Multicellular rhizoids absent; some unicellular outgrowths occur very rarely.

Remarks: Growing in the upper littoral, on moist cliff walls or surfaces periodically exposed to surf. Normally occurring above the high tide mark, this species can withstand considerable desiccation, often forming semi-dry skeins which can be confused with bryophytes. At times it can form "blooms" such as what occurred on beaches of Losin Island, Thailand, in June 2001 (K. Passfield, pers. com.). The French Polynesian species fall within the range of filament diameters of *R. africanum*, as described for Lord Howe Island material by Kraft (2000).



Figs 16-22. **16.** *Chaetomorpha antennina* (UPF RPS 202). Apical cell (a) and characteristically long basal cell (b). Scale = 100 μ m. **17.** *Chaetomorpha basiretrorsa* (UC 261301). Habit, showing deflexed cell and ventral rhizoid. Scale = 300 μ m. **18.** *Chaetomorpha linum* (BM 841428). Habit of pressed specimen collected by J. E. Tilden in Tahiti. Scale = 5 mm. **19.** *Chaetomorpha linum* (BM 841428). Detail of rehydrated filament, showing slight incision at cross-wall (arrowhead). Scale = 20 μ m. **20.** *Rhizoclonium riparium* (UPF 2694). Habit, showing coiled filaments. Scale = 50 μ m. **21.** *Rhizoclonium riparium* (UPF 2694). Detail of typically swollen filament end. Scale = 25 μ m. **22.** *Cladophora aokii* (UPF RPS 211). Habit of thallus. Scale = 450 μ m.

Rhizoclonium riparium* (Roth) Harvey, 1849: pl. CCXXXVIII. Peru: Dawson *et al.*, 1964: 11, pl. 8 figs B-E; Trinidad: Richardson, 1975: 85, pl. 18 fig. 2; Indian Ocean: Silva *et al.*, 1996: 786; Belize: Littler & Littler, 1997: 95, fig. 131; 2000: 324, fig. on p. 325. **(Figs 20-21)

Basionym: *Conferva riparia* Roth, 1806: 216 (type locality: Norderney, East Frisian Islands, Germany; type lost according to Dawson *et al.*, 1964).

Material examined: Hakai, Marquesas, 6 May 2002, *leg. S. Sidolle*, UPF 2694.

Thallus filamentous, composed of unbranched, mostly curled filaments, 25-30 μm in diameter, forming yellow-green tangled masses. Short rhizoidal holdfast present. Basal cells 31-40 μm in diameter and 131-155 μm long. Cells of mid-thallus cylindrical, 63-123 μm long. Apical cells characteristically swollen.

Remarks: Growing in brackish water at river mouths. *Rhizoclonium riparium* can be distinguished from *R. africanum* by its finer, darker coloured and more lubricous, somewhat curled filaments with swollen apical cells. It would represent the lower extreme of the range of width variations encountered in the genus, if we follow the opinion of Nienhuis, 1975. In the Marquesas, this species is used as the primary ingredient in a traditional remedy against joint pains (Conte & Payri, 2006).

Genus *Cladophora* Kützing

Seven species of this large polymorphic genus have been reported for French Polynesia by Payri & N'Yeurt (1997), but eight species (including five new records not listed in Payri & N'Yeurt, 1997) have been encountered and confirmed in collections. Setchell (1926) described two new species from Tahiti (*C. leucobryoides* and *C. rhadina*) but they have not been encountered since, although they have been reported from Hawaiian Islands by Abbott & Huisman (2004) who, after examining type material, put them in synonymy with *C. socialis* Kützing and *C. seriacea* (Hudson) Kützing, respectively. Similarly, *C. inserta* f. *typica* and f. *ungulata* Setchell were put in synonymy with *C. vagabunda* (Linnaeus) Hoek. Two other *Cladophora* species reported by Setchell [*C. beneckii* Moebius and *C. insignis* (Agardh) Kützing] were freshwater species not treated here. Because of the taxonomic difficulties associated with morphological plasticity of the species under various environmental conditions and geographic isolation, it is possible that several of the species reported earlier represent the same entities. In particular, the distinction between *C. socialis* Kützing (1849: 416) and *C. patentiramea* (Montagne) Kützing (both originally described from Tahiti) is based on the diameter of apical cells and the length of segments, which were found to be very variable and encompass the circumscription of both species in question (Kraft, 2000: 568). Members of this genus have recently been revised by van den Hoek (1963, 1982), van den Hoek & Chihara (2000), van den Hoek & Womersley (1984) and Leliaert (2004).

Key to the French Polynesian species of *Cladophora*

- 1a. Thallus to 50 cm long, forming fleecy masses. *C. patentiramea*
- 1b. Thallus never exceeding 5 cm in length. 2
 - 2a. Thallus erect, rigid or wiry. 5
 - 2b. Thallus forming short tufts or mats, not rigid or wiry. 3
- 3a. Filaments of mid-thallus 100 μm or less in diameter. 7
- 3b. Filaments of mid-thallus 150 μm or more in diameter 4

- 4a. Filaments of mid-thallus 400-450 μm in diameter, branching irregular . . .
 *C. catenata*
 4b. Filaments of mid-thallus 150-250 μm in diameter, branching lateral
 *C. herpestica*
 5a. Holdfast spreading and lacerate *C. ohkuboana*
 5b. Holdfast rhizoidal 6
 6a. Unbranched basal portion about half of thallus length, median segments
 50-100 μm in diameter *C. feredayoides*
 6b. Basal portion much shorter than thallus length, median segments 170-
 350 μm in diameter *C. aokii*
 7a. Filaments delicate, main axes not reaching over 65 μm in diameter, branching
 irregular with non-percurrent axes, forming cushions *C. socialis*
 7b. Filaments about 100 μm in diameter, slippery, branching pseudodichotomous
 with percurrent axes, forming matted masses *C. seriacea*

Cladophora aokii* Yamada, 1925: 85-86, fig. III (type locality: Mao-pi T'ou, Taiwan). Taiwan: Sakai, 1964: 54; Japan & Russian Far East: van den Hoek & Chihara, 2000: 64, fig. 27A-C. **(Fig. 22)

Heterotypic synonym (given by van den Hoek & Chihara, 2000): *Cladophora ryukyuensis* Sakai et Yoshida in Yoshida, 1977: 71 (type locality: Loo Choo Islands, Ryukyus, Japan). Lord Howe Island: Kraft, 2000: 550, fig. 17A-C.

Material examined: Rapa Island, Australs: Karapoo, *Sargassum* beds -28 m, 1 Nov. 2002, leg. J. L. Menou, UPF 1860; Tematapi Pt., 1. Nov. 2002, leg. J. L. Menou, UPF 1878; Komire Pt., 13 Nov. 2002, leg. J. L. Menou, UPF 2199; Ha'urei, 13 / 26 Nov. 2002, leg. J. L. Menou, UPF 2176, 2337; east oceanic slope, -68 m, 23 Nov. 2002, leg. J. L. Menou, UPF 2315, 2328; Tarakoi Islet, 5 / 6 Nov. 2002, leg. C. E. Payri, UPF 2011, 2034; Anarua Bay, 7 Nov. 2002, leg. C. E. Payri, UPF 2057; Aruroa Pt., 22 Nov. 2002, leg. A. D. R. N'Yeurt, UPF 2239, 2240; Tauna Islet, 27 Nov. 2002, leg. C. E. Payri, UPF 2351, 2352.

Thallus olive green, 15-35 mm high; coarse and wiry, with secund or alternate branching at acute angles. Attached to the substratum via basal cells with stout, subparallel primary rhizoids, and secondary rhizoids from lower axial cells. Apical cells rounded, segments of mid-thallus 170-350 μm in diameter and 250-4000 μm long. Nodes with 2-4 axes occur near ultimate branches.

Remarks: Found growing subtidally from -10 to as deep as -68 metres, this species is characterised by its coarse habit and thick branches. It resembles *C. dotyana* Gilbert (1965) from Hawaii, but the latter is much coarser and has mature cells of the order of 500-700 μm in diameter, while *C. aokii* never exceeds 450 μm even in apical portions. According to van den Hoek & Chihara (2000: 65), Sakai (1964: 52) incorrectly interpreted the type of *Cladophora fastigiata* Harvey, on which *C. ryukyuensis* was based, but his description of the latter species conforms to that of the type of *C. aokii* Yamada, which has nomenclatural priority.

**Cladophora catenata* (Linnaeus) Kützing, 1843: 271. Papua New Guinea: Leliaert & Coppejans, 2003: 53, fig. 4.

Basionym: *Conferva catenata* Linnaeus, 1753: 1166 (type locality: Bahamas according to van den Hoek, 1963: 12, 123).

Misapplied name (given by Gilbert, 1962: 138): *Cladophoropsis membranacea* (C. Agardh) Børgesen. Hawaiian Islands: Egerod, 1952: 356, fig. 3.

Heterotypic synonyms (given by Leliaert, 2004): *Cladophoropsis luxurians* Gilbert, 1962: 136, fig. 3A-B (type locality: shore of Molokai opposite Mokuhooniki Island, Hawaii). French Polynesia: Payri et al., 2000: 72. — *Cladophora luxurians* (Gilbert) Abbott & Huisman, 2003: 282; 2004: 77, fig. 22D (Hawaii).

Material examined: Taiaro, 23 Sep. 1992, *leg. R. Galzin*, UPF 67; Haraiki, 14 Nov. 1996, *leg. J. Orempuller*, UPF 68, 554; Marokau, 22 Nov. 1996, *leg. J. Orempuller*, UPF 70; Nuku Hiva, Marquesas, 1997, *leg. J. Orempuller*, UPF 587.

Thallus dark-green, up to 3 cm tall and forming small, tough mats on the reef top. Branching sparse to profuse and irregular, filaments 400-450 µm in diameter, turgid, with lateral branchlets secundly or irregularly issued from distal or proximal ends of mother cells, often curving downwards with frequent formation of secondary holdfasts from the crenulate tips of filaments. Formation of cross-walls at the base of the lateral branches markedly delayed.

Remarks: Found on coral rubble, in the lagoons and passes of atolls of the Tuamotu archipelago and in the Marquesas. Abbott & Huisman (2003) transferred the Hawaiian species *Cladophoropsis luxurians* to *Cladophora luxurians* based on the presence of delayed cross-wall formations at the base of lateral branchlets, a feature inconsistent with the criteria for *Cladophoropsis*. Concurrently, Leliaert (2004: 122, 235), after examining relevant material, transferred Hawaiian records of *Cladophoropsis membranacea* and *C. luxurians* to *Cladophora catenata* as he found them to be indistinguishable from the latter species.

Cladophora feredayoides* Kraft *et* Millar in Kraft, 2000: 556, fig. 19 (type locality: Erskotts Hole, Lord Howe Island, Australia). **(Fig. 23)

Material examined: Rapa Island, Australs: Rukuaga, base of cliffs -10 m, 30 Nov. 2002, *leg. J. L. Menou*, UPF 2429, 2690, 2691, RPS 75; Tupua'i Bay, 2 Dec. 2002, *leg. J. L. Menou*, UPF RPS 71.

Thallus stiff and wiry, 30-40 mm high, growing solitarily from entangled basal rhizoids. Lower portion of plant unbranched for 10-20 mm. Segments of mid-thallus cylindrical, 50-100 µm in diameter and 630-2200 µm long; branching secund or alternate.

Remarks: Growing from 8-10 m depth, this small stiff, wiry species is characterised by an unbranched lower portion of the thallus reaching at least half the length of the plant (Fig. 23b). The Rapa plants are in good agreement with the Lord Howe Island material described in Kraft (2000), and this represents the first published record for this species outside of the type locality.

Cladophora herpestica* (Montagne) Kützing, 1849: 415. **(Fig. 24)

Basionym: *Conferva herpestica* Montagne, 1842: 15 (type locality: New Zealand).

Homotypic synonym (given by Leliaert, 2004): *Cladophoropsis herpestica* (Montagne) Howe, 1914: 31. French Polynesia: Setchell, 1926: 77, pl. 8 figs 1-3, Payri & N'Yeurt, 1997: 881; South Australia: Womersley, 1984: 184, figs 58B, 59C; Indian Ocean: Silva *et al.*, 1996: 791; Lord Howe Island: Kraft, 2000: 575, fig. 25E-F.

Heterotypic synonym (given by Leliaert, 2004): *Cladophoropsis adhaerens* Gilbert, 1962: 136 (type locality: Hawaii).

Material examined: Punaruu Pass, Tahiti, 11 Jul. 1922, *leg. W. A. Setchell & H. E. Parks*, BM 841145; Akananue Bay, Rapa Island, Australs, 2 Nov. 2002, *leg. C. E. Payri*, UPF 2686.

Thallus forming compact, sediment-infiltrated dark green cushions to 15 mm thick and 200 mm wide, composed of stiff, subparallel often curved filaments 150-250 µm in diameter. Cross walls always present between two cells, but generally absent at the base of lateral branches, with a distal, single non-septate rhizoid being issued from the basal poles of most cells. Branching lateral, distal to intercalary cells.

Remarks: Leliaert (2004: 240) and Leliaert & Coppejans (2006) excluded *Cladophoropsis herpestica* (Montagne) Howe from *Cladophoropsis*, and placed it,

along with *Cladophoropsis zollingeri* (Kützinger) Reinbold, in synonymy with *Cladophora herpestica*. Abbott & Huisman (2004: 87) considered *Cladophoropsis adhaerens* Gilbert (1962: 136) from the Hawaiian Islands a synonym of *C. membranacea*, but Leliaert (2004: 244) found it to be indistinguishable from *Cladophora herpestica* (Montagne) Kützinger. The species has recently not been found other than in the Austral islands in French Polynesia, although it occurs in neighbouring Cook Islands (N'Yeurt & Payri, in prep). Setchell's (1926) record of this species from Tahiti (verified by us in BM) has not been recollected since from that locality.

Cladophora ohkuboana* Holmes, 1896: 249, pl. 10 fig. 1 (type locality: Japan). Japan: Sakai, 1964: 15; Lord Howe Island: Kraft, 2000: 554, fig. 18 D-E; Japan & Russian Far-East: van den Hoek & Chihara, 2000: 84, figs 35, 36A-D. **(Fig. 25)
Material examined: Tauna Islet, Rapa Island, -20 m on coral rubble, 27 Nov. 2002, leg. C. E. Payri, UPF 2692, RPS 85.

Thallus olive-green, rigid, up to 70 mm high. Holdfast spreading and lacerate, composed of a fibrous disc with radiating furcate, unseptated flattened rhizoids to 2 mm long. Branching alternate, opposite or secund, with laterals issued from main axis at narrow angles. Segments thick, cylindrical, 400-500 µm in diameter and 900-4000 µm long.

Remarks: Superficially similar to *C. dotyana* Gilbert, this coarsest of *Cladophora* species is characterised by its thick cell dimensions and unique, spreading lacerate holdfast.

Cladophora patentiramea (Montagne) Kützinger, 1849: 416 pl. 60, fig. I. French Polynesia: Setchell, 1926: 74, pl. 9, Payri & N'Yeurt, 1997: 880, Payri *et al.*, 2000: 68, Conte & Payri, 2002: 167, fig. 4; Viêt Nam: Dawson, 1954: 388, fig. 7e; Indian Ocean: Silva *et al.*, 1996: 778; Lord Howe Island: Kraft, 2000: 566, fig. 23.

Basionym: *Conferva patentiramea* Montagne, 1842: 15 (type locality: Tahiti).
Material examined: Botanical Gardens Papeari, Tahiti, 1 Oct. 1995, 10 Jun. 1997, leg. A. D. R. N'Yeurt, UPF 62, 60; Hotel Beachcomber, Faa'a, Tahiti, 13 Apr. 1997, 7 May 1997, leg. A. D. R. N'Yeurt, UPF 61, 64; Opunohu, Moorea, 1 Jul. 1997, leg. A. D. R. N'Yeurt, UPF 63; Tarakoi islet, Rapa, 5 Nov. 2002, leg. C. E. Payri, UPF 2693.

Thallus to 50 cm long, light yellowish green in colour, forming fine fleecy tufts attached to the substratum via a small inconspicuous holdfast. Main axis to 250 µm in diameter, sparsely branched, bearing profuse, plumose, basally septate lateral branchlets in an irregularly opposite manner.

Remarks: A common species growing in estuaries (Tahiti), or on the reef face 15-20 m depth (Rapa).

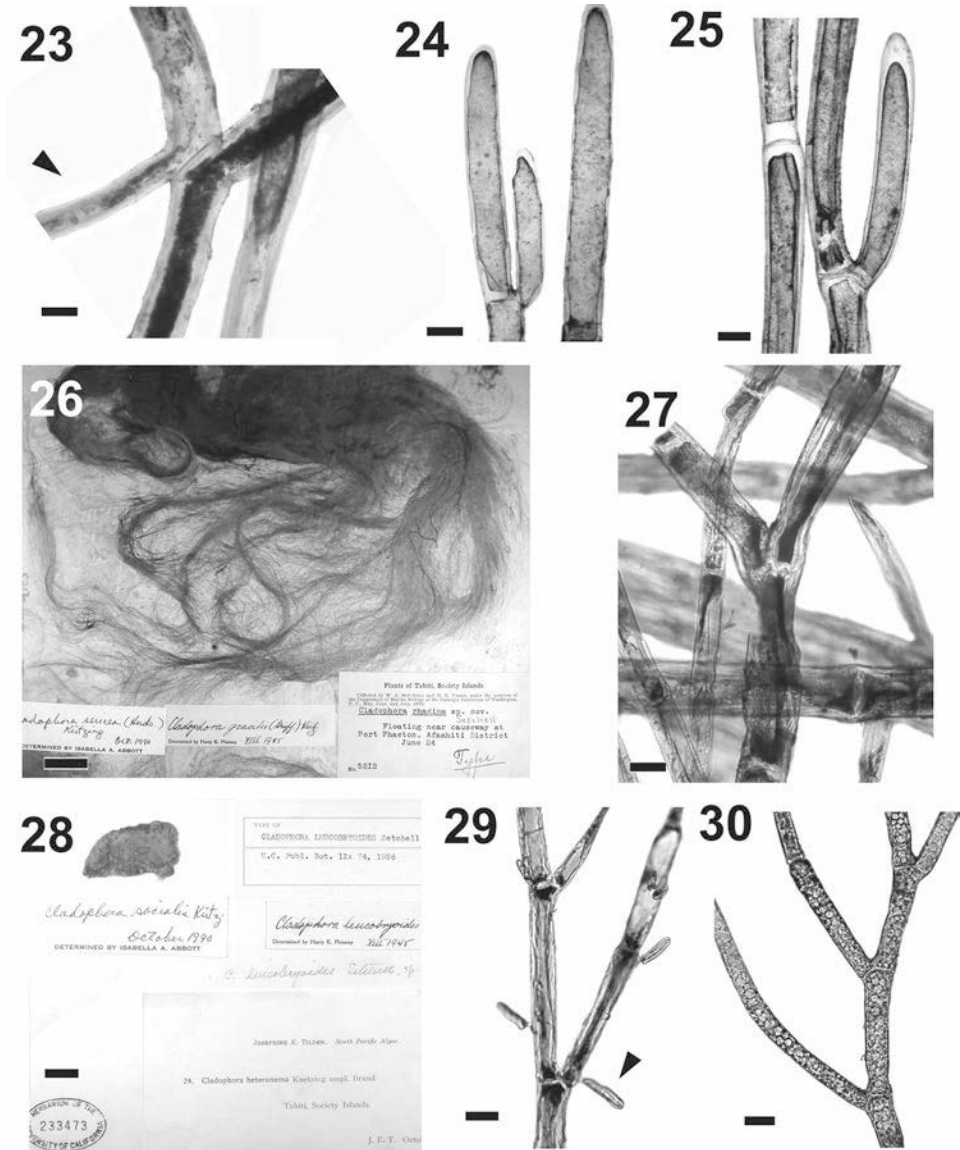
Cladophora sericea (Hudson) Kützinger, 1843: 264. Indian Ocean: Silva *et al.*, 1996: 780; Hawaiian Islands: Abbott & Huisman, 2004: 77, fig. 22E. **(Figs 26-27)**

Basionym: *Conferva sericea* Hudson, 1762: 485 (lectotype locality: Isle of Sheppey, Kent, England).

Heterotypic synonym (given by Abbott & Huisman, 2004): *Cladophora rhadina* Setchell, 1926: 76, pl. 10 fig. 1 (type locality: Afaahiti District, Tahiti).

Material examined: Port Phaeton, Afaahiti, Tahiti, 24 Jun. 1922, leg. W. A. Setchell & H. E. Parks, !UC 261235.

Thallus 30-40 cm high, with matted holdfasts, forming pale green silky, slippery floating masses. Branching dense and pseudodichotomous, with both long and short laterals of mixed ages. Main filaments about 100 µm in diameter,



Figs 23-30. **23.** *Cladophora feredayoides* (UPF RPS 71). (a) Habit of stiff, erect thallus. (b) Lower holdfast of extensive, unbranched basal portion. Scale = 80 μ m. **24.** *Cladophora herpestica* (UPF RPS 42). Detail showing production of basal, non-septate rhizoid (arrowhead) from filament cell. Scale = 200 μ m. **25.** *Cladophora ohkuboana* (UPF RPS 85). Habit of distal portion of thallus. Scale = 500 μ m. **26.** *Cladophora sericea* (UC 261235). Habit of dried Holotype collected by Setchell, and Parks from Afaahiti, Tahiti. Note annotation by I. A. Abbott on leftern side. Scale = 20 mm. **27.** *Cladophora sericea* (UC 261235). Detail of rehydrated portion of thallus showing pseudodichotomous branching. Scale = 50 μ m. **28.** *Cladophora socialis* (UC 233473). Habit of dried, felt-like material collected from Tahiti in 1909 by Josephine Tilden. Scale = 15 mm. **29.** *Cladophora socialis* (UC 233473). Detail of rehydrated portion of thallus, showing abundant epiphytic diatoms (arrowhead) imparting greyish colour to plant. Scale = 50 μ m. **30.** *Cladophora socialis* (UPF 3003). Detail of portion of mid-thallus, showing irregular branching. Scale = 50 μ m.

sharply distinct from secondary branches, with segments up to 400 μm long. Apical cells 12-16 μm in diameter and up to 280 μm long; apices rounded. Secondary branches often in 3s or 4s in lower nodes.

Remarks: Floating near causeway. The synonymy of *Cladophora rhadina* and *C. sericea* was proposed by I. A. Abbott (October 1990, annotation on herbarium sheet of type material, Fig. 26) and reiterated in Abbott & Huisman (2004: 77). The Tahitian material from Afaahiti District in UC also contains fragments of the red alga *Sarconema filiforme* (Sonder) Kylin, which in recent time has been reported from neighbouring Papeari District (Payri *et al.*, 2000).

Cladophora socialis Kützing, 1849: 416 (type locality: Tahiti). French Polynesia: Setchell, 1926: 74; Easter Island: Børgesen, 1924: 249, fig. 2a-c; Marshall Islands: Dawson, 1957: 103, fig. 4B; Pakistan: Nizamuddin & Begum, 1973: 9, figs 44-49; Thailand: Egerod, 1975: 137, figs 17-21; Somalia: Sartoni, 1986: 361, fig. 4A; 1992: 302, fig. 6A-B; South Africa: Leliaert & Coppejans, 2003: 51, fig. 3; Hawaiian Islands: Abbott & Huisman, 2004: 78, fig. 23A-C. **(Figs 28-30)**

Heterotypic synonym (given by Abbott & Huisman, 2004): *Cladophora leucobryoides* Setchell, 1926: 74 (type locality: Tahiti).

Material examined: Tahiti, October 1909, *leg. J. E. Tilden*, !UC 233473; Punaauia, 3 Apr. 2005, *leg. A. D. R. N'Yeurt & K. Pouira*, UPF 3003.

Thallus forming pale to dark green dense felty cushions about 10 mm in diameter and 15-20 mm thick (Fig. 28). Branching irregular. Basal filaments to 52 μm in diameter with segments up to 180 μm long (Fig. 30). Apical cells to 20 μm in diameter, obtuse. Secundly branched one-cell laterals present near apices. Axes slender and intertwined, with cylindrical cells. Uniseriate rhizoids common from basal poles of cells (even in distal parts of the thallus), ending in dislike attachment pads. Distinctly felt-like when dry.

Remarks: Growing as dark green moss-like masses, in small inlets (Tautira) and on semi-exposed rocks on the foreshore (Punaauia). The synonymy of *Cladophora leucobryoides* and *C. socialis* was proposed by I. A. Abbott (October 1990, annotation on herbarium sheet of type material) and reiterated in Abbott & Huisman (2004: 78). The plants often appear grey due to the presence of abundant epiphytic diatoms (Fig. 29).

Family **Siphonocladaceae** Schmitz

Genus ***Boodlea*** G. Murray *et De Toni* in Murray

Boodlea, a genus of some six species, differs from closely related *Phyllocladion* by its spongy three dimensional network, lacking a stalk and growing directly on the substratum (Kraft & Wynne, 1996). Species demarcations within the genus are poorly defined, and there exists wide variations in single populations depending on environmental conditions. Three species are reported from French Polynesia in Payri & N'Yeurt (1997), with only a single species confirmed in collections.

Boodlea composita (Harvey) Brand, 1904: 187, pl. 6 figs 28-35. French Polynesia: Taylor, 1973: 38 (Bora Bora, Huahine); Hawaiian Islands: Egerod, 1952: 362, pl. 32a, fig. 6a, Abbott & Huisman, 2004: 85, figs 26A-B; Viêt Nam: Dawson, 1954: 390, fig. 9c-d; New Caledonia: Valet, 1968: 38, pl. 12 fig. 2; Thailand: Egerod, 1975: 50, fig. 19; Somalia: Sartoni, 1986: 306, fig. 7C; Indian Ocean: Silva *et al.*, 1996: 789; Papua New Guinea: Leliaert *et al.*, 1998: 184, figs 14-20; Lord Howe Island: Kraft,

2000: 569, fig. 24 A-C; Fiji: N'Yeurt, 2001: 703, Littler & Littler, 2003: 200; Samoa: Skelton & South, 2002b: 10, pl. 7 figs 44-46; Rodrigues Island: Coppejans *et al.*, 2004: 2970.

(Figs 31-34)

Basionym: *Conferva composita* Harvey, 1834: 157 (type locality: Mauritius).

Misapplied name: *Boodlea kaeneana* Brand, 1904: 190, pl. 6 figs 36-39; French Polynesia: Setchell, 1926: 77, pl. 7 fig. 5, Payri & N'Yeurt, 1997: 880, Payri *et al.*, 2000: 70.

Heterotypic synonyms (given by Leliaert, 2004): *Boodlea coacta* (Dickie) Murray *et De Toni* in Murray, 1889: 245. Rotuma: N'Yeurt, 1996: 368, fig. 19. — *Boodlea montagnei* (Harvey *ex* J.E. Gray) Egerod, 1952: 332. Cook Islands: Dickie, 1877: 33; Somalia: Sartoni, 1986: 307, fig. 7D; Hawaiian Islands: Abbott & Huisman, 2004: 86, fig. 27.

Material examined: Tahiti, 3 Apr. 1911, *leg. J. E. Tilden*, BM 701624; Maraa, Tahiti, Sep. 1928, *leg. C. Crossland*, BM 841661; Taharaa, Tahiti, 14 Apr. 1997, *leg. C. E. Payri & A. D. R. N'Yeurt*, UPF 9; Taapuna, Tahiti, 7 May. 1997, *leg. A. D. R. N'Yeurt*, UPF 8; Tiapura, Moorea, 1 Jul. 1997, *leg. A. D. R. N'Yeurt*, UPF 383; Atituiti, Mangareva, Gambier, 18 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 917; Matira, Bora Bora, 16 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2522; Tauna Islet, Rapa, 27 Nov. 2002, *leg. C. E. Payri*, UPF 2368; Rapa Iti, 28 Nov. 2002, *leg. J. L. Menou*, UPF 2413; Punaauia, Tahiti, 15 Apr. 2005, *leg. A. D. R. N'Yeurt*, and *V. Pouira*, UPF L15-04-05.

Thallus shiny light green, spongy and crisp, forming unattached masses to 13 cm in diameter. Main filaments about 240 µm in diameter, composed of cells 500-560 µm long. Thallus highly polymorphic; arrangement of older branches are mostly three-dimensional and random (Fig. 31), while younger portions of thalli range from semi-plumose (Fig. 32) to regularly organised, *Phyllocladion*-like two-dimensional blades (Fig. 33). Branching irregularly lateral, the terminal branchlets 35-65 µm in diameter, with frequent secondary attachments between branches via terminal, crenellated sucker-like pads on unmodified segments (type-1 tenacular cells in Leliaert, 2004: 204; Fig. 34).

Remarks: Setchell (1926: 77) distinguished Tahitian and Hawaiian *Boodlea kaeneana* Brand by its single or unilateral second-order branchlets, contrasting to the regularly opposite branching of the Mauritius species *B. composita* (Børgesen, 1940: 21, fig. 6). The French Polynesian plants were found to exhibit variable regular, irregular or unilateral branching. Thus it is reasonable to assume Tahitian *B. kaeneana* records a misapplied name for *B. composita*, a species previously reported from the Society Islands by Taylor (1973). Furthermore, the Hawaiian type material of *B. kaeneana* was found conspecific with *Cladophoropsis membranacea* (Leliaert, 2004: 120). The genus *Boodlea* (along with *Phyllocladion* and several others) form a close cluster with *Cladophoropsis* in the Cladophorophyceae based on recent phylogenetic studies (Kooistra *et al.*, 1993; Wysor, 2002; Leliaert *et al.*, 2003) and a single, highly variable species (*Boodlea composita*) may need to be recognized (Leliaert, 2004). We have ourselves examined the type specimens of *Conferva composita*, *Cladophora coacta*, *Microdictyon montagnei*, *Boodlea paradoxa* and *Boodlea siamensis* in BM, and have to agree with Leliaert's encompassing view of this highly polymorphic genus.

Genus *Cladophoropsis* Børgesen *amend.* Papenfuss

The taxonomy of this polyphyletic genus has most recently been revised by Leliaert (2004) and Leliaert & Coppejans (2006).

Cladophoropsis sundanensis Reinbold, 1905: 147 (lectotype locality: Kangean, Indonesia according to Leliaert, 2004: 127). French Polynesia: Setchell, 1926: 77; W.R. Taylor, 1973: 38 (Makatea); Payri & N'Yeurt, 1997: 881, Payri *et al.*, 2000: 72; Indian Ocean: Silva *et al.*, 1996: 793; Rotuma: N'Yeurt, 1996: 370, fig. 11; Lord Howe Island: Kraft, 2000: 573, fig. 25A-D; South Africa: Leliaert *et al.*, 2001: 452, figs 6-8; Fiji: N'Yeurt, 2001: 706, fig. 16; Leliaert, 2004: 127, figs 3L-M, 13, 14.

Heterotypic synonym (given by Leliaert, 2004): *Cladophoropsis carolinensis* Trono, 1971: 48 (type locality: Truk, Micronesia).

Material examined: Tikehau, lagoon, 7 Nov. 1995, *leg. A. D. R. N'Yeurt*, UPF S154; Motu Taraururoa, Gambier, fringing reef on ocean side, 16 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 851; Motu Totegegie, Gambier, fringing reef, 22 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 796; north plateau, -40 m, Rapa Island, Australs, 25 Nov. 2002, *leg. J. L. Menou*, UPF 2332.

Plants tufted, greenish-brown, forming sediment-infiltrated flaccid cushions up to 15 mm high with filaments 60-176 µm in diameter; loosely branched with branchlets at 300-500 µm intervals along the main axis. Branches non-septate and entangled at the base, secund or irregular and projecting from the distal end of the primary axial cells, with a rhizoid arising from the base of most cells immediately above a lateral in open connection with the cell immediately below.

Remarks: Leliaert (2004: 127), after examining relevant type material, found no basis to distinguish *Cladophoropsis carolinensis* from *C. sundanensis*. Recent molecular phylogeographic studies on *Cladophoropsis membranacea* (Kooistra, 1992; van der Strate *et al.*, 2002) revealed the presence of cryptic species, notably separate clades for Atlantic, Caribbean and Pacific (Japanese, Hawaiian) material. In the same studies, *C. sundanensis* was found to be a sister species to the *C. membranacea* clade.

Genus ***Dictyosphaeria*** Decaisne ex Endlicher

Key to the French Polynesian species of *Dictyosphaeria*

- 1a. Thallus hollow, intracellular spines absent *D. cavernosa*
 1b. Thallus solid, intracellular spines present *D. versluysii*

Dictyosphaeria cavernosa (Forsskål) Børgesen, 1932: 2, pl. 1 fig. 1. French Polynesia: Taylor, 1973: 38 (Bora Bora); Payri & N'Yeurt, 1997: 881, Payri *et al.*, 2000: 76; Hawaiian Islands: Egerod, 1952: 350, figs 1b-f, 2f-g; Abbott & Huisman, 2004: 89, fig. 29A; Viêt Nam: Dawson, 1954: 388, fig. 8i; Indian Ocean: Silva *et al.*, 1996: 794; Rotuma: N'Yeurt, 1996: 371, fig. 12; Papua New Guinea: Leliaert *et al.*, 1998: 188, figs 30-33; Lord Howe Island: Kraft, 2000: 578, fig. 27 A-B; Fiji: N'Yeurt, 2001: 707; Littler & Littler, 2003: 202; South Africa: De Clerck *et al.*, 2005: 54, fig. 23. **(Fig. 35)**

Basionym: *Ulva cavernosa* Forsskål, 1775: 187 (syntype localities: "Gomfodae" (Al-Qunfidha), Saudi Arabia; Mokha, Yemen).

Heterotypic synonym (given by Silva *et al.*, 1996): *Dictyosphaeria favulosa* (C. Agardh) Decaisne ex Endlicher, 1843: 18. French Polynesia: Setchell, 1926: 78.

Material examined: Reka Reka, 9 Nov. 1996, *leg. J. Orempuller*, UPF 80; Haraiki, 15 Nov. 1996, *leg. J. Orempuller*, UPF 79, 707; Hotel Intercontinental, Bora Bora, 19 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2590; Mohio, Bora Bora, 21 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2601; Tarakoi islet, Rapa, shelves with *Sargassum*, 6 Nov. 2002, *leg. C. E. Payri*, UPF 2036; Akaeke Pt., Rapa, dead patch reef, 7 Nov. 2002, *leg. C. E. Payri*, UPF 2055; Tiahura, Moorea, 1 Oct. 2004, *leg. A. D. R. N'Yeurt*, UPF 2955.

Thallus 8-13 cm in diameter; shiny light green, sessile, sometimes spherical and often irregularly lobed. Internal structure hollow, the walls one-cell thick, with angular or polygonal cells clearly seen with the naked eye. Intracellular spines absent. Thallus lightly attached to substratum via small rhizoids.

Remarks: Commonly found growing on coral and other hard substrata in the lagoon of atolls, where it can reach large sizes.

Dictyosphaeria versluysii Weber-van Bosse, 1905: 144 (“*versluysi*”) (syntype localities: “Plusieurs récifs dans l’Archipel Malaisien”). French Polynesia: Payri *et al.*, 2000: 76; Hawaiian Islands: Egerod, 1952: 351, 354-355, figs 1a, 2h-k; Abbott & Huisman, 2004: 89, fig. 29B; New Caledonia: Valet, 1966a: 256, figs 1-2; Indian Ocean: Silva *et al.*, 1996: 796; Papua New Guinea: Leliaert *et al.*, 1998: 190, figs 37-39; Fiji: N'Yeurt, 2001: 707, Littler & Littler, 2003: 204; South Africa: De Clerck *et al.*, 2005: 56, fig. 24. **(Fig. 36)**

Heterotypic synonym (given by Valet, 1966a): *Dictyosphaeria australis* Setchell, 1926: 79, pl. 8 figs 9, 10 (type locality: Arue, Tahiti). French Polynesia: Payri & N'Yeurt, 1997: 881.

Material examined: Maraa, Tahiti, 24 Sep. 1928, *leg. C. Crossland*, BM 841316; Taharaa, Tahiti 14 Apr. 1997, *leg. A. D. R. N'Yeurt*, UPF 77; Taapuna, Tahiti, 7 May 1997, *leg. A. D. R. N'Yeurt*, UPF 78; Punaauia, Tahiti, 10 May 1997, *leg. A. D. R. N'Yeurt*, UPF 76; Mohio, Bora Bora, 21 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2601; Atituiti, Mangareva, 18 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 916.

Thallus to 4 cm in diameter, shiny dark green, sessile and cartilaginous, with angular or polygonal cells clearly seen with the naked eye. Internal structure solid throughout, with sparse intracellular spines 60-88 µm long. Attached to the substratum via sparse basal rhizoids.

Remarks: Forming tightly adhering, solid button-like crusts on coral debris. Valet (1966a) found that characters previously used to separate solid species of *Dictyosphaeria* of the *versluysii* group were overlapping and unreliable; *D. australis* Setchell fell within that category.

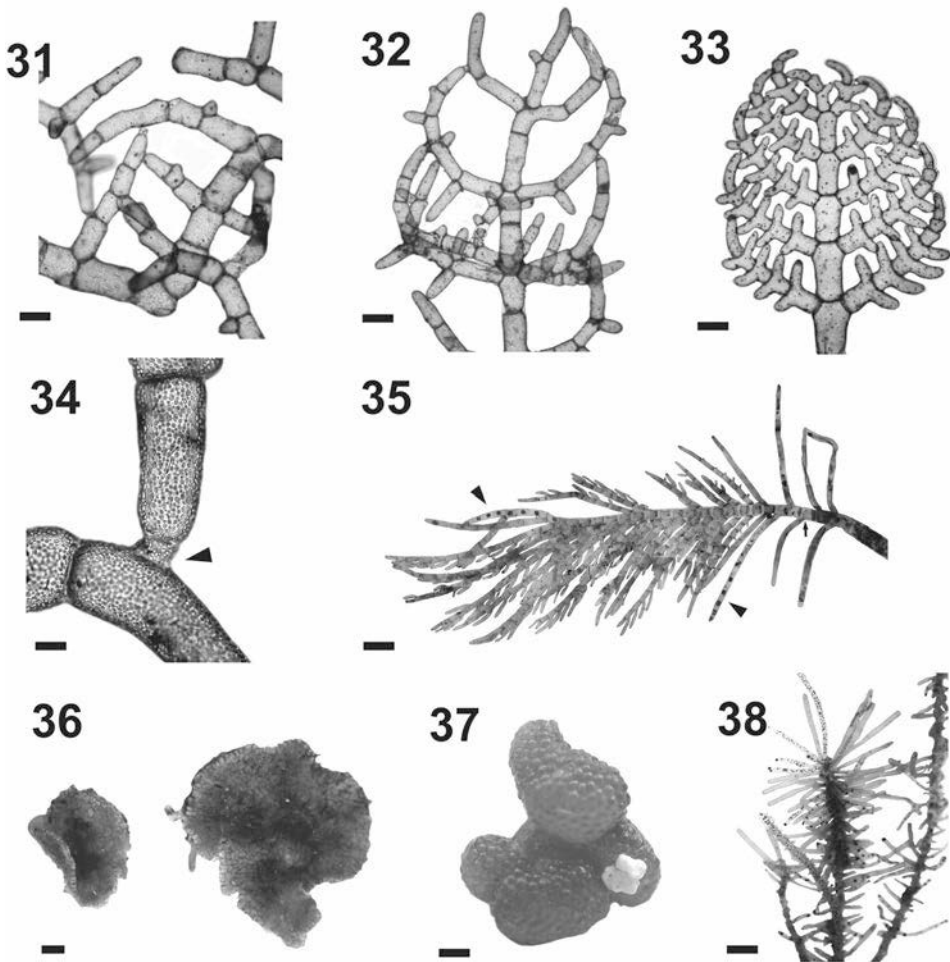
Genus *Phyllodictyon* J.E. Gray

Phyllodictyon anastomosans (Harvey) Kraft *et* Wynne, 1996: 139, figs 16-25. French Polynesia: Payri *et al.*, 2000: 74; Papua New Guinea: Leliaert *et al.*, 1998: 186, figs 23-24; Oman: Wynne, 2001: 368, fig. 34; Fiji: Littler & Littler, 2003: 200; Hawaiian Islands: Abbott & Huisman, 2004: 63, fig. 16A-B.

Basionym: *Cladophora? anastomosans* Harvey, 1859: pl. CI (type locality: Fremantle, Western Australia).

Heterotypic synonyms (given by Kraft & Wynne, 1996): *Struvea anastomosans* (Harvey) Piccone *et* Grunow *ex* Piccone, 1884: 20. West Indies: Børgesen, 1913: 54, fig. 39; Mauritius: Børgesen, 1952: 7, fig. 3; Hawaiian Islands: Egerod, 1952: 359, pl. 31 fig. 4; Viêt Nam: Dawson, 1954: 390, fig. 8g; Thailand: Egerod, 1975: 50, fig. 15a-b; Somalia: Sartoni, 1992: 317, fig. 12B-C; Papua New Guinea: Coppejans *et al.*, 1995: 96, fig. 38; Maldives: Wynne, 1993: 20; 1995: 332, fig. 86; Indian Ocean: Silva *et al.*, 1996: 798; Rotuma: N'Yeurt, 1996: 369, figs 21-22. — *Struvea delicatula* Kützinger, 1866: 1, pl. 2 figs e-g (type locality: New Caledonia). Japan: Okamura, 1908 (1907-1909): 203, pl. 40 figs 9-12; Segawa, 1938: 135, fig. 3; Ryukyu Islands: Yamada, 1934: 46, fig. 10; New Caledonia: Valet, 1968: 37.

Material examined: Punaauia PK 18, Tahiti, 28 Feb. 1998, *leg. A. D. R. N'Yeurt*, UPF 613.



Figs 31-38. **31.** *Boodlea composita* (UPF L15-04-05). Habit of randomly organised, older part of thallus. Scale = 250 μ m. **32.** *Boodlea composita* (UPF L15-04-05). Habit of younger part of thallus. Scale = 100 μ m. **33.** *Boodlea composita* (UPF L15-04-05). Habit of very young blade-like part of thallus. Scale = 100 μ m. **34.** *Boodlea composita* (UPF L15-04-05). Detail of crenellated attachment pad (arrowhead) between adjacent branchlets. Scale = 100 μ m. **35.** *Dictyosphaeria cavernosa* (UPF 2036). Habit of flattened-out thallus. Scale = 10 mm. **36.** *Dictyosphaeria versluisii* (UPF 2601). Habit of solid thallus. Scale = 5 mm. **37.** *Siphonocladus tropicus* (UPF 2091). Habit of freshly-collected plant. Scale = 2 mm. **38.** *Struveopsis* sp. (UPF RPS 20). Habit of thallus, showing irregular branching and portions with segregative cell division (arrowheads). Also shown is the lack of cross wall between the main axis and side branchlets (small arrow). Scale = 500 μ m.

Thallus to 30 mm high, dark to light green, composed of a segmented, hollow stalk to 800 μ m wide bearing an irregularly shaped flat blade to 10 mm wide and 15 mm long. The blade is composed of a network of segmented, anastomosing filaments 60-100 μ m in diameter repeatedly branched in a mostly opposite manner along upper parts of the main axis. Tenacular cells

predominantly composed of small modified cells produced distally on terminal segments (type-3 cells in Leliaert, 2004: 104).

Remarks: Growing usually solitarily, among algal mats on coral heads in the lagoon. Leliaert (2004) advocated the merging of *Phyllocladus* and other genera such as *Boodlea* under *Cladophoropsis*. Indeed, some ecomorphs of French Polynesian *Boodlea composita* are strikingly alike *Phyllocladus anastomosans* as circumscribed here, and the validity of this and other related genera might change in future.

Genus *Siphonocladus* F. Schmitz

Siphonocladus tropicus* (P. et H. Crouan) J. Agardh, 1887: 105. Somalia: Sartoni, 1992: 315, fig. 12A; Indian Ocean: Silva *et al.*, 1996: 797; Hawaiian Islands: Abbott & Huisman, 2004: 90, fig. 30; Wallis: N'Yeurt & Payri, 2004: 372. **(Fig. 37)

Basionym: *Apjohnia tropica* P. et H. Crouan in Schramm *et Mazé*, 1865: 47 (syntype localities: Guadeloupe, West Indies).

Material examined: Rarapai Islet, Rapa, 12 Nov. 2002, *leg. J. L. Menou*, UPF 2170; between Matarepe and Takaraotara Points, Rapa, 9 Nov. 2002, *leg. C. E. Payri*, UPF 2091.

Thallus to 40 mm high, composed of erect subcylindrical vesicles 1-3 mm in diameter, with prominent basal annular constrictions, and well developed, non-septate basal rhizoids. Each axis consisting of a pseudoparenchymatous filament of appressed, polygonal cells 200-500 µm in diameter. Blunt-ended lateral branchlets in irregularly radial whorls, to 10 mm long, formed from rounded-up protoplast of main axis or previous branch order.

Remarks: growing between 12 and 32 m on hard substrata, so far in French Polynesia only reported from the southern Australs (Rapa).

Genus *Struveopsis* Rhyne *et H. Robinson*

Struveopsis* sp. **(Fig. 38)

Material examined: Marotiri, Australs, 6 Nov. 2002, *leg. I. R. D.*, UPF 2106, RPS 20.

Thallus plumose, grass-green, rugose when dry, 20-30 mm high and 5-6 mm broad, including a non-annulated, terete stipe 9-10 mm long and 500-600 µm in diameter, attached to the substratum via cylindrical, blunt-ended rhizoids. Central axis 250-300 µm in diameter, composed of cylindrical to subquadrate cells 300-600 µm long, with thick stratified cell walls. Side branchlets 100-220 µm in diameter are issued alternately, opposite or unilaterally at irregular intervals along the main axis, and are at their base in continuous connection with the parent cell, lacking a cross wall. Some parts of side branchlets apparently with segregative cell division, most portions of thallus with intercalary, asynchronous cell division.

Remarks: Dredged from 52 m depth. The genus *Struveopsis* is intermediate between *Cladophoropsis*, *Struvea*, and *Phyllocladus* and is conspecific with the genus *Pseudostruvea* Egerod (1975: 47) (Kraft & Wynne, 1996: 140). The genus could be considered a phenodeme in the highly polymorphic *Cladophoropsis* complex (Leliaert, 2004: 167). The Marotiri plant clearly belongs in the Siphonocladales, and the presence in some parts of the thallus of segregative cell division would suggest placement in *Struvea*, following the interpretation of Kraft & Wynne (1996). However, Leliaert (2004) revised this interpretation, finding both segregative and intercalary division in many members of the Cladophorales. The long naked stipe and erect, percurrent main axis of the plant distinguishes it from *Cladophoropsis*. The Marotiri plant differs from *Cladophora (sensu stricto)*

based on the lateral branches with distinct delayed cross-wall formation, and from *Struvea* by the total lack of tenacular adhesion between adjacent branchlets (absence of a reticulum), and the asynchronous, partially unilateral, *Cladophoropsis*-like side branchlets with delayed cross wall formation, features characteristic of *Struveopsis* (F. Leliaert, pers. com.).

Family **Valoniaceae** Nägeli

Genus **Valonia** C. Agardh, 1822: 429

Key to the French Polynesian species of *Valonia*

- 1a. Thallus forming mostly erect clumps..... *V. fastigiata*
 1b. Thallus forming encrusting mats 2
 2a. Vesicles ovoid to ocellate, solitary or in colonies, mostly unbranched ...
 *V. macrophysa*
 2b. Vesicles cylindrical to clavate, much branched *V. aegagropila*

Valonia aegagropila C. Agardh, 1823: 429 (lectotype locality: Venezia, Italy according to Egerod, 1952: 348). French Polynesia: Payri & N'Yeurt, 1997: 881, Payri *et al.*, 2000: 78; Hawaiian Islands: Egerod, 1952: 348, pl. 29b; Abbott & Huisman, 2004: 92, fig. 31A; Indian Ocean: Silva *et al.*, 1996: 801; Rotuma: N'Yeurt, 1996: 372, fig. 15a-b; Papua New Guinea: Leliaert *et al.*, 1998: 192, figs 40-41; Fiji: N'Yeurt, 2001: 708, Littler & Littler, 2003: 206.

Material examined: Mokoto, Mangareva, 27 Sep. 1997, *leg. J. Starmer*, UPF 623; Hotel Intercontinental, Bora Bora, 19 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2589.

Thallus encrusting, light yellowish to olive-green, composed of cylindrical to clavate vesicles 3-13 mm long and 1.5-2 mm broad, subdichotomously branched from the sides or the ends of the cells. Young plants attached to each other, the older ones more or less free.

Remarks: Forming extensive mats at the base of coral heads and on flat surfaces, in the lagoon of high islands.

Valonia fastigiata Harvey *ex* J. Agardh, 1887: 101, pl. I fig. 5 (syntype localities: Sri Lanka; Tonga). French Polynesia: Setchell, 1926: 80, Payri & N'Yeurt, 1997: 881; Payri *et al.*, 2000: 78; Somalia: Sartoni, 1992: 321, fig. 14C; Papua New Guinea: Coppejans *et al.*, 1995: 98, fig. 39, Leliaert *et al.*, 1998: 192, figs 42-44; Indian Ocean: Silva *et al.*, 1996: 801; Samoa: Skelton & South, 2002a: 162, fig. 24A; Fiji: Littler & Littler, 2003: 206. **(Fig. 39)**

Basionym: *Conferva utricularis* Roth, 1797: 160, pl. I fig. 1 (type locality: Mediterranean Sea).

Material examined: Tahiti, Sep. 1875, *leg. H. Moseley*, BM 841146, 841343; Punaruu, Tahiti, 12 Jul. 1922, *leg. W. A. Setchell & H. E. Parks*, BM 841322, 841342; Taapuna, Tahiti, 7 May 1996, *leg. C. E. Payri*, UPF 140, 141; Rurutu, Australs, 18 Aug. 2000, *leg. C. E. Payri*, UPF 730; Matira, Bora Bora, 15/18 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2491, 2537.

Thallus dark olive green, forming erect clumps or cushions to 3 cm high and 10 cm across. Individual vesicles elongate-ovoid, hollow, irregularly branched, to 10 mm long and 5 mm wide, loosely attached to each other.

Remarks: Growing as clumps between branches of coral and crevices in hard substratum, in the lagoon and on the reef flat.

Valonia macrophysa Kützing, 1843: 307 (type locality: Lessina, Croatia). French Polynesia: Payri *et al.*, 2000: 80; Indian Ocean: Silva *et al.*, 1996: 802; Belize: Littler & Littler, 1997: 91, fig. 121; Fiji: Littler & Littler, 2003: 206.

Material examined: Tiahura, Moorea, 3 Nov. 2004, *leg. A. D. R. N'Yeurt*, in Herb. UPF.

Thallus to 10 cm across and 5 cm thick, shiny dark olive green, composed of irregularly ovoid to ocellate, bubblelike macroscopic cells 5-20 mm in diameter and 10-40 mm long, mostly unbranched. Thallus attached to the substratum via rhizoids issued from basal cells.

Remarks: Forming tightly adhering mats on flat coral, usually *Favites* sp. in shallow lagoon waters.

Genus *Valoniopsis* Børgesen

Valoniopsis pachynema (G. Martens) Børgesen, 1934: 10-16, figs 1a-f, 2. French Polynesia: Abbott, 1986: 163, figs 3-5; Micronesia: Dawson, 1957: 102, fig. 2; Fiji: N'Yeurt, 2001: 709, fig. 31; Hawaiian Islands: Abbott & Huisman, 2004: 93, fig. 32A.

Basionym: *Bryopsis pachynema* G. Martens, 1868: 24, 62-63, pl. IV fig. 2 (syntype localities: Benkulen (Bengkulu) and Pulau Tikus, near Bengkulu, Sumatra, Indonesia).

Material examined: Lake Fauna Nui, Huahine, c. 2003, *leg. C. E. Payri*, UPF 3967, 3968.

Thallus forming cushions up to 5-8 cm across and 3 cm high, composed of coenocytic, erect or arcuate, elongated cylindrical vesicles 1-1.5 mm in diameter. Branching irregular, with up to 5 basally-septated branch segments in an umbellate apical cluster on parent segment. Basal rhizoids irregularly branched and tapered, lacking annular constrictions.

Remarks: Growing on the lagoon floor, 0.3 m depth. This unique ball-like form of *Valoniopsis*, illustrated in Abbott (1986), was found growing about 2 miles from the barrier reef, probably having been washed up from its normal habitat and assuming its unusual habit owing to environmental factors inherent to the semi-closed internal lagoon.

Genus *Ventricaria* J.L. Olsen *et J.A. West*

Ventricaria ventricosa (J. Agardh) J.L. Olsen *et J.A. West*, 1988: 104, fig. 11. French Polynesia: Payri & N'Yeurt, 1997: 881; Payri *et al.*, 2000: 80; Somalia: Sartoni, 1992: 323, fig. 14E; Indian Ocean: Silva *et al.*, 1996: 800; Rotuma: N'Yeurt, 1996: 372, fig. 23; Belize: Littler & Littler, 1997: 89, fig. 119; Fiji: N'Yeurt, 2001: 708, Littler & Littler, 2003: 204; Hawaiian Islands: Abbott & Huisman, 2004: 94, fig. 32B. **(Fig 40)**

Basionym: *Valonia ventricosa* J. Agardh, 1887: 96 (syntype localities: St. Croix, Virgin Island; Guadeloupe). French Polynesia: Setchell, 1926: 79, Payri & Meinesz, 1985a: 510; Hawaiian Islands: Egerod, 1952: 347, pl. 29a; Viêt Nam: Dawson, 1954: 388, fig. 8e; Marshall Islands: Dawson, 1956: 28, 1957: 101; Philippines: Trono, 1986: 213, fig. 7.

Material examined: Opunohu Bay, Moorea, 30 Jun. 1997, *leg. A. D. R. N'Yeurt*, UPF 142; Tupai, 3 Jul. 2002, *leg. C. Vermeij*, UPF 2488; Matira, Bora Bora, 15 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2494.

Thallus to 5 cm in height, shiny dark green, consisting of a thin-walled, turgid, fluid-filled subspherical to spherical or pyriform marble-like single cell. Attached to the substratum via minute basal rhizoids. The cell does not rupture if the cell wall is punctured.

Remarks: Common in the lagoon, growing in interstices on coral micro-atolls or epiphytic on algae such as *Galaxaura spp.*; or on coral debris to a depth of 20 meters on the outer reef slope (Society). Large, deep-water specimens are often covered with epiphytic crustose coralline algae.

Order **Bryopsidales** Schaffner
Family **Bryopsidaceae** Bory de Saint-Vincent
Genus ***Bryopsis*** J.V. Lamouroux

Key to the French Polynesian species of *Bryopsis*

- 1a. Thallus light translucent green, branches plumose, not curved. *B. plumosa*
1b. Thallus dark green, branches curved, appearing uniseriate.
..... *B. pennata* var. *secunda*

Bryopsis pennata J.V. Lamouroux var. *secunda* (Harvey) Collins *et* Hervey, 1917: 62. French Polynesia: Payri & N'Yeurt, 1997: 882, Payri *et al.*, 2000: 82; Brazil: Mitchell *et al.*, 1979: 109, pl. 1 figs 6-8; Indian Ocean: Silva *et al.*, 1996: 807; Belize: Littler & Littler, 1997: 97, fig. 134; Fiji: N'Yeurt, 2001: 709, fig. 30, Littler & Littler, 2003: 208; Samoa: Skelton & South, 2002a: 163, fig. 24E; Hawaiian Islands: Abbott & Huisman, 2004: 98, fig. 33C.

Basionym: *Bryopsis plumosa* (Hudson) C. Agardh var. *secunda* Harvey, 1858a: 31, plate XLV.A. figs 1-3 (syntype localities: Key West & Sand Key, Florida, U.S.A.).

Heterotypic synonym (given by Silva *et al.*, 1996: 807): *Bryopsis harveyana* J. Agardh, 1887: 82 (syntype localities: Florida, U.S.A.; Tonga). French Polynesia: Setchell, 1926: 80; Payri & N'Yeurt, 1997: 882.

Material examined: Taharaa, Tahiti, 17 Jun. 1922, *leg. W. A. Setchell & H. E. Parks*, BM 701617; Hikueru, 17 Nov. 1996, *leg. J. Orempuller*, UPF 12; Hotel Beachcomber, Faa'a, Tahiti, estuary, *leg. A. D. R. N'Yeurt*, 4 May 1997, UPF 14, 15; 5 Jun. 1997, UPF 10, 15; Pirae, Tahiti, 15 Apr. 1998, *leg. C. E. Payri*, UPF 718; Taharaa, Tahiti, 22 Apr. 1998, *leg. A. D. R. N'Yeurt*, UPF 719.

Thallus dark iridescent green; in compact clumps 12-60 mm high and 120 mm broad; main axis 300-800 µm in diameter and unbranched, with slight upward curvature. Secondary branches cylindrical to clavate, up to 4 mm long and 100 µm broad, with rounded apex and slight constriction at the base. Branchlets occurring in an offset pair of lateral rows on one side of the primary axis, giving a uniseriate appearance to the thallus. Secondary branchlets typically longer in middle of axis, imparting a renoid curvature to the younger blades.

Remarks: Growing in clumps, intertidally near the reef crest or in dense clumps on pebbles and rocks in the calm, sediment-rich waters of estuaries (Tahiti).

Bryopsis plumosa (Hudson) C. Agardh, 1823: 448. French Polynesia: Payri *et al.*, 2000: 82; Peru: Dawson *et al.*, 1964: 14, pl. 11 fig. D; Kermarrec, 1974: 21, pl. 1 fig. A; Rietema, 1975: 8-24, pls 1-9; Florida: Woelkerling, 1976: 86, figs 9-14; South Australia: Womersley, 1984: 282, figs 96C, 97A; Korea: Lee *et al.*, 1991: 24, figs 1A-E, 4A; Indian Ocean: Silva *et al.*, 1996: 808; Rotuma: N'Yeurt, 1996: 374, figs 49, 60;

Belize: Littler & Littler, 1997: 97, fig. 135; Caribbean: Littler & Littler, 2000: 344; Oman: Wynne, 2001: 365, fig. 33. **(Fig. 41)**

Basionym: *Ulva plumosa* Hudson, 1762: 571 (type locality: Exmouth, Devonshire, England).

Material examined: Taharaa, Tahiti, 14 Apr. 1997, leg. A. D. R. N'Yeurt, UPF 16; Matira, Bora Bora, 17 Aug. 2002, leg. A. D. R. N'Yeurt, UPF 2558; Rarapai Islet, Rapa, 12 Nov. 2002, leg. J. L. Menou, UPF 2158.

Thallus to 40 mm high, iridescent translucent green, in lax clumps composed of feather-like, oppositely branched axes. Main axes straight, to 500 µm in diameter, naked below and furnished above with two opposite rows of secondary branchlets to 100 µm in diameter and 2-3 mm long, progressively smaller towards the apex so as to give a plumose outline to the branches.

Remarks: Non-staggered, opposite ramuli in straight rows differentiate this species from *Bryopsis indica* (Gepp & Gepp, 1908: 169, pl. 22 figs 10, 11). However, *B. indica* from Lord Howe Island (Kraft, 2000: 629) has been reported to vary greatly in respect to the straightness of ramuli rows. The French Polynesian plants (cf. Payri *et al.*, 2000, fig. on p. 83, lower) show axes with straight, opposite ramuli that would conform with *B. plumosa* as understood here.

Family **Derbesiaceae** Hauck

Genus ***Derbesia*** Solier

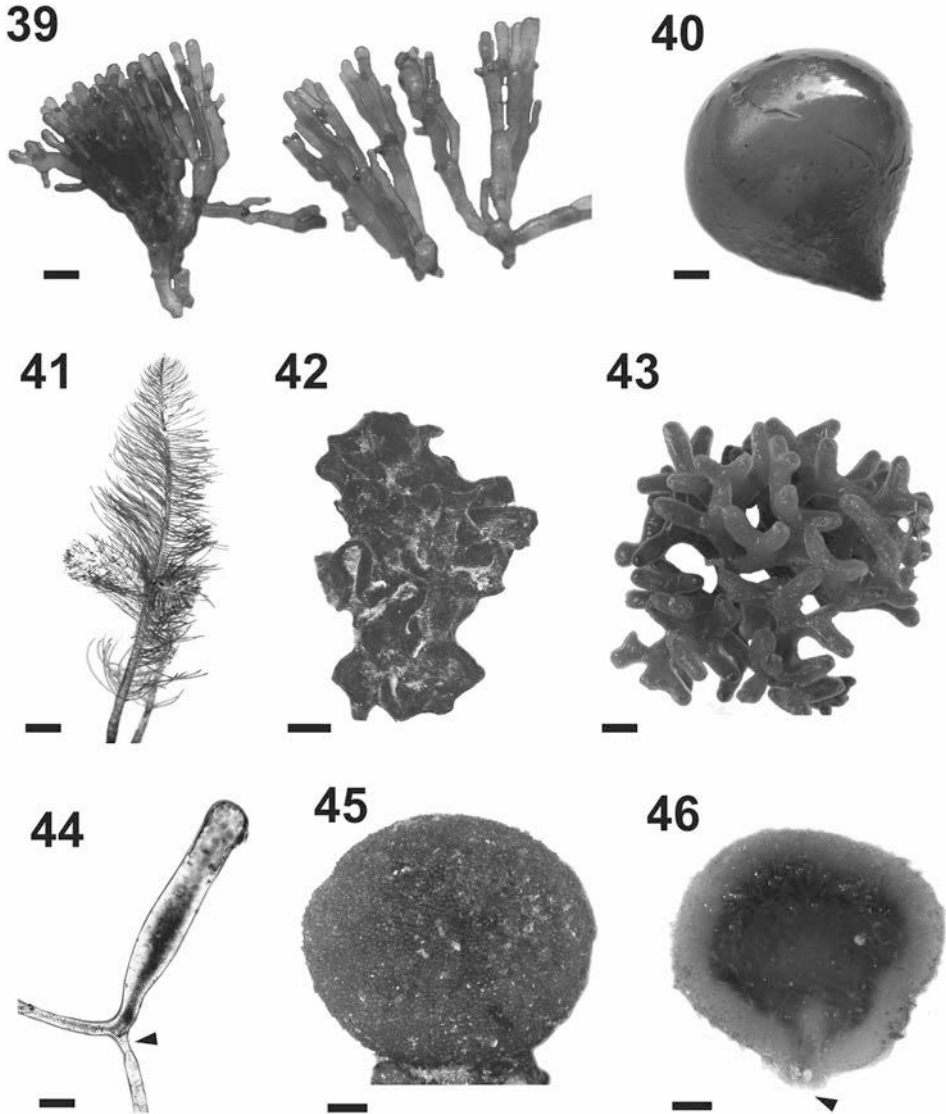
Derbesia marina (Lyngbye) Solier, 1846: 453; French Polynesia: Payri & N'Yeurt, 1997: 882, Payri *et al.*, 2000: 84; Marshall Islands: Dawson, 1956: 35, fig. 15a-b; South Australia: Womersley, 1984: 288, figs 98C-G, 99A; Netherlands Antilles: Stegenga & Vroman, 1988: 300, figs 1-4; Philippines: West & Calumpong, 1990: 186; Indian Ocean: Silva *et al.*, 1996: 810; Belize: Littler & Littler, 1997: 99, fig. 137; Lord Howe Island: Kraft, 2000: 621, figs 39A-E; American Samoa: Skelton & South, 2004: 303, fig. 9.

Basionym: *Vaucheria marina* Lyngbye, 1819: 79, pl. 22A (type locality: Kvivig, Strømø, Faeroes).

Material examined: Entre deux Baies, Moorea, 23 Nov. 1995, leg. A. D. R. N'Yeurt, S109 UPF 495.

Thallus to 30 mm high, dark yellowish green, forming filamentous tufts composed of sparsely branched axes to 20-44 µm in diameter. Chloroplasts circular, 4-6 µm long, pyrenoids absent. Ovoid to pear-shaped sporangia to 130 µm long and 100 µm in diameter occur singly or in pairs on the sides of branches, borne on a small stalk. Double walls sometimes occur at the base of branches or sporangia.

Remarks: Epiphytic on larger algae, to depths of 30 meters. The French Polynesian material has plastids lacking pyrenoids and double septa at the base of sporangia, thus conforming to *D. marina* and not to the similar species *D. tenuissima* (Morris *et de Notaris*) P. Crouan *et* H. Crouan. Moreover, *D. tenuissima* has larger axis diameters (up to 80 µm) than *D. marina* (Womersley, 1984). However, as discussed by Kraft (2000: 621) these characters are sometimes difficult to ascertain, with considerable overlap between the species reported in the literature. The Polynesian plants are most similar to Marshall Islands material described in Dawson (1956: 35), particularly as regards the shape of the sporangia (as illustrated in Payri *et al.*, 2000).



Figs 39-46. **39.** *Valonia fastigiata* (UPF 2491). Habit of freshly-collected, split-out thallus, showing elongate vesicles. Scale = 5 mm. **40.** *Ventricaria ventricosa* (UPF 2494). Habit of young thallus. Scale = 5 mm. **41.** *Bryopsis plumosa* (UPF 2158). Habit. Scale = 1 mm. **42.** *Codium arabicum* (UPF 73). Habit of flattened, convoluted thallus. Scale = 5 mm. **43.** *Codium geppiorum* (UPF 2402). Habit of branched, terete thallus. Scale = 3 mm. **44.** *Codium geppiorum* (UPF 2402). Detail of utricle, showing medullary filament plug (arrowhead). Scale = 200 μ m. **45.** *Codium mamillosum* (UPF 2111). Habit of large, spherical thallus attached to rhodolith. Note large utricles visible to the naked eye. Scale = 5 mm. **46.** *Codium mamillosum* (UPF 2111). Longitudinal section of thallus, showing solid inner region and dense, rhizoidal basal holdfast (arrowhead). Scale = 5 mm.

Family **Codiaceae** (Trevisan) Zanardini
Genus **Codium** Stackhouse

Key to the French Polynesian species of *Codium*

- 1a. Thallus applanate, adherent. *C. arabicum*
1b. Thallus spherical or terete, erect. 2
 2a. Thallus consisting of spherical balls, utricles large and apparent
 *C. mamillosum*
 2b. Thallus terete and dichotomously branched, utricles smaller
 *C. geppiorum*

Codium arabicum Kützing, 1856: 35, pl. 100 fig. 2 (type locality: Tor, Sinai Peninsula, Gulf of Suez, Egypt). French Polynesia: Payri & N'Yeurt, 1997: 883, Payri *et al.*, 2000: 102; Hawaiian Islands: Silva, 1952: 382, pl. 34b figs 11-13, Abbott & Huisman, 2004: 102, fig. 35A-B; Fiji: N'Yeurt, 2001: 718, Littler & Littler, 2003: 210; Marshall Islands: Dawson, 1956: 38, fig. 24; Lord Howe Island: Jones & Kraft, 1984: 255, figs 1-2; Indian Ocean: Silva *et al.*, 1996: 850; Rotuma: N'Yeurt, 1996: 383, figs 41, 43, 59; Kenya: Van den heede & Coppejans, 1996: 391, figs 1, 5, 7. (**Fig. 42**) **Heterotypic synonyms** (given by Silva *et al.*, 1996): *Codium coronatum* Setchell, 1926: 82, pl. 10 figs 2-5, pl. 11 figs 2, 3, pl. 12 figs 1, 5 (type locality: Taharaa, Tahiti). Sri Lanka: Børgesen, 1936: 67. — *Codium coronatum* var. *insculptum* Setchell. French Polynesia: Setchell, 1926: 83 (type locality: Arue, Tahiti).

Material examined: Taharaa, Tahiti, 9 Jul. 1922, *leg. W. A. Setchell & H. E. Parks*, !UC 261420; Arue Reef, Tahiti, 30 May 1922, *leg. W. A. Setchell & H. E. Parks*, !UC 261421; Punaauia, Tahiti, *leg. A. D. R. N'Yeurt*, 10 May 1997, UPF 73, 6 Jul. 1997, UPF 72; Motu Totegegie, Gambier, 22 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 781; Tarakoi Pt., Rapa, Australs, 6 Nov. 2002, *leg. C. E. Payri*, UPF 2023; Takaraotaranga Pt., Rapa, 9 Nov. 2002, *leg. C. E. Payri*, UPF 2087; Mei Pt., Rapa, 18 Nov. 2002, *leg. C. E. Payri*, UPF 2221; Tauna islet, Rapa, 27 Nov. 2002, *leg. C. E. Payri*, UPF 2346; Hotel Pearl Beach, Bora Bora, 17 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2574; Tiahura, Moorea, 29 Sep. 2004, *leg. A. D. R. N'Yeurt*, *In Herb.* UPF.

Thallus dark green, applanate and dorsiventral, up to 15 cm broad and 1 cm thick; adhering strongly to the substratum, assuming a convoluted habit. Medullary filaments 17-23 µm in diameter; peripheral utricles clavate to pyriform, 58-88 µm broad and 380-500 µm long, with rounded apices.

Remarks: Growing in shallow water on coralline substratum, on coral heads in the lagoon near the reef front. Setchell (1926: 82, and cited in a letter relating to Sri Lanka material in Børgesen, 1936: 68) separated the Tahitian species *C. coronatum* from *C. arabicum* by the thinner thallus, and shape and size of vesicles with crown-like circles of hair. However, Silva *et al.* (1996) considered both species conspecific, and our own examination of Setchell's material concurs with this opinion, as the characters used to distinguish the species in question can be highly variable depending on environmental conditions. Throughout the Indo-Pacific, *C. arabicum* shows great anatomical variability (P. C. Silva, pers. com.).

Codium geppiorum O.C. Schmidt, 1923: 50, fig. 33 ("*geppii*"). French Polynesia: Payri *et al.*, 2000: 102; Sri Lanka: Børgesen, 1936: 68, fig. 3; Viêt Nam: Dawson, 1954: 395, fig. 13k ("*geppii*"); Marshall Islands: Dawson, 1956: 39, fig. 26 ("*geppii*"); New Caledonia: Valet, 1968: 41, pl. 10 fig. 5; Thailand: Egerod, 1975: 59, figs 25-26; Indian Ocean: Silva *et al.*, 1996: 856; Kenya: Van den heede & Coppejans, 1996: 400, figs 11, 16; Fiji: N'Yeurt, 2001: 719, fig. 68. (**Figs 43-44**)

Basionym: *Codium divaricatum* A. Gepp et E.S. Gepp, 1911: 136, 145 plate XXII Figs 195-199, *nom. illeg.* (syntype localities: Kai Islands and Celebes, Indonesia).

Heterotypic synonym (given by Silva *et al.*, 1996): *Codium bulbopilum* Setchell, 1924: 173, fig. 38 (type locality: Tutuila Island, American Samoa). French Polynesia: Setchell, 1926: 84, pl. 11 fig. 1, pl. 12 fig. 2; Lord Howe Island: Jones & Kraft, 1984: 26, figs 4, 5B-F, Kraft, 2000: 591, fig. 31F; Rotuma: N'Yeurt, 1996: 384, figs 42, 45; Samoa: Skelton & South, 2002a: 165, fig. 25F; Fiji: Littler & Littler, 2003: 212.

Material examined: Hikueru, 17 Nov. 1996, *leg. J. Orempuller*, UPF 75; Afaahiti, Tahiti, 7 May 1997, *leg. A. D. R. N'Yeurt*, UPF 74; Vairao, Tahiti, 20 Mar. 1998, *leg. J. Orempuller*, UPF 593; Puka Puka, Aug. 1999, *leg. Anonymous*, UPF 767, 822; Motu Tarauraroa, Gambier, 16 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 854; Ha'ruvei, Rapa, 29 Nov. 2002, *leg. J. L. Menou*, UPF 2402; Tiahura, Moorea, *leg. A. D. R. N'Yeurt*, 29 Sep. 2004, *In Herb.* UPF; 30 Sep. 2004, UPF 2940; 1 Oct. 2004, UPF 2941; 3 Oct. 2004, UPF 2942.

Thallus dark-green branched, terete and imbricating axes arching downwards; attached at various points to the substratum. Branching irregularly dichotomous, axes 2-3 mm in diameter and up to 8 cm long. Up to two plugged medullary filaments 35-41 μm in diameter, arising per utricle. Peripheral utricles obovoid, cylindrical to subspherical 140-235 μm broad and 382-500 μm long with rounded apices and occasional hairs up to 29 μm in diameter arising from the apical zone.

Remarks: Growing attached to coral, on the fringing and barrier reefs. This is an edible species, being a favourite dish eaten raw, or cooked with fish in coconut milk, by many Pacific islanders (South, 1993: 339). The *Codium geppiorum* complex of species, which includes several poorly demarcated, dichotomously branched, terete members of the genus, is currently under molecular review with examination of specimens from around the world (P. C. Silva, pers. com.). The relationship of Pacific records of *C. geppiorum* to *C. bulbopilum* remain unclear pending molecular studies; the latter species is currently distinguished from *C. geppiorum* by its imbricating, hummock-like habit (Jones & Kraft, 1984: 26) but intermediate forms do exist.

Codium mamillosum* Harvey, 1855: 565; 1858b: plate XLI, figs 1-4 (lectotype locality: Swan River, Western Australia). Japan: Okamura, 1915: 151, plate CXXXV, figs 10-16; Hawaiian Islands: Silva 1952: 389, fig. 16 pl. 35a, Abbott, 1986: 162, fig. 1, Abbott & Huisman, 2004: 109, fig. 39A-B; South Australia: Silva & Womersley, 1956: 269, fig. 6, Womersley, 1984: 230, figs 77A, 78A; Indian Ocean: Silva *et al.*, 1996: 859; Fiji: N'Yeurt, 2001: 720, figs 48, 50, 69, Littler & Littler, 2003: 212; Wallis: N'Yeurt & Payri, 2004: 373; American Samoa: Skelton & South, 2004: 303. **(Figs 45-46)

Basionym: *Lamarckia mamillosa* (Harvey) Kuntze, 1891: 900.

Material examined: Marotiri, Australs, 6 Nov. 2002, *leg. I. R. D.*, UPF 2111, 2112, 2113, 2114.

Plants spherical, solid, firm, 9-30 mm in diameter. Utricles large and visible to the naked eye, 300-620 μm in diameter and up to 3-4 mm long. Thallus with a single basal point of attachment to substratum. Plants lustrous when dry, non-adhering to the paper.

Remarks: A common species at depths ranging from 15 to well below 60 m on the outer vertical reef slope in other parts of the Pacific (Fiji, Wallis, possibly Samoa and New Caledonia), in French Polynesia it is only reported dredged from great depths (80 to 120 m) in the southern Australs (Marotiri) where it forms large dominant covers littering the seafloor. Whereas in shallower waters this species

assumes a smaller, gregarious habit (9-12 mm in diameter; N'Yeurt, 2001), the French Polynesian deepwater plants are mostly unattached or epiphytic on free-rolling rhodoliths, large (up to 30 mm in diameter) with big utricles visible to the naked eye. Specimens of this unusual growth form were confirmed as belonging to *C. mamillosum* by Professor P. C. Silva, and it represents one of the deepest-inhabiting green algae in the ocean.

Family **Caulerpaceae** Greville *ex* Kützing

Genus **Caulerpa** J.V. Lamouroux

A genus of some 70 tropical to temperate species (Womersley, 1984), many of which are dominant parts of the reef cover in certain areas. Some species (eg. *C. racemosa*, *C. bikinensis*, *C. cupressoides*) are edible and consumed regularly in several tropical localities such as the Philippines (Meñez & Calumpong, 1982), Fiji and Rotuma (South, 1993; N'Yeurt, 1996; South & Skelton, 2003a) and French Polynesia (Conte & Payri, 2002, 2006; this study). Fifteen species are listed for French Polynesia by Payri & N'Yeurt (1997), with one endemic species (*C. seuratii*). Meinesz *et al.* (1981), in a monographic study, listed some 11 species of *Caulerpa* from Moorea and Takapoto.

Key to the French Polynesian species of *Caulerpa*

- 1a. Branchlets usually swollen, spherical or peltate 10
- 1b. Branchlets not swollen, spherical or peltate 2
 - 2a. Branchlets strap-like, sub-dichotomous, dentate, or spirally twisted
..... *C. serrulata*
 - 2b. Branchlets opposite, radial or in multiple rows 3
- 3a. Branchlets spiny 4
- 3b. Branchlets filamentous, plumose or furry 5
 - 4a. Branchlets straight, not basally compressed, spiniform, generally arranged on 3 to 5 opposite rows of densely ranked, sometimes inflated ramuli. *C. cupressoides*
 - 4b. Branchlets angular, slightly compressed at the bases, radially arranged in 3 rows with thorn-like, never inflated ramuli *C. urvilliana*
- 5a. Branchlets in two or three opposite rows, stolons naked 6
- 5b. Branchlets radially or verticillately arranged 7
 - 6a. Branchlets cylindrical and of the same diameter throughout.
..... *C. sertularioides*
 - 6b. Branchlets compressed, basally constricted, with tapered tips . . *C. taxifolia*
- 7a. Branchlets slender, in verticillate whorls, stolons naked. *C. verticillata*
- 7b. Branchlets radial, not in whorls, stolons covered with branchlets. 8
 - 8a. Branchlets in 3 rows only, thallus spiky. *C. seuratii*
 - 8b. Branchlets in more than 3 rows, thallus furry. 9
- 9a. Branchlets forming a continuous, uniform covering on fronds and stolons; thallus to 60 mm high *C. pickeringii*
- 9b. Branchlets forming a non-continuous covering, stolons partly naked; thallus less than 12 mm high. *C. webbiana*
- 10a. Ends of the branchlets terminating abruptly in a single, thin peltate disk
..... *C. peltata*
- 10b. Ends of branchlets cylindrical to clavate, if peltate thick and not occurring singly 11

- 11a. Ends of branchlets inflated, subspherical to subpeltate or a mixture of both, laxly or radially beset about foliar axis *C. racemosa*
 11b. Ends of the branchlets elongate, club-shaped, flattened or slightly convex, arranged in an alternate or distichous manner. *C. bikinensis*

Caulerpa bikinensis W.R. Taylor, 1950: 66, pl. 33 (type locality: Bikini Atoll, Marshall Islands). French Polynesia: Meinesz *et al.*, 1981: 431, figs 5-6; Payri & N'Yeurt, 1997: 882, Payri *et al.*, 2000: 90. **(Fig. 47)**

Material examined: Bikini Atoll, 11 Jul. 1946, *leg. W.R. Taylor*, BM 701601; Rongelap Atoll, 21 Jun. 1946, *leg. W.R. Taylor*, BM 701600; Taiaro, 24 Sep. 1992, *leg. R. Galzin*, UPF 17, SUVA-A 1301; Nihiru, 30 Sep. 1995, *leg. J. Orempuller*, SUVA-A 546; Ilot aux Oiseaux, Tikehau, 4 Nov. 1995, *leg. A. D. R. N'Yeurt*, UPF 20; Takapoto, 5 Nov. 1995, *leg. L. Addressi*, UPF 19, SUVA-A 1202, 1203; 8 Nov. 1995, *leg. P. Loret*, UPF 21; Nengo Nengo, Jun. 1996, *leg. J. M. Zanini*, UPF 615; Marokau, 22 Sep. 1996, *leg. J. Orempuller*, UPF 18, SUVA-A 1201; Haraiki, 15 Nov. 1996, *leg. J. Orempuller*, UPF 22; Vahitahi, Oct. 2000, *leg. Anon.*, UPF 772, 773; Vairaatea, Oct. 2000, *leg. Anon.*, UPF 768; Fangatau, 12 May 2003, *leg. C. E. Payri*, UPF 2707, 2708, 2709; Tatakoto, n.d., *leg. Anon.*, UPF 763.

Thallus to 15 cm high, greenish-yellow in colour, composed of a creeping stolon to 1 metre long and 10 mm wide, with erect axes 2-3 mm in diameter bearing elongate, club-shaped, flattened or slightly convex branchlets to 10 mm long and 4 mm in diameter, arranged in an alternate or distichous manner.

Remarks: Found growing in the lagoon and outer slope of atolls, to depths of 70 m. This species is edible, being a favorite dish as a salad with fish in the Austral Islands. *Caulerpa bikinensis* appears characteristic of atolls of the Tuamotu archipelago, having been collected in the northern section (Tikehau), eastern part (Fangatau, Takatoto, Takapoto) and as far down as Nengo Nengo and Vairaatea. In Takapoto (north-east), it forms an almost continuous belt around the atoll in the outer slope from a depth of 35 m to over 70 m, with covers exceeding 75 % in parts (Meinesz *et al.*, 1981: 433). However, it has not been reported to date from the more southern Gambier islands. It is reported to be present in the Australs Group (Raivavae Island), where the local population traditionally consumes it, along with *C. racemosa* (Payri *et al.*, 2000: 90; Conte & Payri, 2002: 171, 2006). Unfortunately, no herbarium specimens of *C. bikinensis* from the Australs could be located in UPF. The French Polynesian material is in excellent agreement with authentic material from Bikini Atoll examined in BM. Some plants from Bikini Atoll and other Marshall Islands (BM 701599, 701602-701607) originally identified as varieties of *Caulerpa racemosa* by W.R. Taylor (1950), were subsequently determined to be forms of *C. bikinensis* by H. Ohba (31 Jul. 1998, annotation on herbarium sheets), and we concur with that opinion after examination of the same. French Polynesian plants also show a variety of ecomorphs.

Caulerpa cupressoides (Vahl) C. Agardh, 1823: 441. French Polynesia: Setchell, 1926: 85, Payri & N'Yeurt, 1997: 882, Payri *et al.*, 2000: 90; Indian Ocean: Silva *et al.*, 1996: 815; Lord Howe Island: Kraft, 2000: 597, fig. 32 C-E.

Basionym: *Fucus cupressoides* Vahl, 1802: 38 (type locality: St Croix, Virgin Islands).

Remarks: *Caulerpa cupressoides* being a species with continuously variable phenotypes (Coppejans & Prud'homme van Reine, 1992; Kraft, 2000: 597), it may be futile to assign clearly defined infra-specific combinations; however the following two varieties and forms represent consistently encountered patterns in French Polynesian populations.

Caulerpa cupressoides (Vahl) C. Agardh var. ***lycopodium*** Weber-van Bosse, 1898: 335, pl. XXVII figs 5-13; pl. XXVIII figs 10-12, 14. French Polynesia: Payri *et al.*, 2000: 90; Fiji: South & N'Yeurt, 1993: 114, fig. 8; Indian Ocean: Silva *et al.*, 1996: 817; Caribbean: Littler & Littler, 2000: 360, fig. on p. 361. **(Figs 48-49)**

Basionym: *Caulerpa lycopodium* J. Agardh, 1847: 6, *nom. illeg.* (syntype localities: Brazil & West Indian Ocean).

Material examined: Faarapa, Tahiti, 19 Jun. 1922, *leg. W. A. Setchell & H. E. Parks*, UPF 24, 25; Tiahura, Moorea, 13 Jun. 1984, *leg. C. E. Payri*, UPF 2796, 2797, 2878; Afaahiti, Tahiti, 7 May 1997, *leg. A. D. R. N'Yeurt*, UPF 23; Taravai, Gambier, 20 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 874, 880; Motu Totegegie, fringing reef in front of airport, Gambier, 22 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 802; Hotel Intercontinental, Bora Bora, on concrete stilts of bungalows, 19 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2584; Agairoa Bay, Rapa, 2 Nov. 2002, *leg. C. E. Payri*, UPF 1907, 1908; Tekogoteemu Pt., fringing reef, 5 Nov. 2002, *leg. C. E. Payri*, UPF 2000; Aruroa Pt., Rapa, 22 Nov. 2002, *leg. A. D. R. N'Yeurt*, UPF 2246; Ha'urei, Rapa, on first buoy at exit of bay, 29 Nov. 2002, *leg. J. L. Menou*, UPF 2419, 2420.

Thallus forming dense aggregations, with a smooth spreading stolon up to 30 cm long and 3 mm in diameter, anchored by numerous rhizoid-bearing branches spaced at close (0.5-1 cm) intervals. Erect axes up to 4 cm tall and 2 mm wide, oppositely pinnate and compressed, with upward curving tendency, tapering to a sharp point at the tip, and generally twice as long as the diameter of the supporting axis, spaced at relatively wide (2-3 cm) intervals along spreading stolon. The ramuli usually in ranks of threes, sometimes twos, oppositely pinnate with mucronate, upward-curving branchlets up to 1 mm long.

Remarks: This variety of *C. cupressoides* is edible, being consumed raw as a salad in French Polynesia on the island of Rapa (local name: *mama'ga*, Fig. 49). It could be confused with *Caulerpa lessonii* Bory de Saint-Vincent (1828: 193) but the latter species has a pronouncedly wide and flattened rachis, with short, basally constricted pinnules whose length is less than the diameter of the supporting rachis. However, intermediate forms exist between these species, and *C. lessonii* itself is intermediate between *C. cupressoides* and *C. serrulata* (Coppejans & Prud'homme van Reine, 1992: 692).

Caulerpa cupressoides (Vahl) C. Agardh var. ***mamillosa*** (Montagne) Weber-van Bosse, 1898: 332 pl. 28 fig. 6. Somalia: Sartoni, 1978: 402, fig. 2b; Indonesia: Coppejans & Prud'homme van Reine, 1992: 679, fig. 3A, 8B (as *ecad mamillosa*); Indian Ocean: Silva *et al.*, 1996: 818; Rotuma: N'Yeurt, 1996: 377, figs 25, 35; Lord Howe Island: Kraft, 2000: 597, fig. 32C-D; Wallis: Payri *et al.*, 2002: 44, pl. 1 fig. 6; Fiji: Littler & Littler, 2003: 216. **(Figs 50-51)**

Basionym: *Caulerpa mamillosa* Montagne, 1842: pl. 6, fig. 3 (syntype localities: Agalega Islands, Indonesia; Mangareva Islands, Gambier, French Polynesia).

Material examined: Agalega Island, Indonesia, n.d., *leg. Leduc*, BM 515883, PC 10326 (syntype); Mangareva, Gambier, n.d., *leg. M. Hombron*, PC 10329 (syntype); Haraiki, 14 Nov. 1996, *leg. J. Orepuller*, UPF 709; Hikueru, 16 Nov. 1996, *leg. J. Orepuller*, UPF 708; Atituiti, Mangareva, 18 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 776, 19 Nov. 2000, UPF 918; Kirimiro, Mangareva, 21 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 919.

Thallus stout and bushy, with the erect foliar axes closely spaced at 0.5-1 cm intervals along a relatively thick, spreading stolon up to 2.5 mm in diameter. The foliar axes are several times forked very early from the base, bearing mucronate, obovoid to subnavicular, distinctly inflated ramuli in several ranks.

Remarks: This species appears in French Polynesia to be confined to atolls of the Tuamotu and the Gambier. It could be confused with *C. urvilliana*, but our own examination of the relevant type specimens in PC confirmed that *C. urvilliana* is

characterised by angular erect branches with dentate, thorn-like pinnules, contrasting with the straight branches with densely ranked, inflated ramuli of *C. cupressoides* var. *mamillosa* (Fig. 51). Coppejans & Prud'homme van Reine (1992: 686) suggested that *C. urvilliana* could represent an extreme growth form of the continuously variable taxa *C. cupressoides*; molecular studies alone could provide a definitive answer to these questions.

Caulerpa nummularia* Harvey ex J. Agardh, 1873: 38 (syntype localities: Tonga and Nuku-Hiva, Marquesas). Indian Ocean: Silva *et al.*, 1996: 827; Belize: Littler & Littler, 1997: 105, fig. 150; Fiji: Littler & Littler, 2003: 224, South & Skelton, 2003: 542, fig. 3; Hawaiian Islands: Abbott & Huisman, 2004: 121, fig. 44A, Hodgson *et al.*, 2004: 28; South Africa: De Clerck *et al.*, 2005: 66, fig. 35. **(Fig. 52)

Misapplied names: *Caulerpa peltata* J.V. Lamouroux f. *imbricata* (G. Murray) Weber-van Bosse, 1898: 375. French Polynesia: Setchell, 1926: 86. — *Caulerpa peltata* J.V. Lamouroux. French Polynesia: Payri *et al.*, 2000: 93.

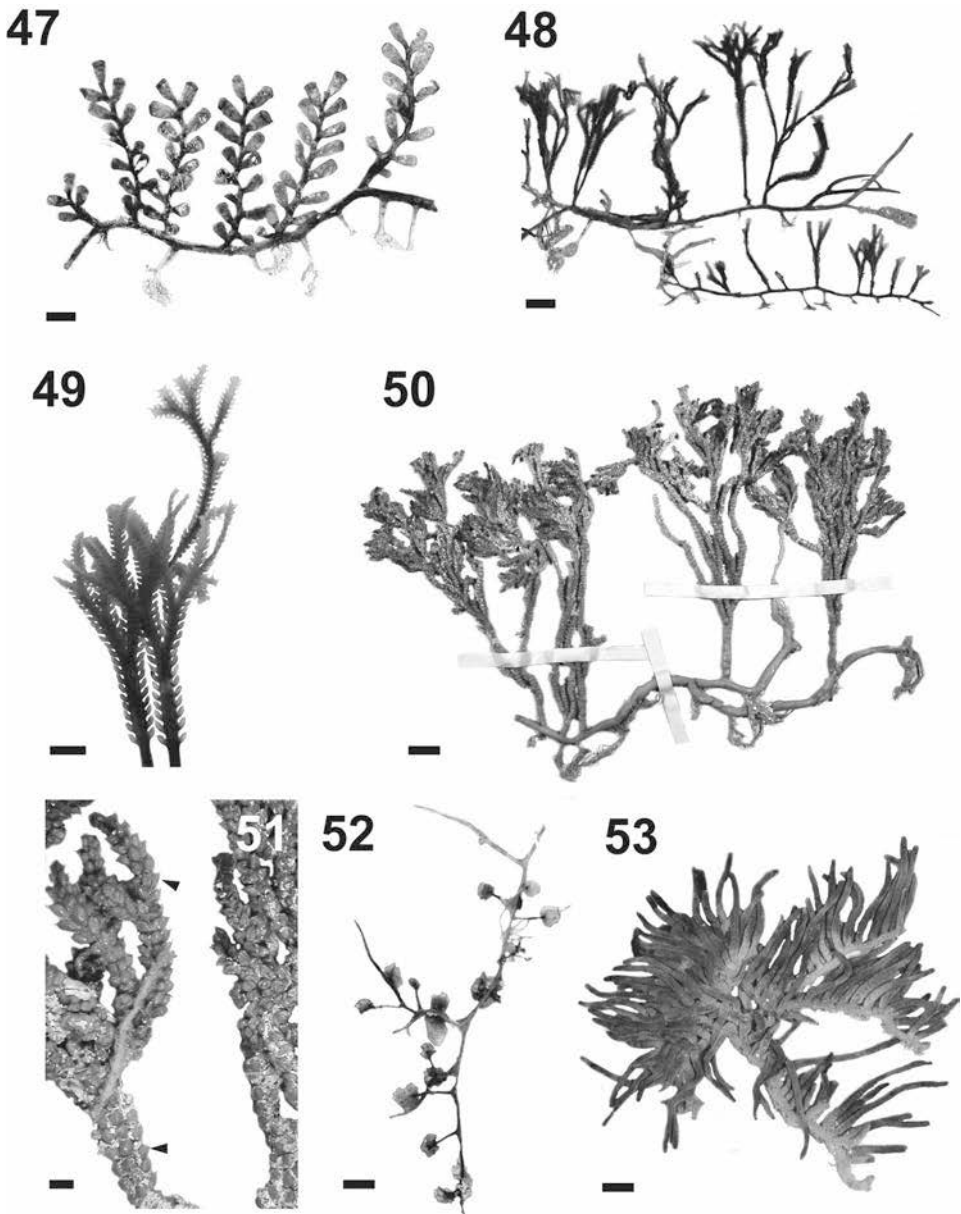
Material examined: Tahara, Tahiti, 17 Jun. 1922, *leg. W. A. Setchell & H. E. Parks*, BM 841598, 841599, 841607 (f. *imbricata*); Rurutu, 18 Aug. 2000, *leg. C. E. Payri*, UPF 755; Akamaru, Gambier, 17 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 855.

Plants small and delicate, occurring as single stolons to 80 mm long and 0.3-0.7 mm in diameter, sparingly provided with short rhizoids. Cylindrical erect branchlets 1-5 mm long occur at 2-3 mm intervals, with consistently thin, terminal irregularly peltate discs 1-3 mm in diameter with crenulate margins; occurring sometimes singly but usually with additional blades proliferating from marginal or central areas of parent blades.

Remarks: *Caulerpa peltata* var. *exigua* (Weber-van Bosse, 1898: 377; Eubank, 1946; Kraft, 2000: 601, fig. 33F) is likely synonymous with *C. nummularia* (Abbott & Huisman, 2004: 121). Other workers consider them a form of *C. racemosa* var. *peltata* (Coppejans & Prud'homme van Reine, 1992: 696), but the latter species has large, non-crenulate, singly-placed, inconsistently peltate assimilators borne on a stolon thicker than 1 mm in diameter. The status of *C. peltata* J.V. Lamouroux (1809c: 332) is unclear, pending molecular studies in the *C. racemosa* – *C. peltata* complex. Some workers (e.g. Kraft, 2000: 601, fig. 33E) recognize *C. peltata* for plants with single, peltate assimilators on stolons less than 1 mm in diameter. Payri *et al.*, (2000: 93, upper photo) show a plant from Moorea under *C. peltata* in fact represents *C. nummularia* (with slightly crenulate, new disks emerging from the borders of subtending ones). Tahitian “*C. peltata* f. *imbricata*” from Setchell's collection (BM 841598) has thin assimilators which would place it well within *C. nummularia* as understood here, but differs from the small, dense clavate ramuli of the Sri Lanka type material of *C. imbricata* G. Murray (Eubank, 1946: 423). A further related species from Tonga, *C. stellata* Harvey, has distinctly stellate, centrally tiered assimilators and is currently placed under *C. peltata* var. *stellata* (Harvey ex J. Agardh) Weber-van Bosse (1898: 377) but its specietal status might need to be resurrected.

Caulerpa pickeringii Harvey et Bailey, 1851: 373 (type locality: “Wilson Island” (Manihi), Tuamotu). French Polynesia: Taylor, 1973: 38 (Moorea); Meinesz *et al.*, 1981: 433, figs 11-14, Payri & N'Yeurt, 1997: 882, Payri *et al.*, 2000: 92; Indonesia: Weber-van Bosse, 1898: 272, pl. 21 figs 7, 8; Caroline Islands: Trono, 1968: 167, pl. 15 fig. 5. **(Figs 53-57)**

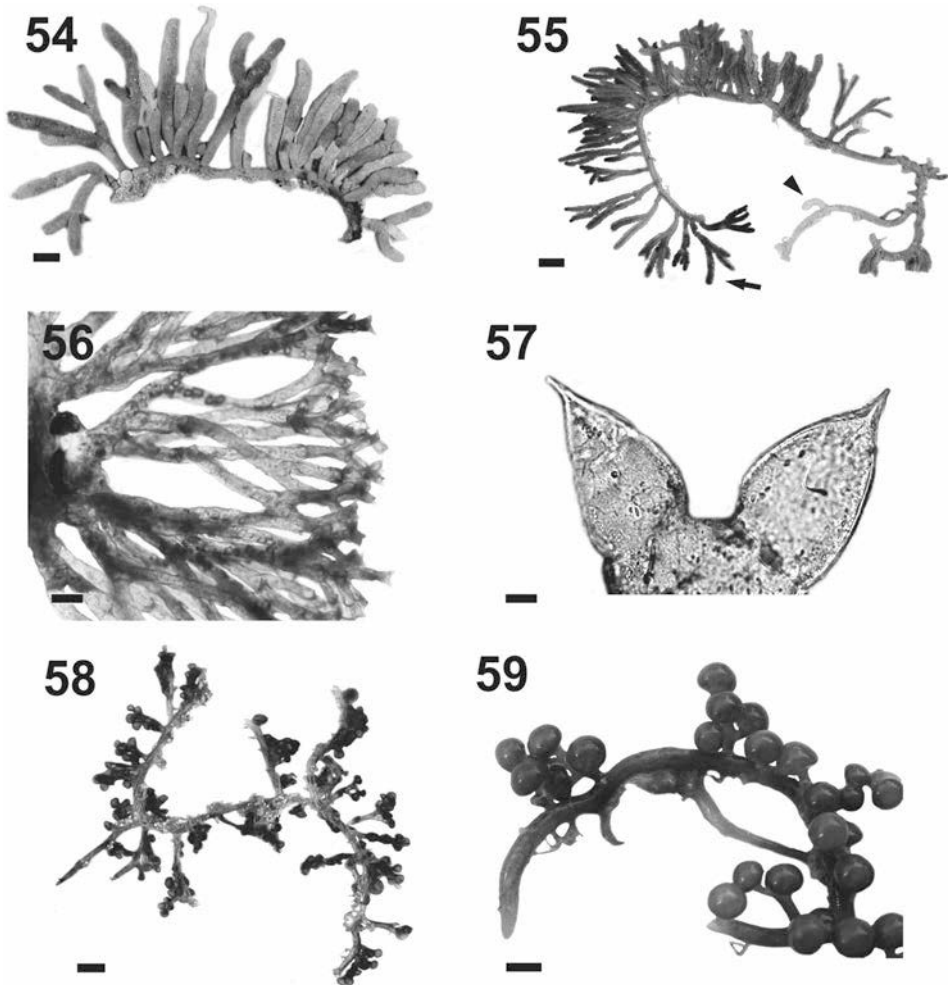
Material examined: Nihiru, 11 Sep. 1995, *leg. J. Orempuller*, UPF 27; Kauehi, 25 Sep. 1995, *leg. J. Orempuller*, SUVA-A 945; Reka Reka, 9 Nov. 1996, *leg. J. Orempuller*, UPF 26, 28, SUVA-A 1348; Oeno atoll, Pitcairn, 2 Aug. 1997, *leg. J. Starmer*, UPF 665; Henderson, Pitcairn, 17 Aug. 1997, *leg. J. Starmer*, UPF 666, 667, 668; Motu aux récifs, Rangiroa, 20 Jul. 2002, *leg. A. D. R. N'Yeurt*, UPF 2461, 2462, 2463.



Figs 47-53. **47.** *Caulerpa bikinensis* (UPF 2703). Habit. Scale = 7 mm. **48.** *Caulerpa cupressoides* var. *lycopodium* (UPF 2000). Habit of dried specimen. Scale = 10 mm. **49.** *Caulerpa cupressoides* var. *lycopodium* (UPF 2419). Habit of freshly-collected thallus. Scale = 2 mm. **50.** *Caulerpa cupressoides* var. *mamillosa* (MA 10329). Partial habit of Syntype collection from Mangareva, Gambier. Scale = 7 mm. Photographed with permission from the Museum National d'Histoire Naturelle, Paris. **51.** *Caulerpa cupressoides* var. *mamillosa* (MA 10329). Detail of Syntype showing distinctly inflated, mucronate ramuli (arrowheads). Scale = 2 mm. **52.** *Caulerpa nummularia* (UPF 855). Habit showing thin, disk-like assimilators with crenate margins. Scale = 3 mm. **53.** *Caulerpa pickeringii* (UPF 26). Habit of densely-invested plant from Reka Reka. Scale = 10 mm.

Plants dark green in colour, spongy, to 6 cm high, composed of a creeping stolon to 3 mm wide and 15 cm long, bearing profuse, sparsely and irregularly branched erect axes to 3 cm long, with blunt rounded tips. Secondary branchlets are usually radially arranged about both the erect axes and stolon, forming a uniform, unbroken fur-like covering (in some cases, parts of the plant are less densely covered than other portions). The secondary branchlets are up to 700 μm long and 130 μm wide, dichotomously branched 3 or 4 times in a single plane, with rounded, mucronate tips.

Remarks: Common on atolls (Tuamotu) on the algal ridge or in the lagoon at depths of 3-5 meters, and less frequently on the outer reef slope at 7-20 metres depth. Less frequent on the barrier reef of high volcanic island. Originally described from Manihi atoll in the Tuamotu archipelago (Harvey & Bailey, 1851), *C. pickeringii* was long considered endemic to French Polynesia, with records of the species elsewhere (eg. Tanzania, Jaasund, 1976: 19, fig. 40) considered to be misapplied names for *C. elongata* Weber-van Bosse (1898: 271, pl. xxi, figs 5, 6; syntype localities Indonesia, Tonga) or *C. webbiana* var. *pickeringii* (Harvey et Bailey) Eubank (1946: 416; type locality Tuamotu) (Meinesz et al., 1981: 433). As remarked by the latter authors, the original material from French Polynesia has both erect branches and stolons densely covered by ramuli, with the stolons totally hidden and having the superficial appearance of terete species of *Codium*. This situation is evident in the herbarium material examined in UPF, and differs from the descriptions of “*C. pickeringii*” in Jaasund (1976), and Littler & Littler, (2003: 226, photo from Fiji) where the stolons are sparsely covered with ramuli, or naked in parts. On the other hand, plants with sparsely covered stolons superficially looking like *C. elongata* or *C. webbiana* var. *pickeringii* have been found in Tatakoto, French Polynesia (UPF 761) and also from Henderson, Pitcairn Island (UPF 666, 668). The latter material from Pitcairn is interesting, because parts of the thallus look like *C. pickeringii* with the stolon densely covered, and others have a more lax appearance (Fig. 55). All the specimens examined from Polynesia however have ramuli 3-4 times dichotomously branched in a single plane, unlike what is reported for *C. elongata*, which has dichotomies at right angles to each other (Littler & Littler, 2003: 216). *Caulerpa webbiana* var. *pickeringii* can have densely clothed assimilators and a *Codium*-like habit (Kraft, 2000: 608, fig. 35 E) but these are not as dense as in *C. pickeringii*, and they are much shorter and also branch at right-angle to each other. *C. seuratii*, as understood here, has mostly tristichous ramuli with distichous or tristichous, mucronate extremities and a plumose appearance when dry, which differs from *C. pickeringii*. “Typical” *C. pickeringii* with fully, densely covered stolons also occurs in Oeno Atoll and Pitcairn Island (UPF 665, 667; Fig. 54). The Oeno Island specimen has very dense arrangement of ramuli, which are the most elongate (1500-2000 μm) and have the smallest diameter (44-90 μm) of all the material examined. Material from Reka Reka (UPF 26, Fig. 53) is intermediate, with a length of 1300-1500 μm and a diameter of 89-178 μm , and a lax plant from Tatakoto (UPF 761) had ramuli lengths of 1300-1780 μm and diameters of 133-244 μm . On the other hand, a specimen from Henderson, Pitcairn Island (UPF 666) had the shortest (1220-1300 μm) and widest (200-355 μm) ramuli. It could be that these variations are related to the degree of exposure, depth or luminosity in the different habitats. These observations raise the question as to whether *C. elongata*, *C. webbiana* var. *pickeringii* and *C. pickeringii* would represent various ecomorphs of the same continuously variable entity (*C. webbiana*), as suggested by Eubank (1946: 416); the definitive answer to this would lie in a molecular study of these taxa.



Figs 54-59. **54.** *Caulerpa pickeringii* (UPF 665). Habit of large, very densely-invested plant from Oeno Atoll. Scale = 10 mm. **55.** *Caulerpa pickeringii* (UPF 668). Habit of "hybrid" plant from Henderson Island, showing both typically dense, *C. pickeringii*-like (arrowhead) and lax, *C. seuratii*-like branches (arrow). Scale = 10 mm. **56.** *Caulerpa pickeringii* (UPF 665). Transverse section of erect branch, showing ramuli 3-4 times dichotomously branched in a single plane. Scale = 100 μ m. **57.** *Caulerpa pickeringii* (UPF 761). Detail of apex, showing rounded, mucronate ends. Scale = 20 μ m. **58.** *Caulerpa racemosa* var. *racemosa* (UPF 669). Habit of pressed specimen. Scale = 5 mm. **59.** *Caulerpa racemosa* var. *typica* (UPF 2592). Detail of freshly-collected plant from intertidal habitat in Bora Bora, showing thick rhizome with clavate to subspherical ramuli. Scale = 2 mm.

Caulerpa racemosa (Forsskål) J. Agardh, 1873: 35-36 (var. *racemosa*). French Polynesia: Setchell, 1926: 85, Taylor, 1973: 38 (Bora Bora); Meinesz *et al.*, 1981: 433, Payri & N'Yeurt, 1997: 882, Payri *et al.*, 2000: 94, Conte & Payri, 2002: 167, fig. 3; Somalia: Sartoni, 1978: 406, fig. 4c; Papua New Guinea: Coppejans & Meinesz, 1988: 191, figs 22, 23, Coppejans, 1992: 397, fig. 4C, Coppejans *et al.*, 1995:

78, fig. 7, Littler & Littler, 2003: 226; Indonesia: Coppejans & Prud'homme van Reine, 1992: 698, fig. 18A-B; Indian Ocean: Silva *et al.*, 1996: 832; Rotuma: N'Yeurt, 1996: 378, figs 28, 36; Lord Howe Island: Kraft, 2000: 602, fig. 34A-D; Fiji: N'Yeurt, 2001: 714, fig. 43; Wallis: Payri *et al.*, 2002: 44, pl. 1 fig. 2; Hawaiian Islands: Abbott & Huisman, 2004: 122, fig. 44B-C. **(Figs 58-59)**

Basionym: *Fucus racemosus* Forsskål, 1775: 191 (type locality: Suez, Egypt).

Material examined: Arue, Tahiti, 27 Jul. 1922, *leg. W. A. Setchell & H. E. Parks*, UPF 33; Marokau, 22 Nov. 1996, *leg. J. Orempuller*, UPF 30; Taharaa, Tahiti, 14 Apr. 1997, *leg. A. D. R. N'Yeurt*, UPF 29; Afaahiti, Tahiti, 7 Jun. 1997, *leg. A. D. R. N'Yeurt*, UPF 32; Punaauia, Tahiti, 6 Jul. 1997, *leg. C. E. Payri*, UPF 35; Tedside, Pitcairn, 28 Aug. 1997, *leg. J. Starnmer*, UPF 669; Arue, Tahiti, 30 Mar. 1998, *leg. J. Orempuller*, UPF 684; Tubuai, 14 Nov. 2000, *leg. C. Monier*, UPF 808; Raivavae, Nov. 2000, *leg. C. Monier*, UPF 807; Rikitea, Mangareva, 16 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 848; Motu Taraururoa, Gambier, 16 Nov. 2000, UPF 891; Atituiti, Mangareva, 18 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 897; Hotel Le Meridien, Bora Bora, 19 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2592; Tauna Islet, Rapa, 27 Nov. 2002, *leg. C. E. Payri*, UPF 2340, 2341.

Thallus dark green, up to 15 cm long, with a spreading stolon to 3 mm in diameter beset with ventral rhizoids to 15 mm long. Ascending foliar axes up to 3 cm long, bearing up to 15 radially disposed stipitate ramuli with subspherical inflated ends 2-4 mm in diameter.

Remarks: Common on the reef flat, growing on coral heads, sponges and soft corals in shallow waters. The typical form of the taxon includes what was previously called *C. racemosa* var. *clavifera* (Turner) Weber-van Bosse, 1898: 361, pl. XXXIII figs 1-3 (see Silva *et al.*, 1996: 832). *Caulerpa racemosa* is one of the most common and variable of *Caulerpa* species, with several recognisable ecomorphs or varieties, and a continuum of intergrades between these depending on environmental factors. It is also one of the most favoured edible algal species complex eaten raw as salad in the Asia-Pacific region (Abbott, 1991; South, 1993, 1998; Trono & Toma, 1993; Conte & Payri, 2002, 2006). Aside from the typical form, at least three distinct varieties of *C. racemosa* occur in French Polynesia.

Caulerpa racemosa* (Forsskål) J. Agardh var. *peltata* (J.V. Lamouroux) Eubank *in* Stephenson, 1944: 349. Hawaiian Islands: Eubank, 1946: 421, fig. 2r-s; Philippines: Meñez & Calumpang, 1982: 8, pl. 2K; Kenya: Coppejans & Beeckman, 1989: 388, figs 27-29; Indonesia: Coppejans & Prud'homme van Reine, 1992: 696, fig. 17B (as *ecad peltata*); Rotuma: N'Yeurt, 1996: 378, figs 31, 37. **(Figs 60-61)

Basionym: *Caulerpa peltata* J.V. Lamouroux, 1809c: 332 (type locality: Antilles).

Material examined: Punaauia, Tahiti, 10 May 1997, *leg. A. D. R. N'Yeurt*, UPF 31; Vairao, Tahiti, 20 Mar. 1998, *leg. J. Orempuller*, UPF 590, 591; Nuku Hiva, Marquesas, 1997, *leg. J. Orempuller*, UPF 576; Rikitea, Mangareva, Gambier, 16 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 848; Akamaru, Gambier, 17 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 856, 893; Bora Bora, 16 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2531, 2532, 2533, 2534; Ha'urei, Rapa, 11 Nov. 2002, *leg. J. L. Menou*, UPF 2125, 2126, 2127, 2128, 2135; 29 Nov. 2002, UPF 2425; 13 Nov. 2002, UPF 2184, 2185, 2186, 2187; Rapa Iti, Rapa, 28 Nov. 2002, *leg. J. L. Menou*, UPF 2403, 2404, 2405; Tiahura, Moorea, 30 Sep. 2004, *leg. A. D. R. N'Yeurt*, and *A. Pham*, UPF 2958.

Thallus in densely intermingled clumps 5-10 cm across; stolons about 8 cm long and sparingly provided with short rhizoidal branches. Erect foliar axes 1-1.5 cm long at 2-3 mm intervals, with flattened clavate to subpeltate (sunhat-shaped) discs 3-5 mm in diameter either singly at the end, or several discs axially arranged around the main foliar branches. Both subsperical and subpeltate ramuli can occur on the same erect branch.

Remarks: This variety of *C. racemosa* with a predominance of large peltate assimilators is often confused in the literature with *C. peltata*, and vice-versa. We follow Eubank (1946) and Kraft (2000) in assigning the varietal name "*peltata*" to plants of *C. racemosa* with thick stolons (1-2 mm diam.) and some (or all) assimilators with peltate ramuli, but never the entire assimilators being small, thin peltate disks on slender stolons to 700 µm in diameter. On the other hand, South & Skelton (2003b) consider *Caulerpa racemosa* var. *peltata* a synonym of *Caulerpa peltata*. In French Polynesia, we have observed plants intermediate between *C. racemosa* vars *peltata*, *occidentalis* (here considered synonymous with var. *racemosa*) and *turbinata*, suggesting that all these ecomorphs represent the same continuously variable entity of *C. racemosa*.

Caulerpa racemosa (Forsskål) J. Agardh var. ***turbinata*** (J. Agardh) Eubank, 1946: 420, figs 2o-q. French Polynesia: Conte & Payri, 2002: 167, fig. 3; Marshall Islands: Dawson, 1956: 35, fig. 16a; Kenya: Coppejans & Beeckman, 1989: 386, figs 24-26; Indonesia: Coppejans & Prud'homme van Reine, 1992: 698, fig. 19A-B (as ecad *turbinata*); Fiji: South & N'Yeurt, 1993: 129, fig. 24; Indian Ocean: Silva *et al.*, 1996: 837; Rotuma: N'Yeurt, 1996: 379, fig. 29. **(Figs 62-63)**

Basionym: *Caulerpa clavifera* (Turner) C. Agardh var. *turbinata* J. Agardh, 1837: 173 (type locality: near Tor, Sinai Peninsula, Egypt).

Material examined: Nengo Nengo, Jun. 1996, *leg. J. M. Zanini*, UPF 34; Ua Huka, Marquesas, Aug. 1999, *leg. E. Conte & C. E. Payri*, UPF 800; Tarakoi, Rapa, 5 Nov. 2002, *leg. C. E. Payri*, UPF 2006, 2007, 2008; Moerai, Rurutu, 20 Jul. 2005, *leg. J. Peterano and N. Gebel*, UPF 3007, 3008.

Thallus lacking a well-defined spreading stolon; erect branchlets to 25 mm long, radially and densely beset with trumpet-shaped, terminally flattened to concave assimilators up to 1.5 mm long and 1-3 mm in diameter. Some subpeltate or clavate ramuli can occur amidst the predominantly turbinate assimilators (Fig. 63).

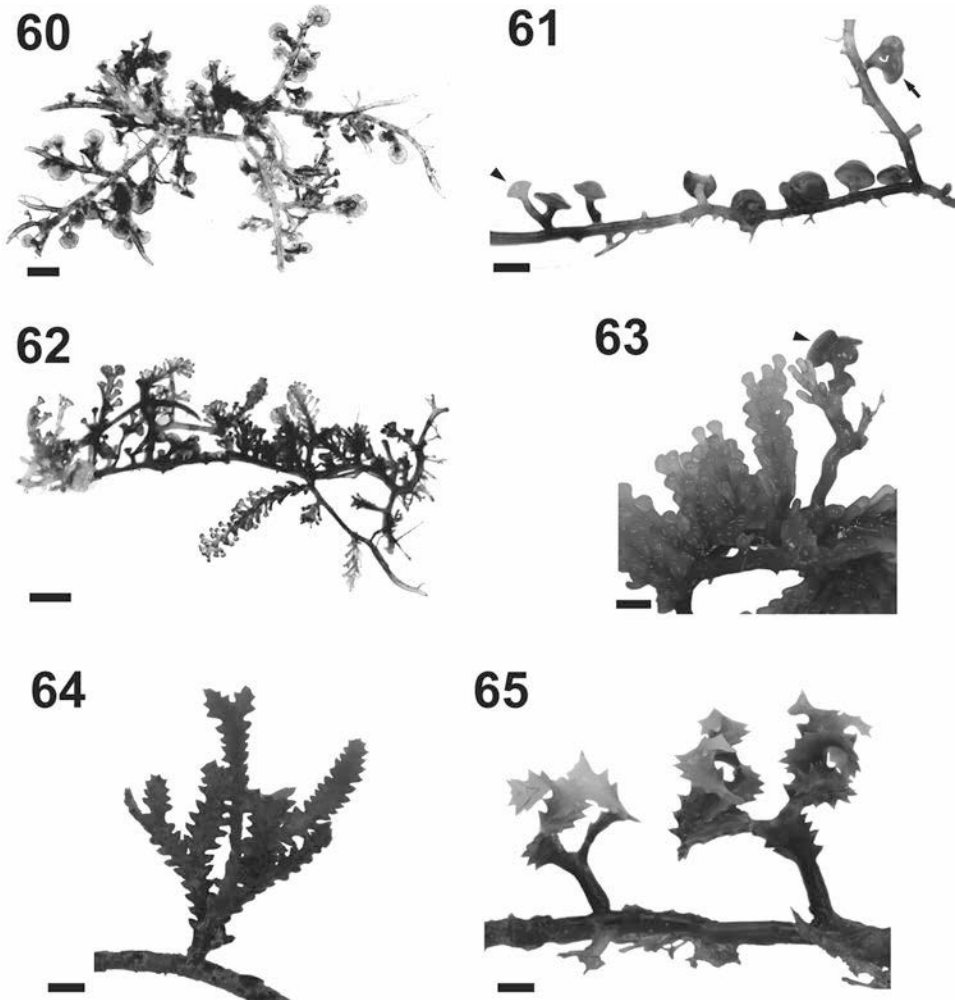
Remarks: This variety (intermediate between vars *clavifera* and *peltata*) of *C. racemosa* has a predominance of characteristic trumpet-shaped assimilators, densely beset about the foliar axis. Formerly known as *C. racemosa* var. *chemnitzia* (Esper) Weber-van Bosse (1898: 370), the nomenclature of this variety was reviewed by Eubank (1946: 421). It is one of the preferred varieties of *C. racemosa* for human consumption (South 1993; Conte & Payri, 2002, 2006). In French Polynesia, it is commonly consumed on the island of Rurutu, Australs (N. Gebel, pers. com.).

****Caulerpa racemosa*** (Forsskål) J. Agardh var. ***uvifera*** (C. Agardh) J. Agardh, 1873: 35. Indonesia: Weber-van Bosse, 1898: 362, pl. 33, figs 6-7; fig. 23; 1913: 105; Bikini Atoll: Taylor, 1950: 63; 1960: 153, pl. 17, fig. 3; pl. 18, fig. 4; Marshall Islands: Dawson, 1957: 106; New Caledonia: Valet, 1968: 45, pl. 7, fig. 2; Solomon Islands: Womersley & Bailey, 1970: 276; Philippines: Meñez & Calumpang, 1982: 9, pl. 2D; Rotuma: N'Yeurt, 1996: 380, fig. 27a-b.

Basionym: *Caulerpa uvifera* C. Agardh, 1817: XXIII (type locality: Red Sea).

Material examined: Tahiti, 15 Aug. 1912, *leg. J. E. Tilden*, BM 841501; Arue Point, Tahiti, 27 Jun. 1922, *leg. W. A. Setchell & H. E. Parks*, BM 841502, 841509; Paea, Tahiti, 28 Jul. 1928, *leg. C. Crossland*, BM 841503.

Branchlets 10-20 mm high, corpulent; ends of branchlets club to trumpet-shaped, 1-2 mm in diameter, compact, very densely beset about foliar axis.



Figs 60-65. **60.** *Caulerpa racemosa* var. *peltata* (UPF 31). Habit of pressed specimen. Scale = 5 mm. **61.** *Caulerpa racemosa* var. *peltata* (IFR). Detail of freshly-collected plant from intertidal habitat in Bora Bora, showing relatively thick rhizome with both clavate (arrowhead) and subpeltate (arrow) ramuli. Scale = 3 mm. **62.** *Caulerpa racemosa* var. *turbinata* (UPF 2006). Habit of pressed plant. Scale = 10 mm. **63.** *Caulerpa racemosa* var. *turbinata* (UPF 3008). Detail of freshly-collected plant of an edible variety from Rurutu Island, showing odd subpeltate assimilators (arrowhead) on same branch as predominantly turbinate ones. Scale = 5 mm. **64.** *Caulerpa serrulata* (UPF 2557). Habit of untwisted ecomorph. Scale = 2 mm. **65.** *Caulerpa serrulata* (UPF 2556). Habit of twisted ecomorph. Scale = 2 mm.

Remarks: This succulent, least fibrous variety is one of the most favoured for human consumption (South, 1993; N'Yeurt, 1996).

Caulerpa serrulata (Forsskål) J. Agardh, 1837: 174. French Polynesia: Payri & Meinesz, 1985a: 507; Payri *et al.*, 2000: 94; Viêt Nam: Dawson, 1954: 393, fig. 10a; 1956: 38, fig. 23; Caroline Islands: Trono, 1968: 169, pl. 14 figs 1-2; pl. 16 figs 4, 8;

pl. 17 fig. 9; New Caledonia: Valet, 1968: 43, pl. 9, fig. 1; Somalia: Sartoni, 1978: 408, fig. 5a; Philippines: Meñez & Calumpang, 1982: 9, pl. 2E, Trono, 1986: 218, fig. 14; Coppejans & Meinesz, 1988: 192, figs 27-28; Coppejans & Beeckman, 1989: 120, figs 24-25; Indonesia: Coppejans *et al.*, 1992: 701, fig. 20B; Fiji: South & N'Yeurt, 1993: 117, fig. 12, N'Yeurt, 2001: 715, fig. 44, Littler & Littler, 2003: 230; Papua New Guinea: Coppejans, 1992: 403, fig. 7; Coppejans *et al.*, 1995: 78, figs 9-10; Indian Ocean: Silva *et al.*, 1996: 841; Rotuma: N'Yeurt, 1996: 382, figs 30, 40; South Africa: Leliaert *et al.*, 2001: 452, fig. 1; Samoa: Skelton & South, 2002a: 164, figs 24B-D; Hawaiian Islands: Abbott & Huisman, 2004: 123, fig. 45A. **(Figs 64-65)**

Basionym: *Fucus serrulatus* Forsskål, 1775: 189 (type locality: Mokha, Yemen).

Material examined: Tahiti, 15 Aug. 1912, *leg. J. E. Tilden*, BM 841450; Tikehau, 5 Nov. 1995, *leg. A. D. R. N'Yeurt*, UPF 36; Haraiki, 15 Nov. 1996, *leg. J. Orempuller*, UPF 37; Mokoto, Mangareva, 27 Sep. 1997, *leg. J. Starmer*, UPF 629; Vairaatea, Oct. 2000, *leg. Anon*, UPF 769; Atituiti, Mangareva, 18 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 897; Taravai, Gambier, 20 Nov. 2000, UPF 872, 889, 871; Kirimiro, Mangareva, blue hole, 21 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 908; Matira, Bora Bora, 17 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2556, 2557, 2582; Hotel Intercontinental, Bora Bora, 18 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2546; Tiahura, Moorea, 28 Sep. 2004, *leg. A. D. R. N'Yeurt*, UPF 2938.

Thallus light to dark green, with a spreading stolon up to 20 cm long and 2 mm wide, bearing flattened to compressed erect branches up to 7 cm tall at 1-4 cm intervals along the spreading stolon. The erect branches are several times dichotomously or irregularly branched, terete below up to point of dichotomy, the rest compressed (1-2 mm broad) with moderate to strong twisting and serrated margins; the serrations more pronounced on the outwardly facing edge of the twist.

Remarks: One of the commonest *Caulerpa* species growing in shallow waters, on the fringing and barrier reef of high islands (Society, Gambier) and in the lagoon of the atolls (Tuamotu). Assimilators are characteristically serrated (sawtooth-like) and of variable ecomorphology, ranging from untwisted, single plane branching to highly twisted.

Caulerpa sertularioides (S.G. Gmelin) Howe, 1905: 576. French Polynesia: Payri *et al.*, 2000: 96; Hawaiian Islands: Eubank, 1946: 417, fig. 2c-d; Abbott & Huisman, 2004: 124, fig. 45B-C; Somalia: Sartoni, 1978: 410, fig. 5b; Papua New Guinea: Coppejans & Meinesz, 1988: 192, fig. 29, Coppejans *et al.*, 1995: 80, fig. 8; Kenya: Coppejans & Beeckman, 1990: 120, figs 26-27; Indonesia: Coppejans & Prud'homme van Reine, 1992: 704, fig. 21A; Indian Ocean: Silva *et al.*, 1996: 843; Belize: Littler & Littler, 1997: 107, fig. 154; Fiji: South & N'Yeurt, 1993: 121, fig. 16, N'Yeurt, 2001: 716, fig. 42; Littler & Littler, 2003: 232; Wallis: Payri *et al.*, 2002: pl. 1 fig. 4. **(Figs 66-67)**

Basionym: *Fucus sertularioides* S.G. Gmelin, 1768: 151, pl. XV fig. 4 (type locality: "in coralliis americanis").

Material examined: Tahiti, 15 Aug. 1912, *leg. J. E. Tilden*, BM 841479; Maraa Point, Tahiti, 24 Sep. 1928, *leg. C. Crossland*, BM 841482; Taaone, Tahiti, 7 May 1997, *leg. J. Orempuller*, UPF 38, 39; Raivavae, Nov. 2000, *leg. C. Monier*, UPF 809; Hotel Le Meridien, Bora Bora, 19 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2591.

Thallus to 6 cm tall, with terete stolons 0.25-1.0 mm in diameter, bearing sparse plumose, pinnate erect branches to 18 mm wide and 70 mm long, simple or occasionally (sub-) dichotomously divided. Ultimate branchlets cylindrical throughout, not constricted at the base, to 8 mm long and 200 µm in diameter, upcurved, with mucronate tips.

Remarks: Growing in patches, creeping in sandy substratum at the bottom of the lagoon or on fallen logs and other surfaces in estuaries.

Caulerpa seuratii Weber-van Bosse, 1910: 2, pl. I figs 5-9, pl. II fig. 1 (type locality: Tokaai, Tuamotu, French Polynesia). French Polynesia: Meinesz *et al.*, 1981: 436, figs 22-25; Payri & N'Yeurt, 1997: 883; Payri *et al.*, 2000: 96. **(Figs 68-70)**

Material examined: Raroia, 2 Aug. 1952, *leg. M. S. Doty & J. Newhouse*, SUVA-A 6742; Kauehi, Sep. 1995, *leg. J. Orempuller*, UPF 40, SUVA-A 1266; Nihiru, 1 Oct. 1995, *leg. J. Orempuller*, SUVA-A 947; Hikueru, 27 Sep. 1996, *leg. J. Orempuller*, UPF 41, 44; Hiti, 11 Nov. 1996, *leg. J. Orempuller*, UPF 46; Marokau, 22 Nov. 1996, *leg. J. Orempuller*, UPF 42, 43, 45, SUVA-A 1265; Nengo Nengo, Jun. 1996, *leg. J. M. Zanini*, UPF 619.

Thallus to 8 cm high, with stolons to 40 cm long and 4 mm wide, bearing occasionally irregularly divided erect branches. Stolons spiky, being covered with short mucronate branchlets to 1.3 mm long and 300 µm in diameter. Erect branches bear terete pinnules to 5 mm long and 300 µm in diameter which are disposed radially in 3 or 4 parallel lines around the branch axis, with di- or trichotomously divided, mucronate tips.

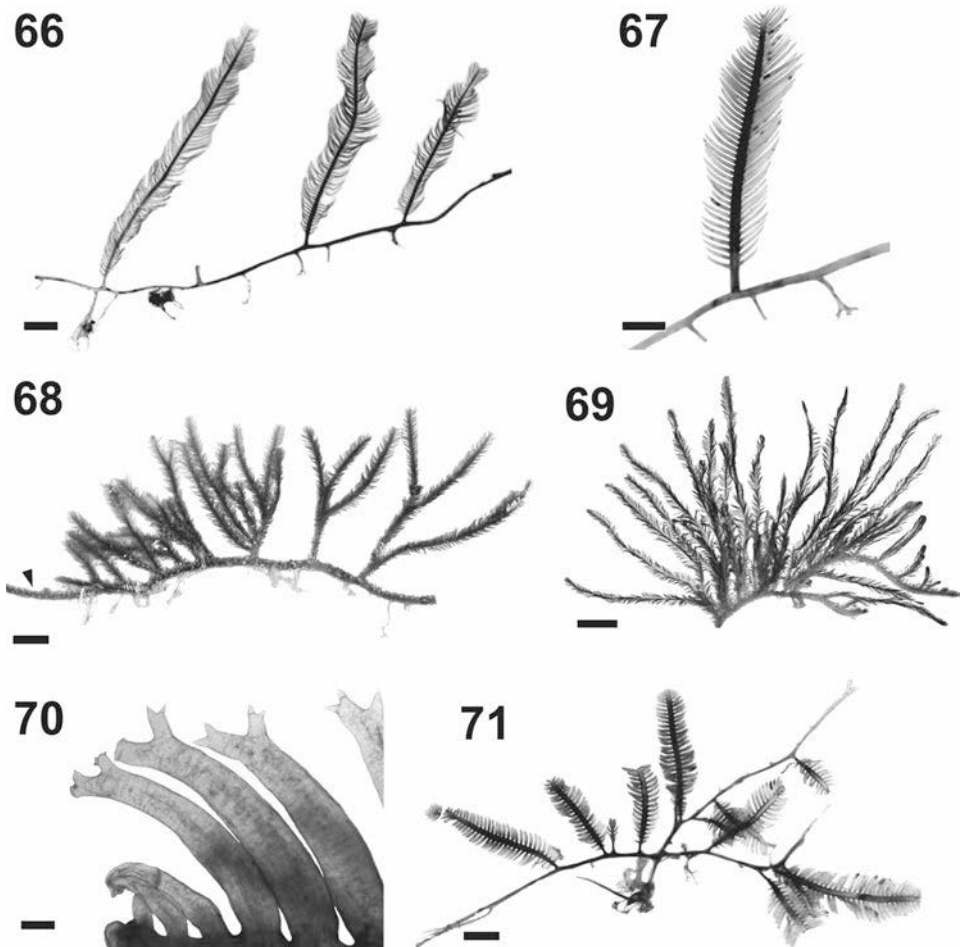
Remarks: This elegant species has long been considered endemic to the Tuamotu archipelago, French Polynesia, and indeed had not been republished since the original description by Weber-van Bosse (1910) until over 70 years later (Meinesz *et al.*, 1981), although it had been collected in 1952 from Raroia atoll by Maxwell Doty & Jan Newhouse (SUVA-A 6742). It has also been reported from Fiji (Littler & Littler, 2003: 232), but the inconspicuous plants from the latter locality appear predominantly bipinnate with a lax habit and non-pubescent runners, contrasting with the always tristichous, larger French Polynesian plants whose runners are fully invested with short ramuli. Furthermore, the end of the pinnules in French Polynesian plants are always distichously to tristichously divided (Fig. 69), while those reported for the Fiji plants are divided up to five times, and could rather represent a form of *C. webbiana*.

Caulerpa taxifolia (Vahl) C. Agardh, 1817: XXII. French Polynesia: Payri *et al.*, 2000: 98; Somalia: Sartoni, 1978: 410, fig. 5c; Indonesia: Coppejans & Prud'homme van Reine, 1992: 706, figs 6B, 22B; Fiji: South & N'Yeurt, 1993: 122, fig. 17; Littler & Littler, 2003: 234; Papua New Guinea: Coppejans, 1992: 406, fig. 8A-G; Coppejans *et al.*, 1995: 80, fig. 11; Indian Ocean: Silva *et al.*, 1996: 846; Belize: Littler & Littler, 1997: 109, fig. 155; Lord Howe Island: Kraft, 2000: 604, figs 34E, 35A; South Africa: Leliaert *et al.*, 2001: 452, fig. 2; Wallis: Payri *et al.*, 2002: 44, pl. 1 fig. 5; Hawaiian Islands: Abbott & Huisman, 2004: 124, fig. 46A-B. **(Figs 71-72)**

Basionym: *Fucus taxifolius* Vahl, 1802: 36 (type locality: St. Croix, Virgin Islands). **Material examined:** Vairao, Tahiti, 3 Oct. 1997, *leg. C. E. Payri*, UPF 612; 20 Mar. 1998, *leg. J. Orempuller*, UPF 588, 589; Atituiti, Mangareva, 17 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 799; Taravai, Gambier, 20 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 830, 831, 871; Rapa Island, Australs: Agairoa Bay, 2 Nov. 2002, *leg. C. E. Payri*, UPF 1892; off Tarakoi islet, 6 Nov. 2002, *leg. C. E. Payri*, UPF 2044; Tupua'I Bay, 2 Dec. 2002, *leg. J. L. Menou*, UPF 2444; Akatamiro Bay, 2 Dec. 2002, *leg. J. L. Menou*, UPF 2452.

Thallus to 45 mm tall, yellowish-green, composed of a creeping stolon to 25 cm long and 1 mm in diameter, bearing erect, plumose branches at relatively wide intervals. Erect branches to 8 mm wide, bearing pairs of opposite branchlets to 4 mm long and 1 mm in diameter which are compressed, basally constricted, with tapered, upwardly curved tips.

Remarks: Infrequent in the Society islands, more represented in islands of the Gambier and Australs. As discussed in N'Yeurt & Payri (2004: 374), some records



Figs 66-71. **66.** *Caulerpa sertularioides* (UPF 39). Habit of pressed plant. Scale = 10 mm. **67.** *Caulerpa sertularioides* (UPF 2591). Detail of erect assimilator of freshly-collected plant. Note terete, pointed branchlets. Scale = 10 mm. **68.** *Caulerpa seuratii* (UPF 41). Habit of typical plant from Hikueru Island, Tuamotu archipelago. Note densely spinulose stolon (arrowhead). Scale = 5 mm. **69.** *Caulerpa seuratii* (UPF 45). Habit of larger, more lax plant from Marokau Island. Note densely spinulose stolon (arrowhead). Scale = 20 mm. **70.** *Caulerpa seuratii* (UPF 41). Detail of pinnule apex, showing distichously divided ramuli with mucronate tips. Scale = 200 μ m. **71.** *Caulerpa taxifolia* (UPF 2452). Habit of pressed plant. Scale = 5 mm.

of *C. taxifolia* from the South Pacific have been erroneously ascribed to *Caulerpa mexicana* Sonder ex Kützing, a species genetically distinct from *C. taxifolia* (Olsen *et al.*, 1998). True *Caulerpa mexicana* from the Caribbean is characterised by a flattened main axis bearing non-constricted pinnules; the fronds also have a darker green colour with a lustrous sheen not found in *C. taxifolia*. (Meinesz *et al.*, 1994; Littler & Littler, 2000: 364, fig. on p. 365, upper). A main morphological difference between the two species would be in the disposition of the rhizoids: sparse on the stolon and very thick and dense in *C. taxifolia*; close together and with few rhizoids

per shoot in *C. mexicana*. Hawaiian records of *C. mexicana* (Taylor, 1977) have been transferred to *C. taxifolia* (Abbott & Huisman, 2004: 124), and *C. mexicana* would seem not to occur in the South Pacific (A. Meinesz, pers. com.).

Caulerpa taxifolia* (Vahl) C. Agardh ecad. *tristichophylla* Svedelius, 1906: 112, fig. 5. Fiji: Littler & Littler, 2003: 222 (“*Caulerpa mexicana* var. *pluriseriata*”); Wallis: N’Yeurt & Payri, 2004: 374. **(Fig. 73)

Misapplied names: *Caulerpa taxifolia* f. *asplenioides* Greville, 1853: figs 1-2, pl. I. French Polynesia: Weber-van Bosse (1898: 292; 1910: 2). — *Caulerpa mexicana* var. *pluriseriata* W.R. Taylor, 1975a: 77, fig. 1. Fiji: Littler & Littler, 2003: 222.

Material examined: Taravai, Gambier, on coral heads on fringing reef, 20 Nov. 2000, leg. A. D. R. N’Yeurt, UPF 875, 876, 877; Agairoa Bay, Rapa, in *Sargassum* beds, 2 Nov. 2002, leg. C. E. Payri, UPF 1893.

Thallus to 45 mm tall, yellowish-green, composed of a creeping stolon to 25 cm long and 1 mm in diameter, bearing erect, plumose branches at relatively wide intervals. Erect branches to 8 mm wide, bearing sometimes opposite, mostly three-dimensional, radially arranged pinnules to 4 mm long and 1 mm in diameter which are compressed, basally constricted, with tapered, upwardly curved tips.

Remarks: This ecad is distinguished from the typical form of *C. taxifolia* by its three-dimensional, often radial arrangement of pinnules on erect assimilators. Both opposite and radial arrangement of pinnules can be encountered on the same plant, even the same erect branches. This seems to be a shallow-water ecotype of *C. taxifolia*, rather than an infraspecific taxon (A. Meinesz, pers. com.). The combination *Caulerpa taxifolia* f. *asplenioides* was invalidated by Meinesz *et al.* (1994: 108) since it was based on *Caulerpa asplenioides* Greville, a misapplied name for *Caulerpa mexicana*. Plants from Fiji reported by Littler & Littler (2003) as *Caulerpa mexicana* var. *pluriseriata* would best be ascribed to *C. taxifolia* ecad. *tristichophylla* (see remarks above for *C. taxifolia*).

Caulerpa urvilleana Montagne, 1845: 21 (“*urvilliana*”) (type locality: Toud Island, Torres Strait, Australia). French Polynesia: Payri *et al.*, 2000: 98; Indonesia: Weber-van Bosse, 1898: 318, pl. 26 figs 7-12; Coppejans & Prud’homme van Reine, 1992: 686, figs 3B, 11B (as *C. cupressoides* ecad. *urvilliana*); Bikini Atoll: Taylor, 1950: 60, pls 31 fig. 1, pl. 32 fig. 1; Indian Ocean: Silva *et al.*, 1996: 848; Fiji: N’Yeurt, 2001: 716, fig. 39 (“*urvilliana*”); Littler & Littler, 2003: 234. **(Figs 74-75)**

Material examined: Toud Island, Torres Strait, Australia, n.d., leg. D. d’Urville, PC 10388 (holotype); Hao, 23 Dec. 1937, leg. C. H. Maggs, BM 841603; Taiaro, 24 Sep. 1992, leg. R. Galzin, UPF 50; Nengo Nengo, Jun. 1996, leg. J. M. Zanini, UPF 617; Kauehi, 21 Sep. 1995, leg. J. Orepuller, UPF 51; Ilot aux Oiseaux, Tikehau, 4 Nov. 1995, leg. A. D. R. N’Yeurt, UPF 52; Takapoto, 7 Nov. 1995, leg. L. Addessi, UPF 47, 48, 49; Puka Puka, Aug. 1999, leg. Anon., UPF 764; Vairaatea, Oct. 2000, leg. Anon., UPF 771; Atituiti, Mangareva, 18 Nov. 2000, leg. A. D. R. N’Yeurt, UPF 895, 907; Motu aux récifs, Rangiroa, 20 Jul. 2002, leg. A. D. R. N’Yeurt, UPF 2464, 2465.

Thallus to 12 cm high, with a creeping stolon to 40 cm long and 3 mm wide bearing sparse erect branches at irregular intervals. Upright branches slender, angular and terete, a few to several times dichotomously branched, or irregularly branched, 5-12 cm tall with axes smooth below, mamillate and spiny above, 1-2 mm in diameter. Assimilators thorn-like, radially arranged with mucronate tips.

Remarks: A common species from the atolls, forms extensive, loose populations on sandy substratum at the bottom of lagoons at depths of 1 to 28 metres, and on the outer reef slope between 3 and 25 metres. Shallow-water populations tend to

be smaller and bushier than deeper-water plants (Tuamotu). There has always been a confusion in the literature between *C. urvilleana* and *C. cupressoides* var. *mamillosa*. An examination of the type material of both species held in PC has shown them to be distinct, at least in gross external morphology. Although Montagne's type of *C. urvilleana* from Toud Island, Northern Australia (Fig. 74) only consists of a single piece of erect assimilator, the slender branches with characteristic thorn-like, non-inflated mucronate pinnules distinguishes it from *C. cupressoides* var. *mamillosa*. The latter species also seems to possess a golden-yellow hue of the stolon and base of erect assimilators which is usually not found in plants of *C. urvilleana*, which are typically dark grass-green in colour.

Caulerpa verticillata J. Agardh, 1847: 6 (type locality: West Indies). French Polynesia: Meinesz *et al.*, 1981: 436, figs 26-27; Indonesia: Weber-van Bosse, 1898: 267, pl. 20 figs 7-10, Coppejans & Prud'homme van Reine, 1992: 708, fig. 21B; Sri Lanka: Svedelius, 1906: 108, fig. 1a-b; Trinidad: Børgesen, 1907: 19, figs 1-3; Ryukyu Islands: Yamada, 1934: 62, figs 31-32; Micronesia: Yamada, 1940: 97, Hodgson *et al.*, 2004: 33; Viêt Nam: Dawson, 1954: 392, fig. 10b; Caribbean: W.R. Taylor, 1960: 138, pl. 10 figs 1-2; Caroline Islands: Trono, 1968: 167, pl. 14 fig. 4; New Caledonia: Valet, 1968: 42, pl. 6 fig. 4; Papua New Guinea: Coppejans & Meinesz, 1988: 194, figs 30-34, Littler & Littler, 2003: 234; Indian Ocean: Silva *et al.*, 1996: 849; Belize: Littler & Littler, 1997: 109, fig. 156; Hawaiian Islands: Abbott & Huisman, 2004: 125, fig. 46C. **(Fig. 76)**

Material examined: Opunohu Pass, Moorea, 22 Aug. 1978, *leg. A. Meinesz*, UPF 2990.

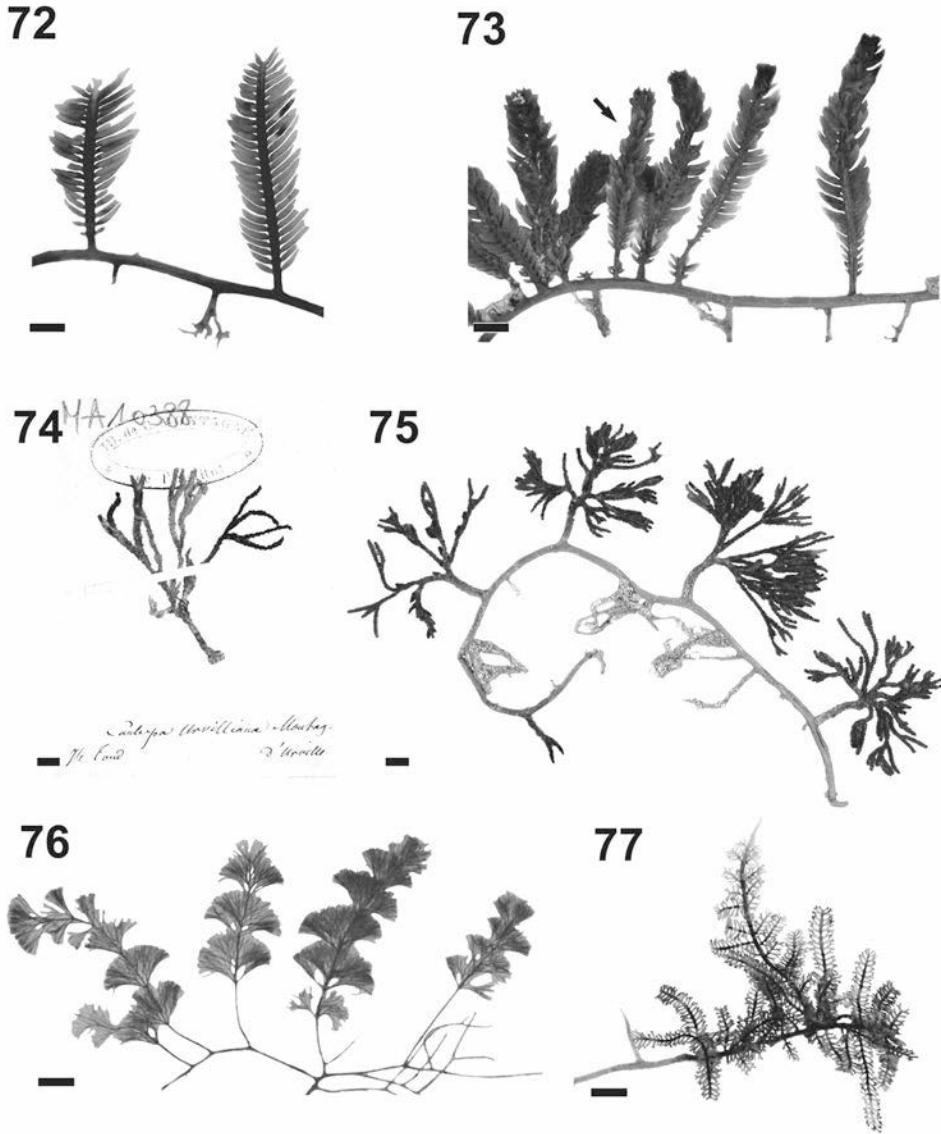
Thallus 30-70 mm high, Branchlets terete and regularly dichotomously branched 3-5 times, clustered in verticillate whorls in distal parts of thallus. Creeping stolons naked, 225-375 µm in diameter, usually interwoven. Vertical axes 220-225 µm in diameter at the base, 70-85 µm in diameter at the top. Apices obtuse. Tufts of ramuli composed of 2-3 regularly disposed series of verticils, each including 3 or 4 ramuli 2.5-3 mm long and 25-30 (top) to 55-65 (base) µm in diameter, with 2 or 3 terminal indentations.

Remarks: Growing abundantly on *Halimeda* sp., 30 metres depth under the ship wreck of *Kersaint*, in the reef pass. This alga seems to be relatively rare in French Polynesia, having been collected only once in the past on Moorea Island.

Caulerpa webbiana Montagne, 1837: 354 (type locality: Arrecife, Isla Lanzarote, Islas Canarias). French Polynesia: Setchell, 1926: 84, Payri & N'Yeurt, 1997: 883, Payri *et al.*, 2000: 100; Philippines: Meñez & Calumpang, 1982: 10, pl. 2G-J; Fiji: South & N'Yeurt, 1993: 124, fig. 15; N'Yeurt, 2001: 718, fig. 74; Littler & Littler, 2003: 236; Papua New Guinea: Coppejans *et al.*, 1995: 81, figs 13-14 (as ecad *disticha*); Indian Ocean: Silva *et al.*, 1996: 849. **(Figs 77-78)**

Material examined: Punaaru, Tahiti, 11 Jul. 1922, *leg. W. A. Setchell & H. E. Parks*, BM 841523, SAP 037722; Afaahiti, Tahiti, 7 Jun. 1997, *leg. A. D. R. N'Yeurt*, UPF 53; Punaauia, Tahiti, 6 Jul. 1997, *leg. C. E. Payri*, UPF 54; Tekokota, 1996, *leg. J. Orempuller*, UPF 56; Agairoa Bay, Rapa, 2 Nov. 2002, *leg. C. E. Payri*, UPF 1895; Tarakoi Islet, Rapa, 6 Nov. 2002, *leg. C. E. Payri*, UPF 2037; Patagaroa Pt., Rapa, 18 Nov. 2002, *leg. J. L. Menou*, UPF 2222, 2223; Rapa Iti, north slope, 28 Nov. 2002, *leg. J. L. Menou*, UPF 2406; Akatamiro Bay, Rapa, 2 Dec. 2002, *leg. J. L. Menou*, UPF 2453.

Thallus dark green and spongy, 5-10 mm high, with a stolon to 7 cm long and 500 µm in diameter. Uprights branches 200-300 µm in diameter, irregularly branched 1-5 times and bearing whorls of fine branchlets to 300 µm long and 80 µm in diameter with mucronate tips, giving the uprights a furry appearance. The branchlets do not completely cover the stolon, which can be partly naked in places.



Figs 72-77. **72.** *Caulerpa taxifolia* (UPF 2044). Detail of erect assimilators with flattened, basally constricted branchlets. Scale = 2 mm. **73.** *Caulerpa taxifolia* ecad. *tristichophylla* (UPF 876). Habit, showing both opposite and three-dimensional (arrow) erect assimilators on the same stolon. Scale = 5 mm. **74.** *Caulerpa urvilleana* (MA 10388). Habit of Montagne's Type from Toud Island, showing assimilators with thorn-like, non-inflated pinnules. Scale = 5 mm. Photographed with permission from the Museum National d'Histoire Naturelle, Paris. **75.** *Caulerpa urvilleana* (UPF 907). Habit of plant from Mangareva Island, showing similarity to Montagne's type from Northern Australia. Scale = 10 mm. **76.** *Caulerpa verticillata* (UPF 2990). Habit of pressed plant, showing ramuli arranged in series of verticils. Scale = 3 mm. **77.** *Caulerpa webbiana* (UPF 2037). Habit of pressed thallus. Scale = 3 mm.

Remarks: An inconspicuous species, growing in crevices on the fringing and barrier reef and on the outer reef slope to a depth of 4 meters.

Family **Halimedaceae** Link

Genus ***Halimeda*** J.V. Lamouroux

Recent molecular studies on this genus (Kooistra *et al.*, 2002, Verbruggen & Kooistra, 2004, Kooistra & Verbruggen, 2005, Verbruggen *et al.*, 2005a, b, 2006) have created upheavals in taxonomy, and have shown the need to re-describe several common Indo-Pacific *Halimeda* species.

Key to the French Polynesian species of *Halimeda*

(Important note: in order for this morphological key to be meaningful in distinguishing superficially similar-looking species, measurements of anatomical structures must represent the median of 10 measurements of the structures in question from a mid-thallus segment, as discussed in Verbruggen *et al.*, 2005a).

- 1a. Holdfast always single, frequently massive and bulbous; plants growing erect in sand or mud; nodal filaments fused in a single unit with intercommunicating pores. 12
- 1b. Holdfast(s) single or multiple, small, not bulbous; plants erect on hard substratum, forming massive clumps, or featuring a sprawling habit 2
 - 2a. Plant sprawling, holdfasts several, diffuse 3
 - 2b. Plant erect or pendant, holdfast single, basal 6
- 3a. Secondary utricles clavate, up to 70 μm in diameter, extending into medulla; nodal filaments fused completely in pairs or triplets for a distance of 400-800 μm *H. gracilis*
- 3b. Secondary utricles not clavate, less than 40 μm in diameter; nodal filaments fused in pairs (occasionally in triplets) for a distance of less than 150 μm 4
 - 4a. Thallus in dense cushions or clumps, branched in perpendicular planes, segments distinctly ribbed, dull and coarse upon drying *H. opuntia*
 - 4b. Thallus sprawling, in lax clumps, branching mostly in one plane 5
- 5a. Segments slightly to distinctly keeled, not distorted, often smooth and shiny, middle and distal segments relatively large and often ivy-leaf shaped *H. distorta* f. *hederacea*
- 5b. Segments not keeled, often distorted, dull and coarse upon drying, distal segments relatively small, not ivy-leaf shaped *H. distorta* f. *distorta*
 - 6a. Thallus pendant, segments small, ribbed. Nodal filaments mostly fused in pairs for a short distance *H. minima*
 - 6b. Thallus erect, segments not ribbed. Nodal filaments unfused, or fused in pairs or triplets. 7
- 7a. Segments often trilobed; daughter segments emerging from isolated pits on distal segment edge; nodal medullary filaments closely adherent, never completely fused 8
- 7b. Segments never lobed; daughter segments emerging at any point from a continuous band along distal segment edge; nodal medullary filaments unfused or completely fused in pairs or triplets 9
 - 8a. Peripheral utricles less than 50 μm in diameter and 60 μm high, segments smooth, never ruffled *H. melanesica*
 - 8b. Peripheral utricles above 67 μm in diameter and 90 μm high, segments rugose, often ruffled *H. heteromorpha*

- 9a. Nodal filaments unfused, basal segment large and fan-shaped, carrying many (> 6) daughter segments. *H. micronesica*
- 9b. Nodal filaments fused in pairs or triplets, basal segments not fan-shaped, carrying only a few daughter segments 10
- 10a. Secondary utricles not inflated; thallus showing an obvious gradient from large and darker brownish segments near the base to small and lighter, whitish green segments near the apices. *H. lacunalis*
- 10b. Secondary utricles distinctly inflated; thallus not showing any obvious gradient in segment size. 11
- 11a. Thallus flaccid, lightly calcified; segments not wedge-shaped; peripheral utricles 38-43 µm in diameter, often merging into one another *H. discoidea*
- 11b. Thallus rigid, heavily calcified, segments wedge-shape to trapezoidal, peripheral utricles 28-32 µm in diameter, not merging into one another *H. taenicola*
- 12a. Plant flaccid, anchored in mostly muddy substratum; branching generally in one plane; segments large, 12-30 mm wide and to 20 mm high *H. macroloba*
- 12b. Plant stiff, anchored in sand, branching in many planes; segments small, 6- 8 mm wide and to 6 mm high *H. borneensis*

**Halimeda borneensis* W.R. Taylor, 1975b: 81, figs 1-2 (type locality: Pulau Gaya, Cleland, North Borneo). Hillis-Colinvaux, 1980: 105, fig. 27; Fiji: Littler & Littler, 2003: 240; Wallis: N'Yeurt & Payri, 2004: 374. (Figs 79-80)

Misapplied names (given by Verbruggen *et al.*, 2005a, b): *Halimeda incrassata* f. *ovata*. French Polynesia: Payri & Meinesz, 1985b: 642, figs 4, 8, 12, 38-40. — *Halimeda simulans* Howe. French Polynesia: Setchell, 1926: 81; New Caledonia: Valet, 1968: 48, pl. 9(4) fig. 3; Hillis-Colinvaux, 1980: 103, fig. 26; Fiji: South, 1992: 10, figs 29-31, N'Yeurt, 2001: 724; Rotuma: N'Yeurt, 1996: 390, figs 76, 85; Belize: Littler & Littler, 1997: 113, fig. 163; Papua New Guinea: Coppejans *et al.*, 2001: 411. **Material examined:** Punaaru, Tahiti, 11 Jul. 1922, *leg. W. A. Setchell & H. E. Parks*, BM 841073 (as *H. simulans*); Maeva, Tahiti, Apr. 1982, *leg. C. E. Payri*, UPF 2816, 2817; Tiahura, Moorea, 13 Jun. 1984, *leg. C. E. Payri*, UPF 2787; Ilot aux Oiseaux Tikehau, 6 Nov. 1995, *leg. A. D. R. N'Yeurt*, UPF 98; Teahupoo, Tahiti, 10 Mar. 2002, *leg. A. D. R. N'Yeurt*, UPF 2828; Matira, Bora Bora, 16 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2519; Hotel Bora Bora Lagoon, Bora Bora, 17 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2569, Hotel Pearl Beach, Bora Bora, 17 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2577; Hotel Intercontinental, Bora Bora, 19 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2588; Hotel le Meridien, Bora Bora, 19 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2593; Tiahura, Moorea, *leg. A. D. R. N'Yeurt*, 28 Sep. 2004, UPF 2867; 29 Sep. 2004, UPF 2868; Punaauia, Tahiti, 9 Oct. 2004, *leg. A. D. R. N'Yeurt*, and V. Pouira, UPF 2829; Sheraton, Moorea, 18 Oct. 2004, *leg. A. D. R. N'Yeurt*, and V. Pouira, UPF 2830; Mataia, Tahiti, 11 Nov. 2004, *leg. A. D. R. N'Yeurt*, UPF 2824, 2825, 2826; Baie de Cook, Moorea, 2 Nov. 2005, *leg. S. Hatosy*, UPF 2723.

Emergent portion (excluding holdfast) about 50 mm high; single basal rhizoidal holdfast bulbous and sand-infiltrated, 15 mm in diameter and 30 mm long (Fig. 79). Colour dark-green to grass-green, heavily calcified and rigid. Texture smooth, surface shiny. Basal segments fan-shaped, 6-15 mm wide and 6-8 mm high; about 1 mm thick, 7-14 mm wide and 6-10 mm high. Peripheral utricles obpyriform and usually flat-topped, 32-(45)-55 µm in diameter and 41-(54.5)-68 µm long (Fig. 80). Nodal medullary filaments 45-64 µm in diameter, fused in groups of three, sometimes two.

Remarks: Growing in sandy areas on the fringing and barrier reefs, and in small tidepools. *Halimeda borneensis* was initially described quite narrowly, without encompassing the full morphological diversity of the species in the Indo-Pacific,

leading to misidentifications in the past. The superficial morphological similarities (large bulbous holdfast, large tripartite segments) between *H. borneensis* from the Indo-Pacific and “true” *H. incrassata* from the Caribbean and Atlantic is likely a result of convergent evolution, since their DNA sequences and internal anatomy are quite distinct (Verbruggen *et al.*, 2005a, b). Similarly, previous Pacific records of *Halimeda simulans* are referable to *H. borneensis*, since *H. simulans* is strictly an Atlantic species, and no specimens with a *H. simulans* DNA barcode were found in the Indo-Pacific (Kooistra *et al.*, 2002: 134; Verbruggen *et al.*, 2005a).

Halimeda discoidea Decaisne, 1842: 102 (type locality: “Kamschatka”, Russia according to Decaisne, 1842 and Silva *et al.*, 1987, but actual type locality unknown, since Kamschatka is an unlikely cold-temperate locality for this genus (Hillis, 1959: 353; Hillis-Colinvaux, 1980: 138; Lipkin & Silva, 2002: 68)). French Polynesia: Payri & Meinesz, 1985b: 642, figs 1, 5, 9, 35-36, Payri *et al.*, 2000: 108; Hawaiian Islands: Egerod, 1952: 398, pl. 38, fig. 19b-d; Abbott & Huisman, 2004: 131, fig. 49B-E; Hillis, 1959: 352, pl. 2, fig. 5; pl. 5, fig. 11; pl. 6, fig. 11; pl. 7, figs 9-10; pl. 8, figs 5-8; pl. 11; Hillis-Colinvaux, 1980: 136, fig. 41; Fiji: South, 1992: 6, figs 15-17; N'Yeurt, 2001: 721, figs 23a-b, 34; Indian Ocean: Silva *et al.*, 1996: 866; Rotuma: N'Yeurt, 1996: 386, figs 67, 79; American Samoa: Littler & Littler, 2003: 244. **(Figs 81-82)**

Material examined: Maraa, Tahiti, 28 Sep. 1928, *leg. C. Crossland*, BM 841193; Beachcomber, Tahiti, Apr. 1982, *leg. C. E. Payri*, UPF 2854; Côte Est, Bora Bora, Apr. 1990, *leg. C. E. Payri*, UPF 88; Tikehau, Oct. 1999, *leg. S. Golubic*, UPF 2702; Rurutu, 18 Aug. 2000, *leg. C. E. Payri*, UPF 744; Rikitea, Mangareva, 16 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 845; Motu Taraururoa, Gambier, 16 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 904; Atituiti, Mangareva, 19 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 909; Tiahura, Moorea, 29 Sep. 2004, *leg. A. D. R. N'Yeurt*, UPF 2860, 30 Sep. 2004 UPF 2988, UPF 2859, 1 Oct. 2004, *In Herb.* UPF.

Thallus to 10 cm tall, with a single short stalk-like segment at the base; lightly calcified, light green to cream in colour (Fig. 81). Segments large and thin (up to 20 mm broad and 15 mm high) and in a single plane, mostly branching dichotomously; plant drying to a papery texture. Daughter segments emerging at any point from a continuous band along distal segment edge. Peripheral utricles hexagonal in surface view, between 38-43 µm in diameter, with neighbouring peripheral utricles often merging with one another (Fig. 82). Cortex generally two-layered; secondary utricles distinctly inflated, up to 128 µm in diameter, supporting 5 to 14 peripheral utricles. Nodal filaments united in pairs or triplets, entangled below the fusion and only slightly adhering.

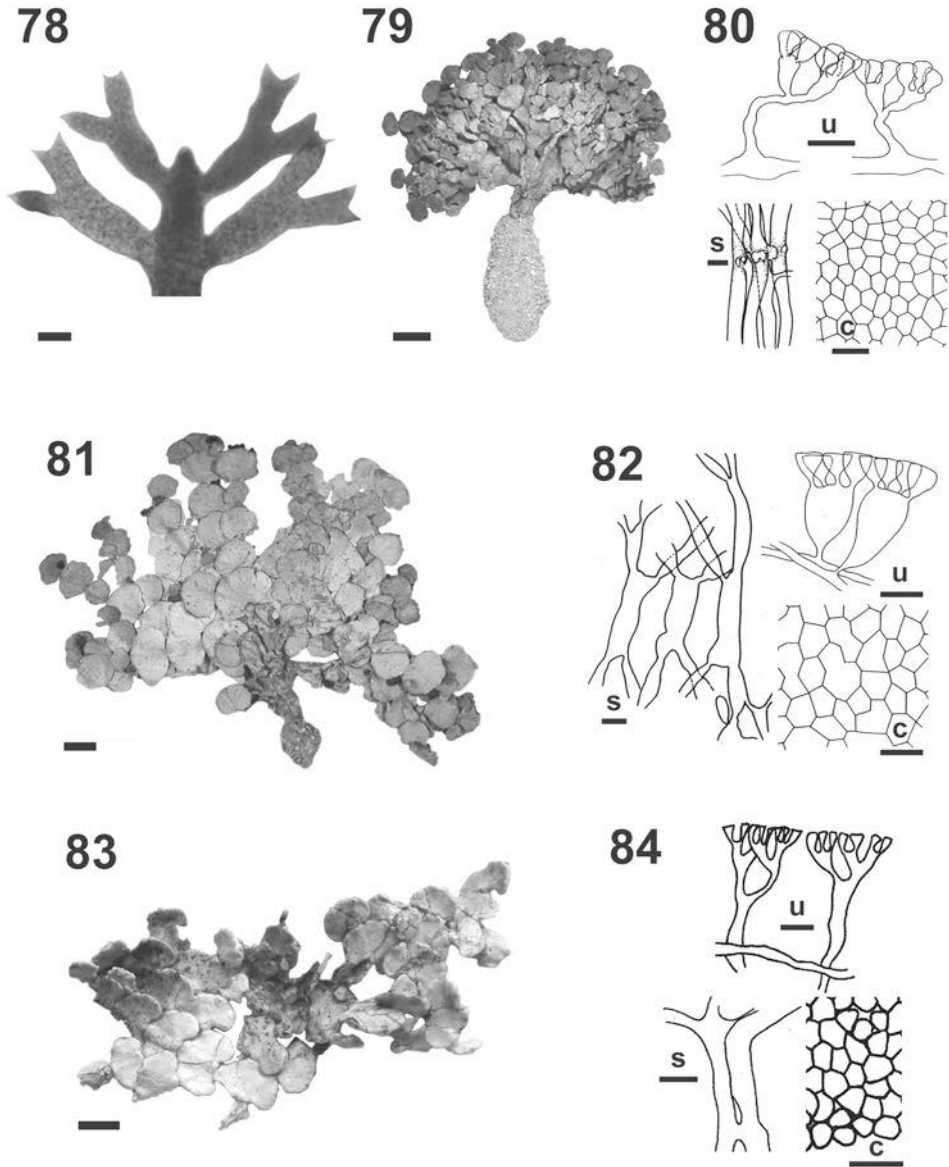
Remarks: Growing on the barrier reef flats and outer reef slope to a depth of 10 metres. Also grows on rocky shores (e.g. Afaahiti). A morphologically highly variable entity, which might contain cryptic entities (*H. Verbruggen*, pers. com.).

Halimeda distorta (Yamada) Hillis-Colinvaux, 1968: 33, figs 4, 6(2) f. ***distorta* f. *inedit.*** French Polynesia: Kooistra & Verbruggen, 2005: 180, fig. 2f-j; Hillis-Colinvaux, 1980: 120, fig. 34; Wallis: N'Yeurt & Payri, 2004: 374. **(Figs 83-84)**

Basionym: *Halimeda incrassata* f. *distorta* Yamada, 1941: 119 (type locality: near Ponape, Ant Atoll, Caroline Islands). Micronesia: Yamada, 1944: 28, Pl. 4.

Misapplied name (given by Kooistra & Verbruggen, 2005): *Halimeda copiosa* Goreau *et* Graham, 1967: 432, figs 1-10. Hawaiian Islands: Abbott & Huisman, 2004: 131, fig. 49A.

Material examined: Maeva, Tahiti, Apr. 1982, *leg. C. E. Payri*, UPF 2846; îlot aux Oiseaux, Tikehau, 6 Nov 1995, *leg. A. D. R. N'Yeurt*, UPF 85; Punaauia, Tahiti, 8 Nov. 1995, *leg. A. D. R. N'Yeurt*, UPF 86; Nuku Hiva, Marquesas, 1997, *leg. J. Orempuller*, UPF 597, 598,



Figs 78-84. **78.** *Caulerpa webbiana* (UPF 2037). Detail of pinnule apex. Scale = 50 μ m. **79.** *Halimeda borneensis* (UPF 2867). Habit of plant from Moorea, showing large bulbous holdfast. Scale = 10 mm. **80.** *Halimeda borneensis*. Internal anatomy (c = surface view of cortex; s = medullary siphons; u = peripheral utricles). All scales = 100 μ m. **81.** *Halimeda discoidea* (UPF 89). Habit of plant from Marquesas. Scale = 10 mm. **82.** *Halimeda discoidea*. Internal anatomy. All scales = 100 μ m. **83.** *Halimeda distorta* f. *distorta* (UPF 2518). Habit of plant from Bora Bora, showing contorted segments. Scale = 5 mm. **84.** *Halimeda distorta* f. *distorta*. Internal anatomy. Scales: c, u = 50 μ m, s = 100 μ m.

600, 601; Nengo Nengo, Jun. 1996, *leg. J.-M. Zanini*, UPF 618; Tikehau, Oct. 1999, *leg. S. Golubic*, UPF 2699; Akamaru, Gambier, 17 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 858; Akamaru, Gambier, 17 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 902; Motu aux récifs, Rangiroa, 20 Jul. 2002, *leg. A. D. R. N'Yeurt*, UPF 2467, 2468; Aquarium, Bora Bora, 15 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2503; Hotel Intercontinental, Bora Bora, 15 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2518; Matira, Bora Bora, 16 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2521; Hotel Bora Bora Lagoon, Bora Bora, 17 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2555; Mohio, Bora Bora, 21 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2607; Tiahura, Moorea, *leg. A. D. R. N'Yeurt*, 28 Sep. 2004, UPF TH12, 29 Sep. 2004, UPF 2865, 30 Sep. 2004, UPF 2858.

Thallus to 30 cm long, sprawling, branched in multiple planes with both prostrate and erect portions and multiple rhizoidal holdfasts (Fig. 83). Segments heavily calcified, 4-6 mm wide and 3-4 mm high, often ribbed or keeled, contorted, predominantly tripartite with three bundles of medullary siphons. Peripheral utricles hexagonal, 36-51 μm in diameter, separating but not becoming rounded after decalcification; up to 4 supported by secondary utricles (Fig. 84). Secondary utricles 19-31 μm in diameter. Nodal siphons joined usually in pairs or triplets, fused for a distance of about 100-160 μm .

Remarks: New molecular data showed that previous Pacific records of *H. copiosa* are referable to *H. distorta*, as the former is exclusively an Atlantic Ocean species (Kooistra & Verbruggen, 2005). Two morphs (f. *distorta* and f. *hederacea*) are present within this species; recent molecular evidence (Kooistra & Verbruggen, 2005) points to their being conspecific. Within the French Polynesian diversity, however, both morphs are morphologically distinct and therefore we describe them here as forms within a single species. *H. distorta* f. *distorta* is superficially characterised by having flat, dull contorted segments, which distinguishes it from f. *hederacea* which has keeled, shiny unctorted segments.

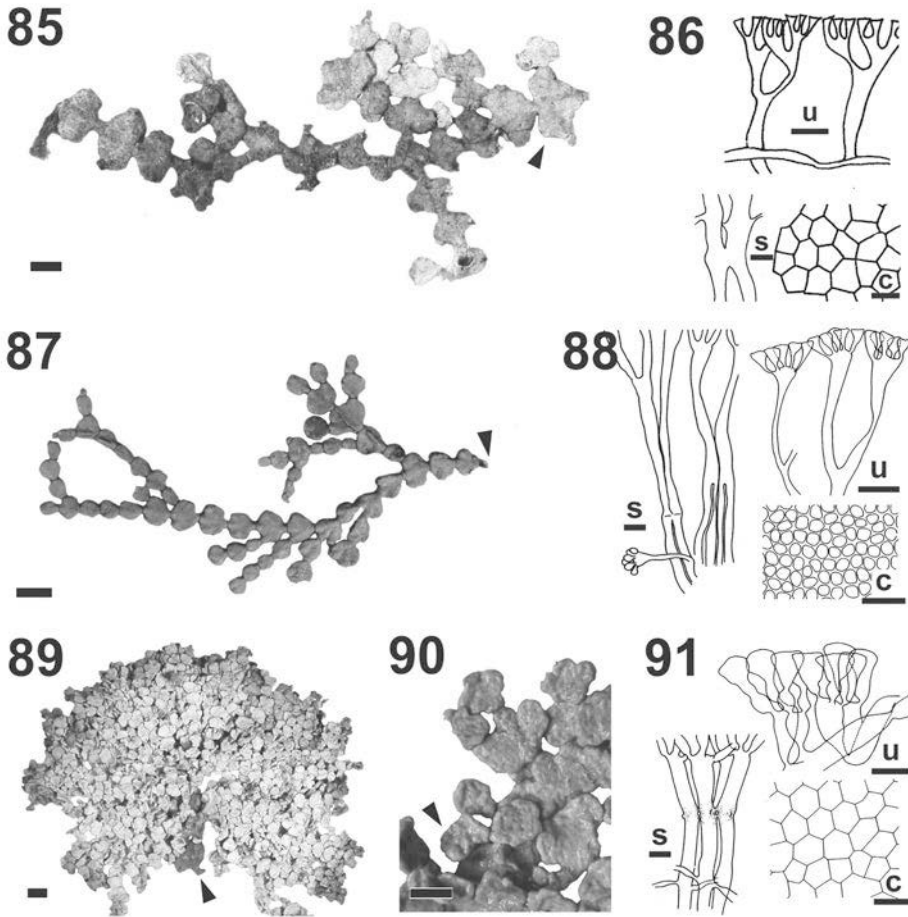
Halimeda distorta (Yamada) Hillis-Colinvaux f. *hederacea* (Barton) **comb. inedit.**
(Figs 85-86)

Heterotypic synonyms (given by Kooistra & Verbruggen, 2005): *Halimeda hederacea* (Barton) Hillis, 1968: 30, figs 3, 6:1, 6:4-8. French Polynesia: Kooistra & Verbruggen, 2005: 180, fig. 2a-e; Fiji: Littler & Littler, 2003: 242; Wallis: N'Yeurt & Payri, 2004: 375. — *Halimeda opuntia* f. *hederacea* Barton 1901: 21, pl. 2, fig. 23 (type locality: Indonesia). — *Halimeda opuntia* var. *hederacea* (Barton) Hillis, 1959: 360, pl. 2 fig. 7, pl. 5 fig. 4. Bikini Atoll: Taylor, 1950: 81, pl. 40 fig. 1; Rotuma: N'Yeurt, 1996: 389, figs 70c, 84.

Misapplied name (according to H. Verbruggen, pers. com.): *Halimeda copiosa* Goreau et Graham. Papua New Guinea: Coppejans *et al.*, 1995: p. 84 fig. 21.

Material examined: Maeva, Tahiti, Apr. 1982, *leg. C. E. Payri*, UPF 2846; Nuku-Hiva, Marquesas, 1997, *leg. J. Orempuller*, UPF 598; Taapuna, Tahiti, 8 Nov. 1998; *leg. C. E. Payri*, UPF 2874, 2875; Aquarium, Bora Bora, 15 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2503; Hotel Intercontinental, Bora Bora, 15 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2518; Matira, Bora Bora, 16 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2521; Tiahura, Moorea, 28 Sep. 2004, *leg. A. D. R. N'Yeurt*, UPF 2866, 30 Sep. 2004, UPF 2858.

Thallus stiff and sprawling, to 38 cm long, moderately calcified, forming mats (Fig. 85). Branching in one plane, dichotomous or trichotomous. Segments of middle and distal regions relatively large and ivy-leaf in shape, to 10 mm wide and 6 mm high, with those near the base smaller, thick and tripartite. Segments with smooth and shiny surfaces when dried. Peripheral utricles polygonal in surface view, 28-46 μm in diameter, with up to four supported per secondary utricle (Fig. 86). Secondary utricles 19-30 μm in diameter. Nodal filaments united in pair or occasionally in triplets or sextuplets, fused for a distance of 84-116 μm .



Figs 85-91. **85.** *Halimeda distorta* f. *hederacea* (UPF 2866). Habit of plant from Bora Bora, showing characteristic large, ivy-leaf shaped segments (arrowhead). Scale = 5 mm. **86.** *Halimeda distorta* f. *hederacea*. Internal anatomy. Scales: c, u = 50 μm, s = 100 μm. **87.** *Halimeda gracilis* (UPF 93). Habit, showing straggling moniliform habit with subcuneate, centrally thickened segments and single basal rhizoidal holdfast (arrowhead). Scale = 5 mm. **88.** *Halimeda gracilis*. Internal anatomy. All scales = 100 μm. **89.** *Halimeda heteromorpha* (UPF 2810). Habit, showing typically soft and pliable texture, and single basal matted holdfast (arrowhead). Scale = 5 mm. **90.** *Halimeda heteromorpha* (UPF 2809). Detail of segments of mid-thallus, showing rugose, pitted surface (arrowhead). Scale = 2 mm. **91.** *Halimeda heteromorpha*. Internal anatomy. All scales = 100 μm.

Remarks: The relatively large, keeled, ivy-leaf shaped segments branched in one plane are characteristic of this morph. See comments above for f. *distorta*.

Halimeda gracilis Harvey ex J. Agardh, 1887: 82 (type locality: Sri Lanka). Barton, 1901: 22, pl. 3 figs 28-32. French Polynesia: Payri & Meinesz, 1985b: 642, figs 2, 6, 10, 37; Micronesia: Yamada, 1941: 116; Viêt Nam: Dawson, 1954: 396, fig. 13f; Brazil: Joly *et al.*, 1968: 162, figs 2-4; Caroline Islands: Trono, 1968: 186,

pl. 18 fig. 9; Hillis-Colinvaux, 1980: 144, fig. 44; Bahamas: Blair & Norris, 1988: 231, fig. 6; Papua New Guinea: Coppejans *et al.*, 1995: 86, fig. 24; Indian Ocean: Silva *et al.*, 1996: 867; South Africa: Leliaert *et al.*, 2001: 453, figs 3, 9-10, De Clerck *et al.*, 2005: 84, figs 57-58; Palau: Dragastan *et al.*, 2002: 9, pl. 1 figs 6-8, pl. 3 figs 1-4, 6, 8; Fiji: Littler & Littler, 2003: 246; Hawaiian Islands: Abbott & Huisman, 2004: 133, fig. 49F. **(Figs 87-88)**

Material examined: Makatea, Apr. 1982, *leg. C. E. Payri*, *In Herb.* UPF; îlot aux Oiseaux, Tikehau, 6 Nov. 1995, *leg. A. D. R. N'Yeurt*, UPF 93; Tikehau, 7 Nov. 1995, *leg. A. D. R. N'Yeurt*, UPF 92.

Thallus with spreading habit, to 15 cm long, straggling with a main basal attachment point and several secondary attachments at points of contact with the substratum (Fig. 87). Segments subcuneate to reniform, moniliform, to 6 mm high and 10 mm broad and 500-750 μm thick, ribbed, seed-like (thick in central portion), moderately to heavily calcified, often with a glossy surface. Cortex 2-3 layered, peripheral utricles 28-53 μm in diameter, 40-90 μm long, slightly adherent in surface view when decalcified, up to 8 per secondary utricle (Fig. 88). Secondary utricles clavate (club-shaped), 23-70 μm in diameter, long and extending to medulla. Nodal filaments completely fused in pairs or triplets for a distance of 400-850 μm ; fusion groups not entangled.

Remarks: Growing at depths of 10-15 metres on the outer reef slope in atolls of the Tuamotu group. The gracile, straggling habit with small, bead-like segments are characteristic of this species.

Halimeda heteromorpha* N'Yeurt in Verbruggen *et al.*, 2006: 351, figs 14-26, 41-43, 51-54, 63, 64 (type locality: between Papetoai and Motu Tiahura, Moorea, French Polynesia). **(Figs 89-91)

Misapplied names (given by Verbruggen *et al.*, 2006): *Halimeda incrassata* (Ellis) J.V. Lamouroux, 1816: 307. French Polynesia: Payri & Meinesz, 1985b: 642. — *Halimeda incrassata* f. *ovata*. French Polynesia: J. Agardh, 1887: 86; Barton, 1901: 27, pl. IV figs 42, 47; Hillis, 1959: 365.

Material examined: Marquesas, n.d., *leg. EPHE*, UPF 96; Maeva, Tahiti, Apr. 1982, *leg. C. E. Payri*, UPF 2808, 2815; Tiahura, Moorea, 13 Jun. 1984, *leg. C. E. Payri*, UPF 2786, 2789, 2803; Punaauia, Tahiti, 25 Sep. 1995, *leg. A. D. R. N'Yeurt*, UPF 97; Taapuna, Tahiti, 8 Nov. 1998, *leg. C. E. Payri*, UPF 2869; Tikehau, Oct. 1999, *leg. S. Golubic*, UPF 2701; Tupai, 3 Jul. 2002, *leg. C. Vermenot*, UPF 2478; Aquarium, Bora Bora, 15 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2505, 2506; Matira, Bora Bora, 16 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2520; Hotel Bora Bora Lagoon, Bora Bora, 17 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2570; Mohio, Bora Bora, 21 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2597; Tiahura, Moorea, 28 Sep. 2004, *leg. A. D. R. N'Yeurt*, 29 Sep. 2004, UPF 2857, 1 Oct. 2004, UPF 2810, 2814; Punaauia PK 18, Tahiti, 9 Oct. 2004, *leg. A. D. R. N'Yeurt*, and V. Pouira, UPF 2823; Punaauia PK 13, Tahiti, 20 Nov. 2004, *leg. A. D. R. N'Yeurt*, UPF 2809.

Thallus to 55 mm high and 110 mm broad, with a single, circular, basal matted rhizoidal holdfast 15 mm in diameter (Fig. 89). Colour grass-green in upper half of thallus, whitish in lower portions. Moderately to lightly calcified. Basal portion hidden within crevice in the substratum. Texture soft and decumbent, segments highly pliable at nodes; surface rough, dull-pitted (Fig. 90). Branching dense throughout. First two basal segments 6-7 mm wide and 4.5-5 mm high; lower segments fan-shaped to cylindrical, 4-6 mm wide and 5-6 mm high. Middle segments tripartite to reniform, 5-7 mm wide and 4-5 mm high. Daughter segments emerging from isolated pits on distal segment edge. Peripheral utricles in middle portions of thallus elongate obovoid with usually rounded ends, 59-90 μm in diameter and 91-113 μm high (Fig. 91). Nodal medullary filaments 54-90 μm in diameter, adhering

into a single unit at segment nodes; connecting pores between neighbouring segments at segment nodes totally absent or smallish, 25-36 µm in diameter.

Remarks: Common on the fringing reefs and in the lagoon of high islands, nested amongst coral debris and cavities in ledges. Its flaccid habit with small segments could be confused in the field with *H. melanesica*, but the latter species has smaller peripheral utricle diameter and height. Based on new morphological and molecular evidence in Verbruggen *et al.* (2006) there are several species contained in what was previously considered as *Halimeda incrassata*. One species, which is exclusively present in the Caribbean, conforms to the type material of *H. incrassata*, while the other two are Pacific species which were described as new (*H. kanaloana* Vroom from Hawaii, and *H. heteromorpha* from the Indo-Pacific). This species was first recorded from Nuku-Hiva Island in the Marquesas by J. Agardh (1887) and later documented by Barton (1901), as *H. incrassata* f. *ovata* (H. Verbruggen, pers. com.).

Halimeda lacunalis W.R. Taylor, 1950: 91, 208, pl. 51 figs 1-2 (type locality: Eniwetok Atoll, Marshall Islands) f. ***lata*** (W.R. Taylor) Hillis-Colinvaux, 1980: 129, fig. 38b. French Polynesia: Taylor, 1973: 38 (Tikehau); Payri & Meinesz, 1985b: 643, figs 13, 17, 21, 43, Payri *et al.*, 2000: 110; Hillis-Colinvaux, 1980: 129, fig. 38a; Indian Ocean: Silva *et al.*, 1996: 868. **(Figs 92-93)**

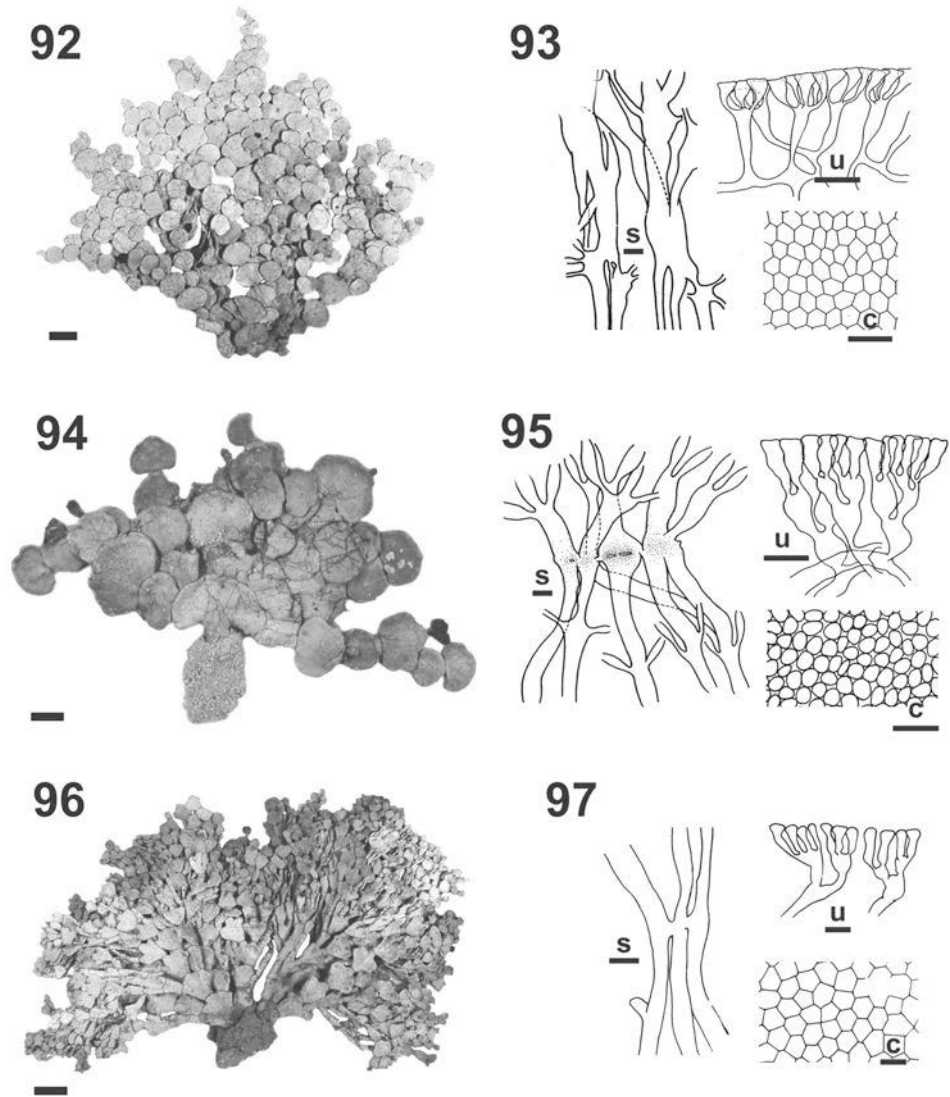
Material examined: Mataiva, Tuamotu, Apr. 1982, leg. C. E. Payri, UPF 2805; Nengo Nengo, Jun. 1996, leg. J.-M. Zanini, UPF 616; Marokau, Tuamotu, leg. J. Orempuller, 22 Nov. 1996, UPF 99, 100.

Thallus erect or hanging, flaccid, up to 18 cm tall, fairly compact, arising from a minute holdfast (Fig. 92). Calcification light to moderate, whitish-green. Branching mainly planar and commonly dichotomous, several segments arising from a single one; basal segments small, cylindrical to subcuneate, upper segments discoidal to reniform, to 15 mm long and 20 mm broad, and 0.5-0.7 mm in thickness. Daughter segments emerging at any point from a continuous band along distal segment edge. Dried plants show an obvious gradient from large and darker brownish segments near the base to small and lighter, whitish green segments near the apices. Cortex 2-4 layered, peripheral utricles hexagonal in surface view, 20-55 µm in diameter, remaining attached after decalcification (Fig. 93). Secondary utricles 15-50 µm broad, not inflated, bearing up to 5 peripheral utricles. Nodal filaments united in pairs or triplets for a distance of about 80-150 µm.

Remarks: Growing on coral heads in the lagoon of atolls. Two forms within this species were described by Hillis-Colinvaux (1980): f. *lacunalis* and f. *lata*. The latter is more compact, and more commonly encountered. The French Polynesian plants conform to f. *lata*.

Halimeda macroloba Decaisne, 1841: 118 (type locality: Red Sea). French Polynesia: Payri & Meinesz, 1985b: 643, figs 14, 19, 22-23, 44-45, Payri *et al.*, 2000: 112; Hillis, 1959: 375, pl. 3 fig. 3, pl. 5 figs 19-20, pl. 6 fig. 17, pl. 12; Thailand: Egerod, 1974: 148, figs 65-68; 1975: 61, fig. 33; Hillis-Colinvaux, 1980: 108-110, fig. 28; Fiji: South, 1992: 8, figs 12-14, N'Yeurt, 2001: 722, fig. 38; Papua New Guinea: Coppejans *et al.*, 1995: 86, fig. 25; Indian Ocean: Silva *et al.*, 1996: 869; American Samoa: Littler & Littler, 2003: 248; Hawaiian Islands: Abbott & Huisman, 2004: 135, fig. 50B. **(Figs 94-95)**

Material examined: Hotel Beachcomber, Tahiti, Apr. 1982, leg. C. E. Payri, UPF 2853; 4 May 1997, leg. A. D. R. N'Yeurt, UPF 101, 102; Taapuna, Tahiti, leg. C. E. Payri, UPF 2873.



Figs 92-97. **92.** *Halimeda lacunalis* f. *lata* (UPF 100). Habit, showing gradient from large and darker brownish segments near the base to small and lighter, whitish green segments near the apices. Scale = 10 mm. **93.** *Halimeda lacunalis* f. *lata*. Internal anatomy. All scales = 100 μ m. **94.** *Halimeda macroloba* (UPF 2873). Habit, showing thick large, epiphyte-laden unribbed segments and sand-incrustated bulbous holdfast. Scale = 10 mm. **95.** *Halimeda macroloba*. Internal anatomy. All scales = 100 μ m. **96.** *Halimeda melanesica* (UPF 2804). Habit of plant from Afaahiti, Tahiti. Scale = 10 mm. **97.** *Halimeda melanesica*. Internal anatomy. Scales: c, u = 50 μ m, s = 100 μ m.

Thallus up to 15 cm high and 20 cm broad, with a large bulbous and incrustated holdfast 30-40 mm long and 15-20 mm wide (Fig. 94). Segments thick and large, subcuneate to reniform, not ribbed, about 1 to 2 mm thick and up to 30 mm wide and 20 mm high. Branching planar to bushy, di- to polychotamous.

Calcification moderate; basal segment compressed and supporting several separate or laterally consolidated segments forming a fan-shaped unit. Cortex 3-4 layered, mature peripheral utricles 25-45 μm in diameter, rounded and remaining separate in surface view following decalcification (immature segments may have peripheral utricles remaining attached following decalcification, see Payri & Meinesz 1985b) (Fig. 95). Secondary utricles 20-58 μm in diameter and 40-80 μm long. Two to four peripheral utricles supported per secondary utricles. Nodal filaments completely united for about 44-80 μm , communicating by pores.

Remarks: This species has the largest and thickest segments, and is commonly found in calm areas subject to much sedimentation (e.g. in the lagoons and estuaries). Despite its conspicuous large segments and massive holdfast, this species has never been collected to date outside of Tahiti and Moorea (Society Group), perhaps due to the unavailability of its typical habitat elsewhere. The broad segments are often the host to a number of creeping epiphytic algae (e.g. *Ceramium* spp., *Chondria* spp.).

**Halimeda melanesica* Valet, 1966b: 683, fig. 2, pl. 1 figs c-d (type locality: Luengöni, Lifou Island, Loyalty Islands, New Caledonia). New Caledonia: Valet, 1968: 49, pl. 9 fig. 3; Hillis-Colinvaux, 1980: 153, fig. 48; Fiji: Littler & Littler, 2003: 250; Verbruggen & Kooistra, 2004; Verbruggen *et al.*, 2006, figs 23-29, 37-39, 48-49.

(Figs 96-97)

Material examined: Taiohae, Nuku Hiva, Marquesas, c. 1899, *leg. E. Jardin*, BM 841150; Marquesas, n.d., *leg. EPHE*, UPF 95; Nuku Hiva, Marquesas, 1997, *leg. J. Orempuller*, UPF 599, 602, 603; Afaahiti, Tahiti, 7 Jun. 1997, *leg. A. D. R. N'Yeurt*, UPF 94; Taiohae, Nuku Hiva, Marquesas, 30 Apr. 2002, *leg. S. Sidolle*, UPF 2714; Afaahiti, Tahiti, 16 Nov. 2004, *leg. A. D. R. N'Yeurt & A. Pham*, UPF 2804, 2811, 2812, 2813, 2821, 2832.

Thalli in flaccid clumps to 12 cm high, attached to the substratum by means of a firm, dense mat of rhizoids (Fig. 96). Segments lightly calcified, consisting of a basal zone of relatively large segments 5 mm long to 9 mm wide, merging into a fan-like structure that carries several branches, with progressively smaller segments to 4 mm long and 3 mm broad, and 500 μm thick. Daughter segments emerging from isolated pits on distal segment edge. Segments from central and upper thallus parts obovate-cuneate, with the majority trilobed, surface generally smooth and shiny, never ruffled or pitted. Cortex consisting of 3 layers of basally-constricted utricles (Fig. 97). Peripheral utricles 40-50 μm in diameter and 40-53 μm high, adherent after decalcification. Median secondary utricles 32-45 μm in diameter and 49-92 μm high. Nodal filaments closely adherent over a distance of 25-30 μm , showing an adhesion band when dissected; sometimes fused in pairs or triplets. Pores small or absent.

Remarks: Growing in clumps on rocky substratum at depths of 2-5 metres, so far in French Polynesia only reported from Nuku Hiva in the Marquesas and Afaahiti District in Tahiti. The species seems to be restricted to wave-washed, exposed habitats, and is known to occur from infralittoral fringe, wave-affected sites to deeper waters at sites with strong swells. Superficially similar to *H. heteromorpha*, *H. melanesica* can be distinguished by its restriction to wave-washed, exposed areas or deeper waters exposed to strong swell. The segments appear smoother in *H. melanesica*. Definite identification relies on measurement of the average diameter of the peripheral utricles, which is less than 50 μm in *H. melanesica*. Upon drying, *H. melanesica* also tends to take on a pale brownish-yellow colour whereas *H. heteromorpha* keeps its green colour in the apical thallus parts. The present distribution of the species at opposite ends of the South Pacific (New Caledonia, Fiji, Tahiti) urges more research to locate it in intervening localities.

Halimeda micronesica Y. Yamada, 1941: 121, fig. 15; 1944: 29, pl. 5 (type locality: Ant atoll, Ponape Island, East Carolines). French Polynesia: Payri & Meinesz, 1985b: 643, figs 16, 18, 24, 46, Payri *et al.*, 2000: 112; Bikini Atoll: Taylor, 1950: 89, pl. 46, fig. 2; pl. 47; Hillis, 1959: 364, pl. 3, fig. 1; pl. 5, figs 13-14; pl. 6, fig. 2; pl. 9; Caroline Islands: Trono, 1968: 186, pl. 17 fig. 6; Ryukyu Islands: Itono, 1973: 160, fig. 21, Tsuda & Kamura, 1991: 71, pl. 4 figs 2-3; Hillis-Colinvaux, 1980: 149; Maldives: Wynne, 1993: 22, fig. 10; Indian Ocean: Silva *et al.*, 1996: 869; Rotuma: N'Yeurt, 1996: 387, figs 69, 81-82; Fiji: Littler & Littler, 2003: 250; Wallis: N'Yeurt & Payri, 2004: 375. **(Figs 98-99)**

Heterotypic synonym (given by Silva *et al.*, 1996): *Halimeda orientalis* Gilbert, 1947: 126, fig. 1 (Philippines).

Material examined: Makatea, Apr. 1982, *leg. C. E. Payri*, UPF 2818; Kauehi, 22 Sep. 1995, *leg. J. Orempuller*, UPF 103; îlot aux Oiseaux, Tikehau, 6 Nov. 1995, *leg. A. D. R. N'Yeurt*, UPF 104; îlot Ono, Bora Bora, Apr. 1990, *leg. C. E. Payri*, UPF 106; Motu aux récifs, Rangiroa, 20 Jul. 2002, *leg. A. D. R. N'Yeurt*, UPF 2466, 2469, 2472; Tupai, 3 Jul. 2002, *leg. C. Vermenot*, UPF 2477, 2480, 2485.

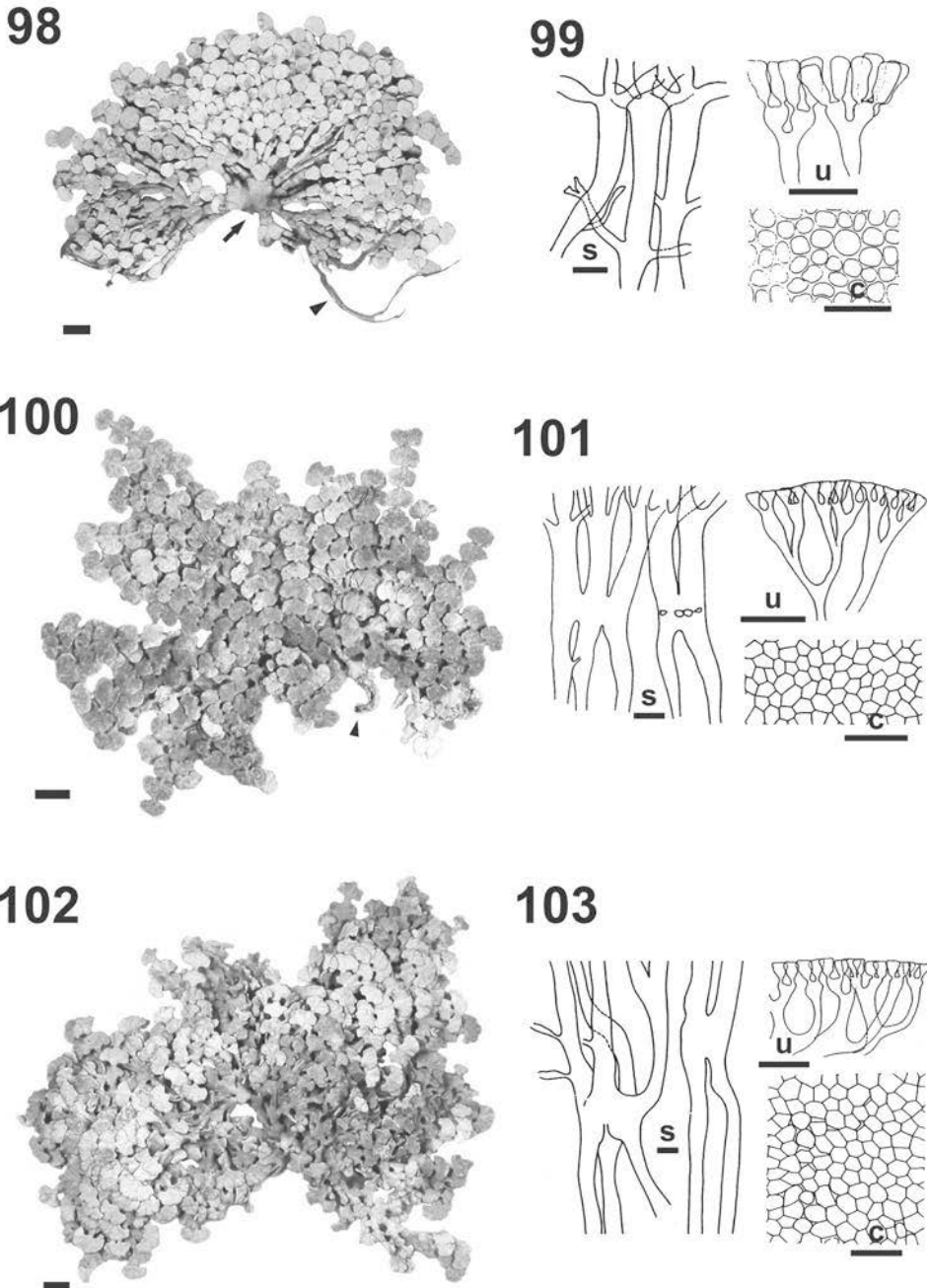
Plants compact and bushy, to 10 cm tall (Fig. 98). Rhizoids long and fibrous, occurring in the basal region and often at the tips of the branches. Calcification moderate, colour light green to whitish. Basal segment conspicuous and large, to 18 mm broad and 12 mm high, reniform (fan-shaped), with an undulate margin, supporting numerous smaller segments. Branching mainly trichotomous, in one plane. Other segments 9 mm broad and 7 mm high, frequently trilobed. Cortex 3-4 layered, peripheral utricles rounded in surface view, 28-48 µm in diameter, usually separating after decalcification; 2-4 borne per secondary utricles (Fig. 99). Secondary utricles 15-45 µm in diameter, generally not basally constricted. Nodal filaments unfused, sometimes slightly adherent, with thickened and pigmented filament walls.

Remarks: Growing usually in the lagoon and on the inner reef and outer reef slope of atolls in the Tuamotu archipelago, but also found in the Society Group in Bora Bora (outer reef flat) and in the atoll of Tupai, which presumably have similar habitats. Specimens were found forming tight clumps on the reef crest, with waves breaking right on top of them (Rangiroa). The single, fused and fan-shaped basal segment of this species is distinctive in the field. Characteristic rope-like uncorticated medullary filaments extend 5-6 cm from some basal segments over the substratum, bearing a young plant at the end. This represents a mode of vegetative reproduction in this species, as well as a means of added attachment to the substratum (Hillis-Colinvaux, 1980; Wynne, 1993).

Halimeda minima (W.R. Taylor) Hillis-Colinvaux, 1968: 32, figs 5-6. French Polynesia: Payri & Meinesz, 1985b: 644, figs 16, 20, 25, 47, Payri *et al.*, 2000: 114, Kooistra & Verbruggen, 2005: 178, fig. 1a-b; Hillis-Colinvaux, 1980: 113, fig. 30; Fiji: South 1992: 8, fig. 34, N'Yeurt, 2001: 723, figs 25, 36, Littler & Littler, 2003: 250; Indian Ocean: Silva *et al.*, 1996: 870. **(Figs 100-101)**

Basionym: *Halimeda opuntia* (Linnaeus) J.V. Lamouroux f. *minima* W.R. Taylor, 1950: 82-83, 206, pl. 39 fig. 2 (type locality: Bikini Atoll, Marshall Islands).

Material examined: Fare Ute, Tahiti, 30 May. 1922, *leg. W. A. Setchell & H. E. Parks*, BM 841221; Tiahura, Moorea, Aug. 1978, *leg. A. Meinesz*, UPF 2847; Maeva, Tahiti, Apr. 1982, *leg. C. E. Payri*, UPF 2848; Afaahiti, Tahiti, 7 Jun. 1997, *leg. A. D. R. N'Yeurt*, UPF 105; Taapuna, Tahiti, 8 Nov. 1998, *leg. C. E. Payri*, UPF 2870; Motu Totegegie, Gambier, 22 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 786; Akamaru, Gambier, 17 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 890; Mohio, Bora Bora, 21 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2597; Tiahura, Moorea, *leg. A. D. R. N'Yeurt*, 29 Sep. 2004, UPF 2851, 30 Sep. 2004, UPF 2850, 2852, 3 Nov. 2004, UPF 2849.



Figs 98-103. **98.** *Halimeda micronesica* (UPF 2818). Habit, showing characteristic fan-shaped basal segment (arrow) and rope-like medullary filaments extended from basal segments (arrowhead). Scale = 5 mm. **99.** *Halimeda micronesica*. Internal anatomy. All scales = 100 μ m. **100.** *Halimeda minima* (UPF 105). Habit, showing single basal holdfast (arrowhead). Scale = 5 mm. **101.** *Halimeda minima*. Internal anatomy. All scales = 100 μ m. **102.** *Halimeda opuntia* (UPF 924). Habit. Scale = 5 mm. **103.** *Halimeda opuntia*. Internal anatomy. All scales = 100 μ m.

Plants bushy, 5-7 cm tall, of pendant habit, with a single minute holdfast about 6 mm high and 3 mm wide (Fig. 100). Segments relatively small, strongly calcified and brittle, 2-4 mm wide and 1-4 mm high, frequently trilobed in lower portions of thallus; rugose-pitted in appearance. Cortex up to four-layered; peripheral utricles 15-25 μm in diameter, subhexagonal and adhering slightly after decalcification, more than 4 borne per secondary utricle (Fig. 101). Secondary utricles 10-20 μm in diameter. Nodal filaments united in pairs or triplets for a distance of 56-75 μm ; occasionally separate.

Remarks: Growing in crevices on the barrier reef flat, and pendant from ledges on the outer reef slope to a depth of 20 meters. *Halimeda minima* can be readily distinguished from members of the *H. hederacea-distorta-opuntia* complex (with which it shares many characters such as incomplete nodal fusion and small, heavily calcified segments) by its pendant habit and single, basal holdfast.

Halimeda opuntia (Linnaeus) J.V. Lamouroux, 1816: 308. French Polynesia: Payri & Meinesz, 1985b: 644, figs 26, 29, 32, 48, 49, Payri *et al.*, 2000: 114; Kooistra & Verbruggen, 2005: 179, fig. 1c-e; Barton 1901: 18, pl. 2 figs 19-27; Hawaiian Islands: Egerod, 1952: 397, pl. 3, fig. 19a, e-f, Abbott & Huisman, 2004: 135, fig. 50C; Bikini Atoll: Taylor, 1950: 80, pl. 39, fig. 1; Viêt Nam: Dawson, 1954: 395, fig. 12; Hillis, 1959: 359, pl. 2, figs 7-8; pl. 5, figs 3-4; pl. 6, fig. 6; pl. 7, fig. 3; pl. 10; Caroline Islands: Trono, 1968: 178, pl. 18 Figs 1-4; Thailand: Egerod, 1974: 147, figs 59-61; Somalia: Sartoni, 1979: 284, fig. 4c; Hillis-Colinvaux, 1980: 110, figs 19, 51, 92; Philippines: Trono, 1986: 234, fig. 35; Ryukyu Islands: Tsuda & Kamura, 1991: 65, pl. 2 fig. 4; Maldives: Wynne, 1993: 23, fig. 11; Papua New Guinea: Coppejans *et al.*, 1995: 86, fig. 27; Indian Ocean: Silva *et al.*, 1996: 870; Rotuma: N'Yeurt, 1996: 389, figs 70b, 83; Belize: Littler & Littler, 1997: 111; Fiji: South, 1992: 9, figs 26-28; N'Yeurt, 2001: 723, Littler & Littler, 2003: 252; Samoa: Skelton & South, 2002a: 165, fig. 25C-D. **(Figs 102-103)**

Basionym: *Corallina opuntia* Linnaeus, 1758: 805 (type locality: Jamaica).

Material examined: Tahiti, Sep. 1875, *leg. H. Moseley*, BM 841222, 841231; Hao, 10 Jan. 1905, *leg. L. G. Seurat*, BM 841220; Tahiti, Oct. 1909, *leg. J. E. Tilden*, BM 701523; Maraa, Tahiti, 24 Sep. 1928, *leg. C. Crossland*, BM 701522; Tiahura, Moorea, Jun. 1980, *leg. C. E. Payri*, UPF 2845; Taapuna, Tahiti, 16 May 1997, *leg. A. D. R. N'Yeurt*, UPF 107; Mt. Mokoto, Mangareva, 27 Sep. 1997, *leg. J. Starmer*, UPF 630; Aukena, Gambier, 21 Sep. 1997, *leg. J. Starmer*, UPF 632; Hikueru, 16 Nov. 1996, *leg. J. Orempuller*, UPF 706; Raivavae, 18 Oct. 2000, *leg. V. Clouard*, UPF 787; Mekiro, Gambier, 17 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 911; Mangareva, Gambier, *leg. A. D. R. N'Yeurt*, 18 Nov. 2000, UPF 783, 21 Nov. 2000, UPF 785, 905; Taravai, Gambier, 20 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 925, 930; Motu aux récifs, Rangiroa, 20 Jul. 2002, *leg. A. D. R. N'Yeurt*, UPF 2471; Povai, Bora Bora, 16 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2544; Tikehau, Oct. 1999, *leg. S. Golubic*, UPF 2699; Tiahura, Moorea, *leg. A. D. R. N'Yeurt*, 28 Sep. 2004, UPF 2862, 2863, 29 Sep. 2004, UPF 2864, 1 Oct. 2004, UPF 2861.

Thallus forming dense or lax bushy clumps to 30 cm in diameter and 6 cm high, with multiple rhizoidal attachment points, light to dark green in colour (Fig. 102). Branching dense and in perpendicular planes. Segments 10 mm broad to 5 mm high, reniform, ribbed and trilobed at base of plant. Basal segments often bleached white. Cortex up to 5-layered; peripheral utricles 10 to 12 μm in diameter, small, rounded and slightly adhering in surface view following decalcification (Fig. 103). Secondary utricles 11-35 μm in diameter, slender and fork-shaped, arising as dichotomies of the medullary filaments. Nodal filaments united in pairs, occasionally in triplets, for a distance of 25-70 μm .

Remarks: Growing in shallow waters on the reef flat. One of the commonest *Halimeda* species, recognized in the field by its clumped habit and reniform, ribbed segments which are characteristically branched in perpendicular planes

Halimeda taenicola W.R. Taylor, 1950: 86, pl. 46 fig. 1. French Polynesia: Payri & Meinesz, 1985b: 645, figs 28, 31, 34, 51, Payri *et al.*, 2000: 116; Hillis, 1959: 354, pl. 2 fig. 6, pl. 5 fig. 12, pl. 6 fig. 14, pls 11, 14; Trono, 1968: 182, pl. 16 fig. 3; Hillis-Colinvaux, 1980: 139, fig. 42; Philippines: Trono, 1986: 236, fig. 37; Maldives: Wynne, 1993: 23, fig. 12; Indian Ocean: Silva *et al.*, 1996: 872; Rotuma: N'Yeurt, 1996: 390, figs 72, 74, 86; Fiji: South, 1992: 10, figs 32-33; Littler & Littler, 2003: 252. **(Figs 104-105)**
Material examined: Tiahura, Moorea, Aug. 1978, *leg. A. Meinesz*, UPF 2855; Maeva, Tahiti, Apr. 1982, *leg. C. E. Payri*, UPF 2856; Makatea, Apr. 1982, *leg. C. E. Payri*, UPF 2806, 2807; Kauehi, 22 Sep. 1995, *leg. J. Orempuller*, UPF 108; îlot aux Oiseaux, Tikehau, 6 Nov. 1995, *leg. A. D. R. N'Yeurt*, UPF 109; Taapuna, Tahiti, 8 Nov. 1998, *leg. C. E. Payri*, UPF 2871, 2872; Tikehau, Oct. 1999, *leg. S. Golubic*, UPF 2704; Akamaru, Gambier, 17 Nov. 2000, *leg. A. D. R. N'Yeurt*, UPF 903; Motu aux récifs, Rangiroa, 20 Jul. 2002, *leg. A. D. R. N'Yeurt*, UPF 2470; Tupai, 3 Jul. 2002, *leg. C. Vermetot*, UPF 2476, 2479, 2486; Fangatau, 17 May 2003, *leg. C. E. Payri*, UPF 2706.

Thallus light green to yellowish, to 8 cm tall, with a small fibrous holdfast (Fig. 104). Branching in one plane; segments to 2 mm thick. Lower segments often fused; upper segments to 8 mm wide and 10 mm high, deltoid to reniform, becoming concave when dried. Daughter segments emerging at any point from a continuous band along distal segment edge. Peripheral utricles hexagonal in surface view, 28-32 µm in diameter, remaining attached after decalcification (Fig. 105). Secondary utricles often markedly inflated, 26-60 µm in diameter and 50-120 µm long, bearing 4-6 peripheral utricles. Nodal filaments completely fused in pairs or triplets for a distance of 40-70 µm.

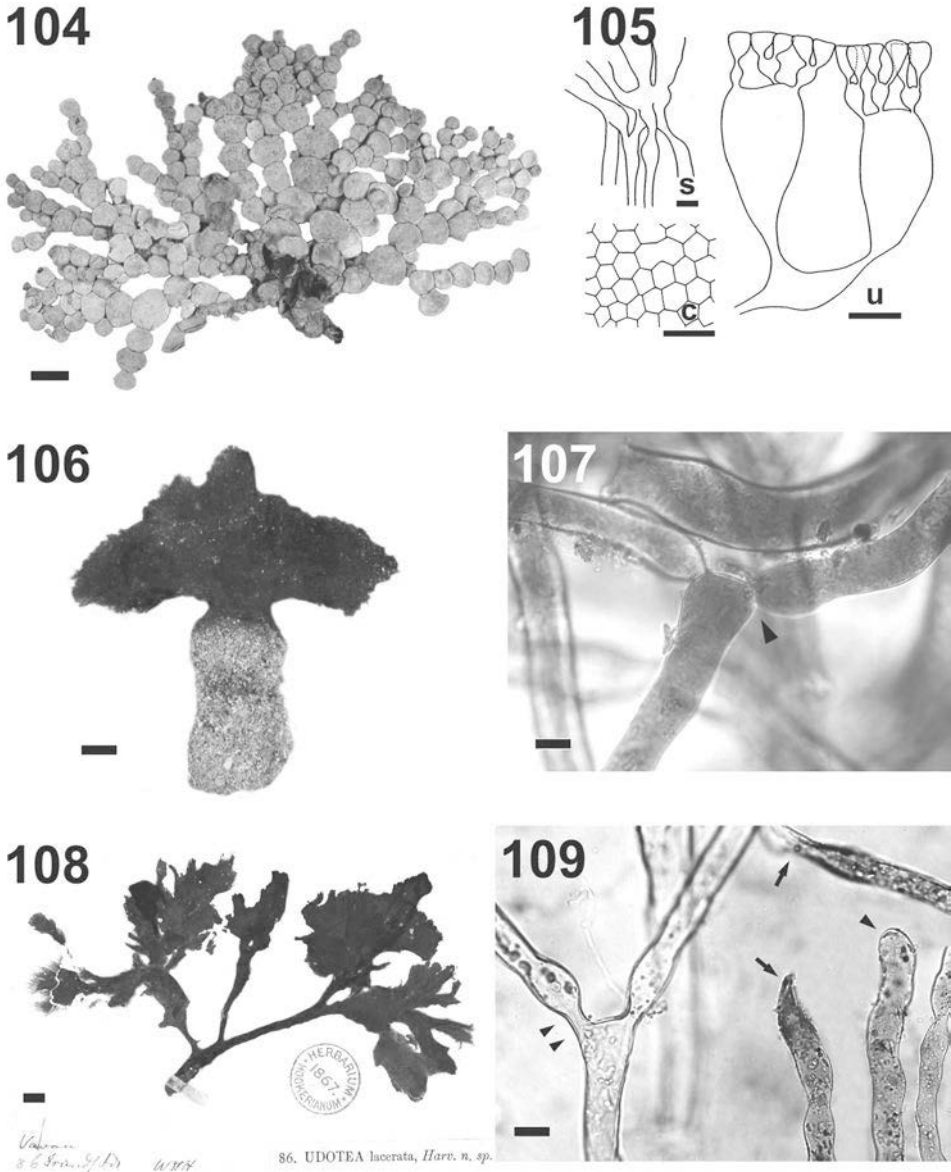
Remarks: Growing on the barrier reef, on the reef crest, in the passes and on the outer slope to a depth of 10-25 meters. The thick, basally fused and heavily calcified segments which become concave when dry, are characteristic of this species.

Family **Udoteaceae** (Endlicher) J. Agardh

Genus ***Avrainvillea*** Decaisne

Key to the French Polynesian species of *Avrainvillea*

- 1a. Stipe slender and prominent, 2-3 mm in diameter and 20-40 mm long; blades gregarious, holdfast matted 3
- 1b. Stipe stout to almost lacking, 5-6 mm in diameter and 10-20 mm long; blades solitary, holdfast bulbous 2
 - 2a. Blade woven, never tufted; siphons bright orange, 30-50 µm in diameter, apices rounded, never clavate *A. erecta*
 - 2b. Blade usually tufted; siphons yellowish green or brown, not bright orange, 66-72 µm in diameter, apices rounded or clavate . . . *A. obscura*
- 3a. Blade thin and papery, margins lacerate; siphons 13-28 µm in diameter, some siphon apices pointed or torn away, others rounded; pseudocortex absent *A. lacerata*
- 3b. Blades spongiose, margins entire; all apices rounded; pseudocortex present, stipes poorly differentiated from blades, siphons 28-38 µm in diameter *A. ridleyi*



Figs 104-109. **104.** *Halimeda taenicola* (UPF 2807). Habit, showing thick wedge-shaped segments. Scale = 10 mm. **105.** *Halimeda taenicola*. Internal anatomy. All scales = 100 μ m. **106.** *Avrainvillea erecta* (UPF 774). Habit. Scale = 5 mm. **107.** *Avrainvillea erecta* (UPF 774). Detail of siphon dichotomy, showing deeply constricted, truncated dichotomy (arrowhead). Scale = 30 μ m. **108.** *Avrainvillea lacerata* (BM 515992). Habit of isotype from Vavau, Tonga. Scale = 5 mm. **109.** *Avrainvillea lacerata* (BM 515992). Detail of blade anatomy of isotype, showing slightly constricted equal dichotomy (double arrowheads), pointed or torn-away apices (arrows) and rounded apices (arrowhead). Scale = 15 μ m.

Avrainvillea erecta (Berkeley) A. Gepp et E.S. Gepp, 1911: 29-32, pl. X fig. 89. French Polynesia: Payri *et al.*, 2000: 118; Ryukyu Islands: Yamada, 1934: 73, fig. 41; Palau: Kanda, 1944: 744, fig. 4; Viêt Nam: Dawson, 1954: 395, fig. 13a; Caroline Islands: Trono, 1968: 174, pl. 19 fig. 9; New Caledonia: Valet, 1968: 50, pl. 11(6) fig. 5; Thailand: Egerod, 1975: 60, figs 30-32; Olsen-Stojkovich, 1985: 22, fig. 11, pl. 3a; Indonesia: Coppejans & Prud'homme van Reine, 1989a: 123, pl. 2 figs 18-37; Indian Ocean: Silva *et al.*, 1996: 876; Fiji: N'Yeurt, 2001: 725, fig. 71; Solomon Islands: Littler & Littler, 2003: 238. **(Figs 106-107)**

Basionym: *Dichonema erectum* Berkeley, 1842: 157, pl. VII fig. 11 (type locality: Philippines Islands).

Material examined: Faa'a Channel, Tahiti, 18 Jan. 1926, *leg. C. Crossland* 6704, UC 667813; Botanical gardens, Papeari, Tahiti, 27 Apr. 1997, *leg. A. D. R. N'Yeurt*, UPF 7; Temae, Moorea, 12 Nov. 2000, *leg. C. E. Payri*, UPF 774.

Thallus solitary, to 60 mm high, consisting of a flabellate, relatively thick and felted reniform blade 3-4 cm wide and a stout unbranched stipe 10-20 mm long and 4-5 mm wide (Fig. 106). Rhizomatous holdfast bulbous and sand-encrusted, 10-15 mm in diameter and 40-80 mm long. Margins smooth, faintly zonate and not lacerate. Siphons bright orange to yellowish brown, 30-50 µm in diameter; cylindrical with moderately to deeply constricted, truncated equal dichotomies (Fig. 107). Siphon apices rounded.

Remarks: Growing in sandy substratum in the lagoon and outer reef (Moorea). The solitary habit, large bulbous holdfast and distinct yellow-orange siphons of this species set it apart from the other French Polynesian members of the genus. Coppejans *et al.*, (2001) group *A. erecta* with *A. obscura*, pending further studies.

Avrainvillea lacerata Harvey ex J. Agardh, 1887: 54 (type locality: Tonga). French Polynesia: Setchell, 1926: 81, Payri *et al.*, 2000: 118; Marshall Islands: Dawson, 1957: 108, fig. 11b; Caroline Islands: Trono, 1968: 175, pl. 19 fig. 8; New Caledonia: Valet, 1968: 50, pl. 10(5) fig. 6; Indonesia: Coppejans & Prudhomme van Reine, 1989a: 125, pl. 2 f igs 1-17; Bahamas: Norris & Olsen, 1991: 321, fig. 5; Indian Ocean: Silva *et al.*, 1996: 877; Papua New Guinea: Coppejans *et al.*, 2001: 419; Fiji: Littler & Littler, 2003: 238. **(Figs 108-112)**

Material examined: Vavau, Tonga, c. 1855, *leg. W. H. Harvey*, BM 515989 (co-type); Otepa, 28 Nov. 1904, *leg. L. G. Seurat*, BM 701631; Otepa, 29 Nov. 1904, *leg. L. G. Seurat*, BM 701632; Hikueru, Feb. 1905, *leg. L. G. Seurat*, BM 701633; Faarapa, Tahiti, 5 Jun. 1922, *leg. W. A. Setchell & H. E. Parks*, BM 841682; Faarapa, Tahiti, 19 Jun. 1922, *leg. W. A. Setchell & H. E. Parks*, BM 841687, 841690; Tahiti, May 1925, *leg. C. Crossland* 6663, UC 667654; Pa'ea, Tahiti, *leg. C. Crossland* 7027, 25 Sep. 1928, UC 341210; 28 Sep. 1928, *Crossland* 7066, UC 341172; Maraa, Tahiti, 28 Sep. 1928, *leg. C. Crossland*, BM 841684; Tahiti, 9 Sep. 1929, *leg. C. Crossland* 7293, UC 667852; Pa'ea, Tahiti, *leg. C. Crossland*, 7 Nov. 1929, UC 7245; Tahiti, 7 Dec. 1929, *leg. C. Crossland* 7246, UC 791864; Taapuna, Tahiti, 7 May 1997, *leg. C. E. Payri*, UPF 2, 5; Afaahiti, Tahiti, 7 Jun. 1997, *leg. A. D. R. N'Yeurt*, UPF 1; entre deux baies, Moorea, 11 Dec. 1995, *leg. A. D. R. N'Yeurt*, UPF 3, 4; Marokau, 22 Sep. 1996, *leg. J. Orepuller*, UPF 6; Aquarium, Bora Bora, 15 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2501; Mohio, Bora Bora, 21 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2599, 2600; Tiahura, Moorea, 29 Sep. 2004, *leg. A. D. R. N'Yeurt*, UPF 2965.

Thallus gregarious, 50-130 mm high, greyish-green, consisting of papery thin, tightly woven wedge-shaped blades 25-50 mm high and 22-30 mm wide, borne from irregularly branched, distinct stipes 2-3 mm in diameter and 20-40 mm long arising out of a diffuse, spongy encrusting holdfast. Blade margins are lacerate, zonation sometimes present (e.g. BM 515990, Tongan isotype, Fig. 108).

Siphons yellowish green, slightly torulose, 13-28 μm in diameter, cylindrical with slightly constricted equal dichotomies and mostly tapering, non-clavate pointed or rounded apices. Parts of the thallus with predominantly pointed or torn-away apices, but at least some siphons with rounded apices present throughout (Fig. 109).

Remarks: Growing deeply wedged in crevices of coral heads in the lagoon, and on the outer reef slope to depths of 10 metres. According to Olsen-Stojkovich (1985), the paper-thin, tightly woven lacerate blades and pointed or torn-away siphon apices of *A. lacerata* distinguish it from *A. amadelpa* (Montagne) A. et E.S. Gepp, which has more loosely woven, never zonate, felt-like spongy blades with entire margins, and rounded siphon apices. *Avrainvillea lacerata* is also reported to differ by lacking a pseudo-cortex. However, these characters were found to be very variable in the French Polynesian material, as well as in Indonesian (Coppejans & Prud'homme van Reine, 1989a: 125) and Papua New-Guinean (Coppejans *et al.*, 2001: 418), material of *A. lacerata*, since both rounded and pointed apices were found to co-exist in the same blade, which can at times be zonate. Both species form gregarious mats deeply lodged in cracks and crevices in coral. We have examined type material of *A. lacerata* from Vavau, Tonga in BM (515989), which had been cited by Olsen-Stojkovich (1985), and indeed found that both rounded and pointed apices are present (Fig. 109), prompting a re-evaluation of species concepts in Olsen's paper. The same held true for a more recent specimen from Moorea Island (UPF 2965, Fig. 110). The only reliable characters seem to be the absence of pointed apices in *A. amadelpa*, and the consistently paper-like, non-spongy lacerate nature of the blade in *A. lacerata*. A specimen from Tahiti (UC 791865, *Crossland* 7245) determined as *A. amadelpa* by W. A. Setchell and cited as such by Olsen-Stojkovich (1985), was examined by us and found to consist of papery blades with some clearly pointed siphon apices present (Figs 111, 112) and was thus placed in *A. lacerata*, together with other Tahitian collections by C. Crossland determined as *A. amadelpa*. Interestingly, Coppejans *et al.* (2001) place together *A. amadelpa* with *A. lacerata* pending further studies, and both species could be merged in future, with *A. lacerata* being the earlier name. Previously considered a shallow-water species, this alga has been found growing as deep as 73 m in the Bahamas (Norris & Olsen, 1991).

Avrainvillea obscura* (C. Agardh) J. Agardh, 1887: 53. Marshall Islands: W.R. Taylor, 1950: 67-68, pl. 34 fig. 1; Olsen-Stojkovich, 1985: 19, figs 9-10, pl. 2; Papua New Guinea: Coppejans *et al.*, 1995: 88, fig. 29; 2001: 419; Indian Ocean: Silva *et al.*, 1996: 877. **(Figs 113-114)

Basionym: *Anadyomene obscura* C. Agardh, 1823: 401 (type locality: Guam, Mariana Islands).

Synonym (according to Olsen-Stojkovich, 1985): *Avrainvillea capituliformis* Tanaka, 1967: 14, figs 2-3 (type locality: Philippines). Japan: Tanaka & Itono, 1969: 4, pl. II figs 4-5, pl. III.

Material examined: Tahiti, c. 1928, *leg. C. Crossland* 7199, UC 791872.

Thallus solitary, 30-70 mm high including stout, short stipe 3-8 mm long (Fig. 113). Rhizomatous holdfast well-developed, 20-40 mm long and 6-15 mm wide, encrusted with sand. Blade olive to dark green, capitulate, 10-20 mm wide and 12-20 mm high, composed of loose-tufted, intermittently torulose filaments. Siphons olive to light brown, loosely woven to free, 66-72 μm in diameter, with deep, acutely constricted dichotomies. Apices rounded to clavate (Fig. 114).

Remarks: The specimen label in UC lacks exact date, locality and habitat information. Initially determined by W. A. Setchell as a new species of *Chlorodesmis* (*C. taitensis?*), this specimen was later determined as a form of *Avrainvillea obscura* by J. O. Stojkovich (1979, annotation label on herbarium sheet). It represents the loose-tufted ecomorph of the species, and is distinguished from *A. erecta* by its larger diameter filaments with clavate ends, which are never yellow. It has not been recollected in Tahiti since Crossland's survey. Interestingly, Coppejans *et al.* (2001) temporarily placed *A. erecta* under *A. obscura*. The French Polynesian material agrees well with Marshall Islands material described as *A. obscura forma* by W.R. Taylor (1950: 68) and Southern Japanese material initially described as *A. capituliformis* by Tanaka & Itono (1969).

Avrainvillea ridleyi A et E.S. Gepp, 1911: 33, pl. XI figs 94-96 (type locality: Christmas Island, Indian Ocean). French Polynesia: Olsen-Stojkovich, 1985: 47, text-fig. 25, pl. 10A. Indian Ocean: Silva *et al.*, 1996: 878.

Material examined (according to Olsen-Stojkovich, 1985: 47): Tahiti, 7 Dec. 1929, *leg. C. Crossland* (7246), in UC.

Thallus gregarious from emergent rhizoidal mat, 5 to 60 mm tall including highly variable, poorly differentiated stipe to 40 mm long. Stipes branched once or twice; blades spongiose, olive-brown, elongate-cuneate or rotundate, not zonate, with entire, rounded or lobed margins. Siphons olive green or brown in colour, 28-38 µm in diameter, becoming torulose in cortex, with rounded to sub-clavate apices. Dichotomies shallowly constricted.

Remarks: This unusual species has not been recollected in French Polynesia since it was found in Tahiti by Crossland in 1929. The latter material, then in UC, was examined and confirmed as such by Olsen-Stojkovich (1985) but has unfortunately since been misplaced or lost (P. C. Silva, pers. com.) and no photographic record could be obtained either.

Genus *Chlorodesmis* Harvey *et* Bailey

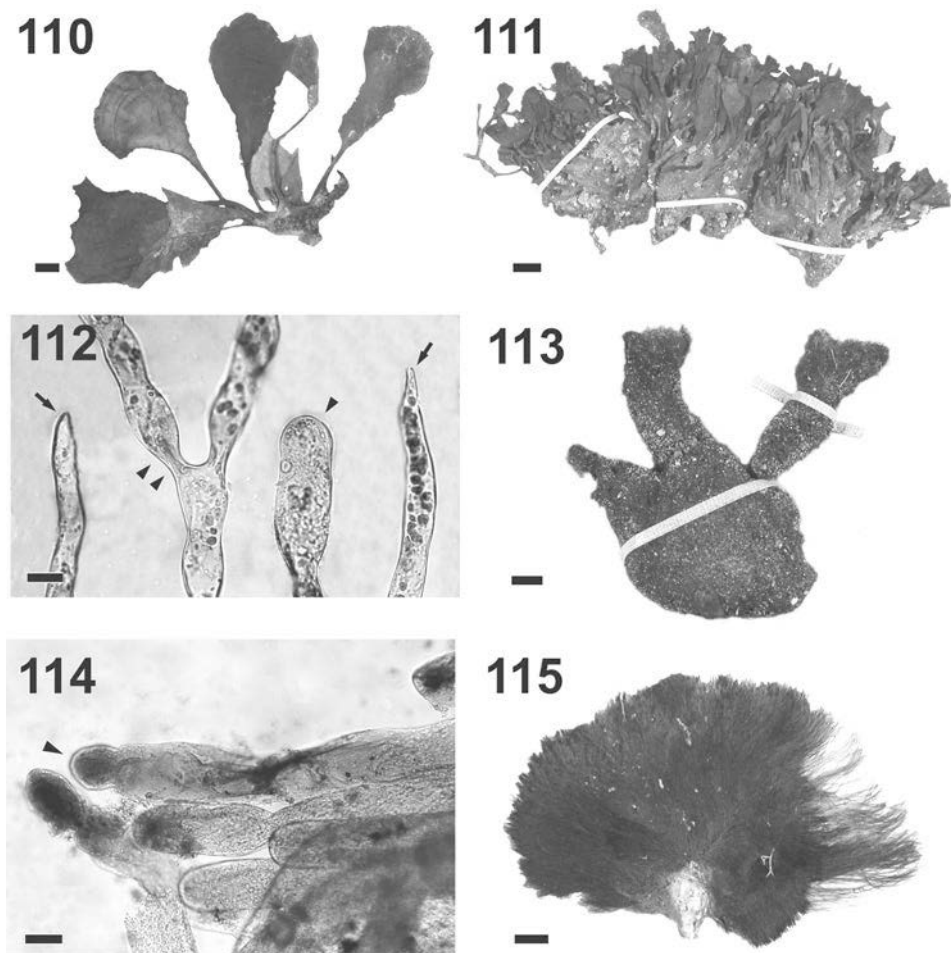
Chlorodesmis fastigiata (C. Agardh) Ducker, 1969: 17, fig. 1. French Polynesia: Payri *et al.*, 2000: 120; Indonesia: Coppejans & Prud'homme van Reine, 1989a: 127, pl. 3 figs 1-4, 12; Papua New Guinea: Coppejans *et al.*, 2001: 421, figs 22-31; Indian Ocean: Silva *et al.*, 1996: 879; Fiji: N'Yeurt, 2001: 726, fig. 73, Littler & Littler, 2003: 238; Wallis: Payri *et al.*, 2002: 44, pl. 1 fig. 8; Samoa: Skelton & South, 2002a: 165, fig. 26B. **(Figs 115)**

Basionym: *Vaucheria fastigiata* C. Agardh, 1824: 176 (type locality: Mariana Islands).

Synonymy: *Chlorodesmis comosa* Harvey *et* Bailey, 1851: 373. French Polynesia: Taylor, 1973: 38 (Bora Bora, Moorea).

Material examined: Pajara, Tahiti, 4 Aug. 1912, *leg. J. E. Tilden*, BM 701544; Tahiti, 15 Aug. 1912, *leg. J. E. Tilden*, BM 841566; Papeete, Tahiti, 26 May 1922, *leg. W. A. Setchell & H. E. Parks*, BM 841569; Arue, Tahiti, 27 Jun. 1922, *leg. W. A. Setchell & H. E. Parks*, BM 841570; Maraa, Tahiti, 28 Sep. 1928, *leg. C. Crossland*, BM 841571; Taharaa, Tahiti, 14 Apr. 1997, *leg. A. D. R. N'Yeurt*, UPF 58, 59; Matira, Bora Bora, 16 Aug. 2002, *leg. A. D. R. N'Yeurt*, UPF 2524; Tiahura, Moorea, 1 Oct. 2004, *leg. A. D. R. N'Yeurt*, UPF TH89.

Thallus up to 30 cm high, consisting of bright green tufts of free filaments, with a short basal spongy filamentous holdfast. Filaments cylindrical, 60-100 µm in diameter, distally dichotomously to trichotomously branched with unequal constrictions above dichotomies.



Figs 110-115. **110.** *Avrainvillea lacerata* (UPF 2965). Habit of dried plant from Moorea, showing thin, papery blades. Scale = 5 mm. **111.** *Avrainvillea lacerata* (UC 791865). Habit of large plant from Tahiti, showing gregarious disposition of blades. Scale = 10 mm. **112.** *Avrainvillea lacerata* (UC 791865). Detail of blade anatomy of specimen from Tahiti once placed in *A. amadelpa* (Olsen-Stojkovich 1985: 64, pl. 7A), showing slightly constricted equal dichotomy (double arrowheads), pointed apices (arrows) and rounded apex (arrowhead). Compare with Fig. 96. Scale = 15 μ m. **113.** *Avrainvillea obscura* (UC 791872). Habit of Tahitian loose-tufted ecomorph. Scale = 5 mm. **114.** *Avrainvillea obscura* (UC 791872). Detail of blade anatomy, showing clavate apex (arrowhead). Scale = 70 μ m. **115.** *Chlorodesmis fastigiata* (UPF 59). Habit. Scale = 5 mm.

Remarks: Growing in small crevices and tide pools, essentially on the exposed fore-reef flat and on the reef crest. In French Polynesia, this species was never found to reach more than 30 mm in height, although it is reported to attain sizes of up to 80 mm in other South Pacific localities (e.g. Fiji, Littler & Littler, 2003). This apparent form of dwarfism could be explained by the fact that in southeastern Polynesia (including the Cook Islands, N'Yeurt & Payri, in prep.) this species has never been found other than in wave-washed, exposed habitats on the fore-reef and reef crest.

Genus *Rhipidosiphon* Montagne

Rhipidosiphon javensis Montagne, 1842: 14-15 (type locality: Leiden Island (Nyamuk-besar), near Jakarta, Java, Indonesia). French Polynesia: Payri *et al.*, 2000: 120; Caribbean: Littler & Littler, 1990: 35; Maldives: Wynne, 1993: 23, fig. 14; Indian Ocean: Silva *et al.*, 1996: 882; Rotuma: N'Yeurt, 1996: 394, fig. 61; Papua New Guinea: Coppejans *et al.*, 2001: 422, figs 32-34; Fiji: N'Yeurt, 2001: 726, fig. 33, Littler & Littler, 2003: 254; Hawaiian Islands: Abbott & Huisman, 2004: 140, fig. 52C-D. **(Figs 116-117)**

Homotypic synonym: *Udotea javensis* (Montagne) A. *et* E.S. Gepp, 1904: 363. Hawaiian Islands: Egerod, 1952: 379, fig. 10; Viêt Nam: Dawson, 1954: 395, fig. 13b-c; Thailand: Egerod, 1975: 58, figs 28-29; Meinesz, 1980: 82, figs 1-2; Indonesia: Coppejans & Prud'homme van Reine, 1989a: 139, pl. 10 figs 3-9.

Material examined: Tikehau, 7 Nov. 1995, *leg. A. D. R. N'Yeurt*, UPF 482L; Hikueru, 29 Sep. 1996, *leg. J. Orempuller*, UPF 131; Taaone, Tahiti, 7 May 1997, *leg. C. E. Payri*, UPF 130.

Thallus yellow-green, up to 7 mm high and 5 mm broad, consisting of a calcified, fan-shaped blade with rounded outer margins and wedge-shaped base (Fig. 116); structure consisting of a single layer of parallel filaments 35-40 µm broad (outer margins) to 80-105 µm broad (base of thallus) with unequal constrictions above each dichotomy (Fig. 117). Stipe up to 200 µm in diameter, filamentous and uncorticated, mostly uncalcified and monosiphonous, anchored by fine, translucent rhizoids with clavate ends.

Remarks: Growing on coral debris in the lagoon, at depths of 1-10 meters. The monostromatic blade with unequal siphon dichotomies is characteristic of the species.

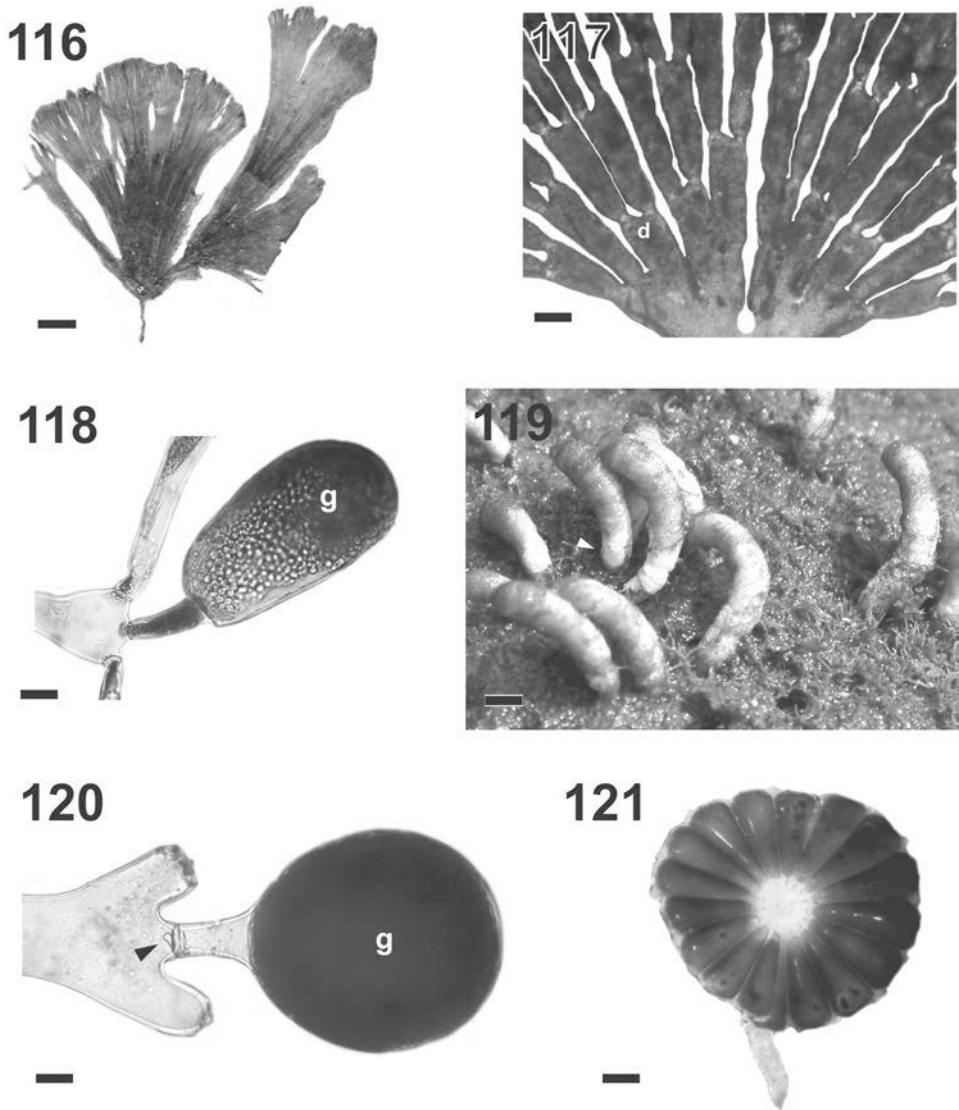
Order **Dasycladales** PascherFamily **Dasycladaceae** KützingGenus ***Neomeris*** J.V. Lamouroux**Key to the French Polynesian species of *Neomeris***

- 1a. Gametangia oblong, radially cohering in annular calcified rows. . . *N. annulata*
 1b. Gametangia spherical, individually calcified in discrete beads. . . *N. van-bosseae*

****Neomeris annulata*** Dickie, 1874: 198 (type locality: Mauritius). Sri Lanka: Svedelius, 1923: 452, figs 1-8; Ryukyu Islands: Yamada, 1934: 51, figs 16-17; Philippines: Gilbert, 1943: 19; Viêt Nam: Dawson, 1954: 396, fig. 13e; New Caledonia: Valet, 1969: 593, pl. 15 fig. 5, pl. 34 fig. 5, Indonesia: Coppejans & Prud'homme van Reine, 1989b: 127, figs 44-48; Indian Ocean: Silva *et al.*, 1996: 889; Belize: Littler & Littler, 1997: 121, fig. 179; South Africa: Leliaert *et al.*, 2001: 457, fig. 22; Samoa: Skelton & South, 2002: 166, fig. 26C; Fiji: Littler & Littler, 2003: 262; Hawaiian Islands: Abbott & Huisman, 2004: 144, fig. 55A-B. **(Fig. 118)**

Material examined: Rarapai Islet, Rapa, 12 Nov. 2002, *leg. J. L. Menou*, UPF 2157.

Thallus light-green, erect and cylindrical, 10-15 mm high and 3-5 mm in diameter, with discontinuous transverse basal rows of calcification, formed of rings of laterally-cohering gametangia. Individual gametangia elongate-ovoid, 100-180 µm long and 40-80 µm in diameter, pedicellate on a stalk cell with paired diamond-shaped assimilatory cells. Basal plug of stalk cell cap-like, without tit-like projection.



Figs 116-121. **116.** *Rhipidosiphon javensis* (UPF 130). Habit. Scale = 1 mm. **117.** *Rhipidosiphon javensis* (UPF 482L). Detail of basal portion of plant from Tikehau, showing unequally constricted dichotomies (d). Scale = 50 μ m. **118.** *Neomeris annulata* (UPF 2157). Detail of elongate gametangia (g) atop stalk cell. Scale = 25 μ m. **119.** *Neomeris vanbosseae* (UPF 2722). Habit *in situ*, showing basal calcification around each individual gametangium (arrowhead). Scale = 4 mm. **120.** *Neomeris vanbosseae* (UPF 2722). Detail of spherical gametangia (g) atop stalk cell, and plug with tit-like projection (arrowhead) into supporting cell. Scale = 25 μ m. **121.** *Parvocaulis parvula* (UPF RPS 55). Habit, showing loosely joined clavate segments and corona superior. Scale = 500 μ m.

Remarks: Growing at 12 m depth, on coralline substratum. This species is characterised by the annular rows of calcified gametangia, and the elongate shape of the gametangial cysts. So far in French Polynesia, it only occurs in the southern Australs, in Rapa.

Neomeris van-bosseae M.A. Howe, 1909: 80, pl. 1 figs 4, 7; pl. 5 figs 17-19 (“*van bosseae*”) (type locality: Sikka, Flores, Indonesia). French Polynesia: Setchell, 1926: 80; Philippines: Gilbert, 1943: 17; Valet, 1969: 596, pl. 153 figs 4-7; Indonesia: Coppejans & Prud’homme van Reine, 1989b: 127, figs 63-71; Payri *et al.*, 2000: 122; Hawaiian Islands: Egerod, 1952: 405, pl. 41, fig. 22b, Abbott & Huisman, 2004: 144, fig. 55C; New Caledonia: Valet, 1968: 52; Papua New Guinea: Coppejans *et al.*, 1995: 100, fig. 41; Indian Ocean: Silva *et al.*, 1996: 890; Rotuma: N’Yeurt, 1996: 396, figs 58, 90; Fiji: N’Yeurt, 2001: 731, Littler & Littler, 2003: 264; South Africa: De Clerck *et al.*, 2005: 92, fig. 68. **(Figs 119-120)**

Material examined: Hiti, 11 Nov. 1996, *leg. J. Orempuller*, UPF 125; Tekokota, 26 Sep. 1996, *leg. J. Orempuller*, UPF 126; Taharaa, Tahiti, 14 Apr. 1997, *leg. A. D. R. N’Yeurt & C. E. Payri*, UPF 124; Rurutu, 18 Aug. 2000, *leg. C. E. Payri*, UPF 728; Matira, Bora Bora, 16 Aug. 2002, *leg. A. D. R. N’Yeurt*, UPF 2523; Tiahura, Moorea, 1 Oct. 2004, *leg. A. D. R. N’Yeurt*, UPF 2728; Trou du Souffleur, Papenoo, Tahiti, 3 Mar. 2005, *leg. A. D. R. N’Yeurt & A. Pham*, UPF 2722.

Thallus dark-green, erect and cylindrical, up to 20 mm tall and 4 mm in diameter, in a broad, 120-130° curve (Fig. 119). Basal portion whitish and moderately calcified around each gametangium giving a beady appearance, upper portion light to dark green with hair-like whorls of radial branchlets at the tip. Surface cells not organized in any distinct ring pattern. Gametangia spherical, 75-100 µm in diameter (Fig. 120), pedicellate on a stalk cell between paired diamond-shaped assimilatory cells. Plug at base of gametangial stalk cell discoid, usually with a tit-like projection into the supporting cell.

Remarks: Growing at the side of tide pools and on coral debris in shallow water, on the reef flat and on the outer reef slope to a depth of 10 metres, in the Society and Tuamotu archipelagos. The individually-calcified, spherical cysts with plugs showing a basal projection are characteristic of this species.

Family **Polyphysaceae** Kützing

Genus ***Parvocaulis*** S. Berger, U. Fettweiss, S. Gleissberg, L.B. Liddle, U. Richter, H. Sawitsky *et* G.C. Zuccarello

****Parvocaulis parvula*** (Solms-Laubach) S. Berger, U. Fettweiss, S. Gleissberg, L.B. Liddle, U. Richter, H. Sawitsky *et* G.C. Zuccarello, 2003: 559. **(Fig. 121)**

Basionym: *Acetabularia parvula* Solms-Laubach, 1895: 29, pl. 2 figs 3, 5 (syntype localities: “Tropical India”; Celebes, Indonesia). New Caledonia: Valet, 1969: 621, pl. 11 figs 1-7; pl. 12 fig. 7; pl. 19 figs 2-4; pl. 20 figs 5-8; pl. 22 figs 1, 4, 7; pl. 29; pl. 38 figs 1, 4-5; pl. 45 figs 5-7; Indian Ocean: Silva *et al.*, 1996: 893; Samoa: Skelton & South, 2002: 167, figs 26D-E, 27A-C; Hawaiian Islands: Abbott & Huisman, 2004: 147, fig. 56C.

Homotypic synonym (given by Berger *et al.*, 2003): *Polyphysa parvula* (Solms-Laubach) Schnetter *et* Bula-Meyer, 1982: 42, pl. 7 figs c-f (type locality: Celebes, Indonesia). French Polynesia: Payri *et al.*, 2000: 122; Rotuma: N’Yeurt, 1996: 396, fig. 89; Fiji: N’Yeurt, 2001: 733; Berger *et al.*, 2003: 533, figs 11a-h, 25.

Material examined: Moruroa, Jun. 1995, *leg. V. Stiger*, UPF 497; Iri Bay, Rapa Island, 16 Nov. 2002, *leg. J. L. Menou*, UPF 3221 RPS 25.

Thallus up to 6 mm high, light green, with a monoplanar reproductive disc 2.5-3 mm in diameter, borne atop a slender stalk. Disc composed of 14 cylindrically clavate segments with rounded apices, the segments loosely joined together by light calcification. Corona superior present, corona inferior lacking.

Remarks: Growing on coral debris in the lagoon. The complicated taxonomy of this species is discussed in Womersley (1984: 295), Silva *et al.*, (1996: 893-894) and Berger *et al.* (2003). The genus *Parvocaulis* was created to accommodate remaining members of the section *Polyphysa* of the Polyphysaceae, after transfer of the type species from *Polyphysa* to *Acetabularia* based on new molecular and morphological information.

DISCUSSION

This study has brought the total number of Chlorophyceae known from French Polynesia to 81 taxa. Of these, 23 (or about 29 %) represent new records, one (*Halimeda heteromorpha*) is a new species, and two (*Microdictyon* sp. and *Struveopsis* sp.) need more detailed studies to describe as new taxa. Most of the species belong to the Indo-Pacific biogeographic province (Veron, 1995).

The species distribution within the French Polynesian islands is very similar to what has been documented for the brown algal flora (N'Yeurt & Payri, 2006). The Society, Tuamotu and Austral groups display the richest floristic diversity (74, 50 and 48 % of the total flora, respectively). For the latter archipelago, Rapa and Marotiri islands (27° S), close to temperate waters, appear unique with 8 species (or 10 % of the total Chlorophyta flora) only recorded in French Polynesia from these islands (Tab. 1), including a number of species such as *Cladophora aokii*, *C. feredayoides* and *C. ohkuboana* known from the northern hemisphere in the western Pacific, and the temperate island of Lord Howe. Other species such as *Neomeris annulata*, *Codium mamillosum*, and *Siphonocladus tropicus* are widely distributed and present in the Hawaiian Islands and other tropical areas. The flora from the Marquesas and Gambiers (15 and 30 % of the total flora, respectively) are less rich due in part to a limited sampling effort, in addition to the lack of typical reef habitats in the Marquesas which could explain the low recorded number of *Halimeda* and *Caulerpa* species.

Most of the taxa (77, or 96 %) recorded in French Polynesian are species with wide distribution in the tropical Pacific, mostly shared with the Central Pacific islands of Fiji and Micronesia (69 and 64 % respectively), while 60 (or 75%) of species are shared with the Indian Ocean in general. Slightly less than half (45%) of the species are shared with the Hawaiian Islands (Tab. 2). While it is difficult to discuss about endemism in highly dispersive organisms like marine algae, 3 (or about 4 %) of the species seem restricted to French Polynesia. On the other hand, the similarity between the flora calculated using Sørensen's index ($SI = 2x / (2x + y + z)$ where x is the number of shared species, y the number of the total species of the first island and z is the total species of the second island or group), shows the greatest affinities with the nearest archipelago of the Cook Islands. Similar species richness and biogeographical affinities had previously been discussed with the Phaeophyta (N'Yeurt & Payri, 2006), and reveal the same trends of relatively high diversity compared to other tropical Pacific areas. This may simply reflect a better sampling effort, but it also highlights the high diversity

Table 1. Distribution of taxa within the different island groups.

	Australis	Gambier	Marquesas	Society	Tuamotu
<i>Avrainvillea erecta</i>				1	
<i>Avrainvillea lacerata</i>				1	1
<i>Avrainvillea obscura</i> §				1	
<i>Avrainvillea ridleyi</i>				1	
<i>Boodlea composita</i>	1	1		1	1
<i>Bryopsis pennata</i> var. <i>secunda</i>				1	1
<i>Bryopsis plumosa</i>	1			1	
<i>Caulerpa bikinensis</i>		1			1
<i>Caulerpa cupressoides</i>	1	1		1	1
<i>Caulerpa cupressoides</i> var. <i>lycopodium</i>	1	1		1	
<i>Caulerpa cupressoides</i> var. <i>mamillosa</i>		1			1
<i>Caulerpa nummularia</i> §	1	1		1	
<i>Caulerpa pickeringii</i>				1	1
<i>Caulerpa racemosa</i> var. <i>racemosa</i>	1	1	1	1	1
<i>Caulerpa racemosa</i> var. <i>peltata</i> §	1	1	1	1	
<i>Caulerpa racemosa</i> var. <i>turbinata</i>	1		1		1
<i>Caulerpa racemosa</i> var. <i>uvifera</i> §				1	
<i>Caulerpa serrulata</i>	1	1		1	1
<i>Caulerpa sertularioides</i>	1			1	
<i>Caulerpa seuratii</i>					1
<i>Caulerpa taxifolia</i>	1	1		1	
<i>Caulerpa taxifolia</i> ecad. <i>tristichophylla</i> §	1	1			
<i>Caulerpa urvilleana</i>		1		1	1
<i>Caulerpa verticillata</i>				1	
<i>Caulerpa webbiana</i>	1			1	
<i>Chaetomorpha antennina</i>	1			1	
<i>Chaetomorpha basiretrorsa</i>				1	
<i>Chaetomorpha fibrosa</i>				1	
<i>Chaetomorpha linum</i> §				1	
<i>Chlorodesmis fastigiata</i>	1		1	1	1
<i>Cladophora aokii</i> * §	1				
<i>Cladophora catenata</i> §			1		1
<i>Cladophora feredayoides</i> * §	1				
<i>Cladophora herpestica</i> §	1			1	
<i>Cladophora ohkuboana</i> * §	1				
<i>Cladophora patentiramea</i>	1			1	
<i>Cladophora sericea</i>				1	
<i>Cladophora socialis</i>				1	1
<i>Cladophoropsis sundanensis</i>	1	1			1
<i>Codium arabicum</i>	1	1	1	1	1
<i>Codium geppiorum</i>	1	1		1	1
<i>Codium mamillosum</i> * §	1				
<i>Derbesia marina</i>				1	1
<i>Dictyosphaeria cavernosa</i>	1			1	1
<i>Dictyosphaeria versluisii</i>		1		1	
<i>Halimeda borneensis</i> §				1	1
<i>Halimeda discoidea</i>	1	1		1	1
<i>Halimeda distorta</i> f. <i>distorta</i>		1		1	1
<i>Halimeda distorta</i> f. <i>hederacea</i>			1	1	
<i>Halimeda gracilis</i>					1
<i>Halimeda heteromorpha</i> §			1	1	1
<i>Halimeda lacunalis</i> f. <i>lata</i>					1
<i>Halimeda macroloba</i>				1	
<i>Halimeda melanesica</i> §			1	1	

Table 1. Distribution of taxa within the different island groups.

<i>Halimeda micronesica</i>				1	1
<i>Halimeda minima</i>		1		1	1
<i>Halimeda opuntia</i>	1	1		1	1
<i>Halimeda taenicola</i>				1	1
<i>Microdictyon</i> sp.* §	1				
<i>Microdictyon okamurae</i>					1
<i>Microdictyon umbilicatum</i>	1	1		1	1
<i>Neomeris annulata</i> * §	1				
<i>Neomeris van-bosseae</i>	1			1	1
<i>Parvocaulis parvula</i> §	1			1	1
<i>Phyllocladon anastomosans</i>				1	
<i>Rhipidosiphon javensis</i>				1	1
<i>Rhizoclonium africanum</i>		1		1	1
<i>Rhizoclonium riparium</i> §			1		
<i>Siphonocladus tropicus</i> * §	1				
<i>Struveopsis</i> sp.* §	1				
<i>Ulva clathrata</i> §	1			1	1
<i>Ulva compressa</i>				1	
<i>Ulva flexuosa</i>			1	1	
<i>Ulva lactuca</i>	1	1	1	1	
<i>Ulva rigida</i>	1				1
<i>Valonia aegagropila</i>		1		1	
<i>Valonia fastigiata</i>	1			1	
<i>Valonia macrophysa</i>				1	
<i>Valoniopsis pachynema</i>				1	
<i>Ventricaria ventricosa</i>				1	1
<i>Verdigellas peltata</i> §					1
Total of 81 taxa	38	24	12	60	40

* taxa present only in Rapa and Marotiri islands in Australs (8 taxa)

§ new records for French Polynesia (23 taxa)

Table 2. Number and percentages of French Polynesian Chlorophyta species in common with selected tropical localities.

Tropical locality	Nr of species shared with FP	%	Sørensen Index	Sources
Fiji & Rotuma	55	69	0.34	N'Yeurt <i>et al.</i> , 1996; N'Yeurt 2001; Littler & Littler, 2003; South & Skelton, 2003b
Guam, Pohnpei, Ant atoll & Micronesia	51	64	0.42	Lobban & Tsuda, 2003; Hodgson & McDermid, 2000
Hawaiian Islands	45	56	0.33	Abbott & Huisman, 2004
Solomon Islands	39	49	0.27	Womersley & Bailey, 1970; Littler & Littler, 2003
Cook Islands	35	44	0.43	Chapman 1977; N'Yeurt & Payri, in prep.
Samoa	31	39	0.31	Skelton & South, 1999, 2002; Littler & Littler, 2003
Lord Howe Island	27	34	0.26	Millar & Kraft, 1994; Kraft, 2000
Norfolk Island	19	24	0.24	Millar, 1999
Kermadec	13	16	0.20	Nelson & Adams, 1984
Indian Ocean	60	75	0.15	Silva <i>et al.</i> , 1996

of available habitats, ranging from high volcanic islands to coral atolls, and the wide latitudinal distribution of the islands which encompass tropical waters in the Marquesas to temperate-cold waters in the southern part of the Australs.

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