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Phycological Observations IV

By

Jun TOKIDA

(時田　郁)

With 6 text-figures

Dermocarpa protea SETCHELL et GARDNER

in GARDNER, New Pacific Coast Marine Algae, III, 1918, p. 456, pl. 38, figs. 4, 5.

Syn. *Dermocarpa Farlowii* (non BÖRG.) YENDO, in litt.

Nom. Jap. *Kikka-awoko.* (n. n.)

Hab. Growing on *Myelophycus caespitosum* KJELLM. in the upper littoral belt. Enosima, Prov. Sagami (YENDO, Jan. 1903); Sirahama and Cape Inuboe, Prov. Bôsyû (TOKIDA, April 1930).

In 1930, the late Dr. K. OKAMURA[1] referred a marine blue-green alga epiphytic on *Myelophycus caespitosum* KJELLM. to *Oncobyrsa adriatica* HAUCK. His plant was collected at Enosima, Prov. Sagami. In the same year I was fortunate enough to collect *Myelophycus caespitosum* clothed with the same epiphyte at Sirahama near Kominato and Cape Inuboe, Prov. Bôsyû. Besides *Oncobyrsa adriatica* was also found on the same host a large number of the colonies of the species of Dermocarpa under consideration.

In 1902, in the description of *Dermocarpa Farlowii*, Dr. F. BÖRGESEN[2] touched on a Dermocarpa from Japan, which had reached him from FARLOW through BORNET. He stated that it agreed exactly with his Faeröese specimens of the species. As the habitat and locality of the Japanese specimen has not been mentioned at all, I wrote to him on the subject. He kindly answered my question giving detailed informations about two of the Japanese specimens of the alga in his possession. One of the two, he writes, is from K. YENDO and is labelled as "*Myelophycus caespitosus* with *Dermocarpa Farlowii* BÖRG. Jan. 1903, Yenoshima, Japan, leg. K. Y." The other one is a small mica preparation with a scratch which is read "On *Chordaria simplex*[3]. Tokyo." He has gained it from FARLOW, who gave a note about this specimen in his letter to BÖRGESEN as follows: "This is a rough preparation of the same specimen as that which I sent in my previous letter and which I supposed to be the same as that which I sent to BORNET several years ago." Comparing this mica preparation with the preparations of my plant sent to BÖRGESEN, he writes that "I was able to see

1. K. OKAMURA, Sôrui-Keitôgaku, 1930, p. 16, fig. 24, Nippon-Kaisôsi, 1936, p. 909, fig. 424.
2. F. BÖRGESEN, The Marine Algae of the Faeröes, 1902, p. 523, fig. 108.
3. *Chordaria simplex* HARVEY is *Myelophycus caespitosum* KJELLM.

(in the mica preparation) some Dermocarpa rather like your sections." Now it is nearly doubtless that I am treating here the same species as that which has been known to occur on our coast under the name *Dermocarpa Farlowii*.

Among species of Dermocarpa previously described, *D. protea* SETCH. et GARDN. is that with which our plant seems to be identical. *Dermocarpa protea* is mentioned by its authors to be the largest among the known species of Dermocarpa and to have the greatest range of variation in size and in shape of the cells. The mature cells are described to be 40–120 μ long, and 6–40 μ wide in the upper parts, while in my specimens they are 45–126 μ long, and 18–34 μ wide at the apices. The gonidia in my plant are 2.5–3.5 μ in diam. They are formed by successive and progressive divisions of the whole protoplast of the gonidangia. Excepting this species, *Dermocarpa Farlowii* is no doubt the only species to which we incline to refer our plant. However, the cells of *D. Farlowii* are somewhat shorter being 60–90 μ in length. BÖRGESEN himself writes me that he thinks it is a great question if really the Faeröese and Japanese plants are the same. He very kindly sent me two herbarium specimens of *D. Farlowii* epiphytic on *Polysiphonia fastigiata* (ROTH) GREV., one from Syderö Isl., Faeröes (leg. F. BÖRGESEN, Nr. 536), and the other from Nahant, Mass., U. S. A. (ex Herb. W. G. FARLOW).

Chordaria Nagaii sp. nov.

Figs. 1–4.

Fronds cylindrical, caespitose, unbranched, hollow throughout except the base, arising from a discoid holdfast, sometimes spirally twisted, smooth on the surface, tapering at the both ends, up to 63 cm. long, 2–4 mm. diam., color olive brown; peripheral filaments cylindrical, erect, simple, 60–129 μ long, 7.5–12 μ diam., composed of 5–7 cells in one row, gradually broadened above, slightly constricted at the partitions, apical and subapical cells often provided with a hyaline outside projection on the wall; unilocular sporangia clavate, 45–75 μ long, 6–13.5 μ wide, at times 2 to several sporangia arising successively on the same basal cell of a peripheral filament; plurilocular sporangia and hairs unknown.[1]

Chordaria sp. KAWABATA, A List of Marine Algae from the Island of Shi-

1. *Chordaria Nagaii* TOKIDA, sp. nov.—Fronde cylindracea, caespitosa, simplicissima, praeter basin tubulosa, radice exiguo discoideo affixa, nonnumquam spiraliter torta, utrinque attenuata, usque ad 63 cm. alta, 2–4 mm. lata, colore olivaceo-fusco; filis peripheric cylindraceis, erectis, simplicibus, 60–129 μ longis, 7.5–12 μ latis, cellulis 5–7 constitutis, superiore sensim dilatatis, parviter ad septa constrictis, cellulis apicalibus et subapicalibus saepe projectis hyalinis ornatis; sporangiis unilocularis clavatis, 45–75 μ longis, 6–13.5 μ crassis, in segmentis basalibus filorum peripheric orum evolutis; pilis ignotis.

kotan. Sc. Pap. of the Inst. of Algol. Res., Vol. 1, No. 2, 1936, p. 203, No. 20.

Chordaria sp. TOKIDA, in "Kenkyû-Syôroku" of the Hattori-Hôkôkai, 2, 1936, p. 250, No. 18.

Nom. Jap. *Nise-turumo.* (n. n.).

Hab. Growing on stones and pebbles in the sublittoral belt. Saghalien: Sôni (TOKIDA, Aug. 1927), Minami-Siranusi (TOKIDA, Aug. 1935), Cape Nisi-Notoro (TOKIDA, July 1932), Tikadomari (July 19... Herb. Karafuto Tyûô Sikenjo), Tiriye (TOKIDA, July 1930), Robben Island (TOKIDA, July 1932, July 1935), and Yôman (TOKIDA, July 1935); Kuriles: Syakotan, Sikotan Island (NAGAI, July 1934), Tiboi and Syakotan, Sikotan Island (KAWABATA).

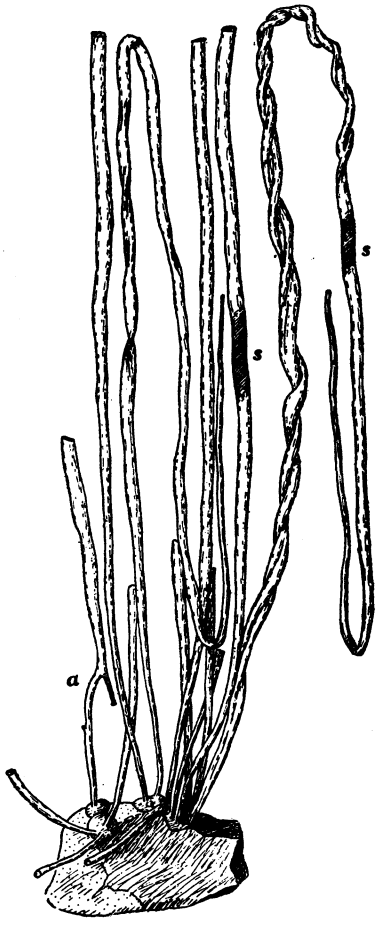

Fig. 1. *Chordaria Nagaii* TOKIDA. Habit sketch of tufts of sterile fronds, attached to a stone (from Yôman). *s.* Sinistral striations on the frond surface, somewhat exaggeratively shown; *a.* A frond abnormally divided near the base. × ca. 2/3.

In outer appearance this alga is readily taken for a tender form of *Chorda Filum* (L.) LAMOUR. Even the inner structure, when sterile, bears some resemblance to that of the latter species. However, it differs from that widely distributed species in lacking both hairs and unicellular paraphyses, and in having much shortened median cells and somewhat broader medullary hyphae in much less abundance never united to form a diaphragm.

The holdfast of our plant is almost entirely pseudoparenchymatous, adhering to the substratum by means of rhizoidal filaments arising from the under surface, while that of *Chorda Filum* is mostly composed of rhizoids arised from the surface layer of the conical base of of the frond axis. (Fig. 1).

The internal structure of the frond is composed of three sets of tissues. The medullary tissue consists of a few vertical rows of hyphal cells. The hyphal cells are sometimes slightly enlarged at ends, especially in the upper portion of a sterile frond, taking the appearance of the trumpet hyphae of Laminariaceous plants. (Fig. 2).

The median tissue is pseudoparenchymatous, nearly ten cell-layered in mature frond,

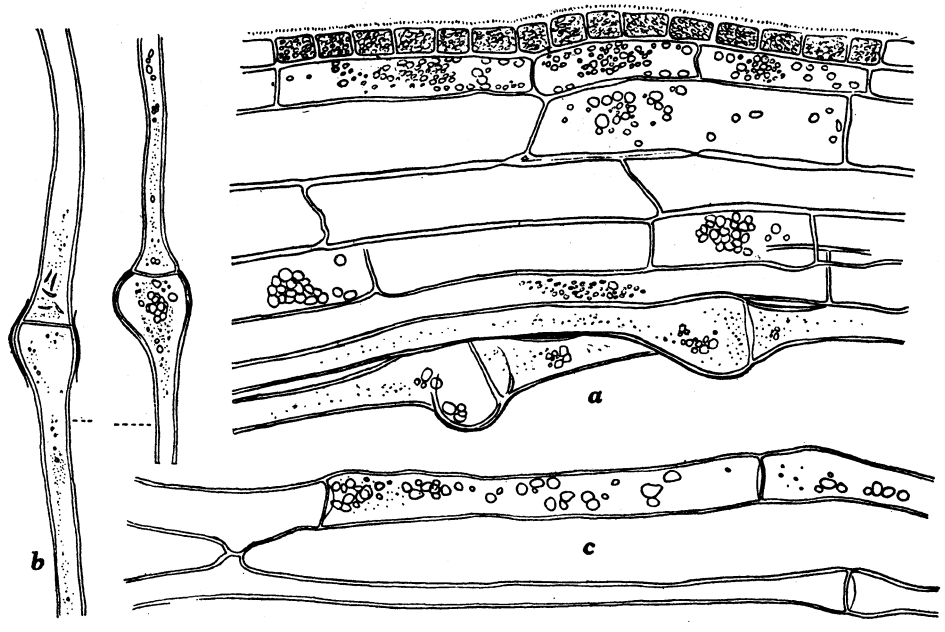

Fig. 2. *Chordaria Nagaii* TOKIDA. *a.* Longitudinal section of the subapical portion of a sterile frond; *b.* Hyphal cells from the subapical portion of a frond; *c.* Hyphal cells from the middle portion of a frond. × 345.

composed of thick-walled, large, somewhat vertically elongated cells, with scattered phaeoplasts. In a vertical section the cells are rectangular, in middle portions of the frond 2–5 times, in apical portions 3–8 times, as long as the diameter. On the wall of the cells small roundish pits are scattered. The pits become quite distinct when the frond is matured accompanied with the remarkable thickening of cell-walls. (Fig. 3).

The outermost tissue of a sterile frond is, in upper portions, usually a single layer of small cells. In middle and lower portions it becomes to be composed of anticlinal rows of several small cells. (Fig. 3). Later on, as the frond become fertile, these peripheral cell-rows take part in the formation of the peripheral filaments, of which a full description is given below.

On the surface of the frond we can often detect spiral striations, neverthless not so marked ones as in *Chorda Filum*. (Fig. 1). The striations are no doubt due to, and accord with, the spiral arrangement of the cells; they are sinistral in our species as in *Chorda adriatica* KÜTZ. (Phyc. gen., Taf. 28, fig. 1), but dextral in *Chorda Filum* (cf. KÜTZING, l. c., Taf. 29, fig. 2).

The frond is not lubricous while sterile. Fertile specimens are lubricous,

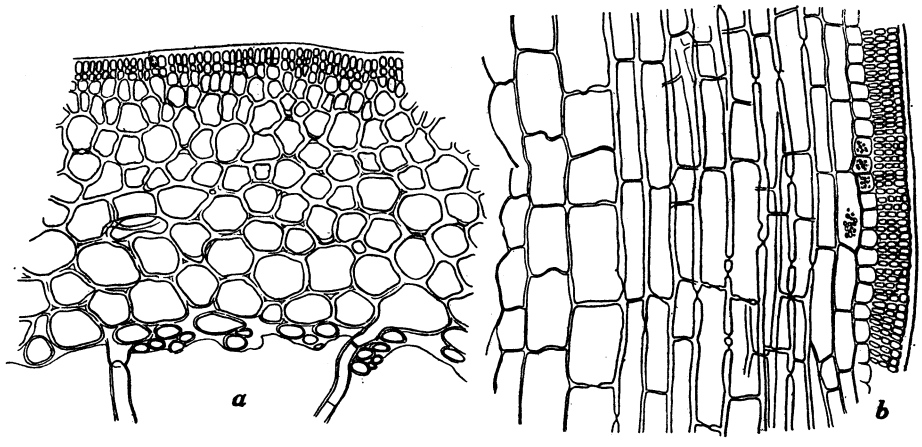

Fig. 3. *Chordaria Nagaii* TOKIDA. Cross (*a*) and oblique-longitudinal (*b*) sections of the lower portion of a sterile frond. × 125.

as they are furnished with the peripheral filaments and the unilocular sporangia covering almost whole surface of the frond. The peripheral filaments are cylindrical, erect, 5–7 cells long, composed of long cells usually five times, sometimes up to ten times, as long as the diameter in the lower portion, gradually shorter and broader ones in the upper portion ending with an apical cell, which is 9–12 μ in width, somewhat flat at the apex. On the wall of the apical and subapical cells of the peripheral filament hyaline membranous appendages are often detected to project obliquely upward. Such kind of appendage has never been observed in Phaeosporeae, so far as I am aware. The assimilating filament of *Compsonema gracile* KUCKUCK[1], which has a peculiar lamellate membrane, is the only example that seems to explain the origin of the appendage in our species. The length of the peripheral filament is 60–75 μ while the sorus is young but attains 120–130 μ when fully grown. (Fig. 4).

The unilocular sporangia are clavate, borne at the basal segment of peripheral filaments. The wall of the sporangium is much thickened at the apex. The content of immature sporangia is homogeneous and its tip is usually acute. The mature sporangium closely resembles the zoosporangium of a Laminaria. (Fig. 4, b, c, d).

All the specimens in our possession, young and mature, are always eroded at the apex, and therefore the growth in length of our species is thought to be

1. P. KUCKUCK, Beiträge zur Kenntnis der Meeresalgen, No. 8. Compsonema, ein neues Genus der Phaeosporeen. Wissensch. Meeresunt., Neue Folge III Bd., Abt. Helgoland, 1899, Taf. VI (12), fig. 8-9.

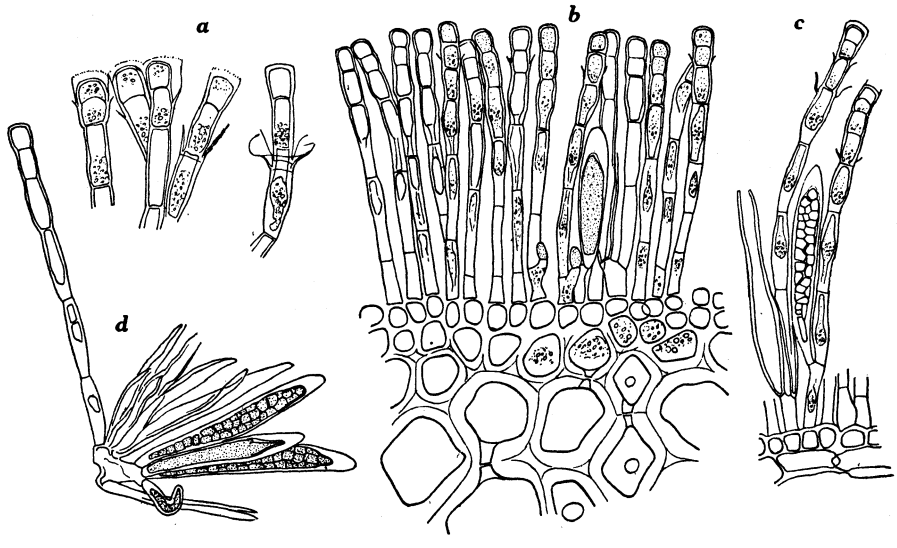

Fig. 4. *Chordaria Nagaii* TOKIDA. *a.* Apical portions of peripheral filaments, showing the membranous appendages; *b*, *c*. Sections through sori, showing peripheral filaments and sporangia; *d*. Fascicle of sporangia successively formed on one and the same basal segment of a peripheral filament. *a* × 480; *b-d* × 310.

intercalary at least except the quite young stage which is unknown to us at present.

The color of the frond is olive brown. Mature fronds in drying become coriaceous and almost black, adhering well or not to paper.

In classifying the present alga in the genus Chordaria I feel some hesitation. In the hitherto known species of Chordaria the frond is usually branched but rather rarely unbranched, clothed always, not only when matured but also while sterile, with the peripheral filaments. However, the inner tissues and the position of the sporangium as well as the nature of the peripheral filaments show that our plant is to be placed in the Fam. Chordariaceae in the definition of SETCHELL and GARDNER (1925, p. 571)[1] and that it is most closely allied to Chordaria. From *Chordaria Gunjii* YENDO[2] and *Chordaria filiformis* (RUPR.) YENDO[3], either of which has a simple frond, our species differs in having much

1. W. A. SETCHELL and N. L. GARDNER, The Marine Algae of the Pacific Coast of North America, Part III, Melanophyceae, 1925.

2. K. YENDO, Some new Algae from Japan. Nyt. Mag. Naturvidensk., Vol. 51, 1913, Part I, p. 280.

3. K. YENDO, On *Hapalosiphon filiformis* RUPR. Trav. Mus. Bot. Acad. Imper. Sci. St.-Pétersb., X, 1913, p. 121.

more thickened median tissue composed of considerably larger cells with thick walls. The last mentioned two species of K. YENDO bear zoosporangia and gametangia on macroscopic plants and so they must be transferred to the genus Heterochordaria, if not identical with *H. abietina* (RUPR.) SETCH. et GARDN. as suggested by K. OKAMURA[1]. Newly combined binomials, viz. *Heterochordaria Gunjii* (YENDO) and *Heterochordaria filiformis* (YENDO), are to be used until the affinity of these species is thoroughly studied in future.

There may be also some doubt as to the relation of our species to Myelophycus, from which it differs, however, in the position of the sporangia.

The specific name is after Mr. MASAJI NAGAI, earnest and able researcher of the marine vegetation of the Kurile Islands. A good amount of well preserved specimens of the present species was brought home by him from one of the southernmost island of the archipelago. From the same island Mr. S. KAWABATA (l. c.) has reported an undetermined species of Chordaria, of which Dr. Y. YAMADA kindly informed me that it is identical with the present species.

The materials for the study of this interesting plant were chiefly gained from my own collection made in 1935 by the support of the fund granted by the Hattori Hôkôkai, to which I wish to express my sincere thanks in this opportunity.

Erythrotrichia japonica sp. nov.

Fig. 5.

Erect fronds numerously arising from a basal disc, ribbon-shaped when well developed, up to 1.7 mm. long and 135–150 μ broad, with a long pedicel; pedicel 9–24 μ diam., composed of 35–108 cells in a single series; spores ovoid, formed partly on disc, partly on erect frond, up to 12–14 μ diam.

Syn. *Bangia ciliaris* (non CARM.) YENDO, Notes on Algae new to Japan, IV, 1916, p. 51; OKAMURA, Nippon Kaisôsi, 1936, p. 377.

Nom. Jap. *Hosino-obi* (n. n.)

Hab. Epiphytic on *Hizikia fusiformis* (HARV.) OKAMURA. Cape Inuboe, Prov. Bôsyû (TOKIDA, April, 1930); Abu, Prov. Awa (YENDO).

Our species is most nearly related to *Erythrotrichia polymorpha* HOWE[3]. As shown in the above diagnosis, however, the ribbon-shaped erect fronds of

1. K. OKAMURA, Nippon Kaisô-si, 1936, p. 199.

2. *Erythrotrichia japonica* TOKIDA, sp. nov.—Frondibus erectis evolutis taeniaeformis, usque ad 1.7 mm. longis et 135–150 μ latis, numerosis a disco basali exsurgentibus, e basi longe pedicellatis; pedicellis 9–24 μ diam., cellulis numerosissimis, 35–108, in serie unica dispositis compositis; sporis ovoideis, tum in disco tum in fronde erecta evolutis, usque ad 12–14 μ diam. metientibus.

3. M. A. HOWE, The Marine Algae of Peru. Memoirs of the Torrey Botanical Club, Vol. 15, 1914, p. 77, tab. 29.

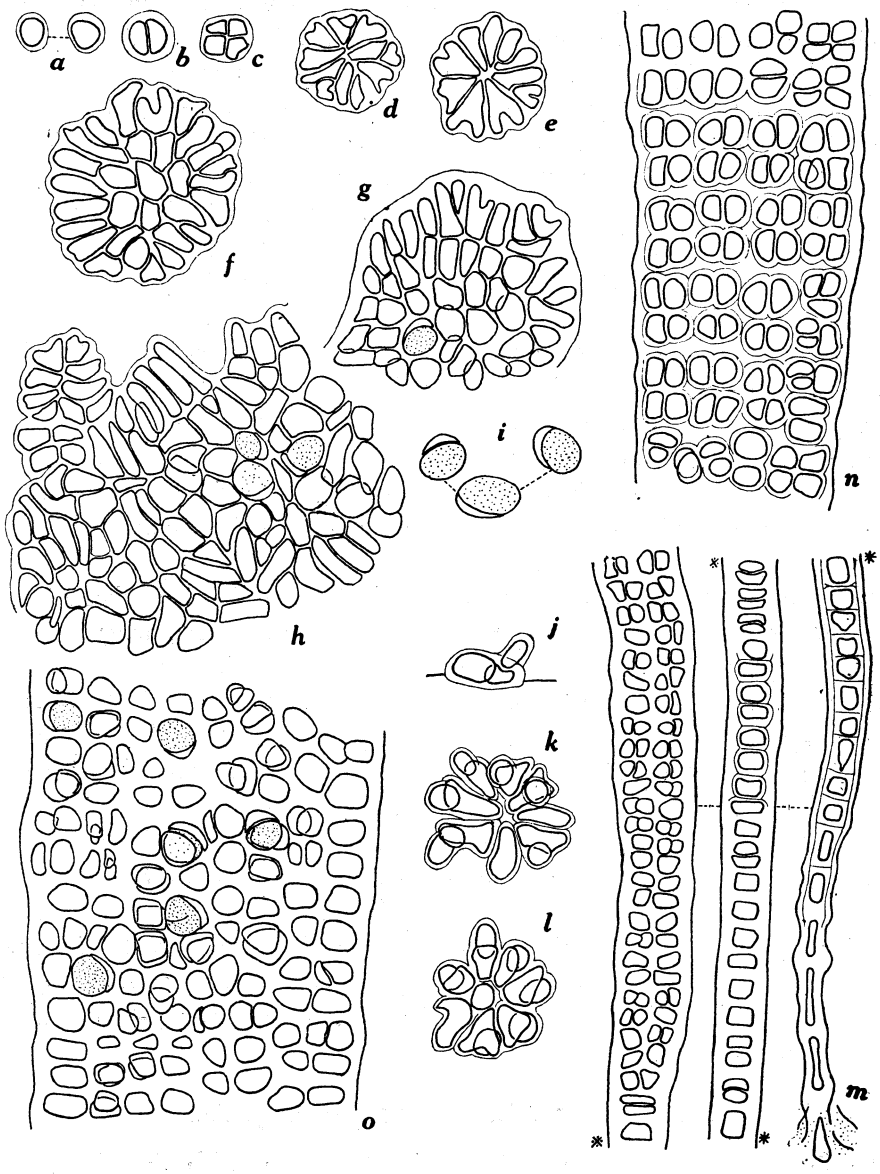

Fig. 5. *Erythrotrichia japonica* TOKIDA. *a–f.* The basal discs in various stages of development; *g, h.* Portions of well developed basal discs bearing spores; *i.* Three spores formed on the disc; *j–l.* Small discs bearing the first cells of the erect filament; *m.* Basal portion of a narrow band-shaped erect frond with a long "pedicel", 46 cells long; *n.* Portion of an erect frond, showing the arrangement of the cells; *o.* Portion of an erect frond, showing spores. The frond is in part irregularly bistratose. *a–l, n, o* × 475; *m* × 300.

our plant are somewhat greater in dimentions as well as in the number of cells of pedicels as compared with those of the Peruvian species. According to Howe, the erect fronds of his plant attain a length of 0.25–1.3 mm. and a maximum width of 35–85 μ, tapering very gradually into a pedicel, 8–18 μ broad, consisting of 5–25 cells in a single series. The pedicel, or the monosiphonous basal portion of erect fronds is 9–14 μ broad at the base in our plant, 18–22 μ, or rarely up to 24 μ, broad in the upper portion, and composed of greater number of cells. . The basal disc is usually formed closely contacting with each other, so that its boundary is often hardly discernible except while young. In the Peruvian plant it is described that the strongly developed basal discs attain often a diameter of 150–600 μ, and the older ones become irregularly distromatic in the central portions and at length give rise there to few or many erect filaments. In our species the erect fronds often arise from a small, undeveloped disc. The erect frond attains 135 μ or 150 μ in breadth at the broadest portion, where the frond is 16 cells in width. The arrangement of the cells as well as the size and the location of spores of our species are quite similar to those of *Erythrotrichia polymorpha* HOWE.

In 1916, YENDO (l. c.) added to our algal flora a rather imperfectly known species, *Bangia cilialis* CARMICHAEL[1]. It had been transferred long before to the genus Erythrotrichia by BERTHOLD[2], and by BATTERS[3]. The conception of CARMICHAEL's species was rather confused among botanists until BATTERS has settled it by studying CARMICHAEL's original specimens. For his identification, YENDO is referring to DE TONI (1897) but not to BATTERS (1900). His plant is mentioned to be found on *Turbinaria ? fusiformis* YENDO, but nothing else is described. In April 1930, I have collected *Hizikia fusiformis* (HARV.) OKAM. (=*Turbinaria ? fusiformis* YENDO) densely covered with an Erythrotrichia, viz. *E. japonica* TOKIDA, at Inuboe, where the climatic conditions seem to be not so markedly distinct from Abu, the original locality of YENDO's plant. I think it is not unreasonable to suppose that our specimens of *Erythrotrichia japonica* TOKIDA may be identical to those referred by K. YENDO twenty-two years before to *Bangia ciliaris*.

Bostrychia Moritziana (SOND.) J. AG.

Sp. II, 3, 1863, p. 862; DE TONI, Syll. Alg. IV, 3, 1903, p. 1158; ERIKA

1. *Bangia ciliaris* CARMICHAEL, in HOOKER, Brit. Flor. II, 1833, p. 316; DE TONI, Syll. Alg. IV, Sect. 1, 1897, p. 7.

2. *Erythrotrichia ciliaris* BERTHOLD, Bangiaceae, 1882, p. 25. (=*E. Bertholdii* BATTERS).

3. *Erythrotrichia ciliaris* BATTERS, in Journ. Bot., 1900, p. 374, (non THURET, nec BERTHOLD, nec alior. auctor.); DE TONI, Syll. Alg., VI, 1924, p. 15.

POST, Systematische und pflanzengeographische Notizen zur Bostrychia-Caloglossa-Assoziation, in Rev. Algol., 1936, p. 10.

Syn. *Polysiphonia? Moritziana* SOND. in KÜTZING, Sp., 1849, p. 838.

(For other synonyms, see DE TONI, l. c. and E. POST, l. c.)

Nom. Jap. *Edane-kokemodoki.* (n. n.).

Hab. Growing in crevices and caves in rocky bank, near high-tide level, associated with *Caloglossa ogasawaraensis* OKAM. Makurazaki, Prov. Satuma (TOKIDA, June 1938).

Our plant agrees in every respect with the descriptions of the present species given in the works above cited. According to ERIKA POST (l. c.) *Bostrychia Moritziana* is pantropic in its areal and has the widest distribution among the species of Bostrychia.

For the discovery of the species in Japan, I owe to Mr. K. HAMANA of the Makurazaki Suisangakko, who kindly assisted me in various ways during my stay at Makurazaki in last June.

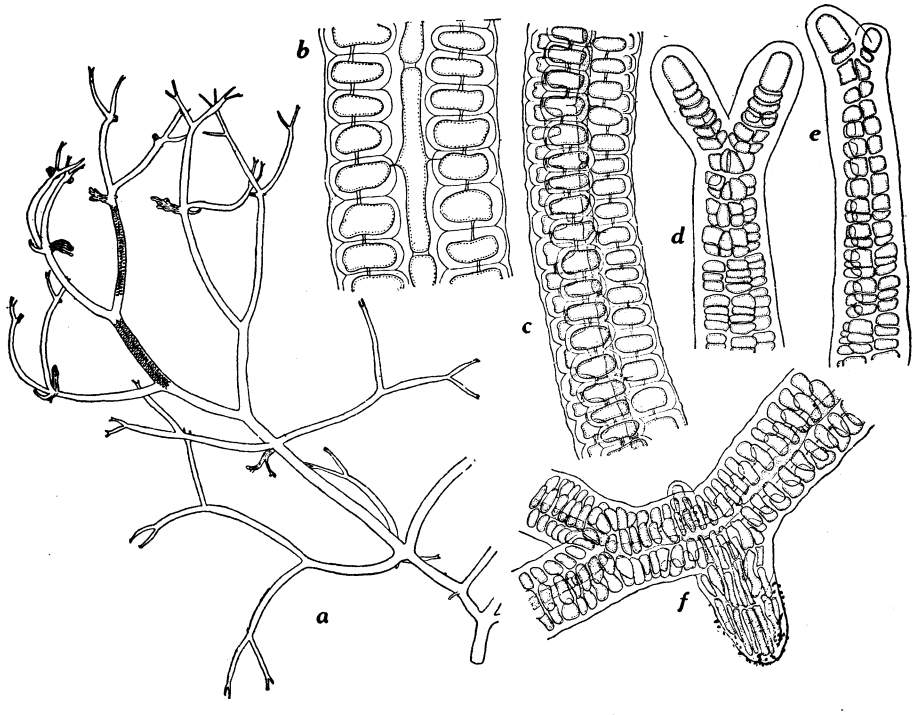

Fig. 6. *Bostrychia dichotoma* TOKIDA. *a.* Habit sketch of a part of the type; *b.* Optical section of a branch; *c.* Surface view of a branch, axial cells being shown by dotting; *d, e.* Apical portions of branches; *f.* Showing a holdfast and an adventitious branchlet just behind a bifurcation. *a* × 8; *b, d, e* × 210; *c, f* × 120.

Bostrychia dichotoma sp. nov.

Fig. 6

Frond repent, ecorticate, cylindrical, up to 12 mm. long, 60–165 μ diam., dichotomously branched; branches gradually attenuated upward, 30 μ diam. at apices; pericentral cells 6, transversely divided into 6 segments, 2–5 ultimate cells undivided; fruits unknown[1].

Nom. Jap. *Hamana-kokemodoki.* (n. n.).

Hab. Growing in crevices and caves in rocky bank, near high-tide level, intermingled with *Caloglossa ogasawaraensis* OKAM. Makurazaki, Prov. Satuma (TOKIDA, June 1938).

A few sterile specimens only are before us. However, this is a well defined species, I believe. So far as I am aware, in the genus Bostrychia has never been described a dichotomous species such as the present one. The holdfast of our species belongs to the category of the subgen. Flagellifulcratae of E. POST (l. c.). It is polysiphonous, usually arising near the bifurcation. An adventitious branchlet often arises on the dorsal side of the frond at the point just opposite to the holdfast, resulting some disturbance to the primary, fairly regular, dichotomous ramification. The Japanese name of the present new species, *Hamana-kokemodoki*, is after Mr. KAMESUKE HAMANA, a diligent collector of the marine algae in the southern districts of Kyûsyû, to whom I return my hearty thanks for his kindness shown to me as already mentioned.

In concluding this short article, it is my pleasant duty to acknowledge my indebtedness to Emer. Prof. Dr. K. MIYABE and Prof. Dr. Y. YAMADA, for their kindest and valuable advices.

October 30, 1938.

Hakodate College of Fisheries
Hakodate, Japan.

藻類觀察 (四)

本邦の海藻フロラに新に追加すべき次の五種を報告し，新種(三種)に記載を與へた.

1. キクカアヲコ(新稱) *Dermocarpa protea* SETCH. et GARDN. イワヒゲに着生する藍藻, 產地：江ノ島；東京；白濱(房州)；犬吠.
2. ニセツルモ *Chordaria Nagaii* TOKIDA. (新種). 產地：樺太；色丹島.
3. ホシノオビ *Erythrotrichia japonica* TOKIDA. (新種). ヒジキに着生. 產地：犬吠；阿波.
4. エダネコケモドキ(新稱) *Bostrychia Moritziana* (SOND.) J. AG. 產地：枕崎 (薩摩).
5. ハマナコケモドキ *Bostrychia dichotoma* TOKIDA. (新種). 產地：枕崎 (薩摩). 和名は枕崎水產學校教諭濱名龜助氏の名を採つた，同氏は，鹿兒島縣及び附近の海藻の熱心な蒐集家である. 本種と前種は，同氏の案內で採集するを得た.

1. *Bostrychia dichotoma* TOKIDA, sp. nov.—Fronde repente, tota ecorticata, tereti, usque ad 12 mm. longa, 60–165 μ diam., dichotome ramosa; ramis supero longe attenuatis, ad apices 30 μ diam.; cellulis pericentralibus 6, transverse 6-divisis, cellulis ultimis 2–5 nudis et indivisis; fructibus ignotis.