Micronesica 39(1): 73–105, 2006

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*
1. Unicellular, colonial or multicellular, free-living; chlorophyll *a* plus water-soluble phycobilins 2

2. Unicellular or forming non-linear clusters (colonies), cells separated by sheath 3
2. Cells with common crosswalls united into filaments (trichomes + sheath) 11

Unicellular and non-linear colonial genera

3. Colonies spherical, square, or irregularly shaped 4
3. Colonies with polarized growth (distinct origin or basal end versus apical end, or extending as pseudofilaments) 9

4. Cells elongate, isopolar (oval) or heteropolar 5
4. Cells spherical or hemispherical 6

5. Cells isopolar, irregularly arranged in colony ..... *Aphanothece*
5. Cells heteropolar, radially arranged in colony ..... *Gomphosphaeria*

6. Daughter cells within concentric layers of mucilage 7
6. All cells in common mucilage 8

7. Multiple fission giving isolated packets of cells within layered sheath ..... *Chroococcus*
7. Binary fission giving irregular colonies of cells surrounded by concentrically layered mucilage sheath ..... *Gloeocapsa*

8. Cells irregularly arranged in mucilaginous colonies ..... *Microcystis*
8. Cells arranged in perpendicular rows in flat ± square colonies ..... *Merismopedia*

9. Cells in adjacent serial rows ..... *Entophysalis*
9. Cells in single row (pseudofilamentous) 10

10. Prostrate colonies forming short ± branched chains, reproduction by nanocytes (endospores) ..... *Pleurocapsa*
10. Erect unbranched pseudofilaments, no nanocytes ..... *Johannesbaptistia*

Filamentous genera

11. Heterocytes [heterocysts], akinetes and true branching all absent ..... 12 (Oscillatoriales)
11. Heterocytes, akinetes, or true branching present 26

Without heterocytes

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 (Oscillatoriaceae)

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

With heterocytes

26. Trichomes unbranched, heterocysts intercalary ..... *Hormothamnium*
26. Trichomes with true or false branching; or if apparently unbranched, the heterocytes 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 heterocytes 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. Heterocytes terminal or lateral, thallus boring into rock and shells ..... *Mastigocoleus*
33. Heterocytes 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. *Ventricaria*, *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 *Dasyphila* ..... *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*) ..... *Stenopeltis*
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 ....*Griffithsia*

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 49

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 ..*Pleonosporium*
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. Carposoprophyte 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 ..... *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 ..... *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 ..... *Balliella*
66. Gland cells absent ..... *Dasyphila*

67. Pericentral cells three; containing golden gland cells (gametophyte heavily corticated, fleshy; sporophyte filamentous) ..... *Asparagopsis*
67. Pericentral cells 4 or more 68

68. Main axes polysiphonous with monosiphonous laterals (not counting trichoblasts—colorless, often deciduous hairs) 69
68. All branches polysiphonous (± trichoblasts) 76

69. Monosiphonous filaments arising endogenously [from axial cells] ..... *Cottoniella*
69. Monosiphonous filaments arising exogenously [appearing outside the pericentral cells] 70

70. Laterals consistently monosiphonous throughout 71
70. Some laterals monosiphonous at least at the tip, others polysiphonous;strongly dorso-ventrally flattened plants of caves and mangroves ..... *Bostrychia*

71. Branchlets on every segment, ± radially arranged 72
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 thoughout 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/gooey

95. Thick gelatinous/gooey 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
1. Thallus not calcified 10

Calcified

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

3. Thallus simple, "wormlike", white below, often green near apices where assimilatory filaments pass out through the calcification ..... *Neomeris*
3. Thallus otherwise..... 4

4. Simple axis with whorls of filamentous branches alternating with whorls of pod-like branches, heavily calcified ..... *Halicoryne*
4. Thallus otherwise, lightly calcified 5

5. Branched axes entirely surrounded by whorl branches, like a bottle brush ..... *Tydemania* (in part)
5. Thallus comprising unbranched stipe with apical whorl or mass of filaments..... 6

6. Heavily calcified stipe with "cotton candy" mass of uncalcified filaments arising at apex..... *Chamaedoris*
6. Thallus with an apical whorl of assimilatory filaments; distinctive "cap" at maturity ..... *Parvocaulis*

7. Thallus a flat blade, not segmented 8
7. Thallus consisting of chains of flat or cylindrical segments..... *Halimeda*

8. Blade and stipe polystromatic and often corticated..... *Udotea*
8. Blade small, delicate, monostromatic, arising from a mono-siphonous stalk 9

9. Single blade arising from undivided stalk..... *Rhipidosiphon*
9. Multiple blades arising from branched stalk..... *Tydemania* (in part)

Not calcified

10. Embedded within calcareous substrata 11
10. On the surface of substratum, creeping or erect 12

11. Multicellular: branched filaments of irregular cells ..... *Gomontia*
11. Siphonous: slender siphons with irregular local swellings .....*Ostreobium*

12. Thalli parenchymatous or filamentous/pseudoparenchymatous, multicellular or siphonous, but not vesicular 13
12. Thalli globular or balloon-like, single or multiple vesicles 14

13. Thalli evidently cellular (regular cross walls); uni- or multinucleate 19
13. Thalli siphonous, without crosswalls 39

Vesicular/globose

14. Thallus comprising of individual large (>5 mm diam.) vesicles or clusters of large vesicles 15
14. Thallus comprising small vesicles (<5mm) or surface like bubbles or pebbles (one genus with an elongate erect thallus, vesicular but not globose) 16

15. Thallus dark green, solitary, spherical or oval, often appearing silvery underwater, often partially covered by crustose corallines ..... *Ventricaria*
15. Thallus light green, elongate, clavate [club-shaped], clustered ..... *Boergesenia*

16. Thallus appearing to be a branched filament, but branches arising internally as vesicles (segregative cell division) ..... *Siphonocladus*
16. Thallus more or less globose 17

17. Externally dark green, spherical or curved club-shaped, pebbly texture; internally hollow, a single axial filament producing radiating branches with swollen tips .....*Bornetella*
17. Externally hemispherical cushions to irregular masses; if hollow not with a radially branched axis 18

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

Cellular

19. Cells solitary or irregularly aggregated .....*Gloeococcus*
19. Thallus multicellular 20

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 ..... *Ulva* (in part)
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 25
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 pseudo-parenchymatous 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*
34. Flat mesh-like blades, filaments joined by trabeculae or by invisible attachment pad 35

35. Foliose blades (often multiple) without a stipe .....*Microdictyon*
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.....46

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

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 ~20C 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

14. Thallus calcified, erect broad to elongate fans with inrolled margins ..... *Padina*
14. Thallus not calcified, margins not inrolled 15

15. Thallus fan-shaped or tapering markedly from apex to base; apical meristem diffused along the leading edge of the blade 16
15. Thallus straplike, branches not tapering markedly; apical meristem a single cell or small cluster of cells..... 18

16. Medullary cells uniformly rectangular, in stacked tiers..... 17
16. Medullary cells not uniformly regular or stacked ..... *Stypopodium*

17. Cross section with a central medullary layer of cells bigger than other medullary and cortical cells; thick largely creeping plant often with ventral surface well anchored to substratum.....*Lobophora*
[*Distromium* looks like *Lobophora* but is 2 cells thick; not yet reported]
17. Cross section showing medulla of equal layers.....*Zonaria*

18. Blades with distinct midrib ..... *Dictyopteris*
18. Blades without distinct midrib 19

19. Growth from one apical cell per branch; medulla, at least near the apices, generally a single layer surrounded by a single layer of markedly smaller cortical cells .....*Dictyota*
19. Growth from multiple apical cells per branch; blades several cells thick without marked distinction between cortex and medulla.....*Spatoglossum*

Terete/globose

20. Thallus irregularly-shaped mass without distinct axes, ... 21
20. Thallus with one or many axes, having some consistent pattern to the branches or blades 22
21. Thallus sac-like, often lobed, hollow when mature; margins not inrolled .....*Colpomenia*
21. Thallus initially hollow, soon becoming flattened with many holes; margins inrolled .....*Hydroclathrus*

22. Thallus floats when detached from substratum, possessing some type of air bladder; reproductive organs within sunken conceptacles 23
22. Thallus sinks when detached from substratum, without air-bladders; reproductive organs on surface, not sunken in conceptacles; without leaflike or pyramidal branches 25

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, occasionally 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

Kyrtuthrix maculans (Gomont) Umezaki. Palau: Ohba (1996).

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)

Chrysymenia okamurae Yamada et Segawa (cf. Abbott 1999: 230): collected at 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)

insert color plate facing p. 96

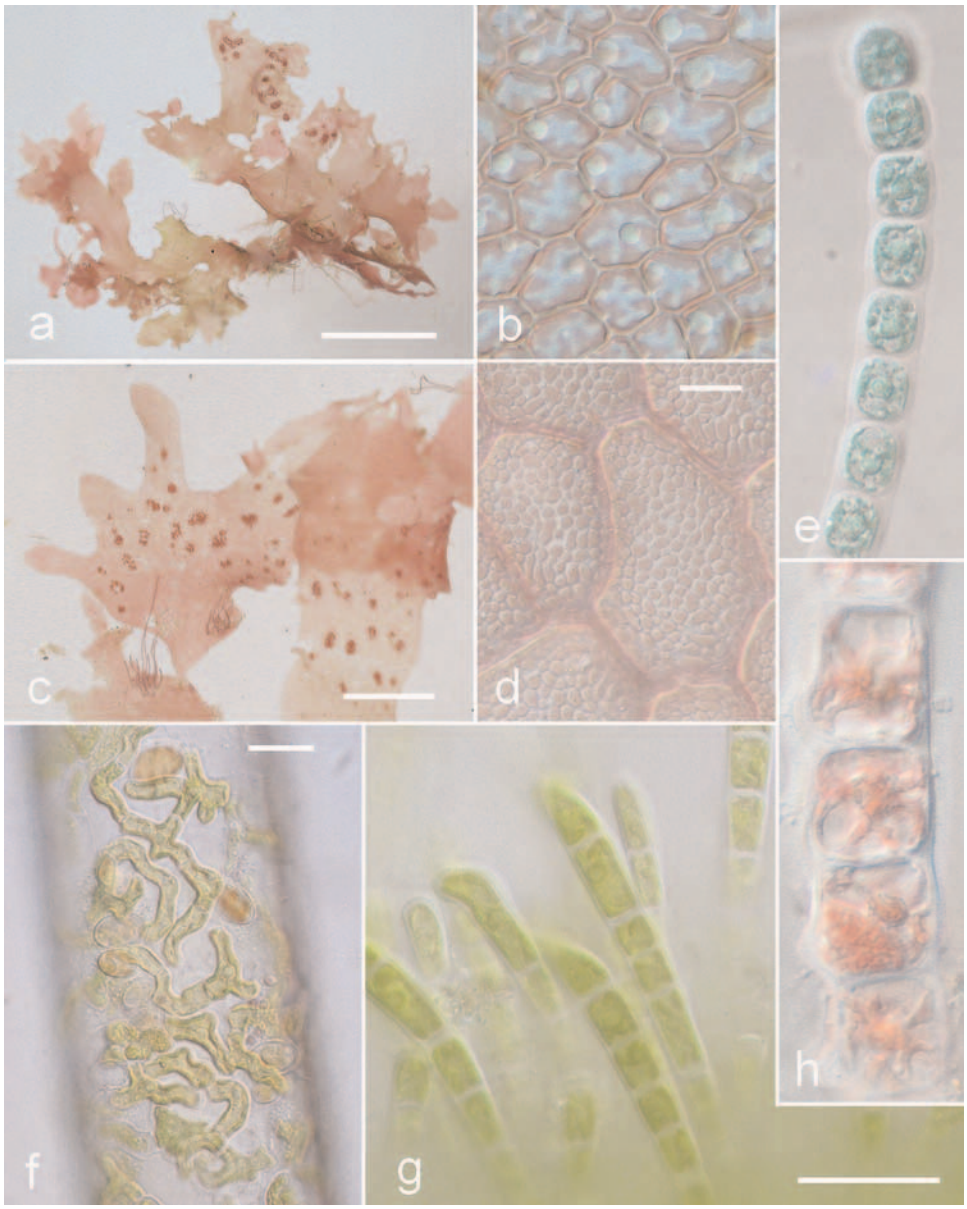


Figure 1. a, b, *Schizoseris bombayensis*, plant (veins weakly visible on left) and detail of cells; c, d, *Nitophyllum adhaerens*, plant and detail of cells; e, *Chroodactylon ornatum*, portion of a branch; f, *Entocladia viridis*, endophytic in *Lyngbya*; g, unknown green epiphyte (on *Anadyomene*); 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 a 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 *Predaea*, except for one report of acrochaetioid 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)

Gracilaria bursa-pastoris (S. Gmelin) P. Silva. Palau: Ohba (1996).

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* (Børgesen) Womersley [=*Myriogramme bombayensis* Børgesen] (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).

Peyssonnelia caulifera Okamura. Palau: Ohba (1996).

Peyssonnelia obscura Weber-van Bosse. Palau: Ohba (1996).

Peyssonnelia orientalis (Weber-van Bosse) Cormaci & Fumari. Palau: Ohba (1996).

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. *C. 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 ceylanica Kützing: see Tsuda (2004).

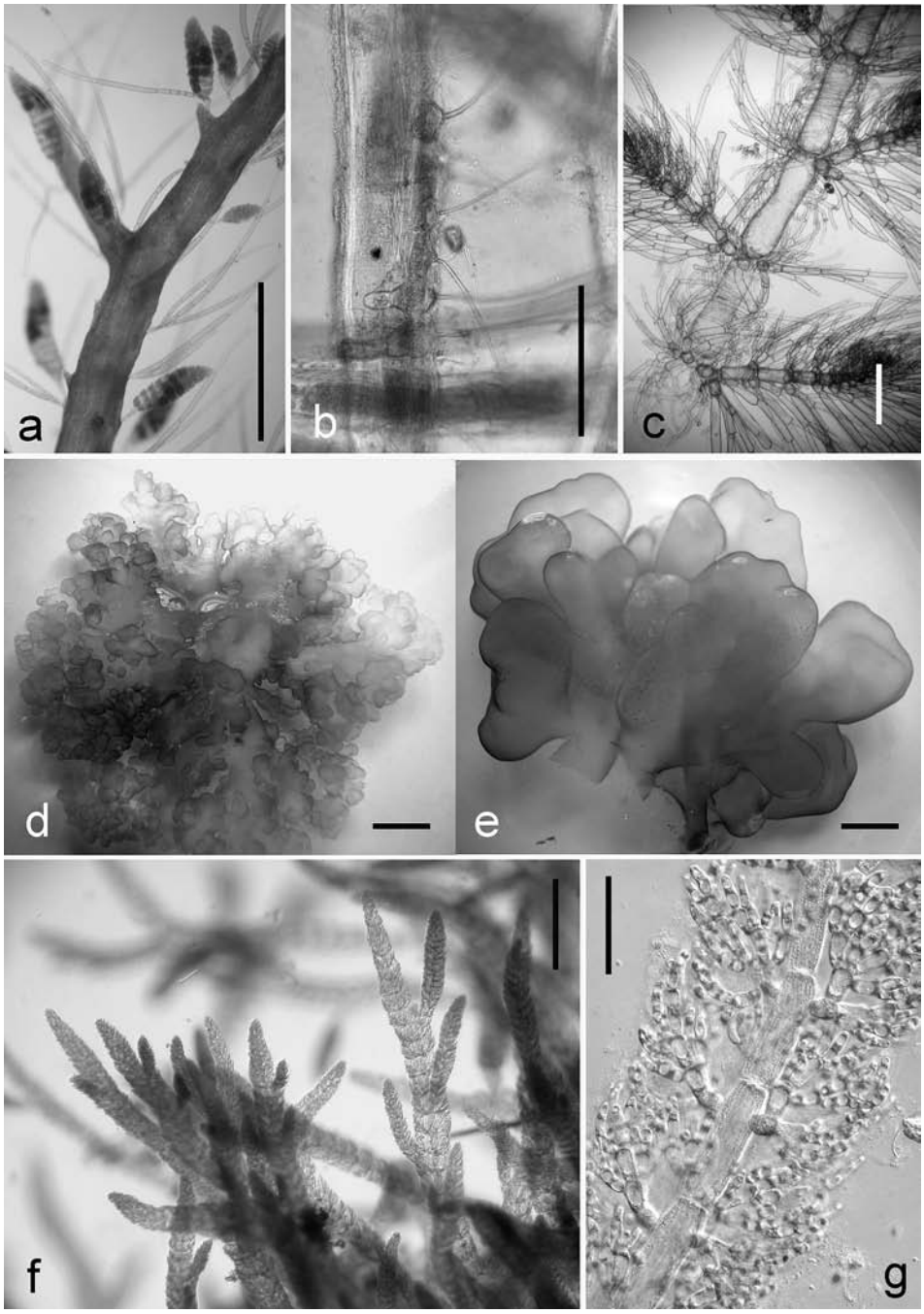
Dictyota alternifida J. Agardh. Palau: see Tsuda (2002a).

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.


a
b
c
d
e
f
g

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.

Caulerpa opposita Coppejans & Meinesz. Palau: Ohba (1996).

Caulerpa selago (Turner) C. Agardh. Palau: see Tsuda (2002a).

Caulerpa subserrata Okamura. Palau: Ohba (1996).

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)

Halimeda minima (Taylor) Colinvaux: new record for Guam (Apra Harbor) in Kooistra & Verbruggen (2005).

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 *Chondrophycus cruciatus* (Harvey) K.W. Nam. *Chondrophyllum* has not been recorded in Micronesia.

Dicranema 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 Børgesen changed to *Schizoseris bombayensis* (Børgesen) 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 *Symploca hydnoides* (Harvey) Kützing. The presence in Guam of *S. mexicana* (as currently conceived) is now doubtful.

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

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

Acknowledgments

Besides our great debt to the authors of published keys from nearby regions, the present keys have benefited from contributions and suggestions by Robert Steneck and the reviewers. CL appreciated the assistance of the U. Guam Marine

Botany classes of 2001, 2003, and 2005. These students helped with the initial attempt to develop keys and labored through draft keys at several stages: Jennifer Blum, Zerlene Cruz, Michael Lansangan, Chrisy Mafnas, Nalene Mesa, Angelo Palacios, Simeon Pinaula, Annalee Preuc, LisaMarie Quinata, Teina Rongo and Alethea Spittler (2001); Rachael Ada, Albert Borja, Eric Cruz, Vincent Duenas, Analyn Gatus, Mevany Hecita, Ian Lundgren, Ron Paulino, Jon-Robert Taitano, Randall Toal, Elaina Todd and Holly Tupper (2003); Jenny Drake, Theresa Hecita, Ann Garrido, Isumechraard Ngirairikl, Rozalyn Pama and Dohn So (2005).

Several experts have helped with identifications along the way: Isabella Abbott; John Huisman, Alan Millar and Michael Wynne. María Schefter has been CL's constant dive buddy, always ready to point out something potentially different and to share the excitement of a new discovery.

A very important asset in searching for and documenting new records, has been the Nikon Eclipse 600 photomicroscope funded by NIGMS as part of the U. Guam *RISE* program, R25 GM63682. Finally, CL thanks COMNAVMAR for access to collecting sites on US Naval Operations Guam, where several new records were found.

This paper is a contribution from the University of Guam Herbarium.

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Received 31 Jan. 2006, revised 26 March.