Provisional keys to the genera of seaweeds of Micronesia, with new records for Guam and Yap

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Abstract—Artificial keys to the genera of blue-green, red, brown, and green marine benthic algae of Micronesia are given, including virtually all the genera reported from Palau, Guam, Commonwealth of the Northern Marianas, Federated States of Micronesia and the Marshall Islands. Twenty-two new species or genera are reported here for Guam and 7 for Yap; 11 of these are also new for Micronesia. Note is made of several recent published records for Guam and 2 species recently raised from varietal status. Finally, a list is given of nomenclatural changes that affect the 2003 revised checklist (Micronesica 35-36: 54–99). An interactive version of the keys is included in the algal biodiversity website at www.uog.edu/classes/botany/474.

Introduction
The seaweeds of Micronesia have been studied for over a century but no one has yet written a comprehensive manual for identifying them, nor does it seem likely that this will happen in the foreseeable future. In contrast, floras have recently been published for Hawai‘i (Abbott 1999, Abbott & Huisman 2004) and the South Pacific (Payri et al. 2000, Littler & Littler 2003). A few extensive or intensive works on Micronesia (e.g., Taylor 1950, Trono 1969a, b, Tsuda 1972) gave descriptions of the species in the style of a flora for particular island groups. Ideally keys would be part of a floristic work in which all records are checked and evaluated, but in the meantime regional keys to the genera would be an aid to identifying seaweeds in Micronesia. Only Dawson’s (1956, 1957) studies of the Marshall Islands included master keys to genera. Excellent keys to the genera and species in Hawai‘i and the South Pacific are included in the studies cited above. However, artificial keys are intended only to separate the taxa known to be present in a specified region and are not intended to work elsewhere. As shown by phytogeographic analysis of various recent checklists (Vroom et al. 2006), the seaweed flora of Micronesia is different from that of Hawai‘i, Fiji or Tahiti, thus a separate set of keys is required. Lobban & Tsuda (2003) recently
updated the checklist for Micronesia, based on Tsuda & Wray (1977), and Tsuda (1981), and the purpose of the present work was to develop artificial keys to the genera in that list, including additions and changes that are documented here or have been published by others.

The keys are loosely based on keys from nearby areas, especially Dawson’s keys for the Marshall Islands and Viêt Nam (Dawson 1954, 1956, 1957)—the closest, but the oldest; the books of Abbott (1999) and Abbott & Huisman (2004) on seaweeds of the Hawaiian Islands; Littler & Littler (2003) diver’s guide to South Pacific seaweeds; Payri et al. (2000) on French Polynesian algae; and Littler & Littler (2000) on Caribbean algae. The keys to Cyanophyta were extracted from the revised generic characters described by Anagnostidis & Komárek (1988, 1990) and Komárek & Anagnostidis (1986, 1989), with reference also to keys in Desikachary (1959) and Littler & Littler (2000). Additional keys used as models included those in Gordon et al. (1976), Wynne (1996), and some in Taylor (1960). We have included a few genera from records not identified to species, mostly from Tsuda’s regional checklists (Tsuda 2002a-c, 2003); these were omitted from the published checklists, and we have omitted or combined a few genera for various reasons. The keys can also be accessed on Lobban’s algal biodiversity site (www.uog.edu/classes/botany/474), where they are linked to photographs of all the genera that he has encountered (primarily on Guam).

Several important caveats attend these keys. First, the keys are intended as a convenience and are not an authoritative guide to identifications, even within the region they are intended to serve. Users of this key should consult, at a minimum, Abbott’s authoritative flora of Hawai‘i (Abbott 1999, Abbott & Huisman 2004), Payri et al. (2000) and Littler & Littler (2003) for descriptions of many of the genera and species, and for glossaries of technical terms. Second, the keys are for the genera in the checklist (Lobban & Tsuda 2003) or claimed here as new; to the extent that these records are in error, the key may be misleading. Third, several groups of algae—notably the filamentous, non-heterocyst bearing cyanophytes (see Abed et al. 2003), the coccoid and colonial cyanophytes, and the crustose corallines—are in taxonomic flux or are difficult to separate even on technical details. We have ventured to include these genera but the user must recognize that the keys at these points are no better than a first approximation. Given the state of knowledge of the Cyanophyta, especially the coccoid and colonial genera, the most accessible and useful keys are those of Komárek (2003) and Komárek et al. (2003) even though they are for freshwater genera. Komárek (2003: 68) warns, however, that “cyanobacterial genera are characterized mainly by molecular sequencing and cell ultrastructure in modern taxonomy.” Finally, we do not have personal experience with all the genera listed and, in these cases, as with the difficult groups, have relied on the literature from other regions. The keys presented here will be updated periodically on the web site as new records are made, and further records and name changes will be posted there. A list of such updates since 2003 is included here, following the keys.
Cyanophyta (Cyanobacteria)

1. Unicellular symbionts inside tunicates; chlorophylls a+b, no water-soluble pigments ................................................................. Prochloron

2. Unicellular or forming non-linear clusters (colonies), cells separated by sheath .................................................................................. 3

3. Colonies spherical, square, or irregularly shaped ................................. 4

4. Cells elongate, isopolar (oval) or heteropolar ........................................... 5

5. Cells isopolar, irregularly arranged in colony ....................................... Aphanothece

6. Daughter cells within concentric layers of mucilage ................................ 7

7. Multiple fission giving isolated packets of cells within layered sheath ................................................................. Chroococcus

8. Cells irregularly arranged in mucilaginous colonies ......................... Microcystis

9. Cells in adjacent serial rows ................................................................. Entophysalis

10. Prostrate colonies forming short ± branched chains, reproduction by nanocytes (endospores) .................................................... Pleurocapsa

11. Heterocytes [heterocysts], akinetes and true branching all absent ......................................................................................... 12 (Oscillatoriales)

11. Heterocytes, akinetes, or true branching present .................................. 26
Without heterocysts

12. Trichomes spirally twisted, lacking a sheath, often motile .................. 13
12. Trichomes straight, with or without sheath, motile or nonmotile ............ 14

13. Trichomes with visible cross walls ................................................. Arthrospira
13. Trichomes with invisible cross walls, appearing to be
    single long, spiral cells ................................................................  Spirulina

14. Cells distinctly wider than long; fragmentation via necridia
    [dead cells]; motile or not; [cells beginning new division
    before reaching size of parent (appears as multiple ingrowths
    of cross wall in growing regions near apex)]; ............................... 15
14. Cells approx. isodiametric (nearly square in profile) or longer
    than wide; trichomes motile; with or without necridia;
    [divided cells grow to size of parent before dividing again] ............. 19

  cells wider than long

15. Filaments made of multiple trichomes in common, often thick
    sheath that is conically closed at the apex; growth diffuse;
    trichomes nonmotile ................................................................. Schizothrix
15. Single trichome in sheath, or if several then apex of sheath
    open; growth in meristematic zones (usually near apex);
    trichomes often motile ......................................................... 16 (Oscillatoriaeae)

16. Sheath absent ........................................................................ 17
16. Sheath present ........................................................................ 18

17. Free-living trichomes, often exhibiting movement ....................... Oscillatoria
17. Short, non-motile trichomes, symbiont in sponges ....................... Hormoscilla

18. One trichome per sheath .............................................................. Lyngbya
18. Several trichomes per sheath, sheath is open at the end .............. Blennothrix

  cells longer than wide

19. Without sheaths, or with a fine, thin sheath; trichomes
    breaking into fragments without necridia; .................. 20 (Pseudanabaenaceae)
19. Firm sheaths usually present [Microcoleus sheath fine and
    diffluent; Phormidium can lack sheath]; trichomes
    breaking into fragments via necridia; ................................. 21 (Phormidiaceae)

20. Filaments epiphytic, attached to the substratum along their
    length, but having both ends free .......................................... Leibleinia
20. Very narrow trichomes (0.5–3 µm wide), sometimes with
    fine but distinct sheath ..................................................... Leptolyngbya

21. Sheath (if present) containing only one trichome ..................... 22
21. Sheath present with more than one trichome ......................... 24
22. Sheath lamellated, often colored ............................................ *Porphyrosiphon*
22. Sheath not lamellated ..............................................................23

23. Thallus organized as erect bundles of trichomes .................. *Symploca*
23. Trichomes separate (not bundled); facultative sheaths .......... *Phormidium*

24. Sheath lamellated ................................................................. *Hydrocoleum*
24. Sheath not lamellated ..............................................................25

25. Sheath fine and diffuent (with an indistinct margin) .......... *Microcoleus*
25. Sheath firm and limited ......................................................... *Sirocoleum*

**With heterocyes**

26. Trichomes unbranched, heterocysts intercalary .......... *Hormothamnium*
26. Trichomes with true or false branching; or if apparently unbranched, the heterocyes basal ...........................................27

27. Trichomes with false branches, or appearing unbranched.................................................28 (Nostocales)
27. Trichomes with true branching ........................................33 (Stigonematales)

28. False branching arising from a heterocyte (thus always a heterocyte at the base of a branch) .........................................................29
28. False branching arising from necridic cell, usually a pair of branches, without a heterocyte at the junction; trichomes often also forming loops .................................32 (Scytonemataceae)

29. Branching common, intercalary heterocyes also common, filaments isopolar .................................................................*Tolypothrix*
29. Branching uncommon or not apparent; filaments heteropolar, the base with a heterocyte, the apex tapering to a long hyaline hair .........................................................30 (Rivulariaceae)

30. Solitary trichomes or groups, one trichome in a sheath .......... *Calothrix*
30. Filaments organized into colonies .............................................31

31. Branches within same sheath; colonies hemispherical, a common mucilage surrounding the sheathed trichomes .......... *Rivularia*
31. Branches in separate sheath; colonies fasciculate (branches not in a common mucilage) .........................................................*Dichothrix*

32. Filaments endolithic ................................................................*Kyrtuthrix*
32. Filaments free ................................................................. *Scytonema*

33. Heterocyes terminal or lateral, thallus boring into rock and shells .............................................................................. *Mastigocoleus*
33. Heterocyes intercalary, thallus free .............................................34

34. Main axes, often multiseriate, distinct from branches; branches arising at right angles to main axes (“T” branching) .......... *Fischerella*
34. Main axes indistinguishable from branches, all uniseriate; “Y” branching................................. Brachytrichia

Rhodophyta

1. Thallus soft or slippery, even if calcified ................................................................. 2
1. Thallus stony or stiff from heavy calcification ......................................................... 3

2. Thallus with some internal calcification, but slippery or soft
   (test for calcium with HCl), often pink or whitish ............................................. 28
2. Thallus uncalcified ......................................................................................... 32

Calcified

Stony or stiff

3. Parasitic (minute endophytic filaments)................................................... Choreonema
3. Free living, not parasitic................................................................................... 4

4. Thallus crustose or forming flat plates or massive lumpy thalli .............. 5
4. Thallus not crustose: branches erect or creeping but attached only
   at base ....................................................................................................... 16

5. Tetrasporangia borne in nemathecial sori ..................................................... 6
5. Tetrasporangia borne in enclosed conceptacles
   [crustose corallines] .................................................................................. 7

6. Thallus made up of anastomosing fan-shaped sections ................... Cruoriella
6. Thallus lobes not divided into sections .......... Peyssonnelia (in part)

7. Sporangium borne in an individual conceptacle, conceptacles
   in rows in the perithallium ................................................................. Sporolithon
7. Many sporangia in each conceptacle, conceptacles scattered
   throughout the perithallium ............................................................ 8

8. Thin adherent crusts or thin, fragile plates ....................................................... 9
8. Massive crusts, plates or knobs .................................................................. 10

9. Adherent crusts, often epiphytic on green algae (esp. Venticaria,
   Caulerpa) (chalky surface, to 3 mm thick – contrast
   Titanoderma [< 0.5 mm, smooth slick surface, not yet reported from Micronesia]) .................................. Hydrolithon (in part)
9. Thin, fragile plates on Dasysphila .................................................. Lithoporella

10. Sporangial conceptacles with many pores .................................. Mesophyllum
10. Sporangial conceptacles with single pore ................................................. 11

11. Secondary pits present between perithallium cells (One species
    forming massive heads on intertidal algal ridges)........... Lithophyllum
11. Secondary pits absent, cell fusions present between perithallium cells .................................................. 12
12. Trichocytes [large, thick-walled cells] single, scattered .................. 13
12. Trichocytes grouped .......................................................................................................................... 15
13. Hypothallium one cell layer thick .............................. Hydrolithon (in part)
13. Hypothallium more than one cell layer thick, coaxial or parallel ............ 14
14. Hypothallium coaxial .............................................................. Neogoniolithon
14. Hypothallium parallel ................................................................ [Spongites]
15. Trichocytes loosely grouped, hypothallium is coaxial ............................................................... Paragoniolithon
15. Trichocytes tightly grouped, hypothallium parallel ............... Porolithon
16. Reproductive cells in conceptacles .................................................................................................. 17
16. Reproductive cells not in conceptacles ......................................................................................... 22
17. Thalli composed of calcified segments separated by non-calcified joints [articulated corallines] ....................................................... 18
17. Thalli straplike, generally flexible, not segmented .......................................................... 21
18. Conceptacles scattered over the surface of the segments .......... Amphiroa
18. Conceptacles marginal or terminal ................................................................................................. 19
19. Conceptacles formed at the extended upper angles, or along the upper margins of flat segments .......... Cheilosporum/ Serraticardia
19. Conceptacles central in the tips of the terminal segments at the time of formation, though later often passed by the growth of lateral branches ................................................................. 20
20. Branching dichotomous, segments cylindrical .............................................................. Jania
20. Branching lateral and at every segment, segments flat ............... Corallina
21. Thallus flexible, several cells thick .......................................................... Mastophora
21. Thallus rigid, one cell thick; thin and brittle ........................................ Metamastophora
22. Thalli flat or rolled ............................................................................................... 23
22. Thalli more or less terete .................................................................................. 24
23. Thalli, small (~ 4 cm tall), matted intertidal plants, brownish-cream; cortical cells distinctly inflated or club-shaped; carpogonial branch straight, 3-celled, calcification annulate .............................................................. Yamadaella
23 Thalli taller, broader axes with rolled margin, subtidal, rose-pink .................................................. Dichotomaria (in part)
24. Thalli thin (0.5 mm), smooth (resembling a bald Actinotrichia) ........................................................................ 25
24. Thalli thicker, with or without hairs .................................................................................. 25
25. Thallus with whorls of filaments extending from the cortex .......................................................... *Actinotrichia*

25. Thallus without hairs, or hairs not in distinct whorls ........................................26

26. Cortical filaments separating when decalcified thallus is squashed; cystocarp with sterile pericarp .................................. *Tricleocarpa*

26. Cortical filaments adherent when squashed; cystocarp without pericarp ..........................................................27

27. Tetrasporangia borne laterally or terminally on relatively long cortical filaments .............................................. *Galaxaura*

27. Tetrasporangia borne on much reduced epidermal cells .......................................................... *Dichotomaria* (in part)

**Calcified, soft**

28. Thallus flabellate [fan-shaped] or irregular blades, often calcified throughout .................................................. *Titanophora*

28. Thallus cylindrical to ligulate [strap- or ribbon-shaped] ..............................................29

29. Thallus calcified very lightly only at the base .................................. *Dermonema*

29. Thallus lightly to heavily calcified throughout except at young tips .......................................................... 30

30. Carpogonial branches borne on specialized (initially short) cortical filaments, surface seems mealy/powdery [farinose] .......................................................... *Ganonema*

30. Carpogonial branches borne on regular cortical filaments ..........................31

31. Sterile (or involucral) filaments intermingling with gonimoblast filaments; lacking a stalk cell (large, elongate fusion cell subtending the gonimoblast) ...................................................... *Liagora*

31. Sterile (or involucral) filaments subtending gonimoblast, forming a separate cluster; stalk cell present ................................................. *Izziella*

**Not calcified**

32. Thallus crustose [forming more or less adherent crusts or plates] ..........33

32. Thallus not crustose: erect and/or creeping ......................................................34

33. Tetrasporangia in sunken conceptacles ..................................... *Hildenbrandia*

33. Tetrasporangia in nemathecial sori ..................................... *Peyssonnelia* (in part)

(P. is calcified in the hypobasal region, but this may not be apparent in an adherent specimen.)

34. Thallus with axes consisting of more than a single row of cells: corticated, polysiphonous or fleshy ......................................................35

34. Thallus with axes consisting of a single row of cells ± branches ..........36
35. Thalli filamentous in overall appearance, but consisting of more than a single row of cells; axes corticated &/or polysiphonous ........................................................................................................60
35. Thalli more massively corticated, fleshy, or otherwise ........................................83

**Filamentous: monosiphonous axes, little/no cortication**

36. Filaments unbranched .......................................................... *Erythrotrichia* (Fig. 1h)
36. Filaments branched .....................................................................................37

37. Minute epiphytes; pseudofilamentous, the cells separated from one another within a gelatinous matrix .................................................. 38
37. Micro- or macroscopic true filaments, cells joined by common wall .................................................................39

38. Plastids blue-green, prominent central pyrenoid; cells isodiametric or longer than broad ...................... *Chroodactylon* (Fig. 1e)
38. Plastids red, stellate; cells shorter than broad ............................................. *Stylonema*

39. Cells of subultimate segments less than 100 µm in diameter ......................40
39. Very large cells: cells of subultimate segments over 160 µm in diameter ........................................................................................................42

40. Microscopic epiphytes with very narrow axes: cells of main axes less than 20 µm in diameter ........................................................................41
40. Cells of main axes 50–100 µm in diameter ..................................................44

41. Chromatophores stellate ........................................................................ *Kylinia*
41. Chromatophores parietal ........................................................................... *Acrochaetium*

42. Fourth-fifth cells behind apical cell < 300 µm in diameter ......................43
42. Fourth-fifth cells behind apical cell > 350 µm in diameter ..........44

43. Tetrasporangia borne singly on pedicel .................................................. *Anotrichum*
43. Tetrasporangia borne 2–4 on a pedicel ................................................... *Ossiella*

44. Mat-like plants with fused laterals forming spongy network ................................................................. *Haloplegma*
44. Plants with branches free, not forming a mat .............................................45

45. Gland cells (small clear cells) present .............................................................46
45. Gland cells absent .................................................................47

46. Gland cells spherical, often containing crystals, and on axis against the abaxial (proximal) side of branches; loose cortication of cells of the prostrate axes ........................................ *Balliella*
46. Gland cells hemispherical and on the adaxial (distal) side of branches or subspherical and at the tips of lateral axes .................................47
47. Gland cells subspherical and at the tips of lateral axes ....... *Acrothamnion*
47. Gland cells hemispherical and on the adaxial (distal) side of branches ................................................................. 48

48. Gland cells covering or in contact with only one vegetative cell .................................................................................. *Antithamnionella*
48. Gland cells bridging 2 vegetative cells .................................. *Antithamnion*

49. Main axes with whorled branchlets ............................................. 50
49. Main axes filamentous, alternate or irregularly branched .......... 51

50. Gelatinous thallus, branches embedded in mucilage; branches arise near middle of cells .................................. *Acrosymphyton*
50. Thallus small, not gelatinous; branches arise at apex of cells ........................................................................... *Crouania* (Fig. 2f, g)

51. Plants producing large, asexual multinucleate propagules .................................................................................. *Monosporus*
51. Asexual propagules absent ................................................................. 52

52. Carposporophyte single, unilateral .................................................. 53
52. Carposporophytes ‘twinned’, bilateral on main axis ....................... 57

53. Carposporophyte lacking inner involucral filaments .................... 54
53. Carposporophyte with erect inner involucral filaments forming a pericarp ........................................................................................................ 56

54. Carposporophyte with 2-4 free outer involucral filaments .............. 55
54. Carposporophyte lacking outer involucral filaments .................... 58

55. Cystocarps on morphologically differentiated fertile axes .......................... *Pleosporium*
55. Cystocarps on non-differentiated fertile axes ................................. 59

56. Erect axes mostly unbranched, 18-26 µm in diameter .................. *Lejolisea*
56. Erect axes distichously branched, 45-75 µm in diameter ....... *Diplothamnion*

57. Cells uninucleate, gonimoblast angular or lobed ................. *Aglaothamnion*
57. Cells multinucleate, gonimoblast spherical .......................... *Callithamnion*

58. Carposporophyte developed from 2 auxiliary cells per procarp; T-shaped fusion cell prominent .................................. *Tiffaniella*
58. Carposporophyte from single auxiliary cell; fusion cell absent ................................................................. *Gymnothamnion*

59. Carposporophyte developed from a single auxiliary cell; hypogenous cell twice to four times as long as subapical cell, fusion cell slight to absent .................................................. *Ptilothamnion*
59. Carposporophyte developed from two auxiliary cells; hypogenous cell once to twice as long as subapical cell, fusion cell prominent ........................................... *Spermothamnion*
Filamentous: corticated/polysiphonous axes:

60. Main axes monosiphonous with cortication ........................................61
60. Main axes polysiphonous (having an axial cell surrounded by
    pericentral cells) ± corticated .............................................................67
61. Cortication continuous in main axes, discontinuous in lateral
    branchlets..........................................................................................62
       Spyridia
61. Cortication essentially the same in branches of different orders........62
62. Cortication only at nodes (at least in younger parts)..........................63
62. Cortication continuous when present in younger parts .....................64
63. Cortication in bands of cells closely surrounding the nodes ............Ceramium
63. Cortication arising as loose filaments that grow down from
    nodes .......................................................................................................65
       Wrangelia (in part; Fig. 2c)
64. All orders of branching similar, all corticated ..................................65
64. Higher order branches smaller, uncorticated ....................................66
65. Tetrasporangia projecting around distal nodes .................................Centroceras
65. Tetrasporangia embedded in cortication ...........................................Corallophila
66. Spherical gland cells present at many nodes, only the prostrate
    axes loosely corticated by filaments arising from the
    nodes .....................................................................................................67
       Balliella
66. Gland cells absent ..............................................................................68
67. Pericentral cells three; containing golden gland cells
    (gametophyte heavily corticated, fleshy; sporophyte
    filamentous) ......................................................................................69
       Asparagopsis
67. Pericentral cells 4 or more ....................................................................68
68. Main axes polysiphonous with monosiphonous laterals
    (not counting trichoblasts—colorless, often deciduous hairs) ............70
68. All branches polysiphonous (± trichoblasts) .......................................71
69. Monosiphonous filaments arising endogenously
    [from axial cells] ................................................................................72
       Cottoniella
69. Monosiphonous filaments arising exogenously [appearing
    outside the pericentral cells] ...............................................................73
70. Laterals consistently monosiphonous throughout ...............................74
70. Some laterals monosiphonous at least at the tip, others
    polysiphonous; strongly dorso-ventrally flattened plants of
    caves and mangroves ........................................................................74
       Bostrychia
71. Branchlets on every segment, ± radially arranged .............................75
71. Branchlets on every other segment ....................................................74
72. Stalks of tetrasporangial stichidia polysiphonous at base; uncorticated, tetrasporangial stichidia with 4 sporangia per segment.................................................. *Murrayella*

72. Stalks of tetrasporangial stichidia monosiphonous ...........................................73

73. Axes heavily corticated except at apices; branching strongly radial; tetrasporangial stichidia with 4 sporangia per segment.................................................. *Dasya* (Fig. 2a)

73. Older axes (if any) corticated; tetrasporangia in spiral stichidia........................................... *Lophocladia*

74. Branchlets fusing to form distinctive 4-sided network .............. *Dictyurus*

74. Branchlets not fusing to form a network .................................................75

75. Branchlets spirally arranged; tetrasporangia spirally arranged .................................................. *Endosiphonia*

75. Branchlets free bilaterally arranged (distichous); tetrasporangia in straight rows, not spirally arranged................. *Heterosiphonia*

76. Pericentral cells unequal: lateral two larger than ad/abaxial two; tetrasporangia in flattened stichidia........................ *Malaconema*

76. Pericentral cells equal, 4 or more .................................................................77

77. Polysiphonous branches arising endogenously .................. *Dawsoniella*

77. Polysiphonous branches arising exogenously ...........................................78

78. Branchlets complanate (flat), with midrib .................................................79

78. All branchlets terete.....................................................................................81

79. Dorsiventral; second-order branches flattened as wings, resembling a leafy liverwort.................................................. *Leveillea*

79. Prostrate and erect axes, erect axes narrowly complanate..................80

80. Mature erect branches ending in 2-3 hairs........................... *Taenioma*

80. Mature erect branches ending in complex trichoblast.............. *Abbottella*

81. Plants with short, spinose laterals.................................................. *Tolypiocladia*

81. Plants with all branches similar (may have prostrate and erect branches)..................................................................................82

82. Axes with extensive prostrate axes .................................................. *Herposiphonia*

82. Axes primarily erect .................. *Polysiphonia/Neosiphonia/Lophosiphonia* [see Kim & Lee (1999) for separation of *Neosiphonia* from *Polysiphonia*.]

**Fleshy or blade-like thalli**

83. Thallus complanate [flat] and membranous [one or a few cells thick], at least in part, often with midrib or forming network ..........84
83. Thallus fleshy, gelatinous, or wiry, many cells thick, cylindrical, compressed or flattened but not membranous .................................................95

**membranous**

84. Thallus consisting of a cylindrical axis bearing membranous blades ........................................................................................................85
84. Thallus flat/membranous throughout .................................................... 86
85. Prostrate axes bearing leaflike wings, resembling leafy liverwort ........................................................................................Leveillea
85. Prostrate axes bearing narrow, complanate erect axes ...................................Abbottella/Taenioma (see 80)
86. Thallus prostrate, blades with distichous veins ..............................Symphyocladia
86. Thallus erect .................................................................................................87
87. Straplike blades, often in rosettes, with inrolled apices ..............Amansia
87. Blades otherwise ..........................................................................................88
88. Distinct apical cell present ..........................................................................89
88. No distinct apical cell: growth via marginal meristem .....................93
89. Fronds a coarse network throughout ........................................................90
89. Fronds not net-like – blades without perforations ...............................91
90. Branches only from ventral (adaxial) surface, small sori ..............Vanvoorstia
90. Branches only from dorsal (abaxial) surface, extensive sori ..........Claudea
91. Branching subdichotomous ...........................................................Caloglossa
91. Branches arising from the midrib .............................................................92
92. Small, largely prostrate plants, blades not fusing ............................Hypoglossum
92. Robust erect plants, branches often fusing with adaxial surface of adjacent lower-order branch ......................................................Zellera
93. Thallus forming a latticework at margin, sometimes converting much of the blade ..........................................................Martensia
93. Thallus membranous, without lattice or network .................................94
94. Blade with macroscopic veins; cells to 30 µm long, with 1-2 ribbonlike plastids.........................................................Schizoseris (Fig. 1a, b)
94. Blade without veins; cells to 80 µm long, containing numerous discoid plastids ................................Nitophyllum (Fig. 1c, d)

**gelatinous/goey**

95. Thick gelatinous/goey thalli constructed of very loose uncorticated branches (see also soft calcified thalli, 28) ..............................96
95. Thalli otherwise ..........................................................................................100
96. Thalli much larger than 10 cm high, multiaxial, resembling very gooey Halymenia durvillei ....................................................... Schmitzia
96. Thalli less than 10 cm high .................................................................. 97

97. Thallus highly branched, uniaxial, a single central filament with whorls of branches arising from near the center of axial cells ........................................................................................................... Acrosymphyton
97. Thallus lobed, multiaxial, medulla filamentous or pseudoparenchymatous, giving rise to cortex of loosely aggregated, dichotomously branched, small-celled filaments .......................... 98

98. Plants with perennial stipe bearing lobed or paddle-shaped clusters; cortical filaments with long branches consisting of elongate cylindrical cells; auxiliary cells terminal or intercalary in special lateral branches .................. Gibsmithia (Fig. 2e)
98. Plants lacking stipes, lobed; cortical filaments with short, candelabra-like branches consisting of short, sometimes (ob)pyriform cells .................................................................................... 99

99. Medulla pseudoparenchymatous; thallus creeping, attached by pegike haptera; branching distichous to irregularly pinnate, axes less than 20 mm long and 500 μm in diameter .......... Gloiocladia
99. Medulla filamentous; thallus erect from single basal holdfast, blade-like to broadly lobed; axes more than 40 mm long and 2 mm wide ........................................ Predaea (Fig. 2d)

100. Thallus hollow ......................................................................................... 101
100. Thallus not hollow .................................................................................... 107

fleshy, hollow

101. Thallus divided by transverse diaphragms ........................................ Champia
101. Thallus without diaphragms .............................................................. 102

102. Thallus consisting of a short, solid stipe bearing one or more hollow vesicles ................................................ Botryocladia
102. Thallus cylindrical, blade-like, or cushions ........................................... 103

103. Thallus parts long and slender compared to diameter .......................... 104
103. Thallus broad, lobed blades or cushions .............................................. 105

104. Tetrasporangia borne in swollen, terminal stichidia ........ Coelothrix
104. Tetrasporangia borne in sunken cavities in the branches ......................... Lomentaria

105. Thick, cartilaginous blades, branched but not a series of lobes ................. Chrysymenia
105. Thinner frond consisting of series of rounded lobes ............................... 106
106. Plant adhering to substratum; often fusing to adjacent blades; tetrasporangia scattered .......................................................... *Erythrocolon*

106. Blades not fusing to adjacent blades; tetrasporangia clustered in patches (nemathecia) .......................................................... *Chamaebotrys*

**fleshy, solid blades**

107. Thallus a broad or narrowly flat blade .......................................................... 108
107. Thallus ± cylindrical, terete or if flattened not blade-like .......................... 114

108. In cross section: medulla filamentous .......................................................... 109
108. Medulla full of rounded cells .............................................................. 111

109. Medullary filaments few, some anticlinal (crossing blade from cortex to cortex); cortex 2-3 cells thick .......................... *Halymenia*
109. Medullary filaments all parallel to axis of blade ........................................ 110

110. Cortex 2-3 cells thick .......................................................... *Cryptonemia*
110. Cortex 8-9 cells thick .......................................................... *Grateloupia*

111. Blade peltate (stipe attached to the center of the blade) ....................... 112
111. Stipes attached to base of blade ......................................................... 113

112. Blades not fusing with one another; blades typically becoming star-shaped but specimens seen in Guam more or less round to funnel-shaped; tetrasporangia scattered in unmodified cortex .......................... *Asteromenia*

112. Blades foliose, fusing at margins with adjacent blades, multiple attachment to substratum; tetrasporangia clustered in nemathecia .......................................................... *Halichrysis*

113. Blades divided more or less dichotomously ........................................ *Rhodymenia*
113. Blades irregularly divided, anastomosing ........................................... *Leptofauchea*

**fleshy, solid, terete to compressed**

114. Branching in one plane, axes flattened, forming flat, highly dissected fronds, apices of branches curling toward ventral surface .......................................................... *Portieria*
114. Branching three dimensional .......................................................... 115

115. Thallus evidently uniaxial, a single apical cell distinguishable at least in young, growing parts, and visible in cross sections .............. 116
115. Thallus multiaxial or obscurely uniaxial: no central axial filament evident in cross section .......................................................... 123

116. Rhizines (thin, hyphal filaments) among medullary cells; axial cell hard to see ............................................................................. 117
116. Lacking rhizines; axial cell evident in cross sections .............................. 118
117. Attachment haptera irregularly arranged; axes not repent or secondarily attached; developing gonimoblasts with moniliform chains of nutritive filaments .................. Gelidium

117. Attachment haptera regularly arranged; axes often repent and secondarily attached; developing gonimoblasts with nutritive filaments forming a nearly solid cylinder .............. Pterocladiella

118. Soft, pale rose plants with horizontal rhizomes and erect plumose fronds; three pericentral cells evident in uncorticated branches ........................................ Asparagopsis

118. Stiff, dark red to yellowish brown plants .............................................. 119

119. Fleshy plants ............................................................................................ 120

119. Tough, wiry plants, similar to Gelidium, but lacking rhizines ............................................................ Gelidiella/Parviphycus
[see Santelices (2004) for separation of Parviphycus species from Gelidiella]

120. Axes with numerous short spines or spinose branches ...... Acanthophora

120. Ultimate branches longer if spinose, or rounded .................. 121

121. Ends of branches often hooklike or pointed; axial cell without pericentral cells .............................................................. 122

121. Ends of branches not hooklike; axial cell surrounded by 5 large pericentral cells; spermatangia in flat plates ................... Chondria

122. Axes less than 100 µm in diameter, cortical cells not uniformly aligned; 2 cortical filaments per axial cell in cross section ................................................................. Caulacanthus

122. Axes more than 200 µm in diameter, cortical cells uniformly aligned; 6-8 cortical filaments per axial cell in cross section ................................................................................ Hypnea

123. Growing with and resembling a sponge ................................. Ceratodictyon

123. Not as above .............................................................................................. 124

124. Very coarse alga with stout, warty branches ................. Kappaphycus

124. Not as above .............................................................................................. 125

125. Plants wiry, axes narrow ................................................................. 126

125. Plants fleshy ............................................................................................. 127

126. Branching subdichotomous, tetrasporangia cruciately divided ................................................................. Gelidiopsis

126. Branching irregular, tetrasporangia zonately divided .......... Wurdemannia

127. Main axes erect with short, rounded branches ................................ Laurencia/Chondrophycus
[see Nam (1999) for separation of Chondrophycus species from
Laurencia.

127. Main axes indistinct; erect and lax with long tapering branches, or massive stiff mats. ........................... Gracilaria

Chlorophyta

1. Thallus calcified, at least in parts ................................. 2
2. Thallus not calcified .................................................... 10

Calcified

2. Thallus simple [unbranched main axis], cylindrical, or with branches radially arranged .............................................. 3
3. Thallus flat; if branched, branches not radially arranged ............. 7

Calcified

3. Thallus simple, “wormlike”, white below, often green near apices where assimilatory filaments pass out through the calcification ......................................................... Neomeris
4. Simple axis with whorls of filamentous branches alternating with whorls of pod-like branches, heavily calcified .......... Halicoryne
5. Branched axes entirely surrounded by whorl branches, like a bottle brush .................................................... Tydemania (in part)
6. Heavily calcified stipe with “cotton candy” mass of uncalcified filaments arising at apex ........................ Chamaedoris
7. Thallus with an apical whorl of assimilatory filaments; distinctive “cap” at maturity ................................ Parvocaulis

Not calcified

10. Embedded within calcareous substrata ................................. 11
11. On the surface of substratum, creeping or erect ..................... 12
11. Multicellular: branched filaments of irregular cells \textit{Gomontia}  
11. Siphonous: slender siphons with irregular local swellings \textit{Ostreobium}

12. Thalli parenchymatous or filamentous/pseudoparenchymatous, multicellular or siphonous, but not vesicular \textit{Ostreobium}  
12. Thalli globular or balloon-like, single or multiple vesicles \textit{Gomontia}

13. Thalli evidently cellular (regular cross walls); uni- or multinucleate \textit{Gomontia}  
13. Thalli siphonous, without crosswalls \textit{Ostreobium}

\textbf{Vesicular/globose}

14. Thallus comprising of individual large (>5 mm diam.) vesicles or clusters of large vesicles \textit{Ventricaria}  
14. Thallus comprising small vesicles (<5mm) or surface like bubbles or pebbles (one genus with an elongate erect thallus, vesicular but not globose) \textit{Bornetella}

15. Thallus dark green, solitary, spherical or oval, often appearing silvery underwater, often partially covered by crustose corallines \textit{Bornetella}  
15. Thallus light green, elongate, clavate [club-shaped], clustered \textit{Bornetella}

16. Thallus appearing to be a branched filament, but branches arising internally as vesicles (segregative cell division) \textit{Bornetella}  
16. Thallus more or less globose \textit{Bornetella}

17. Externally dark green, spherical or oval, often appearing silvery underwater, often partially covered by crustose corallines \textit{Bornetella}  
17. Externally hemispherical cushions to irregular masses; if hollow not with a radially branched axis \textit{Bornetella}

18. Thallus a dark green mass of larger, clavate segments, easily separated; segregative cell division showing as dark “buttons” on the vesicles \textit{Bornetella}  
18. Thallus hemispherical or irregular, pale green, solid or hollow, the cells compacted together, not easily separated \textit{Dictyosphaeria}

\textbf{Cellular}

19. Cells solitary or irregularly aggregated \textit{Gloeococcus}  
19. Thallus multicellular \textit{Dictyosphaeria}
20. Thallus flat sheets, or hollow tubes .................................................................21
20. Thallus filamentous, or with filaments forming pseudo-parenchyma...............................23
21. Thallus tubular, branched or unbranched (if flattened, hollowness seen at margins) ...21
21. Thallus flat, solid sheet (not made of coalesced filaments—see 32) ....................................................22
22. Thallus monostromatic [one cell thick].................................................. Gayralia
22. Thallus distromatic .................................................................................. Ulva (in part)
23. Unbranched filaments ...............................................................................24
23. Branched filaments or pseudoparenchymatous ............................................27
24. Microscopic epiphyte ................................................................................24
24. Macroscopic: forming visible tufts or turf ................................................26
25. Plastid completely filling the cell .................................................. Uronema
25. Plastid an incomplete parietal band ..................................................... Ulothrix
26. Slender filaments with occasional short lateral rhizoids (if lacking rhizoids, filaments generally less than 100 μm diam.) .................................................. Rhizoclonium
26. More robust filaments (usually > 100 μm diam.) without lateral rhizoids .................................................. Chaetomorpha
27. Microscopic prostrate epiphytes ................................................................28
27. Filaments erect, thalli visible to the naked eye ...........................................30
28. Many cells with long colorless hairs; endophytic ........................................ Phaeophila (Fig. 2b)
28. Cells without hairs; endophytic or epiphytic .............................................29
29. Filaments irregularly branched, prostrate/endophytic ................................ Entocladia (Fig. 1f)
29. Filaments branching and coalescing to form a circular pad that can become >1 cell thick in the middle Ulvella
30. Filaments more than 1 cell broad ..............................................................31
30. Filaments monosiphonous, free or coalesced to form a pseudoparenchymatous blade ...........................................32
31. Filaments one cell thick but becoming two or more cells wide ...................................... Percursaria
31. Unbranched filaments appearing two cells wide but actually a tube of 4-6 cell rows Ulva (in part)
32. Filaments branched in one plane, spaces between main axes filled with small branches to form a flat fan-shaped blade Anadyomene
32. Filaments free, or anastomosing [fusing together] but spaces not filled in. 33

33. Filaments anastomosing by minute hapteroid cells (tenacula), or outgrowths of the cell wall (trabeculae) (or apparently just stuck together) 34

33. Filaments generally free 37

34. Spongy, three-dimensional mass, filaments joined by tenacula. *Boodlea* 35

34. Flat mesh-like blades, filaments joined by trabeculae or by invisible attachment pad 35

35. Foliose blades (often multiple) without a stipe. *Microdictyon* 36

35. Blade with a distinct stipe 36

36. Foliose blade with branches arising palmately at each node. *Rhipidiphyllon*

36. Paddle-shaped blade. *Phyllodictyon*

37. Cells very long, almost appearing siphonous, branches infrequent. *Spongocladia*

37. Cells short (length to several times width), branching frequent 38

38. Most lateral branches with crosswalls; hapteroid cells absent. *Cladophora*

38. Lateral branches never forming crosswalls, but crosswalls present in main axes, just above the lateral; often with rhizoids arising just above the crosswall; hapteroid cells often present as well. *Cladophoropsis*

**Siphonous**

39. Thalli composed of individual siphons, generally filamentous in appearance, but with very thick siphons in *Caulerpa* 40

39. Thalli composed of interwoven siphons, forming pseudo-parenchymatous blades 40

40. Thallus with horizontal rhizomes giving rise to erect branches and branched rhizoids; siphons supported by trabeculae [ingrowths of the cell wall]. *Caulerpa/Caulerpella* 46

40. Thallus without rhizomes, trabeculae absent 41

41. Siphons dichotomously branched 42

41. Siphons with pinnate or secund [featherlike] branching. 45

42. Siphons regularly constricted above the branch points. 43

42. Siphons not constricted 44
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43. Creeping matted plant of the high intertidal zone ................. *Boodleopsis*

43. Erect thalli forming silky tufts in the low intertidal /
subtidal ............................................................... *Chlorodesmis*

44. Tiny thallus, a monosiphonous stipe tightly branching into
a capitulum .............................................................. *Rhipiliopsis*

44. Larger plants, branching less frequent; sporangia globose,
lateral ........................................................................ *45*

45. Attached by calcified basal disc .................................................. *Pedobesia*

45. Attached by rhizoidal filaments ................................................ *Derbesia*

46. Plants long (to 15–20 cm) and slender, appearing after typhoons,
bases of the laterals markedly swollen .................................. *Trichosolen*

46. Plants common, bases of laterals not markedly swollen ............... *Bryopsis*

47. Flat blades ............................................................................. *48*

47. Terete, branched axes or irregular cushions ................................ *49*

48. Plants usually smaller than 5 cm high, siphons cross-
connected by short, fingerlike projections .................................. *Rhipilia*

48. Plants larger, often with multiple blades, some species
anchored in sand by bulbous masses or rhizoids; siphons
not cross connected ................................................................ *Avrainvillea*

49. Utricles generally rounded in surface view ................................. *Codium*

49. Utricles hexagonal in surface view ................................................ *Pseudocodium*

**Heterokontophyta**

1. Thallus colonial, consisting of separate individual cells in a
common matrix or tube ................................................................ *2*

1. Thallus multicellular, the cells closely adherent to one another .......... *6*

**Colonial heterokonts (Sarcinochrysidales and Bacillariophyceae)**

2. Colony filamentous ........................................................................ *3*

2. Colony globular ............................................................................. *4*

3. Filaments comprising corrugated tubes containing very long,
needle-like diatom cells .................................................................. *Nitzschia*

3. Filaments with cells packed into them, only evident when
colonies are kept at ~20°C for a day or more, when they
round up and separate .......................................................... *Chrysonephos*

4. Colonies extremely fragile, disintegrating if picked up .............. *Chrysocystis*

4. Colonies rubbery or mucilaginous but easily handled .............. *5*
5. Colonies rubbery golden, spherical cells distributed throughout matrix ................................................................. *Sarcinochrysis*

5. Colonies very mucilaginous, mostly colorless with a powdery mustard-yellow surface dust; elongate cells with distinctive apex, on long mucilaginous stalks ........................................... *Chrysophaeum*

**Multicellular (Phaeophyceae)**

6. Thallus exclusively filamentous, generally in tufts or turfs ....................... 7

6. Thallus not exclusively filamentous ................................................................. 11

**Filamentous**

7. Filaments multiseriate (more than one row of cells), parenchymatous; pyramidal, globose or Y-shaped vegetative propagules commonly present .......................................................... *Sphacelaria*

7. Filaments uniseriate (one row of cells) ................................................................ 8

8. Filaments tangled into rope-like tufts, “flowerlike” plastids, appearing to have four lobes with a central pyrenoid ............... *Asteronema*

8. Filaments not tangled and ropey, appearance fuzzy or silky ....................... 9

9. Plurilocular sporangia commonly present, thallus brown or tan ............... 10

9. Sporangia entirely absent, zoids formed by cells in tube rounding up, thallus yellow-brown ......................................................... *Chrysonephos*

10. Meristematic zone (dividing cells) distinct, generally at base of long unbranched filament; sporangia mostly stalked .................................................................................. *Feldmannia*

10. Meristematic zone diffuse, rarely at base of short lateral branch; sporangia mostly sessile (not stalked) ........................................ *Hincksia*

11. Thallus of parenchymatous plates partially adherent to substratum or erect flat, terete or globose fronds ................................................. 12

11. Thallus crustose, uncalcified, pseudoparenchyma of filaments forming basal layer and erect carpet-like layer ........................................ 13

12. Thallus flat fan-shaped to strap-like blades ...................................................... 14

12. Fronds terete (may be compressed/oval), globular or irregular ............... 20

**Crustose, uncalcified**

13. Relatively thick crust, difficult to remove, basal layer 1-2 cells, erect filaments tightly adherent ............................................................... *Ralfsia*

13. Thin crust easily removed, base 3-4 cells, erect filaments separating easily .......................................................... *Hapalospongidion*
### Flat, erect/prostrate

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<th>Description</th>
<th>Key</th>
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<tr>
<td>14</td>
<td>Thallus calcified, erect broad to elongate fans with inrolled margins</td>
<td>Padina</td>
</tr>
<tr>
<td>14</td>
<td>Thallus not calcified, margins not inrolled</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Thallus fan-shaped or tapering markedly from apex to base; apical meristem diffused along</td>
<td>Lobophora</td>
</tr>
<tr>
<td></td>
<td>the leading edge of the blade</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Thallus straplike, branches not tapering markedly; apical meristem a single cell or small</td>
<td>Stypopodium</td>
</tr>
<tr>
<td></td>
<td>cluster of cells</td>
<td></td>
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<tr>
<td>16</td>
<td>Thallus not calcified, margins not inrolled</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Medullary cells uniformly rectangular, in stacked tiers</td>
<td>Lobophora</td>
</tr>
<tr>
<td></td>
<td>Medullary cells not uniformly regular or stacked</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Cross section with a central medullary layer of cells bigger than other medullary and</td>
<td>Zonaria</td>
</tr>
<tr>
<td></td>
<td>cortical cells; thick largely creeping plant often with ventral surface well anchored to</td>
<td></td>
</tr>
<tr>
<td></td>
<td>substratum</td>
<td>Lobophora</td>
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<tr>
<td></td>
<td>[Distromium looks like Lobophora but is 2 cells thick; not yet reported]</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Blades with distinct midrib</td>
<td>Dictyopteris</td>
</tr>
<tr>
<td>18</td>
<td>Blades without distinct midrib</td>
<td></td>
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<tr>
<td>19</td>
<td>Growth from one apical cell per branch; medulla, at least near the apices, generally a</td>
<td>Dictyota</td>
</tr>
<tr>
<td></td>
<td>single layer surrounded by a single layer of markedly smaller cortical cells</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Growth from multiple apical cells per branch; blades several cells thick without marked</td>
<td>Spatoglossum</td>
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<tr>
<td></td>
<td>distinction between cortex and medulla</td>
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### Terete/globose

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<th>Step</th>
<th>Description</th>
<th>Key</th>
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<tbody>
<tr>
<td>20</td>
<td>Thallus irregularly-shaped mass without distinct axes,</td>
<td></td>
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<tr>
<td>20</td>
<td>Thallus with one or many axes, having some consistent pattern to the branches or blades</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Thallus sac-like, often lobed, hollow when mature; margins not inrolled</td>
<td>Colpomenia</td>
</tr>
<tr>
<td>21</td>
<td>Thallus initially hollow, soon becoming flattened with many holes; margins inrolled</td>
<td>Hydroclathrus</td>
</tr>
<tr>
<td>22</td>
<td>Thallus floats when detached from substratum, possessing some type of air bladder;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>reproductive organs within sunken conceptacles</td>
<td></td>
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<tr>
<td>22</td>
<td>Thallus sinks when detached from substratum, without air-bladders; reproductive organs on</td>
<td></td>
</tr>
<tr>
<td></td>
<td>surface, not sunken in conceptacles; without leaflike or pyramidal branches</td>
<td></td>
</tr>
</tbody>
</table>
23. Main axes terete, with leaf-like, terete, or pyramidal branches.............24
23. Main axes divided into leaf-like sections, each generally
with a vesicle at the center..............................................................Hormophysa
24. Blades leaf-like; air bladders bulbous and obvious .......................Sargassum
24. Blades pyramid-shaped; air-bladders sunken within
blades ...................................................................................................Turbinaria
25. Tough, erect or matted thalli..............................................................26
25. Thallus lax, irregularly branched; branches hollow,
occaisionally collapsed and somewhat flattened....................Rosenvingea
26. Erect thalli with cryptostomata .......................................................Chnoospora
26. Creeping mat of narrow terete or compressed axes,
cryptostomata absent.................................................................Padina (Vaughaniella stage)

New records and nomenclature changes

The new records are based largely on Lobban’s observations since the
revised checklist (Lobban & Tsuda 2003) was completed, together with records
found by searching AlgaeBase (Guiry et al. 2006). Also included below are
additional records from Ohba’s (1996) list for Palau that were not included in the
revised checklist. Tsuda (2004) completed a monograph on Dictyota of
Micronesia and printed a series of checklists for individual island groups within
Micronesia (Tsuda 2002a-c, 2003, 2005). Records, arranged alphabetically in
each phylum, are new for Micronesia unless Guam or Yap is specified. Some
records are illustrated in Figures 1 and 2, and additional photographs are posted
on the genus pages on the biodiversity web site, http://www.uog.edu/classes/
botany/474.

New Cyanophyta


New Rhodophyta

Champia vieillardii Kützing (new for Guam): specimens found several times in
algal mats, e.g., from Dadi Beach, 3/9/03.
Chroodactylon ornatum (C. Agardh) Basson [= Asterocystis ornata (C. Agardh)
Hamel] (new for Guam): Single individual photographed on Tolypothrix at
Orote Point reef flat, 2/19/05. (Figure 1e)
Dadi fore reef, 1/23/05, –5m; specimen deposited in GUAM-ML.
Crouania minutissima Yamada (new records for Guam, Yap) Collected on
Halodule blades, Wanyaan reef flat, Yap, 3/25/05; single specimen photographed on Guam 2/3/03. (Figure 2 f, g)
Figure 1. a, b, *Schizoseris bombayensis*, plant (veins weakly visible on left) and detail of cells; c, d, *Nitophyllum adhaerens*, plant and detail of cells; e, *Chroodactylon ornatum*, portion of a branch; f, *Entocladia viridis*, endophytic in *Lyngbya*; g, unknown green epiphyte (on *Anadyomene*); h, *Erythrotrichia carnea* cells and sporangium. Scale bars: a = 5 mm; c = 2 mm; all others = 20 µm; scales for b=d, e=h=g.
Crouania sp. cf. Abbott 1999: Collected by Lee Goldman, Jeff Mahon, very deep (~65 m) off Orote Peninsula, 7/31/03. The size of this Crouania agrees with Abbott's (1999:294-5) description of an unnamed species, which is much larger than the others in Hawaii. Specimen deposited in GUAM-ML.

Dasya cf. mollis Harvey (new for Guam): specimens collected at “Coral Gardens,” Agat Bay, 10 m, 2/16/03, appear to be Dasya rather than Heterosiphonia; no previous records of Dasya from Guam.

Dasya roslyniae Millar & Chidgey in Millar: collected at Double Reef, Guam, –5 m, 5/8/05. Dr. Alan Millar (pers. comm.) examined this material (now deposited at SYD) and concluded that it is a Dasya and probably roslyniae, although there are some differences. (Figure 2a)

Erythrotrichia carnea (Dillwyn) J. Agardh: additional collection 1/16/05 (Figure 1h) deposited in GUAM-ML replaces photo record listed in Lobban & Tsuda (2003). Filaments, together with Acrochaetium sp., forming visible fringe on Sargassum blade in drift, Ipan Talofofo, Guam.

Ganonema farinosum (new for Guam) collected Feb. 1991 identified by Dr. I.A. Abbott (pers. comm.); specimen deposited in GUAM-ML. Commonly collected along with several Liagora species.

Gibsmithia dotyi Kraft & Ricker: commonly collected at GabGab reef, Apra Harbor, Guam, e.g., 3/16/03. Identified by G. Kraft (pers. comm.) on the basis of photos. Especially significant in distinguishing this from Predaea are the terasporangia (none reported for most Predaeas, except for one report of acrochaetiod tetrasporophyte). There is a very short cartilaginous stalk (again in contrast to Predaea). The smooth surface distinguishes it from Gibsmithia hawaiiensis, which is also common in Apra Harbor. (Figure 2e)


Haloplegma duperreyi Montagne (new record for Yap Islands—previously reported from Ifaluk Atoll, Yap State). “Spanish Wall,” south tip of Yap Island, 3/23/05, ca. –20 m, at the mouth of a small cave; specimen deposited in GUAM-ML.

Nitophyllum adhaerens Wynne and Schizoseris bomayensis (Børgeesen) Womersley [=Myriogramme bombayensis Børgeesen] (both new for Guam) were found together at GabGab (Apra Harbor), ca. –5m, both in a farmer fish territory among coral (Porites rus) branches. Identified by M. Wynne (pers. comm.); specimens deposited at MICH. The cell size and plastids easily distinguish the two species (Figure 1c, d; Figure 1a, b, respectively).


Porphyridium purpureum Bory occurs as a symbiont in the miliolid foram Peneroplis pertusus. This foram species was listed by Richardson & Clayshulte (2003) for Guam as “Coscinospira cf. Pertusus.” We collected it from “Cemetery Wall”, Agat Bay, on Padina, 5/15/06.
Predaea cf. tumescens Kraft & Saunders: Collections of highly lobed gelatinous plants were identified by G. Kraft (pers. comm.) on the basis of photos as Predaea, probably P. tumescens because of the pyramidal gonimocarp and a lack of gland cells. The sterile collection “P. weldii 3/15/01” mentioned in the revised checklist was a misidentified G. dotyi; we have not seen P. weldii in Guam. (Figure 2d)

Schmitzia sp. (Calosiphoniaceae). A specimen collected by Ron Legrande at Gun Beach, Tumon Bay, February 1997, in the shallow subtidal, was recently identified by Dr. Abbott as being in this genus. The genus and the family have not been previously reported from Micronesia. Portion of specimen on paper in GUAM-ML and fragments in liquid deposited in HAWAII.

Stylonema alsidii (Zanardini) Drew (new for Guam) Several specimens found in floating green algal mat (Chaetomorpha, Boodlea, etc.) in UOG Marine Lab tank, 3/14/05.

Wrangelia anastomosans Yamada: collected at “Spanish Wall,” south tip of Yap Island, 3/23/05, ca. ~20 m, flat against substratum; specimen deposited in GUAM-ML. Cortication extended to the apex, suggesting that these specimens are W. anastomosans rather than W. penicillata (C. Agardh) C. Agardh; the latter is the species presumed to be on Guam but this should be reviewed.

Wrangelia argus (Montagne) Montagne (new for Guam and Yap): collections from Tagachang reef 3/30/05 on rock in rim pools and Dadi reef 4/24/05 (Guam) and Wanyaan reef flat 3/25/05 on Halodule blades (Yap), have loose corticating filaments and branchlet tips blunt or with single spines. (Figure 2c) Yap specimen deposited in GUAM-ML

New Heterokontophyta

Chrysocystis fragilis (new record for Yap): observed at “Spanish Wall”, 3/23/05, ca ~20m.

Chrysonephos lewisii (new record for Yap): observed on Wanyaan reef flat, 3/25/05.


Dictyota grossedentata De Clerck & Coppejans: see Tsuda (2004).

Padina cf. boergesenii Allender & Kraft: Distinguished from other species of Padina on Guam by presence of 3 cells layers. Specimens collected on intertidal reef at Inarajan, 3/21/03, identified by R. Tsuda (pers. comm.), deposited in GUAM-ML.

Sargassum oligocystum Montagne: two older records from Palau (see Tsuda 2002a).

Figure 2 (facing page): a, Dasya roslinae; b, Phaeophila; c, Wrangelia argus; d, Predaea cf. P. tumescens; e, Gibsmithia dotyi; f-g, Crouania minutissima. Scale bars: a = 1 mm; b, c, g = 100 µm; d, e = 10 mm; f ~ 1 mm.
New Chlorophyta

Caulerpa nummularia Harvey ex J. Agardh and C. macrophysa (Sonder ex Kützing) G. Murray -- elevated from varietal status (see Abbott & Huisman 2004). Since we did not list varieties, these appear as additions to the flora. C. nummularia was reported from Enewetak Atoll by Dawson (1957) (as C. racemosa var. peltata f. nummularia) and from Palau by Ohba (1996). The Caulerpa racemosa group (including lentillifera and peltata) should be reexamined in Guam on the basis of recent monographs.


Derbesia sp. confirmed for Guam on the basis of fertile specimens found in UOG Marine Laboratory tank, 10/18/04; specimen deposited in GUAM-ML.

Entocladia viridis Reinke (new for Guam): specimens photographed growing in the wall of old Lyngbya bouillonii filaments, ca. –5 m., Dadi reef, Guam, 1/23/05. (Figure 1f)


Phaeophila dendroides (P. & H. Crouan) Batters. Filaments photographed in the sheath of a bundle of Tolypothrix trichomes, reef flat, Orote Point, Guam, 2/19/05. (Figure 2b)

Pseudocodium sp.: small specimen collected by Lee Goldman, Jeff Mahon from very deep (ca –85 m) off Orote Point, Guam, 5/8/03; specimen sent to Dr. Paul Silva, Berkeley.

Ulothrix cf. flacca (new for Guam) found as epiphyte on Chaetomorpha in UOG Marine Laboratory tanks, 3/16/05.

Ulva ralfsii (Harvey) Le Jolis (new for Guam), found among Chaetomorpha filaments (which it resembles) from East of Ajayan Bay, Malesso, –35 m deep, 6/10/04; specimen deposited in GUAM-ML.

Uronema cf. marinum Womersley (new for Yap) found as epiphyte on an unidentified red alga, 3/27/05.

Another unbranched minute green filament was found on Anadyomene from Guam, but unlike Ulothrix and Uronema is gregarious. Figure 1g; specimen deposited in GUAM-ML

Nomenclature changes and corrections to the checklist

Acetabularia. All three species listed as Acetabularia were transferred to a new genus Parvocaulis (Berger et al. 2003).

Chondrophyllum cruciata (Harvey) K.W. Nam is correctly named Chondrophyccus cruciatus (Harvey) K.W. Nam. Chondrophyllum has not been recorded in Micronesia.

Dieranema rosaliae Setchell & Gardner has been virtually removed from the genus and family by Kraft (1977) and is hence not reported here.
Dictyota patens now included in D. bartayresiana (see De Clerck 2003).

Dilophus radicans Okamura from the Caroline Islands is considered a stage of Padina (Fan 1953); removed from our flora.

Enteromorpha spp. no longer considered distinct from Ulva (Hayden et al. 2003).

A list of the currently accepted names and authorities for Micronesian records is on http://www/uog/edu/classes/botany/474/chloro/ulva.html.

Galaxaura: two of our species assigned to Dichotomaria: Dichotomaria marginata (Ellis & Solander) Lamarck [=Galaxaura marginata (Ellis & Solander) Lamouroux] and Dichotomaria obtusata (Ellis & Solander) Lamarck [= G. obtusata (Ellis & Solander) Lamouroux] (see Huisman et al. 2004a, Wang et al. 2005)

Gelidiella pannosa (Feldmann) Feldmann & Hamel and G. adnata Dawson transferred to Parviphycus tenuissimus (Feldmann & Hamel) Santelices and Parviphycus adnatus (E.Y. Dawson) Santelices, respectively (Santelices 2004).

Izziella orientalis (J. Agardh) Huisman & Schils restored from Liagora orientalis (Huisman & Schils 2002).

Melanamansia glomerata (C. Agardh) R.E. Norris from Guam re-identified as Amansia rhodantha (Harvey) J. Agardh; see N’Yeurt (2002). Status of other records of Amansia / Melanamansia in Micronesia not checked, but N’Yeurt found that most specimens from the Pacific that he examined lacked pseudo-pericentral cells and were therefore Amansia, although “true” Melanamansia did exist in New Caledonia and the Hawaiian Islands.

Monosporus pedicellatus (J.E. Smith) Solier is the currently accepted synonym of Neomonospora pedicellata (Smith) Feldmann & Meslin.

Myriogramme bombayensis Børge sen changed to Schizoseris bombayensis (Børge sen) Womersley (see Womersley 2003: 112).

Pseudochlorodesmis removed from our flora. The only species reported from Micronesia, P. furcellata, is now recognized as a stage in the development of Halimeda tuna (see Abbott & Huisman 2004: 141).

Pterocladia caloglossoides changed to Pterocladiella caloglossoides (Howe) Santelices (Santelices 1998).

Specimens listed as Schizothrix mexicana Gomont are now referred to Symplaca hydroides (Harvey) Kützing. The presence in Guam of S. mexicana (as currently conceived) is now doubtful.

Stenopeltis gracilis transferred from Polyidaceae to Liagraceae (Huisman et al. 2004b).

Stichtosiphonia: Zuccarello & West (2006) argued for retaining these species in Bostrichyia until the lineages within that genus are better resolved.

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References


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