

MARINE ALGAE OF NORTHERN TAIWAN (RHODOPHYTA)

by

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This paper is a continuation of my study of the marine algae of Northern Taiwan and deals with the Rhodophyceae of the same area as treated in my paper last year⁽¹⁾.

I am only reporting these which I have been able to identify. A considerable number of species remain to be reported at a later date.

13 new records are reported for Northern Taiwan. There seems to be a difference between the conditions on the east and west coasts as some species which have very wide distribution have only been found on one side and not on the other.

I wish to thank Dr. Y. Yamada, of Hokkaido University and Dr. E. Yale Dawson, of Beaudette Foundation Solvang California for helping me to identify some doubtful specimens.

Key to the genera of Rhodophyta of Taiwan

- | | |
|---|---------------------|
| 1. Thallus calcified wholly or in part | 2. |
| 1. Thallus uncalcified | 6. |
| 2. Thallus crustose..... | <i>Peyssonnelia</i> |
| 2. Thallus not crustose, the erect portions branching freely..... | 3. |
| 3. Thallus jointed..... | 5. |
| 3. Thallus not jointed..... | 4. |
| 4. Thallus erect, more than 3 cm. high | <i>Galaxaura</i> |
| 4. Thallus epiphytic or prostrate on rocks | <i>Mastophora</i> |
| 5. Conceptacles terminal; segments less than 300 μ in width..... | <i>Jania</i> |
| 5. Conceptacles lateral; segments more than 500 μ in width..... | <i>Amphiroa</i> |
| 6. Thallus filamentous, cells uniseriate..... | <i>Bangia</i> |
| 6. Thallus not as above | 7. |
| 7. Thallus membranous throughout, consisting of one layer of cells..... | <i>Porphyra</i> |
| 7. Thallus not membranous..... | 8. |
| 8. Thallus consisting of filaments throughout, forming a cylindrical branched plant | <i>Nemalion</i> |
| 8. Thallus not as above | 9. |
| 9. Thallus with an axis, at least in the young parts..... | 10. |
| 9. Thallus without an axis | 23. |

(1) Marine Algae of Northern Taiwan (Cyanophyta, Chlorophyta, Phaeophyta). *Taiwania* (7): 51-75, pl. 1, 1960.

10. Axis clearly observed either in cross-section or longitudinal section11.
10. Axis detectable only in young parts, but obscure and not detectable in older parts19.
11. Thallus consisting of segments, each with a whorl of teeth, except on old part.....*Centroceras*
11. Thallus not as above.....12.
12. Thallus flat or compressed throughout13.
12. Thallus cylindrical or subcylindrical15.
13. Thallus with a single tier of cells surrounding the central axial filaments; with 6 to 8 pericentral cells*Symphyocladia*
13. Thallus not as above.....14.
14. Tetrasporangia borne in nemathecia, and zonately divided into four tetraspores.....*Chondrococcus*
14. Tetrasporangia not borne in nemathecia, and cruciately divided into four tetraspores*Microcladia*
15. Medullary layer composed of filaments.....*Scinaia*
15. Thallus not as above.....16.
16. Thallus consisting of central axial cells and a cortex which is discontinuous and in the form of bands.....*Ceramium*
16. Thallus consisting of central axial cells and continuous cortical cells or pericentral cells.....17.
17. Thallus densely corticated with small cells*Acanthophora*
17. Thallus with pericentral cells around the axial cells18.
18. Pericentral cells equal to the axial cells in length.....*Herposiphonia*
18. Pericentral cells half the length of axial cells.....*Bostrychia*
19. Thallus with slender, rhizoidal filaments among the medullary cells20.
19. Thallus without rhizoidal filaments.....21.
20. Cystocarps unilocular.....*Pterocladia*
20. Cystocarps bilocular.....*Gelidium*
21. Apical cell surrounded by short trichoblasts.....22.
21. Apical cell not surrounded by trichoblasts, and axes provided with numerous short branchlets*Hypnea*
22. Branchlets long, fusiform, and pointed at both ends.....*Chondria*
22. Branchlets club-shaped.....*Laurencia*
23. Thallus hollow with transverse septa.....*Champia*
23. Thallus not hollow.....24.
24. Medullary layer consisting of filaments.....25.
24. Medullary layer without filaments31.
25. Thallus foliaceous.....26.
25. Thallus flat or compressed30.

26. Thallus usually 3 to 4 times dichotomously branched.....27.
 26. Thallus not flabellate; cystocarps produced all over both surfaces and margins*Sarcodia*
 27. Thallus less than 6 cm. in height, usually proliferated at the margin at the upper end.....*Chondrus*
 27. Thallus more than 8 cm. in height.....28.
 28. Filaments of the medullary portion more or less densely compacted in cross-section*Carpopeltis*
 28. Filaments of the medullary portion loosely arranged20.
 29. Thallus margins serrate*Halymenia*
 29. Thallus margins not serrate*Meristotheca*
 30. Thalli caespitose, the segments arching.....*Gigartina*
 30. Thalli not caespitose, erect*Grateloupia*
 31. Thallus less than 1.5 mm. in width*Gelidiopsis*
 31. Thallus more than 3 mm. in width.....32.
 32. Thallus with wart-like protuberances in longitudinal rows*Eucheuma*
 32. Thallus smooth and sometimes dentate on the margins.....*Gracilaria*

Bangiaceae

Bangia Lyngbye

1. *Bangia fusco-purpurea* (Dillw) Lyng., Hydrophyt. Dan. 83, 1819; Okamura, 1921, p. 87, pl. 171, figs. 6-12; Shen and Fan, 1950, p. 331.

Fig. I 1, 2

The plants grow on rocks very abundantly and are almost in pure association or sometimes growing together with *Porphyra* near the upper littoral zone.

Collected at: Pachihmen (105), Tali (432).

Distr. Japan, Taiwan, Medit. Sea, Europe, Both coasts of North America, Australia.

Porphyra C. Agardh

1. *Porphyra crispata* Kjellman, Jap. Arter of Slaegt. *Porphyra* 1897, p. 15; Okamura, 1931, p. 108; Okamura, 1936, p. 382; Dawson, 1954, p. 412, fig. 24.

The specimens at hand are about 4 to 6 cm. high, and are in full agreement vegetatively with this species. The thallus is monoecious, each carpogonium produces about 26 carpospores, and each spermatangium produces about 128 sperms.

Collected at: Laomei (190), Patoutsu (635), Tali (434).

Distr. Japan, Ryukyu, Taiwan, Amoy, Vietnam.

Helminthocladiaceae

Nemalion Targione-Tozzetti

1. **Nemalion pulvinatum** Grunow, in Holmes. On New Mar. Alg. Jap. 1895, p. 269, pl. 12, fig. 6; Okamura, 1907, pl. 9, figs. 2-9; Okamura, 1936, p. 414, fig. 192; Dawson, 1952, p. 35, pl. 15, fig. 1.

A few sterile specimens were found growing on exposed rocks. They closely coincide with this species both in habit and structure.

Collected at: Pachihmen (604), Shihcheng (679).

Distr. Japan, Taiwan, Pacific Mexico.

Chaetangiaceae

Scinaia Bivona

Key to the species

1. Frond strongly constricted like an isthmus; joints oblong or oblong-cuneate *S. moniliformis*
 1. Frond not constricted, cylindrical or compressed *S. pseudo-japonica*
 1. **Scinaia moniliformis** J. Ag., Till Alg. Syst. 4, 1884, p. 72; Okamura, 1930, p. 28, pl. 265 figs. 1-4; Okamura, 1936, p. 434; Segawa, 1956, p. 59, pl. 34, fig. 261.

Fig. I 3

A few of our specimens are represented by cystocarpic plants. They were found cast upon the shore. Plants are from 5.5 to 8 cm. high; rose red in color and quite turgid when fresh.

Collected at: Shihmen (57).

Distr. Japan, Taiwan, Australia.

This is a new record for Taiwan.

2. **Scinaia pseudo-japonica** Yam. et Tan., Not. on Som. Jap. alg. 8, 1938, p. 127, pl. 24; Shen and Fan, 1950, p. 333.

The plants were found with *S. moniliformis* cast upon the shore. They clearly show the characteristics of the species which coincide fairly well with the detailed description given by Yamada.

Collected at: Shihmen (58).

Distr. Taiwan.

Galaxaura Lamour.

Key to the species

1. Thallus cylindrical *G. fastigiata*
 1. Thallus with subcylindrical stipe and flattened blades *G. arborea*
 1. **Galaxaura fastigiata** Decaisne, Sur les Corallines 16, 1842; Tanaka, 1936, p. 157, pl. 37, fig. 2; Okamura, 1931, p. 109; Dawson, 1954, p. 419, fig. 30 b.

Fig. I 4

The specimens at hand are cystocarpic plants. In external appearances they

are somewhat different from the figure given by Tanaka. Our specimens are never decompound or with proliferations from the apices.

Collected at: Tali (267), Shihmen (380).

Distr. Japan, Ryukyu, Taiwan, Philippin Islands, Malay Archipelago, Red Sea, Polynesia.

2. **Galaxaura arborea** Kjellm., Floride-slaegtet Galaxaura, 1900, p. 72, pl. 11, figs. 1-11, pl. 20, fig. 39; Tanaka, 1936, p. 161 figs. 24-25, pl. 40; Okamura, 1936, p. 447; Tseng, 1941, p. 94, fig. 6.

Collected at: Shihmen (59), (260).

Distr. Japan, Ryukyu, Taiwan, Penghu Australia.

Gelidiaceae

Gelidium Lamour

Key to the species and forms

1. Fronds prostrate or arising from creeping parts; branchlets are more or less irregularly pinnate.....*G. pusillum*
 1. Fronds erect, arising from fibrous roots; branchlets more or less regularly pinnate.....2.
 2. Fronds with a midrib; branchlets irregularly and densely placed on both the margins and surfaces of the branches*G. japonicum*
 2. Fronds with an inconspicuous midrib or flat; branchlets only arise from the margins of the branches3.
 3. Fronds with filiform ramuli5.
 3. Fronds without filiform ramuli4.
 4. Ramuli almost equal in length, elegantly arranged on both sides of branches.....*G. Amansii* f. *elegans*
 4. Ramuli variable in length, more or less aggregated*G. latiusculum*
 5. Fronds more less corymbose in shape; ramuli long straight and tufted*G. planiusculum*
 5. Fronds not corymbose in shape; ramuli short and curved ...*G. Amansii* f. *latioris*
1. **Gelidium pusillum** (Stackhouse) Le Jolis, List Alg. Mar. Cherb. 1864, p. 139; Okamura, 1912, p. 11, pl. 54; Okamura, 1936, p. 457; Fan, 1951 p. 17 fig. 10; Dawson, 1952, p. 62.

Fucus pusillum Stackhouse Nereis Britanica, 1801, p. 17, pl. 6

Fig. I 5

Thalli 2 to 10 mm. high, tufted, creeping on rocks or on shells in pure stands or intermixed with other small algae.

A few materials seem to fall within the limits of var. *conchicola* Pice. et Grun.

Collected at: Pachihmen (605).

Distr. Japan, Taiwan, Spain, England, Pacific Mexico, Australia.

2. **Gelidium japonicum** (Harr.) Okam., *Illust. Mar. Jap.* 1:57, pl. 21, 1901; Fan, p. 3, fig. 1, 1951.

This species seems to be rather widely distributed on the North-eastern side of Taiwan, but not so common on the North-western side.

Collected at: Kueishan (50), Tali (226), Patoutsu (551), Pachihmen (537).

Distr. Japan, Taiwan.

3. **Gelidium Amansii** Lmx. f. **latioris** Okam., *Jap. Assoc. Adv. Sci.*, 10:443, 1935; Shen and Fan, p. 334, 1950; Fan, 1951, p. 4, pl. 2, figs. 1-2.

Collected at: Pachihmen (166).

Distr. Taiwan.

4. **Gelidium Amansii** Lmx. f. **elegans** Okam., *Icones Jap. alg.*, 1912, p. 25, pl. 106, fig. 1; Okamura, 1936, p. 461; Fan, 1951, p. 4, pl. 1, fig. 1.

This plant is characteristically different from the former form by the absence of curved filiform branchlets and by the arrangement of its short branchlets. Cystocarps swollen beneath the apex of the branchlet.

Collected at: Tali (411).

Distr. Japan, Taiwan.

5. **Gelidium planiusculum** Okam., in *Jap. Assoc. Advanc. Sci.* 1935, 10:442; Okamura, 1936, p. 465; Fan, 1951, p. 7, pl. 3, figs. 1-2, text-fig. 4.

This plant grows on rocks or shells from the middle littoral zone to the lower littoral zone intermixed with other *Gelidium*.

Collected at: Pachihmen (167).

Distr. Taiwan.

6. **Gelidium latiusculum** Okam., in *Jap. Assoc. Advanc. Sci.*, 1935, p. 443; Okamura, 1936, p. 465; Fan, 1951, p. 5, pl. 1, fig. 3, text-fig. 3.

This plant is closely allied to *G. Amansii* f. *elegans* in structure, but differs from the latter in the variable length of the branchlets.

The plants grow on rocks from the upper littoral belt to middle littoral belt.

Collected at: Tali (131), Yeliu (483).

Distr. Taiwan.

Pterocladia J. Ag.

Key to the species

1. Fronds large (9 to 12 cm. high or more); more or less pyramidal in shape.....*P. tenuis*
 1. Fronds small (4 to 7 cm. high); more or less corymbose.....*P. nana*
 1. **Pterocladia tenuis** Okam., *Gelid. Pterocol. Jap.*, 1934, p. 62, pls. 29-30, fig. 3, pl. 33, figs. 1-3; Okamura, 1936, p. 467; Fan, 1951, p. 18, pl. 15, fig. 3.
Pterocladia capillacea Okam. (non Borm. et Thur.) *Icon. Jap. Alg.* 3:50, pl. 115.

This is a common species extending from the upper to the lower littoral zones.

Collected at: Pachihmen (170), Tali (323).

Distr. Japan, Korea, Taiwan.

2. *Pterocladia nana* Okam., *Gelid. Pterocl. Jap.*, 1934, p. 64, pl. 33, figs. 9-11; Okamura, 1931, p. 53, pl. 278, figs. 1-14; Fan, 1951, p. 18, pl. 5, fig. 2.

The plants are densely branched upward but mostly naked at the lower part, about 4 to 7 cm. high, and seem rather rare in this district, and only found from Pachihmen.

Collected at: Pachihmen (403).

Distr. Japan, Taiwan.

Rhizophyllidaceae

Chondrococcus Kützing

1. *Chondrococcus Hornemanni* (Mert.) Schmitz., *Mar. Florid V. Deuts. Ostaf.*, 1895, p. 170; Okamura, 1921, p. 158, pl. 190, figs. 1-14; Segawa, 1935, p. 76; Shen and Fan, 1950, p. 335.

Fig. I 6

In comparison with our single Japanese specimen in the herbarium at the National Taiwan University, and with the figure given by Okamura in his *Icones* our specimens are more densely pinnated than the former. But in other characteristics our specimens do not show any differences from the descriptions of this plant.

Collected at: Laomei (65), Tali (81).

Distr. Japan, Ryukyu, Taiwan.

Squamariaceae

Peyssonnelia Decaisne

1. *Peyssonnelia distenta* (Harv.) Yamada, *Journ. Fac. Sci. Hokk. Imp. Univ. Ser. V.*, 1930, 1:29, pl. 6, fig. 7; Shen and Fan, 1950, p. 335.
Peyssonnelia involvens Okam. (non Zanard). *Icon. Jap. Alg.* 1909, 2:27, pl. 57.
Galaxaura distenta Harv. *Char. New Alg. Japan.* 1859, p. 331.

Fig. II 1, 2

This low, tubular, irregularly dichotomously branched plant reaches 2 cm. in height. It usually can be found cast ashore the whole year round.

Specimens at hand are in close agreement with the structure and figure of Yamada's Formosa plants.

Collected at: Hsiao Keelung (130), Patoutsu (395), Tali (412).

Distr. Taiwan.

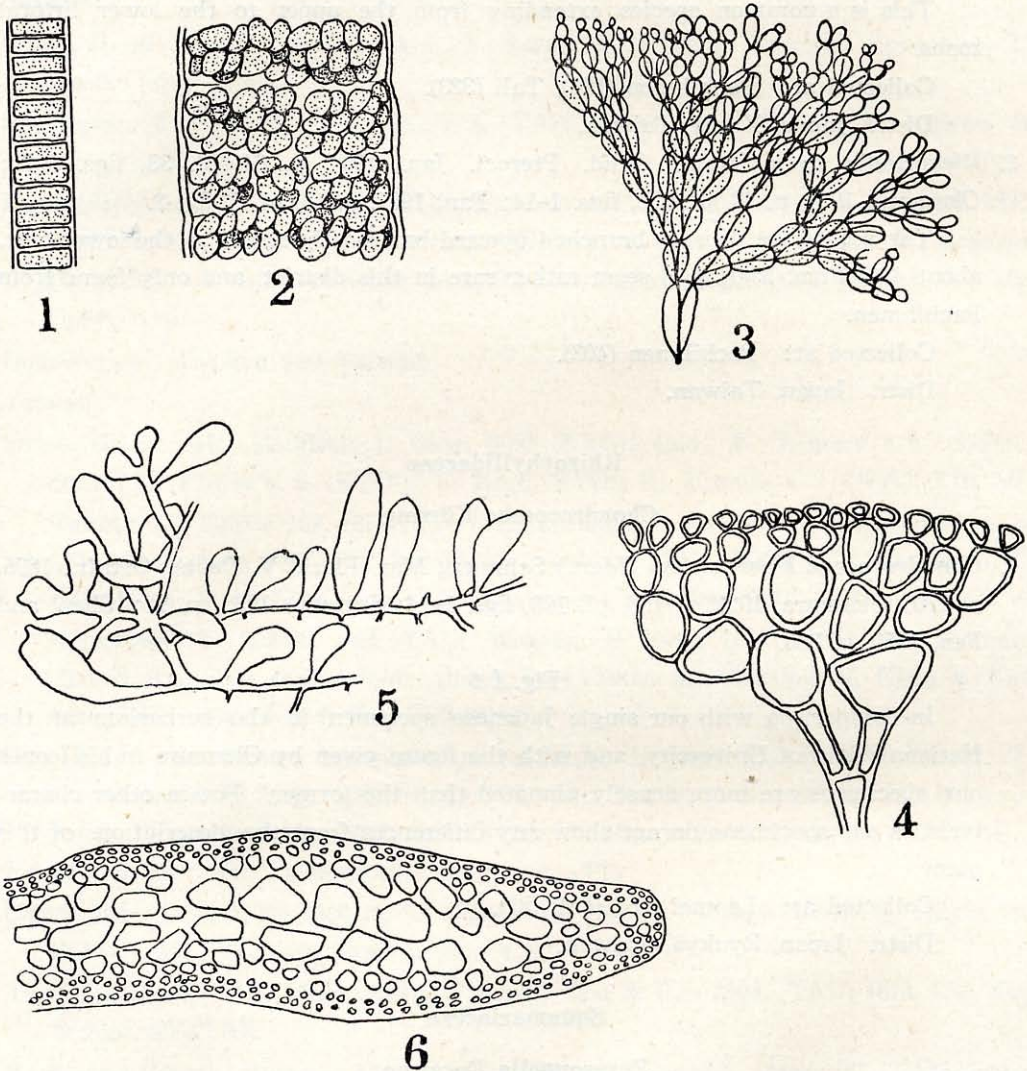


Fig. I. 1-2, *Bangia fusco-purpurea* (Delly) Lyng.: 1, Part of a sterile filament, $\times 130$; 2, A small portion of a fertile filament with fully grown carpospores, $\times 280$; 3, *Scinaia moniliformis* J. Ag.: Habit, $\times 1$; 4, *Galaxaura fastigiata* Decaisne: A portion of cross-section of a frond, $\times 430$; 5, *Gelidium pusillum* (Stackh.) Le Jolis.: Habit, $\times 6$; 6, *Chondrococcus Hornemanni* (Mert.) Schmitz.: A portion of cross-section through the middle part of a frond, $\times 100$.

Corallinaceae

Mastophora Harvey

1. *Mastophora macrocarpus* Mont., Voy. au pol. sud, p. 149; Okamura, 1936, p. 514, fig. 243; Yamada, 1938, p. 72; Shen and Fan, 1950, p. 335.

Fig. II 3

This pale green plant was found in a special habitat, forming a crust closely

attached on the branches of other algae, such as *Gelidium*, *Polyopes*, *Carpopeltis* etc.

Collected at: Kueishan (89), Shihchen (667).

Distr. Japan, Ryukyu, Taiwan.

Jania Lamouroux

Key to the species

1. Thallus entangled into a mass2.
1. Thallus dichotomously branched and fan-shaped.....3.
2. Segments 2 to 5 times as long as broad*J. decussato-dichotoma*
2. Segments 6 to 10 times as long as broad.....*J. adhaerens*
3. Segments mostly compressed, about 300 μ in diameter.....*J. radiata*
3. Segments markedly cylindrical throughout, about 100 μ in diameter.....*J. tenella*
1. **Jania decussato-dichotoma** (Yendo) Yendo, in Okamura, Nippon Kaiso si, 1936, p. 530; Dawson, 1952, p. 117, pl. 27, fig. 3; Shen and Fan, 1950, p. 336.
Corallina decussato-dichotoma Yendo, Coral. ver. Jap., 1902, p. 24, pl. III, 1-3, pl. VII. 3-4.

Fig. II 4

These decussately branched plants were found cast ashore and have segments about 130-180 μ in diameter and are 2 to 5.5 times as long as broad. They are in good agreement both with Dawson's illustrations and figures.

Collected at: Tali (288).

Distr. Japan, Ryukyu, Taiwan, Vietnam, Pacific Mexico.

2. **Jania adhaerens** Lamx., Polp. Coral. 270; Okamura, 1936, p. 529; Shen and Fan, 1950, p. 336.
Corallina adhaerens Kütz., Tab. Phyc., 8: t. 83.

Fig. II 5

I have referred to this species a specimen growing in the form of a lump about 4 cm. high. These plants grow on the branches of *Sargassum* sp. They are irregularly dichotomously branched, somewhat in a corymbose manner; the branches stand at wide angles and are intricately. Joints are cylindrical about 100 to 155 μ in diameter, 5 to 8 times as long as broad.

Collected at: Laomei (66).

Distr: Japan, Ryukyu, Taiwan, Red Sea, Medit. Sea.

3. **Jania radiata** Yendo, Coral. ver. Japan. 1902, p. 26, pl. 3, fig. 6; Okamura, 1936, p. 532.

Fig. II 6

Although I have been unable to compare our plants with the authentic specimens of this species, my specimens agree quite fully with this species as interpreted by Okamura.

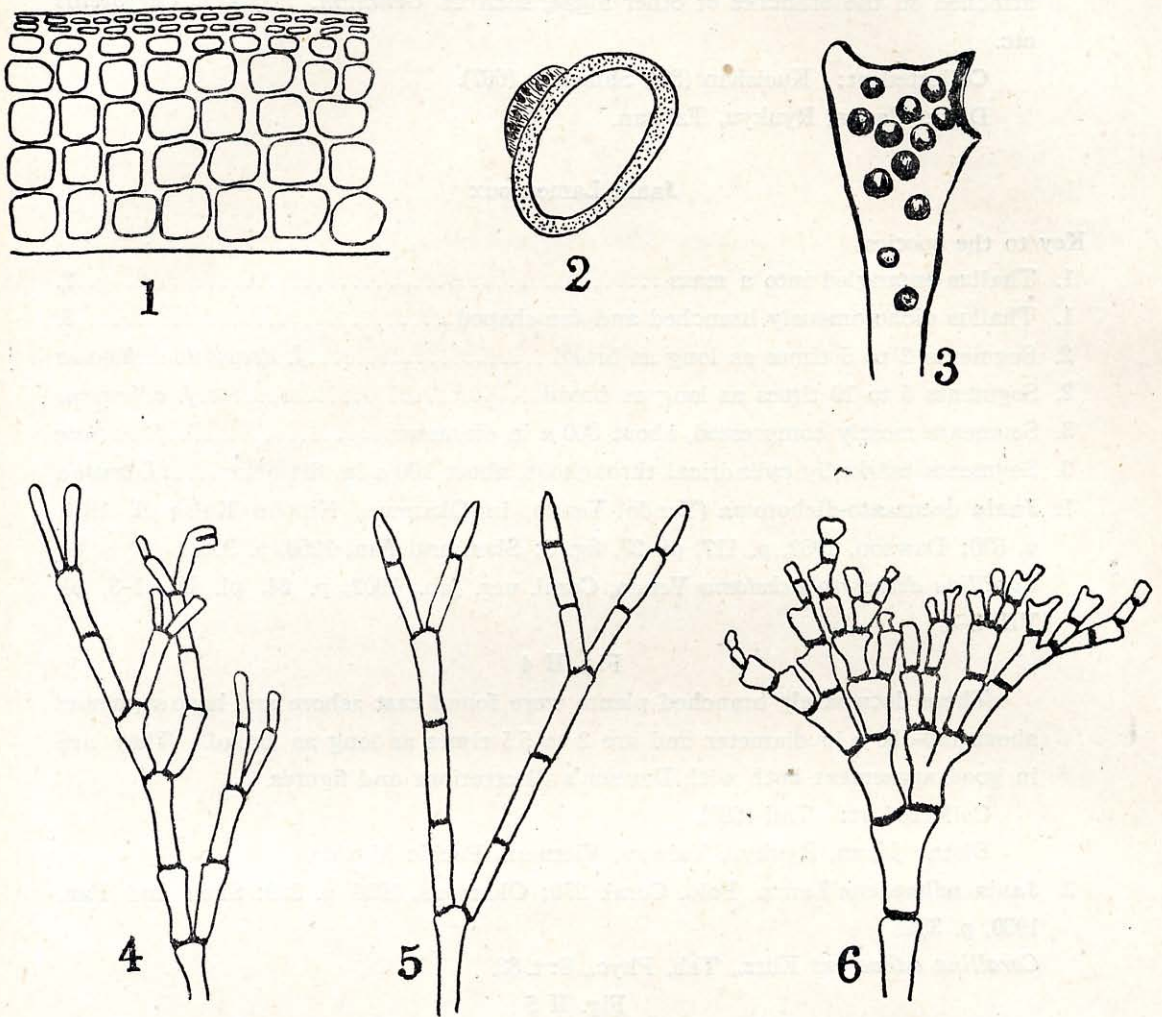


Fig. II. 1-2, *Peyssonnelia distenta* (Harv.) Yamada: 1, Part of cross-section of a frond, $\times 430$; 2, Cross-section of a frond with a sorus, $\times 30$; 3, *Mastophora macrocarpa* Mont.: A portion of a frond, $\times 3.5$; 4, *Jania decussato-dichotoma* (Yendo) Yendo: An upper portion of a plant, $\times 11$; 5, *Jania adhaerens* Lamx.: A small part of a clump, $\times 45$; 6, *Jania radiata* Yendo: An upper portion of a plant, $\times 20$.

My specimens are about 270 to 300 μ broad in the median portion and 2 to 3 times as long as broad.

The plants grow on the branches of *Galaxaura* sp. which was found cast ashore.

Collected at: Laomei (560).

Distr. Japan, Taiwan.

This is a new record for Taiwan.

4. *Jania tenella* Kützing, Tao. Phyc. 1858, 8:41, pl. 85, fig. 2; Okamura, 1936, p. 531; Dawson, 1952, p. 135.

Fig. III 1

Some specimens of this alga were sent to Dr. Dawson and have been kindly identified by him as this species.

The specimens at hand form soft, dense tufts about 2 cm. high; dichotomous branches are often subcorymbose, essentially in one plane, or sometimes with an obscure tendency toward a decussate arrangement, the angles are rather narrow; segments cylindrical about 80 to 250 μ in diameter, 3 to 6 times as long as broad.

Collected at: Tali (218).

Distr. Japan, Taiwan, Pacific Mexico, New Guinea.

This is a new record for Taiwan.

Amphiroa Lamouroux

1. **Amphiroa zonata** Yendo, Coral. ver. Jap. 1902, p. 10, pl. 1, figs. 11-14, pl. 4, fig. 9; Yendo, 1904, p. 4; Okamura, 1936, p. 517; Dawson, 1952, p. 146; Dawson, 1961, p. 410, pl. 14, fig. 1.

Amphiroa peninsularis Taylor. Pacific Mar. alg. Galapagos Isl. 1945, p. 53. *Amphiroa pusilla* Yendo. Coral. Jap. 1902, p. 13, pl. 1, figs. 22-23.

Amphiroa compressa var. *tenuis* Taylor. Pacific mar. alg. Galapagos Isl., 1945, p. 191. pl. 53. fig. 1.

Fig. III 2

Some specimens of this alga were sent to Dr. Dawson and have been identified by him as this species.

The plants were found washed ashore. They are distinguished by their flattened, more less regularly dichotomously branched segments, and are almost in one plane.

Collected at: Tali (219).

Distr. Japan, Taiwan, Pacific Mexico.

This is a new record for Taiwan.

Grateloupiaceae**Halymenia** (C. Ag.) J. Ag.

1. **Halymenia Durvillaei** Bory var. *ceylanica* Web. van Bos., List. Alg. Siboga, 1921, p. 235; Okamura, 1936, p. 536; Borgesen, 1936, p. 83; Shen and Fan, 1950, p. 337. *Halymenia formosa* Harv., Fr. Isl. Alg. no. 55; Okamura, 1907, p. 44, pl. 62, figs. 1-3. *Halymenia Durvillaei* var. *formosa* Okam., (non web. v. Bos.), Mar. Alg. Kotosho, 1931, p. 110.

Although only one specimen has been collected, it agrees quite well with the description of this species both in external form and internal structure, as interpreted by Okamura.

Collected at: Patoutsu (22).

Distr. Taiwan, Malay Archipelago, Indian Ocean, Polynesia, Australia.

Grateloupia C. Ag.

Key to the species

1. Frond linear, cylindrical at the base and compressed above*G. ramosissima*
1. Frond almost flat.....2.
2. Not exceeding 3 mm. in width.....*G. filicina*
2. More than 5 mm. in width.....*G. carnosa*
1. **Grateloupia ramosissima** Okam., Icon. of Japan Alg., 1913, p. 60, pl. 117, figs. 1-11; Chiao, 1932, p. 158 fig. 40; Dawson, 1954, p. 432, fig. 42 b; Shen and Fan, 1950, p. 337.

The present cystocarpic specimens are 7 to 13 cm. high and show clearly the characteristics of this species in habit and branching.

The plants grow abundantly in tufts on the rocks near the upper littoral zone.

Collected at: Patoutsu (396), Shihchen (685).

Distr. Japan, Taiwan, Vietnam.

2. **Grateloupia carnosa** Yamada et Segawa, Notes on Some Jap. Alg., 197, p. 126, pls. 26-27.

Although some of my specimens are not so densely branched as the figures illustrated by Yamada, yet they are all in good agreement with the Japanese species in habit and structure. These cystocarpic plants, grow on the surfy rocks near the middle littoral zone.

Collected at: Kueishan (26), Shihchen (687).

Distr. Japan, Taiwan.

This is a new record for Taiwan.

3. **Grateloupia filicina** (Wulfen) C. Ag., Sp. Alg., 1882, p. 244; Okamura, 1936, p. 538; Dawson, 1958, p. 432, fig. 42 a. *Fucus filicinus* Wulfen, in Jacquin, 1786-1796, p. 157, pl. 15, fig. 2. *Lomentaria drouetii* Dawson, Mar. Alg. Gulf of California, 1944, p. 309, pl. 46, figs. 1-2, pl. 74, fig. 2.

The specimens collected here are fully like the Japanese specimen of this species in the herbarium at the National Taiwan University.

Collected at: Tali (242).

Distr. Very widely distributed throughout the world.

This is a new record for Taiwan.

Carpopeltis Schmitz.

1. **Carpopeltis flabellata** (Holmes) Okam. Icon. Jap. Alg., 1935, 7:39, pl. 321, figs. 1-6; Segawa, 1938, p. 143.

Grateloupia flabellata Holmes, On Mar. Alg. fr. Japan, 1895, p. 254, pl. 9, figs. a-b.

Specimens of this species were found growing on the rocks and are similar to those collected elsewhere.

Collected at: Tali (510).

Distr. Japan, Taiwan.

This is a new record for Taiwan.

Solieriaceae

Eucheuma J. Agardh

1. *Eucheuma serra* J. Ag., Spec. alg., 1852, p. 626; Yamada, 1936, p. 120, pls. 21-22, text-figs. 1-2; Segawa, 1938, p. 146; Shen and Fan, 1950, p. 338.

Fig. III 3

In every characteristic the specimens at hand are in good agreement with the figures illustrated by Yamada. The plants are very abundant and adhere tightly on the rocks or shells near the lower littoral belt in summer.

Collected at: Patoutsu (295), Tali (302), Pachihmen (714).

Distr. Japan, Taiwan.

Meristotheca J. Agardh

1. *Meristotheca papulosa* (Mont.) J. Ag., in Okamura, Nippon Kaiso Si, p. 595, fig. 279. *Meristotheca japonica* (Mont.) Kylin. Florideenordn.-Gigartin., 1932, p. 28.

This large and fleshy plant reaches a height of about 15.5 cm. Only one plant has been found washed ashore.

Collected at: Patoutsu (682).

Distr. Japan, Taiwan.

Hypneaceae

Hypnea Lamouroux

Key to the species

1. Thalli mainly erect and free, main axis cylindrical.....2.
1. Thalli mainly forming a loose or compact tuft, no clear main axis.....3.
2. Main axis of the frond often naked, dichotomously branched*H. chordacea* f. *simpliciuscula*
2. Main axis of the frond with lateral branches throughout the frond.....*H. Boergesenii*
3. Frond loosely intricated, apex of the branches often hamate*H. japonica*
3. Frond compact, matted, densely short-branched.....*H. spinella*
1. *Hypnea chordacea* Kütz. f. *simpliciuscula* (Okam.) Tanaka, Genus Hypnea fr. Jap., 1941, p. 232, pl. 53, fig. 2; Shen and Fan, 1950, p. 340. *Hypnea simpliciuscula* Okam., in De Toni, Sopra Nuove Alg. Mar. Giappone, 1895, p. 345.

The frond of this species is nearly naked and this distinguishes it from *H. Boergesenii* which has lateral branches. The plants grow on rocks near the lower littoral zone during winter.

Collected at: Laomei (10), Shihmen (261), Pachihmen (159).

Distr. Japan, Taiwan.

2. *Hypnea Boergesenii* Tanaka, Genus *Hypnea* fr. Jap., 1941, p. 233, pl. 53, fig. 1, text-figs. 6-8; Dawson, 1954, p. 436, fig. 46 k.

Fig. III 4-6

These specimens agree well with this species. The plants are about the same size as the type and show the exceedingly dense development of lateral branchlets throughout the whole frond.

Collected at: Pachihmen (25), Tali (324).

Distr. Taiwan, Vietnam.

3. *Hypnea spinella* (C. Ag.) Kütz. Species alg., 1849, p. 579; Dawson, 1961, p. 238, pl. 34, fig. 2.

Sphaerococcus spinellus C. Ag., Species alg., 1822, p. 323.

Some specimens of this alga were sent to Dr. Dawson and have been identified by him as this species.

This densely caespitose plant was found in tidal pools attached on rocks near the middle littoral belt. It has strictly cylindrical branches of short, spiny character and are mat-shaped, about 1.0 cm. high.

Collected at: Patoutsu (655).

Distr. Taiwan, West Indies, Pacific Mexico.

This is a new record for Taiwan.

4. *Hypnea japonica* Tanaka, Genus *Hypnea* of Jap., 1941, p. 236, pl. 54, text-figs. 9-10. *Hypnea musciformis* (non Lamouroux) Okamura, Icon. Jap. Alg., 1909, 2:35, pl. 59, fig. 7, pl. 60, figs. 7-11.

Fig. III 7

This species grows entangled among other algae by means of the tendrils at its apex. It grows in tidal pools near the middle littoral belt.

Collected at: Shihchen (688).

Distr. Japan, Ryukyu, Taiwan,

Sarcodiaceae

Sarcodia J. Agardh

1. *Sarcodia ceylanica* Harv., Alg. Ceyl. No. 27; Boergesen, 1936, p. 85; Okamura, 1936, p. 623, fig. 296.

Fig. IV 1, 2

Both cystocarpic and tetrasporic plants have been collected. They vary greatly in shape. But they agree well with the descriptions of this species as given by Okamura both in internal and external features.

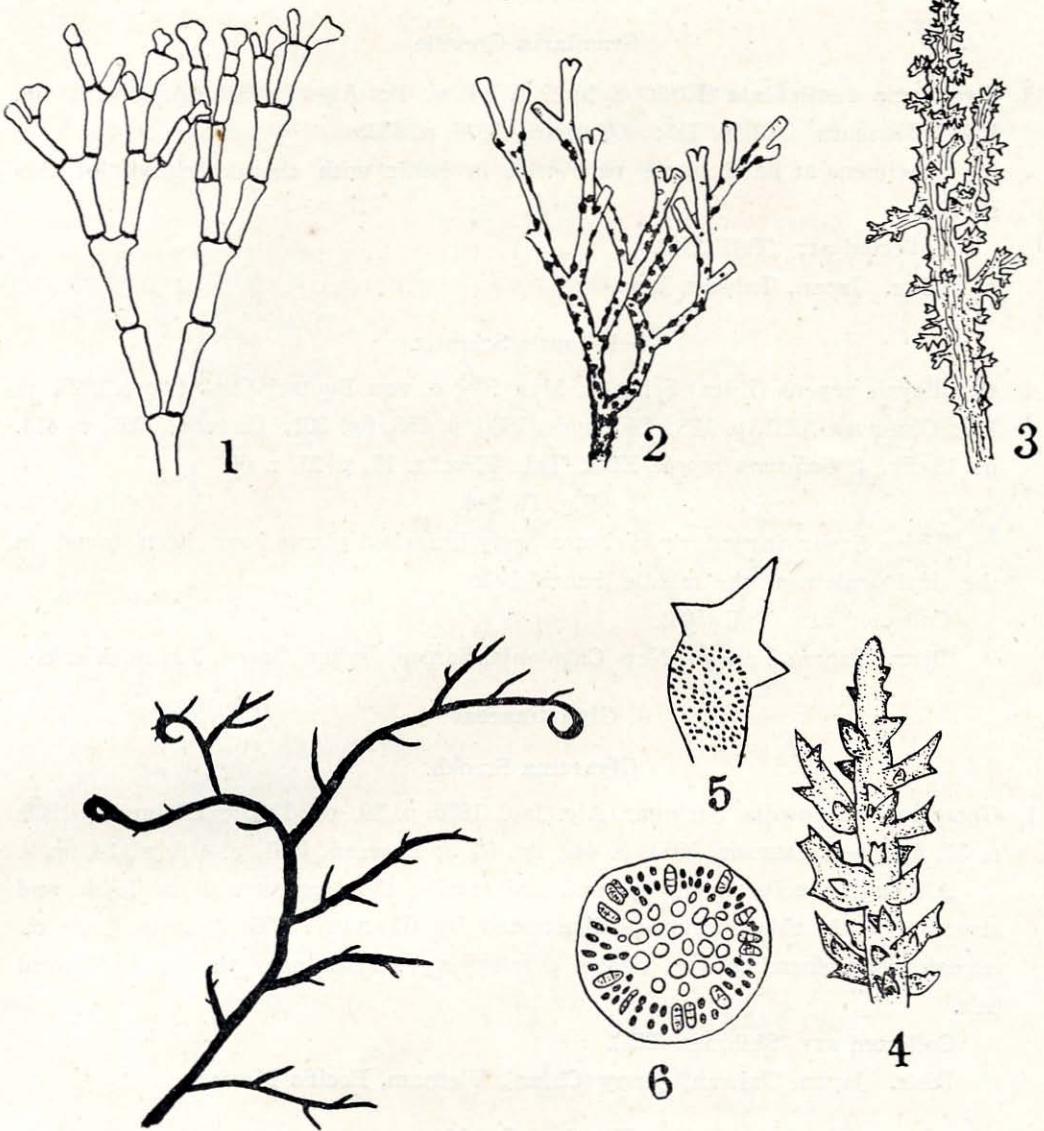


Fig. III. 1, *Jania tenella* Kütz.: A small part of a clump, $\times 13$; 2, *Amphiroa zonata* Yendo: A small portion of a plant with abundant conceptacles, $\times 3$; 3, *Eucheuma serra* J. Ag.: A small upper portion of a branch, $\times 1.4$; 4-6, *Hypnea Boergesenii* Tanaka: 4, Part of a branch, $\times 12$; 5, Tetrasporangial branchlet, $\times 20$; 6, A cross-section of a tetrasporangial branchlet, $\times 43$; 7, *Hypnea japonica* Tanaka: Portion of a plant showing tendrils, $\times 1.1$.

The plants grow on rocks near the lower littoral belt.

Collected at: Patoutsu (527), (656), Pachihmen (715), Shihmen (382).

Distr. Japan, Taiwan, Ceylon, New Zealand.

This is a new record for Taiwan.

Gracilariaceae**Gracilaria** Greville

1. **Gracilaria denticulata** (Kütz.) Schm.? Wed. v. B., Alg. du Siboga, p. 432, fig. 175; Okamura, 1931, p. 113; Okamura, 1936, p. 633.

Specimens at hand agree very well in habit with the description of this species.

Collected at: Tali (212).

Distr. Japan, Taiwan, Java.

Gelidiopsis Schmitz.

1. **Gelidiopsis repens** (Kütz.) Schmitz, Mar. Florid. von Deutsch-Ost-Africa, 1895, p. 148; Okamura, 1931, p. 113; Okamura, 1936, p. 635, fig. 301; Dawson, 1961, p. 414, pl. 18, fig. 4. *Gelidium repens* Kütz. Tab. Phyc. t. 18, p. 21, t. 60.

Fig. IV 3-4

These linear, irregularly dichotomously branched plants have been found in the tidal pools near the middle littoral belt.

Collected at: Tali (504).

Distr. Japan, Taiwan, New Caledonia, Samoa, Indian Ocean, Pacific Mexico.

Gigartinaceae**Gigartina** Stackh.

1. **Gigartina intermedia** Suringar, Alg. Jap., 1870, p. 30, pl. 17 B; Okamura, 1908, p. 35, figs. 1-5; Dawson, 1954, p. 443, fig. 52 b; Dawson, 1961, p. 416, pl. 24, fig. 3.

Although the specimens at hand are sterile, they agree well in habit and structure with this species as illustrated by Okamura. The plants grow on exposed rocks forming low, dense, overlapping masses near the upper littoral belt.

Collected at: Shihmen (381).

Distr. Japan, Taiwan, Amoy (China), Vietnam, Pacific Mexico.

Chondrus Stackh.

1. **Chondrus ocellatus** Holmes f. *typica* Okam., Icon. Jap. Alg., 1932, 6:84, pl. 291, fig. 1, pl. 292, fig. 1.

The cystocarpic specimens at hand show some differences in habit. But they all have the flat, broad, dichotomously branched fronds which are about 0.5 to 1.5 cm. wide. From the ultimate segments they always produce short, bifurcate proliferations, but these are rarely found on the margins.

Collected at: Kueishan (14).

Distr. Japan, Taiwan.

This is a new record for Taiwan.

Champiaceae

Champia Desvaux

1. *Champia parvula* (Ag.) Harvey, Ner. Boreali-Americana, 1853, p. 76; Okamura, 1936, p. 686, fig. 327; Shen and Fan, 1950, p. 341; Dawsom, 1954, p. 443, fig. 52 c. *Chondria parvula* C. Ag., Systema alg., 1824, p. 207.

Fig. IV 5

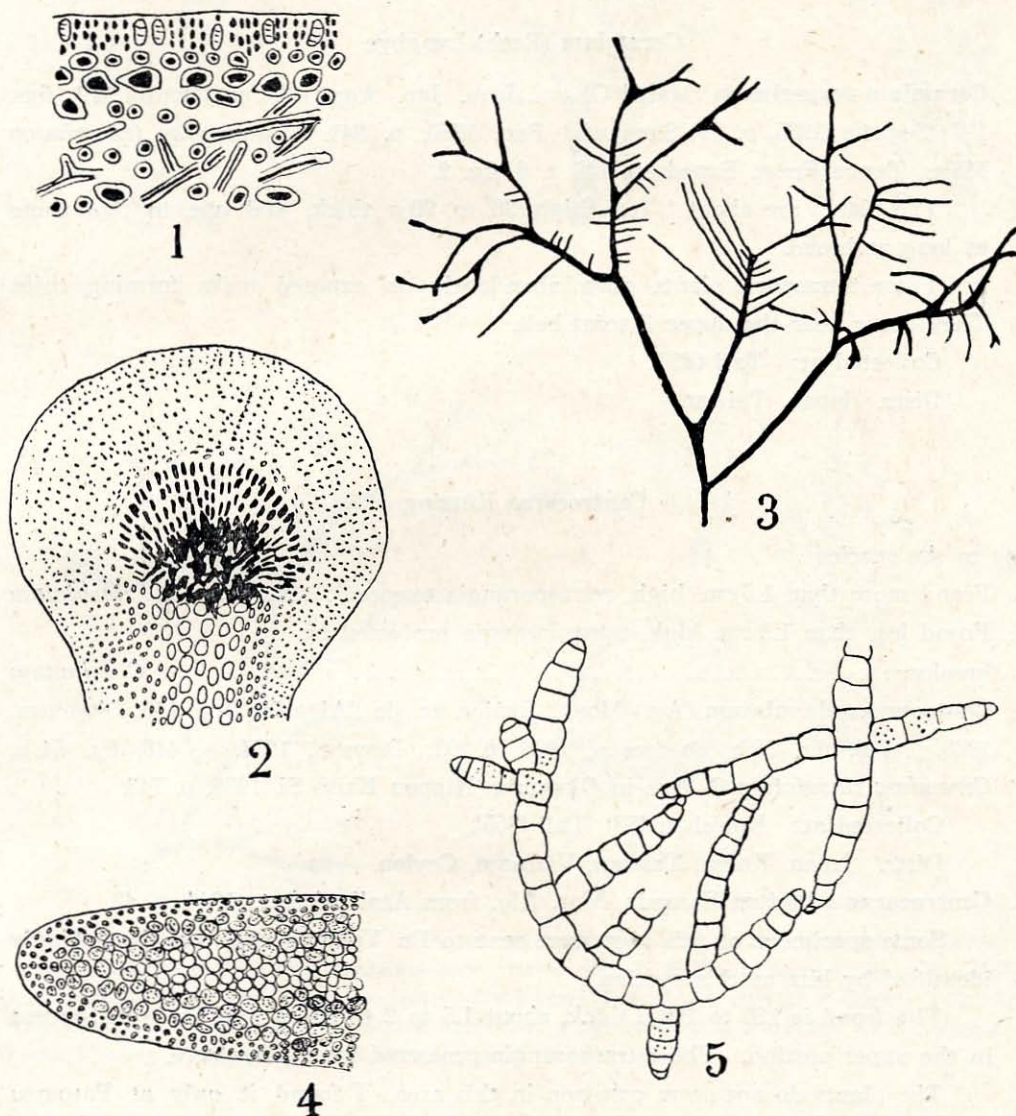


Fig. IV. 1-2, *Sarcodia ceylanica* Harv.: 1, A portion of cross-section of a frond showing tetrasporangia, $\times 80$; 2, A longitudinal-section of a cystocarp, $\times 80$; 3-4, *Gelidiopsis repens* (Kütz.) Schm.: 3, Habit, $\times 1$; 4, Part of cross-section of a frond, $\times 100$; 5, *Champia parvula* (Ag.) J. Ag.: A small part of a plant showing tetrasporic branches, $\times 5$.

These plants grow in clumps in depressions in the rocks which are filled with sand. They are about 1 cm. tall. The lower part of the plant is surrounded by sand.

Collected at: Patoutsu (657).

Distr. Japan, Taiwan, Vietnam, Medit. Sea, West Indies.

Ceramiaceae

Ceramium (Roth) Lyngbye

1. ***Ceramium tenerrimum*** (Mart.) Okam., Icon. Jap. Alg., 1921, p. 112, pl. 179, figs. 1-7; Segawa, 1935, p. 86; Shen and Fan, 1950, p. 341. *Hormoceras tenerrimum* Mart., Tange Preus. Exped. p. 146, t. 8, fig. 2.

The plants are about 1.5 cm. high, 38 to 90 μ thick, and one to five times as long as broad.

These tetrasporic plants grow abundantly on exposed rocks forming tufts. They occur near the upper littoral belt.

Collected at: Tali (435).

Distr. Japan, Taiwan.

Centroceras Kützing

Key to the species

1. Frond more than 1.5 cm. high, tetrasporangia exposed *C. clavulatum*
1. Frond less than 1.3 cm. high, tetrasporangia protected by involucre *C. minutum*
1. ***Centroceras clavulatum*** (Ag.) Mont., Explor. sc. de l'Algeries, 1, p. 140; Okamura, 1936, p. 743, fig. 355; Boergesen, 1936, p. 92; Dawson, 1954, p. 446, fig. 54 b. *Ceramium clavulatum* C. Ag., in Okamura, Nippon Kaiso Si, 1936, p. 743.

Collected at: Kueishan (52), Tali (565).

Distr. Japan, Korea, Taiwan, Vietnam, Ceylon.

2. ***Centroceras minutum*** Yamada, Mar. Alg. from Atoll of Ant., 1944, p. 42.

Some specimens of this alga were sent to Dr. Yamada and have been kindly identified by him as this species.

The frond is 130 to 190 μ thick, about 1.5 to 2 times as long as broad, except in the upper portion. The tetrasporangia protected by an involucre.

The plants do not seem common in this area. I found it only at Patoutsu growing on exposed rocks.

Collected at: Patoutsu (426).

Distr. Taiwan, East Caroline Islands.

This is a new record for Taiwan.

Microcladia Grev.

1. **Microcladia elegans** Okam., Icon. Jap. Alg., 1907, 2:1, pl. 1, figs. 1-10.

Collected at: Patoutsu (649).

Distr. Japan, Korea, Taiwan.

This is a new record for Taiwan.

Rhodomelaceae**Acanthophora** Lamouroux

1. **Acanthophora orientalis** J. Ag., Sp. Alg. 111, 1863, p. 820; Okamura, 1907, p. 35, pl. 8, figs. 1-7; Yamada and Tanaka, 1938, p. 84; Shen and Fan, 1950, p. 342.

Fig V 1-2

Collected at: Shihmen (127), Patoutsu (401), (427), Pachihmen (606).

Distr. Japan, Ryukyu, Taiwan, Malay, Polynesia, Australia.

Chondria Ag.

1. **Chondria armata** (Kütz.) Okamura, Icon. Jap. Alg., 1909, 1:69, pl. 16, figs. 9-19; Shen and Fan, 1950, p. 343.

Fig. V 3

This species is characterized by its thick and naked stem with fusiform long branches. My specimens are not fertile, but they agree well with the figures as illustrated by Okamura.

Collected at: Kueishan (91), Tali (566).

Distr. Japan, Taiwan, Malay Archipelago, Ceylon, Polynesia.

Laurencia Lamouroux

1. **Laurencia palisada** Yamada, In Univ. Calif. Publ. Bot., 1932, p. 196, pl. 4; Okamura, 1936, p. 854; Shen and Fan, 1950, pl. 343.

Fig. V 4, VI 1

The plants at hand are 2 to 3 times pinnately branched. The ultimate branchlets are clavate and about 9 to 11 cm. high.

Collected at: Patoutsu (683).

Distr. Taiwan.

Symphocladia Falkenberg

1. **Symphocladia marchantioides** (Harv.) Falkenb., Rhodomelaceen, 1901, p. 277, t. 2, figs. 18-23, t. 4, figs. 20-24; Okamura, 1912, p. 152, pl. 93. *Placophora marchantioides* (Harv.) J. Ag. Till Alg. Syst., 7:111.

Fig. VI 2-4

The frond is narrowly membranaceous, about 7 cm. high. The margins of the frond are usually irregularly lobed, dentate or much expanded here and there.

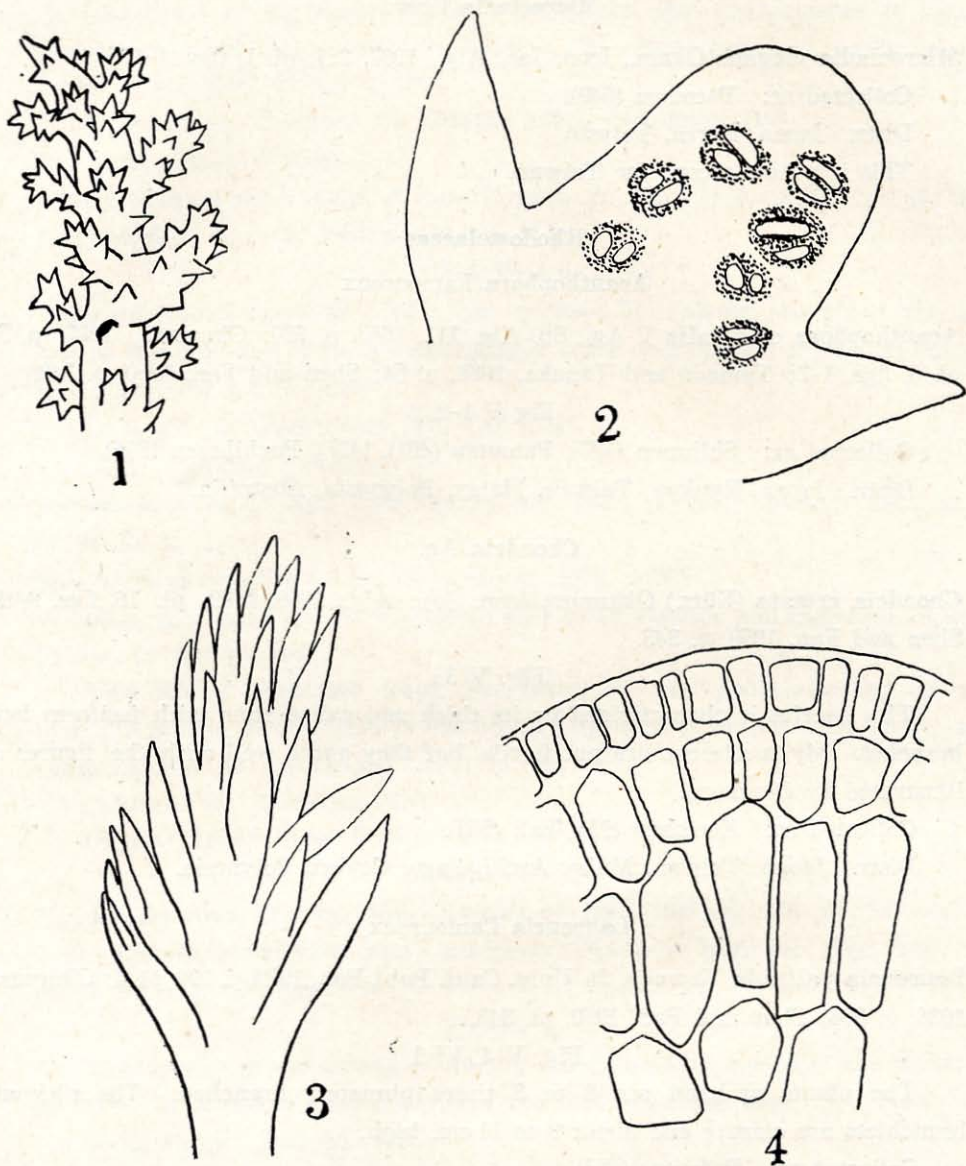


Fig. V. 1-2, *Acanthophora orientalis* J. Ag.: 1, A small portion of a branch, $\times 9$; 2, A portion of tetrasporangia bearing branchlet, $\times 100$; 3, *Chondria armata* (Kütz.) Okamura: An upper portion of a branch, $\times 40$; 4, *Laurencia palisada* Yamada: Part of cross-section of a branch, $\times 250$.

Mature parts of the frond have midrib. Our specimens are all sterile.

Collected at: Laomei (67), Tali (227).

Distr. Japan, Taiwan, Amoy, New Zealand, Australia.

Herposiphonia Naegeli

1. **Herposiphonia subdisticha** Okam., Contr. know. mar. alg. Jap., 1899, p. 37, pl. 1, figs. 12-14; Okamura, 1915, p. 199, pl. 146, figs. 11-18; Shen and Fan, 1950, p. 343.

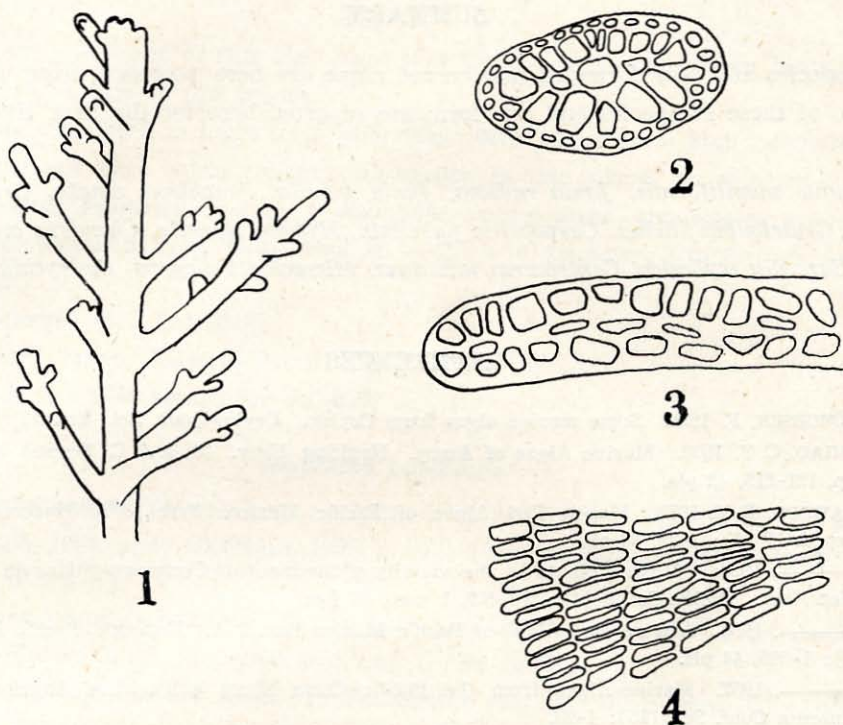


Fig. VI. 1, *Laurencia palisada* Yamada: An upper portion of a branch, $\times 5$; 2-4, *Symphyocladia marchantioides* (Harv.) Falkenb.: 2, Cross-section of a frond through the basal portion, $\times 70$; 3, Cross-section of the same frond through the middle portion, $\times 70$; 4, A portion of surface view, $\times 70$.

The plants are prostrate and adhering to the branches of *Corallina*. They are about 3 cm. in length, about 266μ wide.

Collected at: Shihmen (47), Tali (214).

Distr. Japan, Taiwan, Malay Archipelago, Australia.

Bostrychia Montsagne

1. ***Bostrychia tenella*** (Vahl) J. Ag., Sp. Alg. 11, p. 869; Okamura, 1970, p. 96, pl. 22, figs. 1-13; Okamura, 1936, p. 891, fig. 416. *Fucus tenella* Vahl. in Nat. Hist. Sellsk. Skr. V, 2, p. 45.

Plants grow densely crowded widely covering the rocks, admixed with very thick sands. The specimens at hand agree quite well with this species as illustrated by Okamura.

Collected at: Yeliu (647).

Distr. Japan, Taiwan, Malay Archipelago, Indian, Ocean, Africa.

This is a new record for Taiwan.

SUMMARY

46 species and four forms of marine red algae are here recorded from Northern Taiwan, of these 12 species and one form are reported here for the first time, these are;

Scinaia moniliformis, *Jania radiata*, *Jania tenella*, *Amphiroa zonata*, *Grateloupia carnosa*, *Grateloupia filicina*, *Carpopeltis flabellata*, *Hypnea spinella*, *Chondrus ocellatus* f. *typica*, *Sarcodia ceylanica*, *Centroceras minutum*, *Microcladia elegans*, *Bostrychia tenella*.

REFERENCES

- (1) BÖRGESEN, F. 1936. Some marine algae from Ceylon. Ceylon Jour. Sci., Bot. 12 (2): 57-97.
- (2) CHIAO, C. Y. 1932. Marine Algae of Amoy. Nanking Univ., M. B. A. C. Second ann. Rep. p.p. 121-215, 42 pls.
- (3) DAWSON, E. Y. 1952. Marine Red Algae of Pacific Mexico. Part 1. A. Hancock Pacific Exped. 17 (1): 1-28, 33 pls.
- (4) ———. 1954a. Marine plants in the vicinity of the Institute Oceanographique de Nharang, Viet Nam. Pacific Sci. 8 (4): 373-469, 1 map, 63 figs.
- (5) ———. 1954. Marine Red Algae of Pacific Mexico Part 2 A. Hancock Pacific Exped. 17 (2): 1-396, 44 pls.
- (6) ———. 1957. Marine Algae from the Pacific Costa Rican gulfs. Los Angeles County Museum Cont. Sci. (15): 1-28.
- (7) ———. 1961. Marine Red Algae of Pacific Mexico. Part 4. Pacific Nat. 2 (5-6): 191-343, pls. 1-63.
- (8) FAN, K. C. 1951. The Genera Gelidium and Pterocladia of Taiwan. Taiwan Fish. Res. Inst. Lab. of Biol. Rep. No. 2, p. 1-22, pls. 1-5.
- (9) OKAMURA, K. 1895. New or little known Algae from Japan. Bot. Mag. Tokyo, 9: 472-480, pl. 4.
- (10) ———. 1899. Contributions to the knowledge of the Marine Algae of Japan III. Bot. Mag. Tokyo 13: 2-10, 35-43, pls. 1-2.
- (11) ———. 1907-37. Icones of Japanese algae. Vol. 1, pp. 1-257, pls. 1-50, 1907-09. 1-191, pls. 51-100, 1909-12. Vol. 3, pp. 1-218, pls. 101-150, 1913-15. Vol. 4, pp. 1-205, pls. 151-200, 1916-23. Vol. 6, pp. 1-96, pls. 251-300, 1929-32. Vol. 7, pp. 1-79, pls. 301-345, 1933-37. Published by the auther, Tokyo.
- (12) ———. 1931. On the marine algae from Kotosho (Botel Tobago). Biogeog. Soc. Japan, Bul. 2 (2): 95-122.
- (13) ———. 1932. The distribution of marine algae in Pacific waters. Records of Oceansographic Works in Japan, 4 (4): 30-150.
- (14) ———. 1936. Nippon Kaiso Shi, 964 pp. 427 figs. Uchidarokakuho, Tokyo.
- (15) SEGAWA, S. 1956. Colored illustrations of the Seaweeds of Japan, 175 pp. 72. Pls. Hoikusha, Osaka.
- (16) TANAKA, T. 1936. The genus Galaxaura from Japan. Hokkaido Univ., Inst. Algol. Res., Sci. Papers 1 (2): 141-173, 12 pls.
- (17) ———. 1941. The genus Hypnea in Japan. Hokkaido Univ., Inst. Algol. Res., Sci. Papers 2 (2): 227-250, 2 pls.
- (18) TSENG, C. K. and LI, L. C. 1935. Some marine algae from Tsingtao and Chefoo, Shantung. Bull. of the Fan Memorial Inst. Biol. VI (4): 183-235, 2 maps, 7 figs.
- (19) TSENG, C. K. 1941. Studies on the Chaetangiaceae of China. Bull. of the Fan Memorial Inst. Biol. XI (2): 83-118, 13 figs. 3 pls.

- (20) YAMADA Y. 1932. Notes on *Laurencia* with special reference to the Japanese species. *Calif. Univ., Pubs., Bot.* 16 (7): 185-310, 30 pls.
- (21) ———. 1936. The species of *Euclima* from Ryukyu and Formosa. *Hokkaido Univ., Inst. Algol. Res., Sci. Papers* 1 (2): 119-134, pls. 21-29, figs. 1-12.
- (22) ———. 1944. A List of the Marine Algae from the Atoll of Ant. *Hokkaido Univ., Inst. Algol. Res., Sci. Papers* III (1): 31-45, pls. 6-7.
- (23) ———. 1950. A list of marine algae from Ryukyusho, Formosa. *Hokkaido Univ., Inst. Algol. Res., Sci. Papers* 3 (2): 173-194.
- (24) YAMADA, Y. and T. TANAKA. 1938. The marine algae from the island of Yonakuni. *Hokkaido Univ., Inst. Algol. Res., Sci. Papers* 2 (1): 53-86.
- (25) YENDO K. 1905. A revised list of *Corallinae*. *Tokyo Imp. Univ., Col. Sci., Jour* 20 (12): 1-46.
- (26) ———. 1915. Notes on Algae New to Japan III. *Bot. Mag. Tokyo* 29: 99-117.
- (27) ———. 1920. *Novae Algae Japoniae*. *Decas* I-III. *Bot. Mag. Tokyo* 34: 1-12.