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The Japanese Species of Protofloridae

By

TAKESI TANAKA

For some years the writer has been studying systematically the Japanese species of Protofloridae (Bangiales) under the direction of Prof. Y. YAMADA in the Botanical Institute, Faculty of Science, Hokkaido Imperial University. In the present paper ten species of Protofloridae from the Japanese coast are enumerated, of which five species have not been previously reported from Japanese waters, and four species and one forma are new to science.

Here the writer wishes to express his best thanks to Prof. Y. YAMADA for his kind guidance during the course of the present study. The expenses incurred in collecting the material used for the present study was covered by a grant from the Japan Society for the Promotion of Scientific Research, and by a subsidy from the Department of Education, for which the writer expresses here his sincere thanks.

Asterocytis ornata (C. AGARDH) HAMEL

Text-figs. 1-2.

Floridées de France, II (Revue Algolog., Tome 1, 1924) p. 451, figs. b-d; BOERGENSEN, Mar. Alg. Canary Islands, Rhodophyc., III (1927) p. 11; Mar. Alg. Iranian Gulf (1939) p. 102; FELDMANN, Alg. Mar. de la Côtes des Albères (1939) p. 257, fig. 4; LEVRING, Stud. u. Algenveg. von Blekinge, Suedschweden (1940) p. 71.

Conferva ornata C. AGARDH, Syst. Alg. (1824) p. 104.

Hormospora ramosa THWAITES in HARVEY's Phyc. Brit., pl. 213.

Goniotrichum ramosa (THWAITES) HAUCK, Meeresalg. (1885) p. 519.

Goniotrichum caeruleascens ZANARDINI, Icon. Phyc. Adr., III (1871) p. 67, Tab. 96, B.

Callonema smaragdinum REINSCH, Rech., p. 41.

Asterocytis ramosa (THWAITES) GOBI in Arbeiten St. Petersburg. Naturf. Gesellsch., Bd. X (1877) p. 85; SCHMITZ, in ENGLER u. PRANTL's natur. Pflanzenfam., Teil 1, Abteil. 2 (1897) p. 314; WILLE, Algolog. Notizen, I-IV (1900) p. 7, Taf. I, Figs. 8-14; DE TONI, Syll. Alg., V (1907) p. 690; ROSENVINGE, Mar. Alg. Denmark, pt. 1 (1909) p. 77, fig. 17; BOERGENSEN,

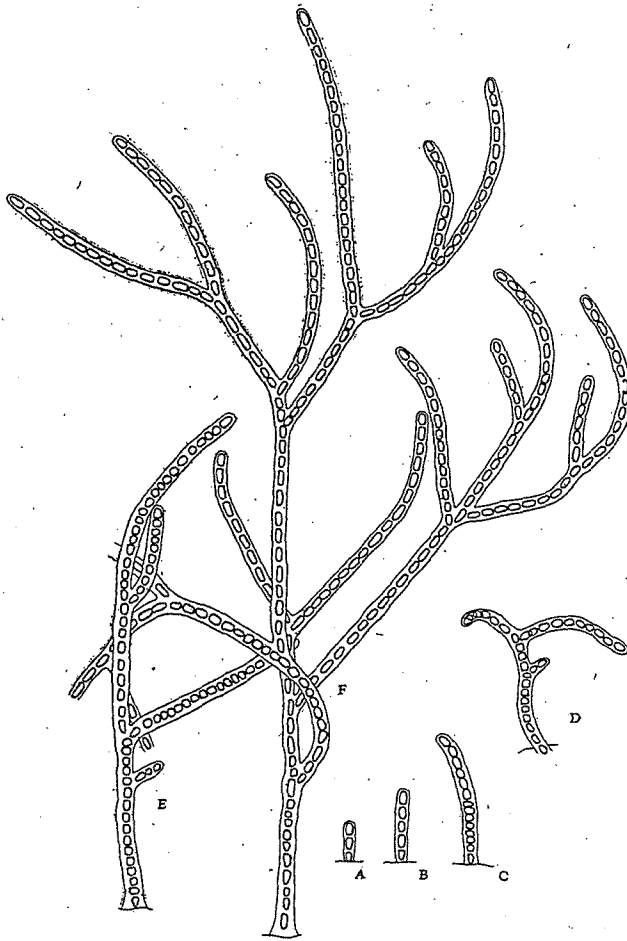


Fig. 1. *Asterocytis ornata* (C. AGARDH) HAMEL.

A-F. Various stages of the plants. $\times 135$.

Mar. Alg. Danish West Indies, Rhodophyc. II (1916) p. 3, fig. 1; HOWE, in BRITTON and MILLSPAUGH's Bahama Flora (1920) p. 554; TAYLOR, Mar. Alg. Florida (1928) p. 132, pl. 20, figs. 1-2, Mar. alg. Northeastern North Amer. (1937) p. 214; LAKOWITZ, Algenf. gesamt. Ostsee (1929) p. 301, fig. 41; NEWTON, Handbook British Seaweeds (1931) p. 247, fig. 151; LEVING, Zur Kennt. Algenf. norwegisch. Westküste (1937) p. 78; SINOVA, Les Alg. de la mer Japan (1940) p. 45.

Japanese name. *Tamatunagi*.

Hab. Palau, Caroline Islands; Kasyōtō, Bōkotō, Formosa; Miyako.

zima, Ryūkyū; Ozika, Gotō Islands; Hinomisaki, Izumo Prov.; Osima, Etizen Prov.; Wagu, Sima Prov.

Distrib. Mediterranean Sea; Atlantic Ocean; Sweden; Iranian Sea; Florida; West Indies; Japan Sea.

This species is always epiphytic upon other algae e.g. on *Sphaecelaria*, *Dasya*, *Champia parvula*, *Digenea simplex*, *Hypnea charoides* and many others. The plant attains a length of at least 1.5 mm. The filaments are below up to 18μ thick, above they become gradually thinner and are at the summit 12μ thick. The frond is subdichotomously much branched and the mode of rami-

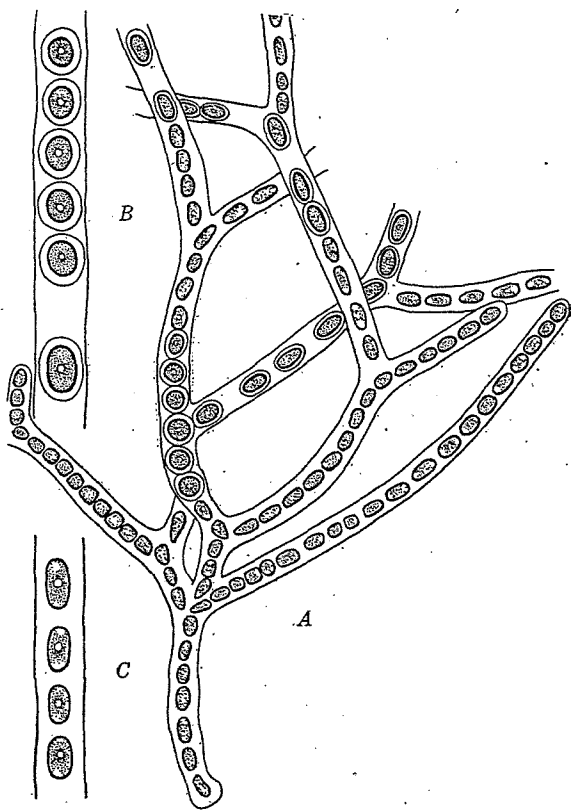


Fig. 2. *Asterocytis ornata* (C. AGARDH) HAMEL.

A. Plant bearing akinetes. $\times 220$. B. Part of a filament with akinetes. $\times 425$. C. Part of a filament. $\times 355$.

fication reminds one of the so-called false branching of *Goniotrichum Alsiedii* (ZANARD.) HOWE. The cells are usually oblong or ellipsoidal, often $1\frac{1}{2}$ times as long as broad, sometimes shorter, nearly globular; they are about $10-18\mu$ broad and $8-20\mu$ long. The chromatophore, as is well known, is star-shaped with a central pyrenoid. The akinetes escape through a hole in the membrane of the filaments. They are often oblong, sometimes also globular or ellipsoidal, measuring $10-13\mu$ in transverse diameter, up to 18μ in length, and have very dense granular contents. The membrane of the akinetes is very thick, about $2-3\mu$. The colour of the frond is blue-green. The specimens with akinetes were collected in the month of August, 1942, at Osima, Etizen Prov. by Mr. Y. NAKAMURA.

In general appearance, *Asterocytis ornata* seems to show some resem-

blance to *Goniotrichum Alsiedii* (ZANARD.) HOWE, but the former differs from the latter in the following points: The present species seems to grow, as a rule, in brackish water, as already noted by several authors, while *Goniotrichum Alsiedii* in water of higher salinity. Furthermore, *Asterocytis ornata* differs from *Goniotrichum Alsiedii* on account of blue-green colour; in the presence of akinetes.

f. **simplex** (LAKOWITZ) HAMEL

Text-fig. 3.

Floridées de France, II (Revue Algolog., Tome 1, 1924) p. 452, Fig. VI, E.

Asterocytis ramosa (THWAITES) GOBI f. *simplex* (LAKOWITZ) ROSENVINGE, in Mar. Alg. Denmark, I (1909) p. 77; LAKOWITZ, Algenf. gesamt. Ostsee (1929) p. 302, fig. 411.

Goniotrichum simplex LAKOWITZ, Algenf. Danziger Bucht (1907) p. 80; DE TONI, Syll. Alg., VI (1924) p. 23.

Japanese name. *Ito-tamatunagi*.

Hab. Bōkotō, Formosa; Makurazaki, Satuma Prov.

Distrib. Denmark; Baltic Sea; Mediterranean Sea.

The present form has been observed upon *Sphacelaria* and *Hypnea charoides* growing on *Sargassum* sp. The filaments are as a rule unbranched and reach a length of about 720μ and a breadth of about $7-9\mu$. The cells of the filaments are usually about as long as broad or somewhat longer. The walls of the cells are rather thick, about $1.5-2\mu$. The colour of the frond is light blue-green.

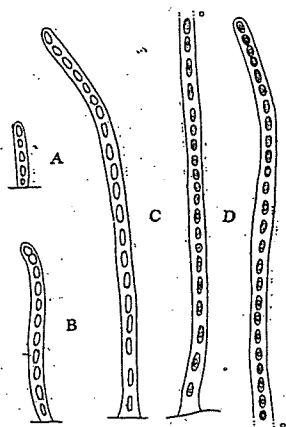


Fig. 3. *Asterocytis ornata* (C. AGARDH) HAMEL
f. *simplex* (LAKOWITZ) HAMEL
A-D. Habit of the plants.
× 200.

***Goniotrichum Humphreyi* COLLINS**

Text-figs. 4-5.

in Phyc. Bor. Amer., no. 421 (1898) Exsicc., Alg. of Jamaica (1901) p. 251, Alg. of Bermuda (1917) p. 95.

Bangiopsis subsimplex (non SCHMITZ) BOERGESEN, Mar. Alg. Danish West Indies, Rhodophyc. III (1915) p. 10, figs. 5-6.

Japanese name. *Nise-usikenori*.

Hab. Satoura, Awa Prov.

Distrib. West Indies; Florida.

The plant was found on rocks forming small tufts. The base of the

frond consists of an enlargement of the lowermost end of the basal cell (often few cells), forming a small disc. The thallus reaches a length of 1.5 mm and a thickness of about 70μ at the thickest portion. When young the frond is filamentous being composed of a single row of cells. The cells of the monosiphonous portion are disc-shaped, their length being much shorter than breadth. In the somewhat older filaments the cells now and then begin to be divided by irregularly longitudinal or more or less oblique walls. The division of the cells is rather irregular. The filaments are, as a rule, unbranched, but now and then short branches are given off from the thicker part. These branches are commonly short, proliferation-like, consisting of a single or a few row of cells.

The cells of the filaments are irregular, rounded polygonal or hemispherical in shape, about $6-10\mu$ in diameter. These are irregularly arranged and often two or three are gathered. Among them crescent-shaped cells are often observed. A transverse section of the frond (Fig. 5, B) shows that the cells are arranged somewhat near the peripheral part. The cells contain a star-shaped chromatophore with a central pyrenoid. The colour of the frond is somewhat darkish purple or purplish red. This alga was collected only once by Mr. Y. UZIKE from Satoura, Awa Prov., in August, 1941, in the littoral zone. Unfortunately the writer has not seen yet any reproductive organ.

Goniotrichum Humphreyi COLLINS has been established by COLLINS in Phyc. Bor. Amer., no. 421 (1898) Exsicc., in which he gives figures and describes it. Later this species was reported from Florida by the same author (1917). In 1915, BOERGENSEN reported a species from St. Croix, West Indies nearly related to *G. Humphreyi* under the name of *Bangiopsis subsimplex* (MONT.) SCHMITZ. The material at hand agrees well with the

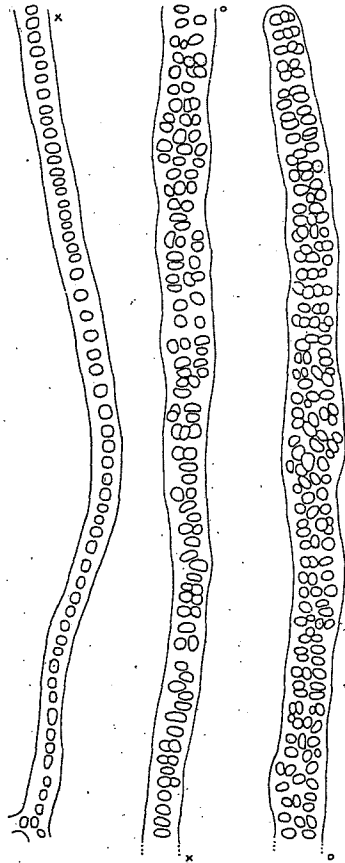


Fig. 4. *Goniotrichum Humphreyi*
COLLINS. $\times 230$.

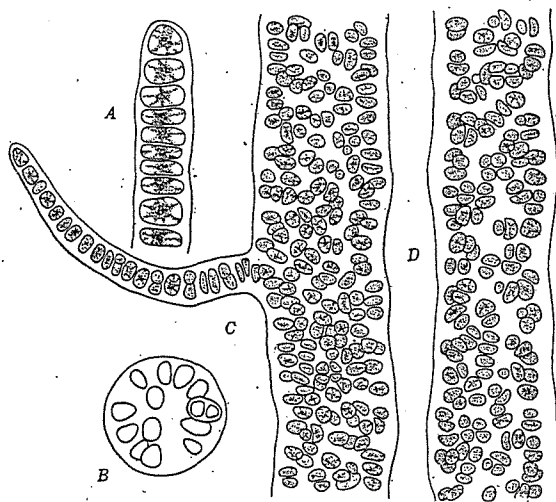


Fig. 5. *Goniotrichum Humphreyi* COLLINS. A. Apex of a filament composed of a single row of cells. $\times 650$. B. Transverse section of a filament. $\times 460$. C. Part of a ramified filament. $\times 460$. D. Thick part of a filament. $\times 460$.

specimens of *G. Humphreyi* in Phyc. Bor. Amer., no: 421, determined and distributed by COLLINS, and also agrees well with the description and figures of *Bangiopsis subsimplex* from Danish West Indies, given by BOERGESEN. The arrangement of the cells as well as the shape and size of our specimens are; however, slightly different from those of Jamaican specimens. In the Jamaican plant the cell arrangement of the filaments is not so dense as that of our plants.

***Bangia Yamadai* spec. nov.**

Text-figs. 6-7.

Frons minuta, caespitosa, ad 1.5-2 cm alta, dioica, inferne rhizoideis numerosis producta; filamentis cylindraceis, erectis, simplicibus vel raro longitudinaliter divis, 15-26 μ crassis, in parte basali et superiore fere 12 μ crassis, cellulis fere quadratis, diametro aequilongis aut paulum brevioribus, raro 1½-2 plo longioribus, parte gelatinoso ca. 5-7 μ crassis; chromatophoris stelliformibus, pyrenoidibus singularibus; antheridiis e cellularum vegetativarum divis, plus minus constrictis, ca. 30 μ crassis, luteolis, spermatiis irregulariter quaternis quadrigeminatis; sporocarpis e transformatione immediata cellularum vegetativarum formantibus, constrictis, ca. 30-48 μ crassis, rubripurpureo, in 8 vel 16 carposporas divis. Colore roseo-purpureo.

Japanese name. *Hime-usikenori*.

Hab. Bōkotō, Formosa.

Frond very small, caespitose, 1.5-2 cm high, attached to the substratum by means of intramatrical rhizoids springing from the lower parts of the filaments; filaments cylindrical, erect, simple, almost uniseriate, but rarely pluriseriate, 15-26 μ diam., gradually decreasing to about 12 μ at the upper ends; cells mostly quadrate, usually as long as broad or somewhat shorter,

rarely $1\frac{1}{2}$ –2 times as long, containing stellate chromatophore and a central pyrenoid within it; cell wall very thick, about $5\text{--}7\mu$ thick, especially thickened in the lower parts of the filaments; species dioecious; antheridia formed from vegetative cells by repeated division, about 30μ thick, more or less constricted, yellowish red, antherozoids irregularly arranged in four tiers of four each; carpogonia formed by the immediate transformation of vegetative cells, constricted, $30\text{--}48\mu$ thick, darkish purple, cystocarps of about 8–16 carpospores; colour of the frond purplish red.

The present species was found growing on rocks, forming more or less small tufts. The plant is at first a filament consisting of a single row of cells, and fixed at the base by rhizines which grow downwards from the lower cells in the common outer wall. But later some cells of the filaments divided into two or rarely four cells by longitudinal divisions. This plant was collected by Prof. Y. YAMADA in the month of March, 1941, and in a fructifying condition.

The new species is most closely related to *Bangia tenuis* GARDNER,

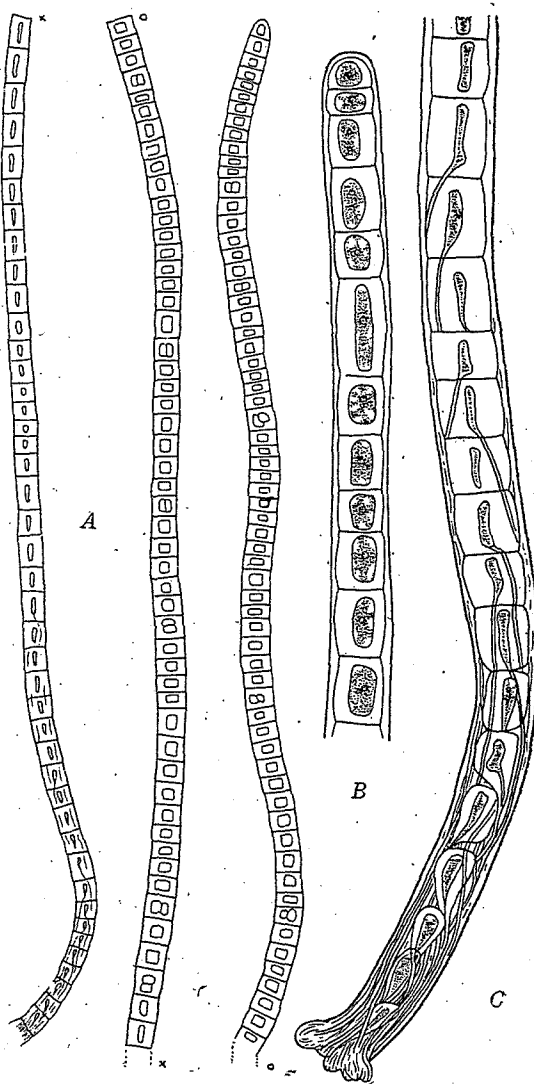


Fig. 6. *Bangia Yamadai* TANAKA.

A. Habit of a plant. $\times 145$.

B. Apex of a filament. $\times 425$.

C. Base of a filament. $\times 425$.

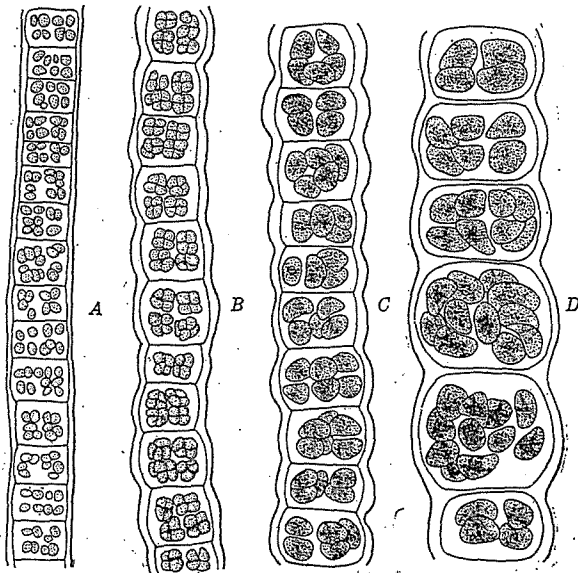


Fig. 7. *Bangia Yamadai* TANAKA. A. A part of male filament. $\times 500$. B. A part of mature male filament. $\times 500$. C. A part of female filament. $\times 500$. D. A part of mature female filament. $\times 500$.

but the former is a little larger and thicker than the latter. Furthermore, the substratum of the plant of *B. Yamadai* differs from that of *B. tenuis* GARDN. The species, also, resembles somewhat *B. compacta* ZANARD., but it differs from the latter in size and shape of the cells.

**Erythrotrichia
biseriata spec. nov.**

Text-fig. 8.

Frons epiphytica, minuta ad 1 mm alta; cellula basali singula lineali-elongata et gra-

cilenta, diametro ca. 8μ crassa et ca. 25μ longa, acuta, in cortice hospitis penetraliter immersa; filamentis suberectis, diam. $10-27\mu$, cellulis numerosis, 15-60 articulatis, uniseriatis, in parte superiore saepe biseriatis; cellulis diametro paullum brevioribus aut fere equilongibus, plerumque in sectione optica quadrato-orbicularibus, $10-22 \times 8-15\mu$, pariete crassiusculo et gelatinoso, $3-4\mu$ crasso, chromatophorum parietali-stellare, pyrenoide centrali instructum continentibus; monosporangiis ovatis, $6-8 \times 5-7\mu$ diam., in parte superiore filamentorum evolutis. Colore roseo-purpureo.

Japanese name. *Hime-ribon*.

Hab. Hatidyō Island (Herb. Biol. Labor., Imp. Palace, Tokyo, no. 1829(c)); Kasyōtō, Formosa.

Frond epiphytic, minute, usually up to 1 mm in length; lower most, basal cell usually linear-elongata and slender, different from the other cells, about 8μ in diam., and about 25μ long, acute at the apex, penetrating vertically through the cortical cells of the host plant; filaments suberect, $10-27\mu$ in diam., composed of 15-60 cells in a series, monosiphonous when young and throughout life in lower part, but often gradually becoming bisiphonous by longitudinal division in upper parts; cells usually slightly

shorter than broad, rarely as long as broad, mostly quadrate with rounded angles, $10-22 \times 8-15\mu$; cell wall about $3-4\mu$ thick, gelatinous especially in bisiphonous portions; chromatophore laminate star-shaped with a large central pyrenoid; spore-mother cells crescent-shaped; monosporangia ovate, $6-8 \times 5-7\mu$, in upper part of the frond. Colour purplish red.

The present species was found upon *Endarachne Binghamiae* J. Ag. and *Chnoospora pacifica* J. Ag. The lower most cell of the filament is slender and has very thin wall. At first, the filaments consist of a single row of cells. The cells of the upper part of the filaments are divided by longitudinal walls into two cells. The broadest portion of the filament attains about 27μ in breadth.

The erect filaments of the present species have a close affinity to *Erythrotrichia investiens* (ZANARD.) BORNET, but the basal structure of this species shows a great difference. In *E. investiens* it is described that the basal part of the frond is always disc-shaped. One of the specimen of *E. investiens* (viz. synonymium of

E. tetraseriata GARDNER) in Phyc. Bor. Amer., no. 782, Exsicc. was examined. The arrangement of the cells as well as the size of our specimens are slightly different from those of *E. tetraseriata* GARDNER.

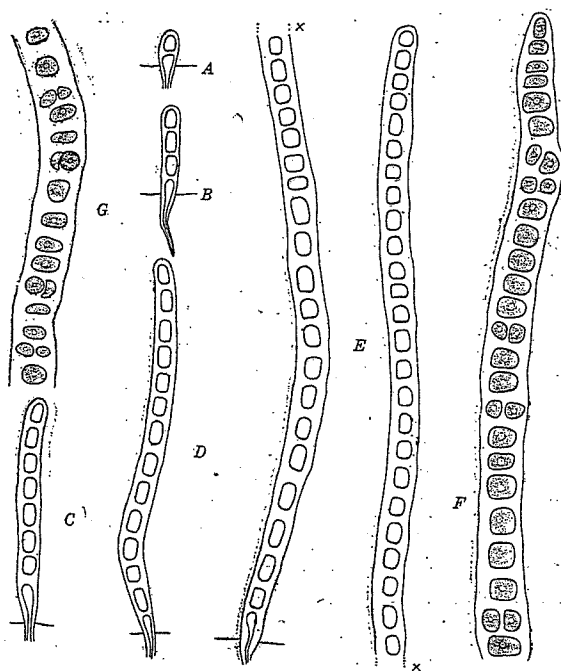


Fig. 8. *Erythrotrichia biseriata* TANAKA. A-E. Various stages of the plants. $\times 460$. F. Upper part of a filament. $\times 460$. G. Part of a filament with monosporangia. $\times 460$.

Erythrotrichia reflexa (CROUAN) THURET

Text-figs. 9-10.

Hamel, Floridées de France (Revue Algolog., vol. 1, 1924) p. 288, fig. 1, 4; ROSENVIINGE, Mar. Alg. Denmark, pt. 1 (1931) p. 613, figs. 611-613; DANGEARD, Sur. quel. *Erythrotrichia* et *Erythrocladia* (1932) p. 146,

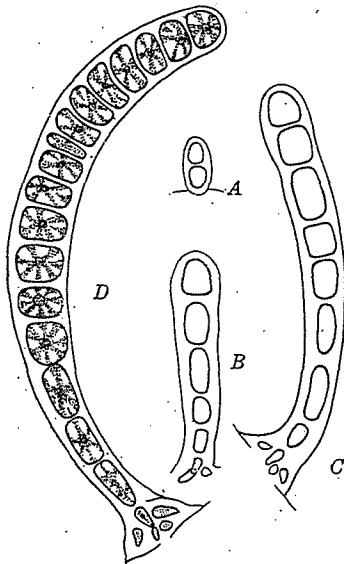


Fig. 9. *Erythrotrichia reflexa*
(CROUAN) HAMEL.

A-D. Young plants. $\times 385$.

- fig. 2; LEVRING, Zur kennt. Algenf. Norwegischen Westküste (1937) p. 79; FELDMANN, Alg. Mar. de la Côtes des Alberès, Rhodophyc. IV (Revue Algolog., vol. XI, 1939) p. 251.

Bangia reflexa CROUAN, Alg. Mar. Finistère, III (1852) n. 394; HAUCK, Meeresalg. Deutsch. u. Oester. (1884) p. 22.

Porphyra reflexa CROUAN, Florule du Finistère (1867) p. 132, pl. 10, fig. 73.

Japanese name. *Yumigata-hosino-obi*.

Hab. Oshoro, Muroran, Suttu, Hokkaido; Asamusi, Fukaura, Mutu Prov.

Distrib. Norway; Denmark; Mediterranean Sea.

The Japanese plants which the writer has referred to *Erythrotrichia reflexa* seem to accord well with the description and figures of ROSENVINGE (l. c.). The

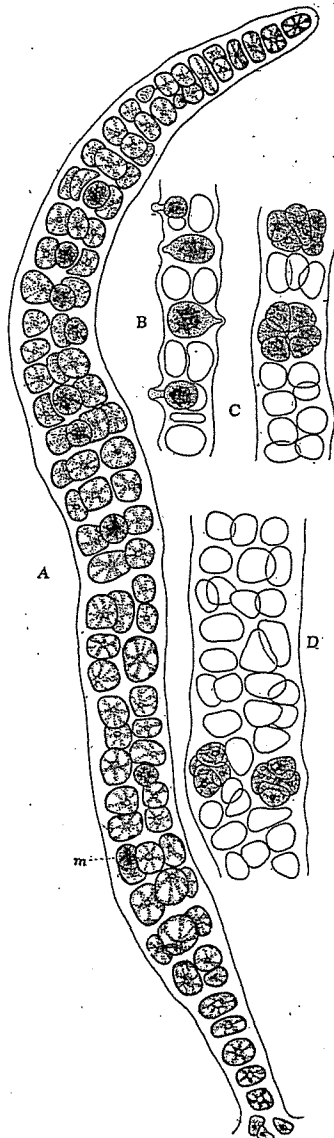


Fig. 10. *Erythrotrichia reflexa*
(CROUAN) HAMEL. A. Mature plant with monosporangia. m. Monosporangium. $\times 255$. B. A part of a female filament with fertilization tubes. $\times 255$. C-D. A part of female filament with cystocarps (?). $\times 255$.

frond was found solitary or 2-3 aggregate upon *Sphacelaria* growing on *Sargassum* sp. or *Rhodomela Larix*, associated with *Goniotrichum Alsiedii* (ZANARD.) HOWE. It is fastened to the substratum by means of the basal cell which forms an irregularly conical disc often with ramified rhizines radiating from it. The filaments reach a length of up to 3 mm, but are usually shorter. At first the filaments are monosiphonous, becoming gradually quadrasiphonous eventually in the middle portion by two successive longitudinal cell divisions. They are often somewhat curved and gradually attenuate at both ends. The lower part of single row of cells shows thickness of $18-30\mu$, and the middle polysiphonous part of the frond a thickness of $46-60\mu$, where the frond has 4 cells at the same level. Near the top the filaments again taper, very often about 24μ thick. The cells of the filaments are usually quadrate with rounded angles in shape, about $12-20\mu$ in diameter. The cells contain a star-shaped chromatophore with a central pyrenoid and long, simple or dichotomously branched arms bent along the vaulted outside of the cell. The monosporangia are cut off by longitudinal or somewhat oblique walls from cells at the polysiphonous portion of the frond. The monospores are spherical or ovate in shape; about 15μ in diameter. They are a little smaller than the vegetative cells, and are easily recognizable by their dense contents. The carpogonia often produce a hyaline protuberance on the surface of the frond. The fertilized carpogonia divide a few carpospores (?). The frond is purplish red in colour.

***Erythrotrichia incrassata* spec. nov.**

Text-figs. 11-12.

Frons epiphytica, caespitosa, suberecta, ca. 5 mm alta, e disco basali et fila erecta sporangifera composita; pars basalis e filis repentibus irregulariter ramosa, in parte centrali sensim confluentibus; frondibus erectis simplicibus, superne sensim taeniiformibus et plus minus incrassatis, $75-150\mu$ latis et $20-35\mu$ crassis, bistromaticis vel monostromaticis, a facie visis in serie 6-8 dispositis; cellulis diametro equilongis aut paulum brevioribus aut longioribus, $15-27 \times 12-20\mu$, plerumque in sectione optica quadrato-orbicularibus, chromatophorum parietali-stellare, pyrenoide centrali instructum continentibus; monosporangiis ovatis, diametro $8-12\mu$, in frondibus erectis evolutis. Colore roseo-purpureo.

Japanese name. *Isoribon*.

Hab. Suttu, Hokkaido.

Frond epiphytic, caespitose, mostly about 5 mm high, attached to the substratum by somewhat expanded basal filaments; basal creeping filaments

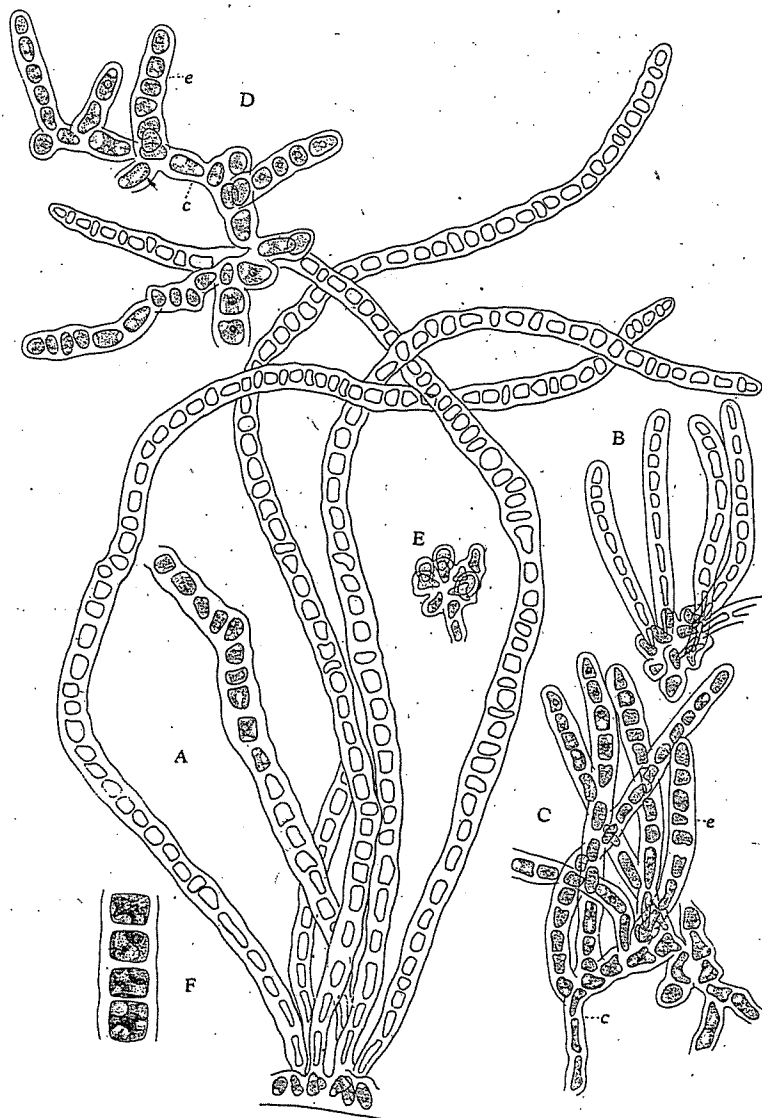


Fig. 11. *Erythrotrichia incrassata* TANAKA.

A-D. Young plants. e. Erect filaments. c. Creeping filaments. $\times 180$.
 E. Small basal filament bearing the first cells of the erect filaments.
 $\times 180$. F. Chromatophores. $\times 450$.

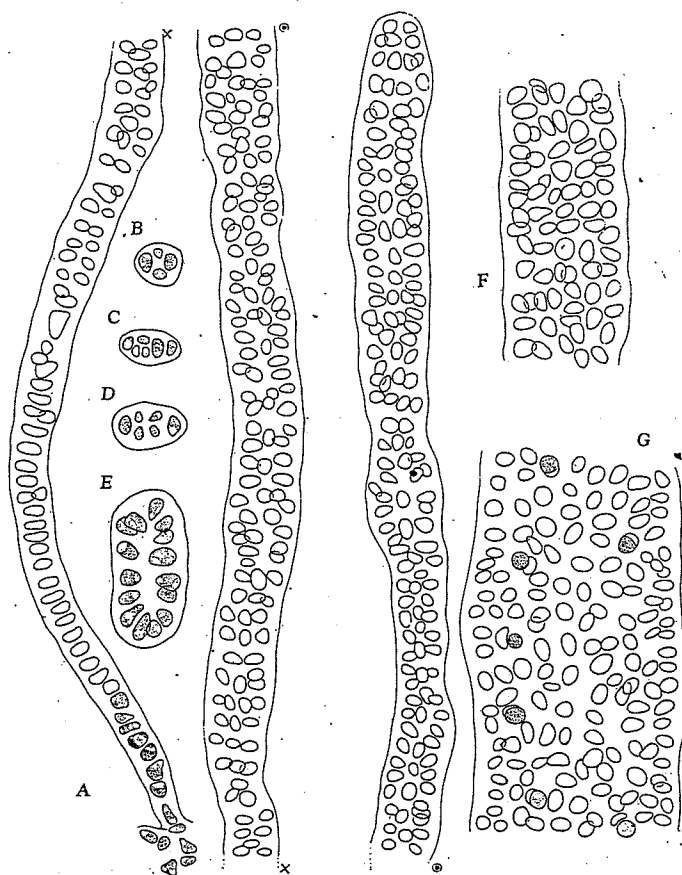


Fig. 12. *Erythrotrichia incrassata* TANAKA.

A. Habit of the plant. $\times 190$. B-E. Transverse sections of the frond. $\times 190$.
 F. Portion of the erect frond. $\times 190$. G. Portion of the erect filament,
 showing monosporangia. $\times 190$.

irregularly ramified and more or less fused together into a basal parenchymatic disc, basal disc unistratose; cells of the basal disc usually subquadrate in $12-25\mu$ diam.; erect filaments monosiphonous when young and throughout life in the lower parts, soon becoming polysiphonous above by longitudinal or vertical division of the cells, remaining ribbon-shaped and increasing in width up to 6-8 μ cells towards the apices, and remaining often two layers of cells; ribbon-shaped regions of the frond attain a width of $75-150\mu$, and a thickness of $20-35\mu$; cells of the erect filaments mostly

quadrate with rounded angles, $15-27 \times 12-20\mu$, but at times slightly longer or shorter than the diameter, arranged more or less irregularly in longitudinal and cross rows; cell wall very thick, about $4-6\mu$ thick; chromatophore laminate star-shaped, nearly filling the cell, with a central pyrenoid; spore mother cells often crescent-shaped; monosporangia ovate, $8-12\mu$ in diam., on the erect filaments of the frond. Colour of the frond purplish red.

This new species was found upon *Grateloupia filicina* (WULF.) AG. and *Sargassum* sp. associated with *Rhodochorton* sp. The primary basal filaments were monosiphonous, but soon ramified radiating in all directions in longitudinal plane, and the filaments were then fused together in the central part. Thus it forms an irregular disc. A great number of erect filaments are given off from the basal creeping filaments, from the central as well as from the peripheral part. At first the erect filaments are monosiphonous, then the breadth and thickness gradually increase upwards, longitudinal and transverse divisions beginning at the upper part of the filaments. In the broadest part the number of vertical septa in each joint of the upper part of the frond may be 8 in surface view. Fig. 13, B-E. show transverse sections of the erect filaments in different stages, almost two layers of cells. Among abundant materials at hand some ramified specimens were rarely observed. The specimens have monosporangia in the month of April.

In general appearance, the present species closely resembles *E. japonica* TOKIDA, but the development and building up the basal disc of this species is apparently different from those of *E. japonica*. In *E. japonica* the basal part of the thallus is a small suborbicular, and polystromatic disc. It has a continuous margin, showing a marginal growth and not a free end. But we are unable to find such habits in our plants as mentioned above. Furthermore, *E. incrassata* differs from *E. japonica* by its thicker thallus and its somewhat irregular arrangement of the cells. Through the kindness of Mr. J. TOKIDA the writer has been able to compare it with a co-type (formalin preserved specimen) specimen of *E. japonica* from Cape Inubō.

***Erythrotrichia carnea* (DILLWYN) J. AGARDH**

Text-fig. 13.

f. *tenuis* forma nov.

Frons erecta, ca. 1.5 mm alta, $9-12\mu$ lata; monosporangia globosa vel subglobosa, ca. 12μ diam.

Japanese name. *Hoso-hosinoito*.

Hab. Ponape, Caroline Islands; Garanbi, Formosa; Yonakuni Island;

Makurazaki, Satuma Prov.; Takamatu, Sanuki Prov.; Fukae, Gotō Islands; Hinomisaki, Izumo Prov.

The frond is attached to the substratum by means of a basal cell which gives off short branches. The filaments of this new forma attain a length of 1.5 mm and have a diameter of about $9-12\mu$. The cells are rather variable length, usually about as long as broad or somewhat longer. Fig. 14, A. shows a typical specimen of fertile frond of *E. carnea* J. Ag., and reaches a thickness of about 25μ . Each cell of the filaments contains a stellate chromatophore with narrow branches radiating in all directions, and with a central pyrenoid. The monosporangia are mostly spherical or subglobose in shape, about 12μ in diameter. The spore mother cell is cut off by an oblique or vertical wall at the upper end of a cell which is not different in form from the vegetative cells. The wall of the cells are rather thin, about 2μ thick. The colour of the frond is purplish red or

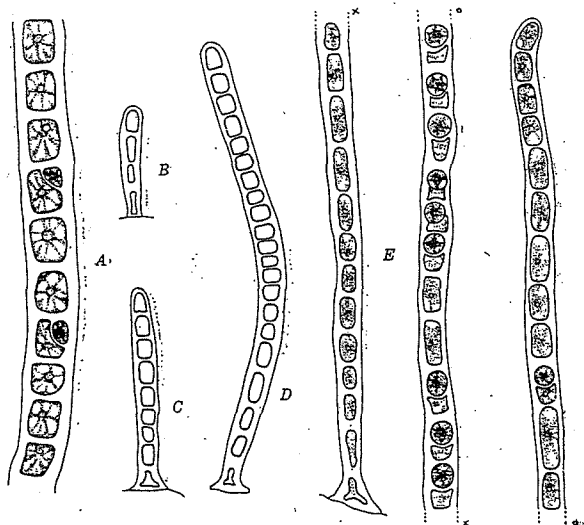


Fig. 13. A. *Erythrotrichia carnea* (DILLW.) J. Ag. Part of a filament with monosporangia. $\times 320$. B-E. *Erythrotrichia carnea* (DILLW.) J. Ag. f. *tenuis* TANAKA. B-D. Young plants. $\times 320$. E. Mature plant with monosporangia. $\times 320$.

pale greenish red. The plants were found growing on various other algae e.g. *Sphacelaria*, *Champia parvula*, *Lomentaria hakodatensis*, *Laurencia*, *Hypnea charoides* etc.

***Erythrocladia irregularis* ROSENVINGE**

Text-fig. 14.

Mar. Alg. Denmark, pt. 1 (1909) p. 72, figs. 11-12; DE TONI, Syll. Alg., VI (1924) p. 17; KYLIN, Mar. red Alg. in the vicinity Friday Harbor, Wash. (1925) p. 9, fig. 3, a-b.

Japanese name. *Toge-isohanabi*.

Hab. Yonakuni Island.

Distrib. Denmark; Atlantic Ocean.

This species has been found upon the branches of *Asparagopsis Sanfordiana* HARVEY associated with *Colaenema* (?) *furcata* TANAKA. It forms an irregular spot of up to 50–100 μ in diameter, and shows a free end at the marginal portions. The daughter cells of spores usually grow out in two opposite directions. The primary filaments give off branchlets at both sides (Fig. 15, B–C.). These branches show apical growth and grow out further, and in the more developed frond the filaments are therefore radiating in all directions in the horizontal plane, and the filaments are then more or less fused together in the central part of the frond. The branches usually arise in the subterminal cells, sometimes also in cells nearer

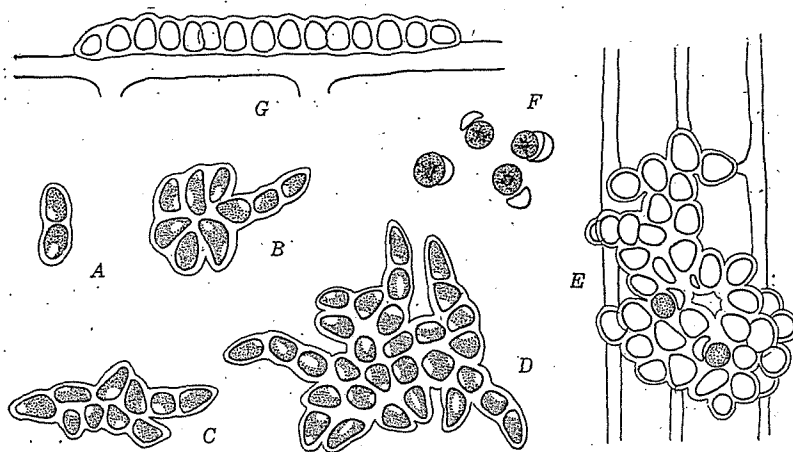


Fig. 14. *Erythrocladia irregularis* ROSENVINGE.

A–D. Young plants. $\times 790$. E. Mature plant with monosporangia, growing epiphytic on *Asparagopsis Sanfordiana* HARVEY. $\times 790$. F. Monosporangia. $\times 790$. G. Transverse section of the frond. $\times 790$.

the center of the frond. The cells are usually cylindrical or oblong, about 5–7 μ broad and 8–11 μ long, usually $1\frac{1}{2}$ –2 times as long as broad. No bifurcating cells in the marginal portion are met with. The chromatophores are parietal laminate, and seem to contain an obscure pyrenoid. The sporangia are, in a similar manner as in the genus *Erythrotrichia*, cut off in the ordinally vegetative cells through a faintly curved wall at the intercalary cells. The monosporangia are nearly globular or somewhat elliptical, about 4–6 μ in diam.; they have more granular contents than the vegetative cells. The colour of the frond is purplish red.

The material at hand agrees well with *Erythrocladia irregularis* ROSEN-

VINGE, in the description and figures given by ROSENVINGE, and also agrees well with the description and figure of this species, given by KYLIN.

***Colaçonema* (?) *furcata* spec. nov.**

Text-fig. 15.

Frons endophytica, roseopurpurea, filamentosa; filamentis uniseriatis, frequenter et irregulariter ramosis, anastomosantibus et tunc reticulatis inordinatis inter cellulas corticales plantae matricis efficientibus; cellulis oblongis, plus minus angulatis, saepe furcatis vel simplicibus, ca. 4μ latis; diametro 3-8 plo longioribus, chromatophorum parietale, pyrenoide centrali instructum continentibus; pilis hyalinis cylindraceis, ca. 3μ latis et ca. 10μ longis, cellulis 2-3 constitutis; monosporangiis globosis vel subglobosis, sessilibus, saepe simplicibus, ca. 6-8 μ diametro, lateralibus vel terminalibus in cellulas filamentorum ornatis.

Japanese name. *Yonakuni-mayudama*.

Hab. Yonakuni Island.

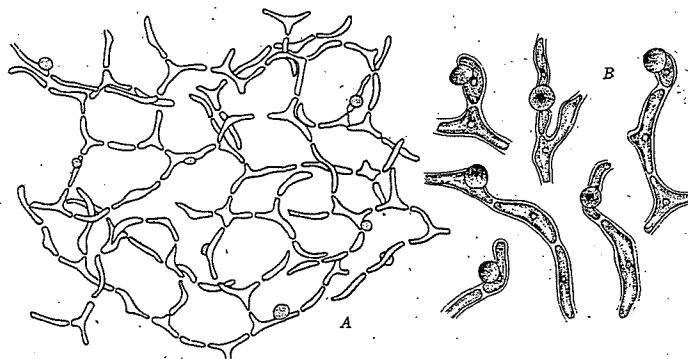


Fig. 15. *Colaçonema*(?) *furcata* TANAKA.

A. Filaments with monosporangia. $\times 320$.

B. Parts of the filaments with monosporangia. $\times 650$.

Frond endophytic, filamentous, forming more or less an irregular network between the cortical cells of the host plant; filaments consisting of a single row of cells, much and irregularly branched; side branches arising from the main filaments or branches nearly at right angles, alternate or opposite; hair-like, erect filaments arising from the endophytic filaments, 2 to mostly 3 cells in length, cylindrical, tapering towards the end, about 3μ in diam. and about 10μ long, almost colourless; cells variable in shape, generally oblong and slender, often furcate, more or less angular, about 4μ in diam., 3-8 times as long as broad; chromatophore parietal laminate with

a central pyrenoid; monosporangia globose or subglobose, sessile, often solitary, about $6-8\mu$ in diam., lateral or terminal on the cells of the filaments; colour of the frond purplish red.

This new species has been found among the cortical cells of *Asparagopsis Sanfordiana* HARVEY. The frond is much and irregularly branched, consisting of a single row of cells, anastomosing so as to form an irregular net-work. The cells of the frond are often forked and somewhat angular. The monosporangia are almost solitary and not aggregated, lateral or terminal on the short branches. The characteristic cup-like base of monosporangia of the genus *Colaconema* is not so distinct. The specimens the writer collected in the month of April are almost fertile.

Colaconema (?) *furcata* spec. nov. is most nearly related to *C. simplex* INAGAKI, but it differs from the latter by the size and shape of the cells. The cells of the filaments of *C. (?) furcata* are somewhat smaller and thinner as compared with those of *C. simplex*.

Genus *Colaconema* was established by BATTERS in 1896 (Journ. of Botany, vol. 34). It was later placed by BATTERS near to the genus *Acrochaetium* and one species of *Colaconema* was removed to *Acrochaetium*. In spite of the likeness of this genus to *Acrochaetium* in habit, it seems correct not to refer it to Nemalionales but to regard it as the representative of Bangiales, characterized in particular by the mode of formation of the monosporangia.

***Colaconema reticulatum* BATTERS**

Text-fig. 16.

Some new British Mar. Alg. (Journ. of Botany, vol. 34, 1896) p. 7, A catalog. British Mar. Alg. (Journ. of Botany, vol. 40, 1902) suppl. p. 57; DE TONI, Syll. Alg., VI (1924) p. 250; NEWTON, Handbook British Seaweeds (1931) p. 250.

Japanese name. *Ami-mayudama*.

Hab. Onagawa, Rikuzen Prov.

Distrib. England.

This species has been found in the membrane of the cortical cells of *Lomentaria hakodatensis* YENDO. The filaments are much and irregularly branched, anastomosing so as to form more or less a regular net-work among the cortical cells of the host plant. The cells are variable in shape, short and angular, about as long as broad or a little longer, $5-10\mu$ wide and $8-11\mu$ long, often somewhat curved at the middle part. The endophytic filaments often bearing hyaline hairs, which are free from the cortical layer of the host plant. The hairs reach a length of about 7μ and are about 2μ in

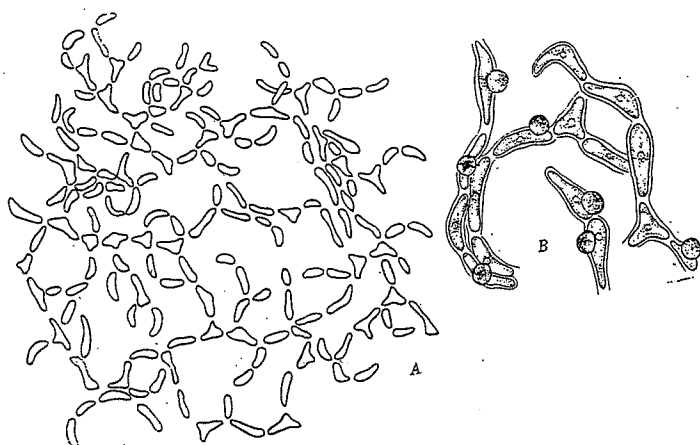


Fig. 16. *Colaconema reticulatum* BATTERS.

A. Habit of the plant. $\times 300$.

B. Fragments of the filaments with monosporangia. $\times 650$.

breadth, one or mostly two cells in length. The monosporangia are subglobose or hemispherical in shape, $6-8\mu$ long and $4-7\mu$ broad, lateral or terminal on the filaments. The cup-like base of the monosporangia is not so distinct. The colour of the frond is greenish red. The specimens with monosporangia were found in July.

The material at hand agrees well with *Colaconema reticulatum* BATTERS in the description given by Batters in 1896 (l. c.), although it shows small difference. According to BATTERS, the side branches often run very close to the primary filaments, it seems as if the thallus consists of double series of cells. But such a habit is scarcely to be seen in our plant. In our plant the shape and size of the cells are quite similar to those of *C. reticulatum* BATTERS in the description which was given by BATTERS.