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Notes on Some Japanese Algae II.

By

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With Plates XVI.—XX.

Cladophora japonica sp. nov.

Pl. XVI.

Frons magna, 20 cm alta et ultra, dichotomo- vel trichotomo-fastigiata; ramulis fasciculatis; cellulis ramorum primorum 0.8-1.0 mm crassis, longissimis, 10-20-plo diametro longioribus (nonnunquam longioribus, praecipue ad basin frondis), non annulatis; cellulis ramulorum apicem versus brevioribus et gracilioribus, prope extremitatem 5-10-plo diametro longioribus, ad dissaeptis leve constrictis, apice obtusis vel acutiusculis.

Loc. Sagami Prov.; Kazusa Prov.

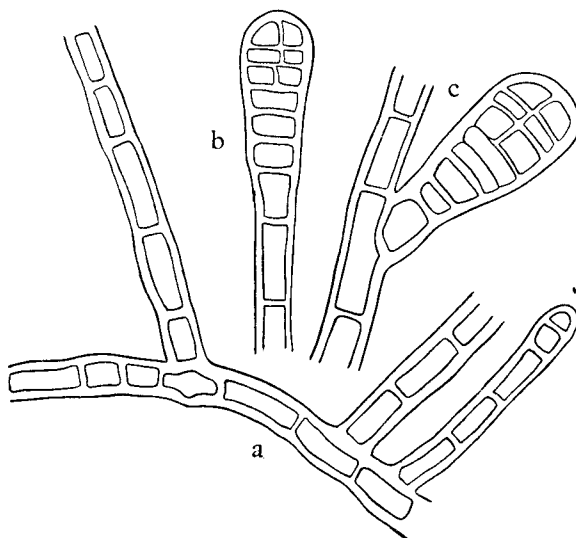
Fronde large, attaining 20 cm or more, dichotomo- or trichotomo-fastigiate; cells of the primary branches 0.8-1.0 mm in diameter, very long, 10-20 times as long as diameter (sometimes longer, especially near the base of the frond), without annulation; cells of branchlets becoming shorter and slenderer toward the extremity, near the extremity 5-10 times as long as diameter, slightly constricted at dissepiments, apex obtuse or somewhat acute. When living in water, whitish in colour, after drying changing into blackish green, rough to the touch.

Among several species of *Cladophora* reported from Japan, *C. Wrightiana* Harv. and *C. Okuboana* Holm. stand most closely to the present species. From Harvey's species, however, our plant is easily to be distinguished by its not brownish colour of the frond and moreover by the absence of annulation in the basal part of the frond. In *C. Okuboana* Holm., branches are not so clearly fasciculated as in the present species and cells in the former species are much thicker and shorter in comparison with those of the latter species.

Ectocarpus Laurenciae sp. nov.

Text-fig. 1 and Pl. XVII. Fig. 1.

Frons epiphytica, parva, 1-4 mm alta, ex parte basale repente et filamentis erectis constructa. Pars basalis irregulariter ramosa, contorta, non parenchymatica; filamentis erectis rarissime ramosis, ramis alternatis; cellulis filamentorum 20-24 μ crassis, 2-4-5-plo diametro longioribus; filamentis principalibus et ramulis apicem versus vix attenuatis; chromatophoris taeniatis(?); sporangiis plurilocularibus

Fig. 1. *Ectocarpus Laurenciae*

a. Base of a plant. b. c. Plurilocular sporangia.

breve pedicellatis vel sessilibus, lateralibus vel raro terminatis, obovatis vel longe ellipticis vel ellipticis, apice obtusis: sporangiis unilocularibus ignotis.

Loc. Kōtōsho, Formosa, epiphytic on *Laurencia* (S. Sasaki).

Fronde epiphytic, small, 1-4 mm high, composed of a basal creeping part and erect filaments; basal part creeping on the host, branched irregularly, contorted, not parenchymatic; erect filaments scarcely branched, alternate, if any, 20-24 μ thick, 2-4-5 times as long as diameter; main filaments and branches not attenuated toward the top; chromatophore band-shaped(?); plurilocular sporangia on a short

pedicel or sessile, rather irregular in shape, obovate or long elliptical or elliptical, obtuse at the apex, situated on the side of filaments, but rarely at the extremity of filaments; unilocular sporangia unknown. Colour greenish brown after drying.

Like *Ectocarpus chantransioides* Setch. et Gard., the present species does not show intercalary growth as is usually the case in *Ectocarpus*. It shows the terminal growth, the terminal cell always having the richest contents. The chromatophore is not disc-shaped, though it can not be said with certainty, because only dried specimens are available. The branches in erect filaments are extraordinarily few in number.

Padina from Japan.

An analytical key to the species of *Padina* from Japan.

- The lower part of the frond consists of six or more layers of cells.
 - Cell-layers more than eight *P. arborescens*.
 - Cell-layers less than eight *P. crassa*.
- The lower part of the frond consists of two or three layers of cells.
 - Cell-layers become three *P. Commersonii*.
 - Cell-layers always two.
 - Tetrasporangial sori in every interpilar space. *P. minor*.
 - Tetrasporangial sori in every other interpilar space.
 - Tetrasporangial sori with inducium *P. japonica*.
 - Tetrasporangial sori without inducium *P. australis*.

Padina arborescens Holmes.

New mar. alg. from Japan. p. 251, Tab. 12, fig. 1 (Journ. Linn. Soc., Bot., vol. 31, 1895); Okamura, Icon. of Jap. alg., vol. 6, p. 3, pl. 251, fig. 10 pl. 252 (1929).

Loc. From Kyūshū to Hakodate; Japan Sea; Fusan (Chōsen).

Padina crassa sp. nov.

Pl. XVII. Fig. 2.

Frons ca. 10-12 cm alta, breve stipitata, stipitis ca. 0.5-1.0 cm longo, flabellata, ad basin 6-8 stratis cellularum, apicem versus 4-2 stratis composita, saepe in multa segmenta divisa, ad basin pillosa; segmentis flabellatis, margine integris, membranaceis, calce leve in-crustatis; zonis interpilaribus latioribus. Sori tetrasporangiorum ad quamque zonam interpilarem irregulariter dispositi, interdum ad

partem mediam zonae interpilaris lineam concentricam, interdum duas lineas supra et praeter lineas pilorum formanti, interdum inter duas lineas pilorum irregulariter sparsi, inducio contexti.

Loc. Sagami Prov. ; Iyo Prov. ; Nagato Prov. ; Chikuzen Prov. ; Hizen Prov. ; Mutsu Prov. ; Izumo Prov.

Fronde about 10-12 cm high, provided with a very short stipe measuring about 0.5-1.0 cm long, flabellate, often dividing into many small segments, composed of 6-8 layers of cells near the base, of 4-2 toward the margin, covered with many short brown hairs at the base ; segments flabellate, membranaceous, entire at margin, incrustated slightly with chalk mostly on the under surface ; interpilar zones rather wide. Tetrasporangial sori in every interpilar zone, rather irregular, sometimes forming a concentric line occupying the middle part of interpilar zone, sometimes forming two lines along the hair lines, or sometimes distributed irregularly between two hair lines, covered with an inducium.

Among the Japanese phycologists, the present *Padina* has passed under the name of *Padina pavonia* Gaill. together with other species which contain chalk. But in number of cell layers of which the frond is constructed and in disposition of tetrasporangial sori, *Padina crassa* is quite different from this Gaillon's species, of which I have examined several Mediterranean specimens.

This species seems to be distributed widely in the middle as well as the southern parts of Japan.

***Padina Commersonii* Bory.**

Voyage de la Coquille, Botanique, p. 114 (1828) ; Hauck, Über einige von J. M. Hildebrandt im Rothen Meere und Ind. Ozean gesam. Algen. p. 42 (Hedwigia 1887) ; Weber van Bosse, Liste des alg. du Siboga, vol. 1, p. 178 (1913) ; Börgesen, Some Ind. green and brown alg. especially from the shores of the Presidency of Bombay, p. 170 (Journ. Ind. Bot. Soc. 1930).

Loc. Garanbi, Formosa.

***Padina minor* Yamada.**

Studien über die Meeresalg. von der Ins. Formosa, I. p. 251 (Tokyo Bot. Mag. vol. 39, 1925).

Loc. Garanbi, Formosa.

This species shows a striking resemblance to *P. Commersonii* Bory especially in the characters of the sporangial sori, but according to the descriptions given by several authors, Bory's species has three layers of cells in the lower parts of the frond, while this is never the case in the present one. And so, I think, it is better to keep it separate from *P. Commersonii* Bory.

Padina japonica sp. nov.

Pl. XIX. Fig. 2.

Frons 2-8 cm alta, ca. 90-100 μ crassa, flabelliformis, saepe multo fissa, duobus cellularum stratis composita, stipite breve pilloso adfixa; segmentis margine integris, vel subfissis, pilis in zonas concentricas conspicuam ordinatis. Sori tetrasporangiorum plerumque supra alternas series pilorum concentricas et nonnunquam ultra infra alternas series pilorum in lineis discontinuis irregulare distributi, inducio contexti.

Loc. Mikawa Prov.; Iyo Prov.; Nagato Prov.; Higo Pro.; Satsuma Prov.; Echigo Prov.

Frond 2-8 cm high, about 90-100 μ thick, flabelliform, often split into several segments, shortly stipitate, hairy near the base; segments entire at margin, sometimes shallowly split; hair lines conspicuous, interpilar spaces usually rather narrow; consists of two layers of cells throughout the whole body; cells near the base with thick wall, nearly rectangular in shape, those of upper and lower layer about of the same shape and size, provided with hairs mostly on the upper surface; cells in the upper portion of two kinds, those constituting the upper surface deep coloured, rectangular in shape, those of lower surface also rectangular, every one of them almost always corresponding to one cell of the upper layer; sori of tetrasporangia usually produced on the upper side of every other hair-line on the upper surface making a continuous line, but sometimes additional discontinuous, rather irregular lines produced along the lower side of the ordinal sori, making an incomplete double line, provided with a well marked inducium. Frond moderately calcified on the lower surface, colour brown to ye'lowish brown.

The present species is very common on the Japanese coast and has hitherto been called *P. pavonia* Gaill. together with *P. crassa* and other species. But as shown by the above description, they are quite dif-

ferent from *P. pavonia* Gaill. Among the species which have been described, *P. Sanctae-Crucis* Börg. seems to come most nearly to the present species, being constructed of two layers of cells throughout the entire frond, and producing the sori of tetrasporangia with a distinct inducium along the upper side of every second row of hairs. I have examined the type specimen of *P. Sanctae-Crucis* Börg. in the herbarium of the Botanical Museum in Copenhagen by the kindness of Dr. Börgesen, and have compared it with our Japanese specimens. In many characteristics both species are very much alike, but the difference between the two is to be found in the arrangement of the tetrasporangial sori. As stated above, in our Japanese species, additional sori are sometimes met with making an incomplete double line, which does not seem to occur in the West Indian species. Taking into consideration this difference between them and the widely separated localities of both species I have described our alga as a new species.

***Padina australis* Hauck.**

Text-fig. 2 and Pl. XVIII.

l.c. p. 44; Weber van Bosse, l.c.p. 179.

Frond erect, 15 cm high, or more, about 80-90 μ thick near the base, 50 μ at the upper parts, attached to the substratum by means of a hairy base, broadened faellately upward, often split into many segments and covered with brownish hairs up to about the middle part of the frond, hair lines moderately conspicuous. Segments flabelliform or narrowly flabelliform, entire or sometimes split shallowly at the margin, consisting of two layers of cells throughout the whole length except the apical portion, a thin surface layer consisting of nearly rectangular cells and a layer of slightly larger cells below, in the basal parts cell walls thick, provided with many rhizoids on both surfaces forming dense cover. Tetrasporangial sori disposed concentrically on the middle parts in every other interpilar space, so that the fertile and sterile interpilar spaces appear in regular alternation, usually the fertile ones being slightly broader than the others. Tetrasporangia irregularly scattered, without inducium, pear-shaped, about 110 μ high, 85-90 μ long, but larger ones measuring about 125 \times 115 μ are met with. Colour brown on the upper surface, but on the lower surface somewhat whitish being slightly incrustated with chalk.

Loc. Tosa Prov. ; Riu-kiu ; Kōtōsho, Formosa.

Dr. Weber van Bosse gives a very valuable note and figure of the present species after examination of the original specimen of Hauck. Our specimens agree very well in every characteristic with her note as well as Hauck's description.

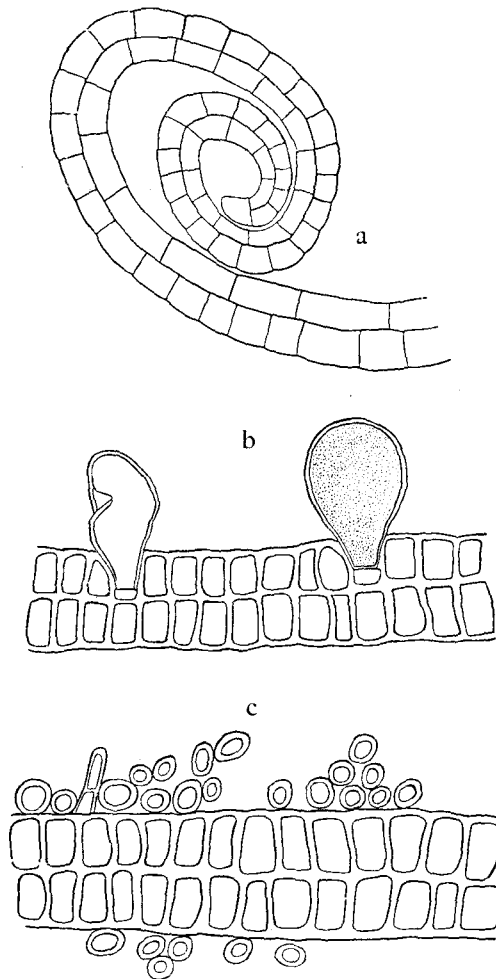


Fig. 2. *Padina australis* Hauck.

Transverse section of the frond.

- a. Upper portion. b. Middle portion with sporangia.
c. Basal portion.

Sargassum crispifolium sp. nov.

Pl. XX.

Syn. Sargassum Grevillei Yendo (non J. Agardh), Notes on Alg. new to Jap. VII. p. 195 (Tokyo Bot. Mag. vol. 31, 1917).

Frons 40-50 cm alta, e radice parva discoidea exurgens, breve stipitata, stipite vix 1.0 cm. longo, tereto; ramis principaribus teretibus, filiformibus, levibus, saepe 1-3, alternato-pinnatis, vel bipinnatis; foliis brevissime petiolatis, vel sessilibus, lineali-spathulatis, 3-5 cm longis, 0.5-1.0 cm latis, membranaceis, apice obtusis vel acutiusculis, minute et acute dentatis, plerumque crispatis, costatis, cryptostomatibus laxe sparsis; vesiculis sphaericis, sed raro ellipticis, diam. 5-8 mm, breve petiolatis, levibus, cryptostomatibus ornatis; receptaculis 1-4 furcatis, inferioribus pedicellatis, superioribus sessilibus, cylindraceis, verrucosis, raro spinulosis.

Loc. Sagami Prov.; Tosa Prov.; Hizen Prov.; Satsuma Prov.; Hiuga Prov.

Root a small round disk, measuring about 0.5 cm in diameter; stem very short, about 0.5-1.0 cm long, cylindrical, primary branches few in number, mostly 1-3; branches alternately pinnate or bi-pinnate, cylindrical, filiform, smooth; leaves very shortly petiolate or nearly sessile, linear-spathulate, 3-5 cm long, 0.5-1.0 cm wide, membranaceous, obtuse or somewhat acute at the apex, finely and sharply dentate at the margin, usually strongly crispate, nerves clear except near the end of leaves, cryptostomata clear, scattered sparingly all over the surface; vesicles sphaerical, but rarely elliptical, 5-8 mm in diameter, shortly petiolate, smooth, with few cryptostomata; receptacles 1-4 times forked, the lower pedicellate, the upper sessile, cylindrical, verrucose, rarely spinose.

The present *Sargassum* is one of the distinct species in the *Eu-Sargassum*-group in the south of Japan, and before looking at the authentic specimens of *Sarg. Grevillei* J. Ag. in Lund, I had followed Prof. Yendo's opinion who referred his specimens to *Sarg. Grevillei* J. Ag. I myself have collected several specimens from the southern parts of Japan, and also received some several times for determination. I brought those specimens with me to Lund where they were compared very carefully with the authentic specimens in J. Agardh's herbarium. All specimens of *Sarg. Grevillei* J. Ag. kept there, are very much like those of *Sarg. Binderi* Sond. in habit, showing clearly flattened stem

and branches. On the contrary in the specimens determined by Prof. Yendo as *Sarg. Grevillei* J. Ag. as well as in my own specimens, the stem and branches are always cylindrical quite unlike J. Agardh's specimens under this name. On the other hand, however, I found another species which comes more closely to our Japanese specimens, that is *Sarg. Desvouxii* Ag. The specimens in the cover of this species in Lund appear to be rather heterogeneous, some of them showing resemblance to the Japanese specimens. The important characteristics of our specimens which separate them from J. Agardh's species, however, are to be found easily in the strongly crispate leaves which show finer and sharper dentation at the margin than *Sarg. Desvouxii* Ag.

***Besa gracilis* sp. nov.**

Text-fig. 3.

Frons in frondibus crustaceis Hildenbrandtiae (?) parasitica (?), dense vel laxe aggregata, cylindrica, carnosu-cartilaginea, 6 mm alta, ca. 1 mm crassa, simplex et clavata vel saepe patenter dichotoma vel repetite dichotoma, vel raro trichotoma, apice rotundato. Cystocarpus in parte superiore frondis simplicis inflatus.

Loc. Enoshima, Sagami Prov.

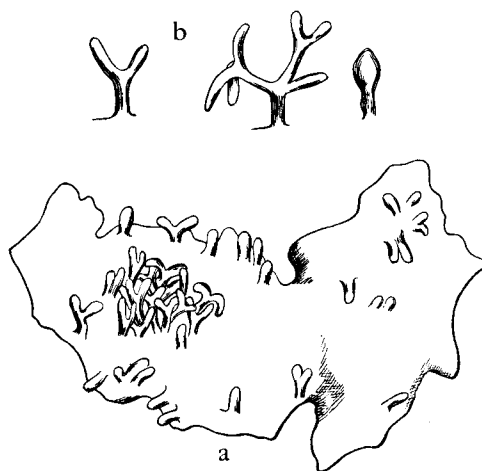


Fig. 3. *Besa gracilis*

a. Habit of plant. b. Different forms of plants.

Fronds parasitic (?) on a *Hildenbrandtia*-like plant, gathering densely or loosely, carnosu-cartilagineous, cylindrical, up to 6 mm high, about 1 mm thick, simple and clavate or often divided dichotomously with a wide angle, or dichotomous again, or rarely trichotomous; with round apex. Cystocarps in the upper portion of the simple frond making the frond evidently clavate.

The genus *Besa* was established by Setchell basing upon materials from Lands End, near San Francisco, California. He found them only in one place and I think no other person has discovered them in any other localities. And so it is not without interest to inform a plant of this genus from Japan though it does not seem to be the same specifically as that from the other side of Pacific. However Prof. Setchell considers that his species grows epiphytically (or hemiparasitically) on a crustaceous plant like *Hildenbrandtia* which is to be found also in the Japanese species.

On the relation between *Besa* and the *Hildenbrandtia*-like plant on which the former is always to be found, I can not say anything. In the latter plant I have not found any reproductive organ either, and the connection between those two plants is very vague, so on this point I have just followed Prof. Setchell's opinion taking *Besa gracilis* as the independent plant from *Hildenbrandtia*-like one.

I have collected the present species only once on a rock in Enoshima after the great earthquake in 1923. Since that time I have never seen it even in the same place.

In California I was allowed by Prof. Setchell to examine the type specimen of *Besa papillaeformis* Setch. It bears some resemblance to the Japanese species, but the latter is slenderer and longer and much more branched than the former.

Grateloupia livida (Harvey) comb. nov.

Syn. *Nemastoma livida* Harvey, in Gray's list of Japanese plants. p. 332 (1857).

Syn. *Schizymenia ligulata* Suringer, Alg. Jap. p. 29, tab. 15. (1870).

Syn. *Grateloupia ligulata* Schmitz, Kleine Beitr. Flord. p. 27 (1894).

Syn. *Grateloupia furcata* Holmes, Mar. alg. from Japan. p. 254, tab. 10, fig. 3, a-c. (1865).

Nemastoma livida Harv. was described very briefly and has long been in question among Japanese phycologists. The examination of the type specimen of Harvey in Dublin shows, however, that this is nothing but a rather short form of what Schmitz called *Grateloupia ligulata* (Sur.) Schm. and has passed among us under this name.

Rhodopeltis borealis sp. nov.

Pl. XIX. Fig. 1.

Fronds minor, ca. 4 cm alta, a radice parva cartilaginea vix incrustata fasciculate caespitosa, rosea, multo calce incrustata, dense dichotomo-fastigiata et saepe proliferationibus ornata, ad nodos hic illic fracta; internodiis complanatis, 2-3 mm latis, ad basin contractis subobconicis, diametro 1.5-2.5 plo longioribus, sicco canaliculatis, glaberrimis, fragilissimis, subnitidis. Tela peripherica crassa, e 7-9 stratis cellularum constructa; cellulis interioribus majoribus ovatis vel ellipticis, 40-50 μ longis, cellulis exterioribus sensim minoribus; cellulis periphericis 3-4 μ latis. Medula vix incrustata, filis 5-7 μ crassis longitudinaliter dense percursa. Nemathecia cystocarporum rotundata vel elliptica, diametro ca. 1.5-2.0 mm magna, sparsa.

Loc. Riu-kiu (S. Sakaguchi); Ryusensui (!), Kōtōsho (S. Sasaki), Formosa.

Frond small, about 4 cm high, standing on a small, cartilagineous, uncalcified root and very short stem. Those uncalcified parts originate in the fall of the peripheral tissue after growing up of the frond. Other parts of the frond are very strongly calcified, often being broken at the base of the branches, red in colour. The branching is very dense, dichotomo-fastigate and branches are often provided with proliferating branchlets. Internodes 2-3 cm broad, slightly narrowed at the base, thus becoming subobconical, about 1.5-2.5 times as long as diameter; in dried specimens they are very smooth, slightly shining, not zonate and very brittle. Anatomically the frond consists of a strongly calcified peripheral layer and an uncalcified medula; the former being constructed from 7-9 layers of ovate or elliptical cells, which are largest at the innermost side and become smaller gradually towards the periphery, the diameter of the smallest, outermost cells being about 3-4 μ . The medula is composed of filaments, which run densely in the longitudinal direction and measures about 5-7 μ in diameter. The cystocarpic nemathecia are round or elliptical in shape,

about 1.5-2.0 mm in diameter, scattered mostly in the upper parts of the frond.

Amphiroa australis Sond. and *Rhodopeltis australis* Harv. were figured by Harvey in Phyc. Austr. as two independent species. He regarded the latter species as a parasite growing on the former. On the other hand, Kützing delineated Sonder's specimen in his Tab. Phyc. (Vol. 8, Pl. 50, Fig. 1) and adds the note: Die Struktur dieser Art, und namentlich die Kortikalschicht ist so eigentümlich, dass sie von den allen übrigen Corallinen abweicht. Ich vermute daher, dass diese Art eine eigne Gattung bildet, welche mit der folgenden Art (*A. dilatata*) nur etwas von Habitus Gemein hat.

Afterward, however, Schmitz considered both species of Sonder and Harvey as one and the same plant, looking upon *R. australis* Harv. as the nemathecium of the plant called *A. australis* Sond. and he referred this plant to the Rhizophyllidaceae calling it *R. australis* (Harv.) Schm. (in Flora 1889). Weber van Bosse, however, established a new genus called *Litharthron* in her Siboga's Corallinaceae basing upon Sonder's *A. australis*, and Yendo appears to have followed her opinion.

The specimens in my hand from Formosa and Riu-Kiu show many common characteristics with the Australian one. I was fortunate enough to compare my specimens with the type specimen of Harvey in Dublin. The latter is much larger and stronger than the former, the diameter of the nemathecium attaining about 1 cm.



Cladophora japonica

The type specimen. \times ca. $\frac{3}{4}$

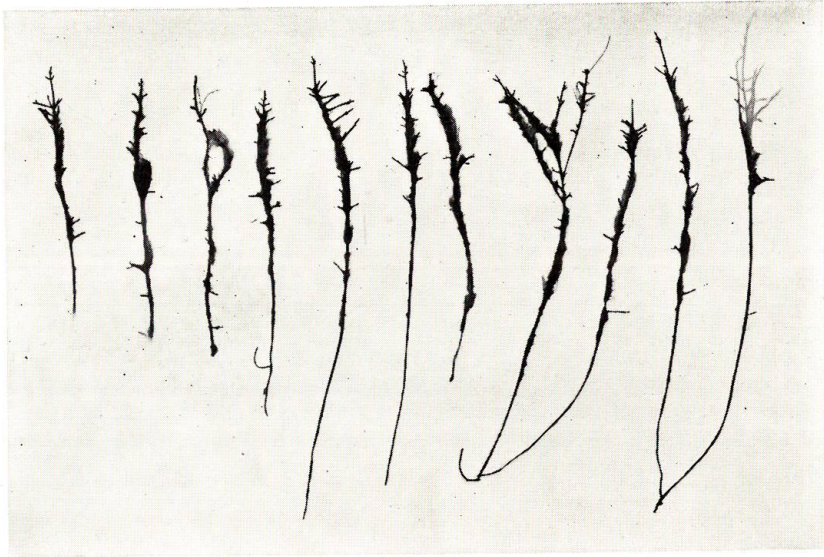


Fig. 1. *Ectocarpus Laurenciae*
The cotype specimen. \times ca. 3/4

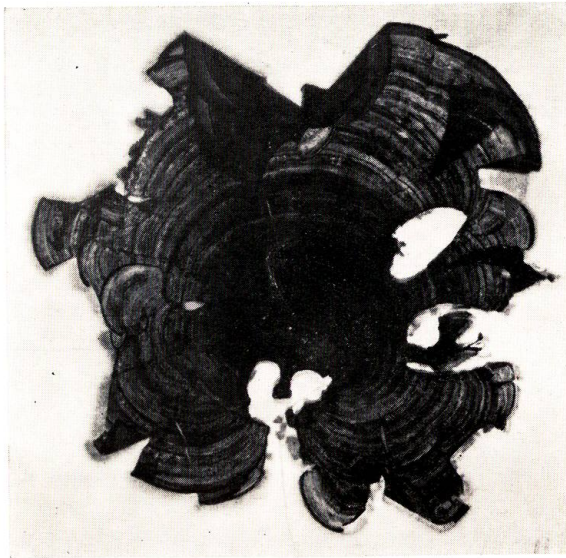


Fig. 2. *Padina crassa*
The type specimen. \times ca. 3/4



Padina australis Hauck. $\times 5/6$

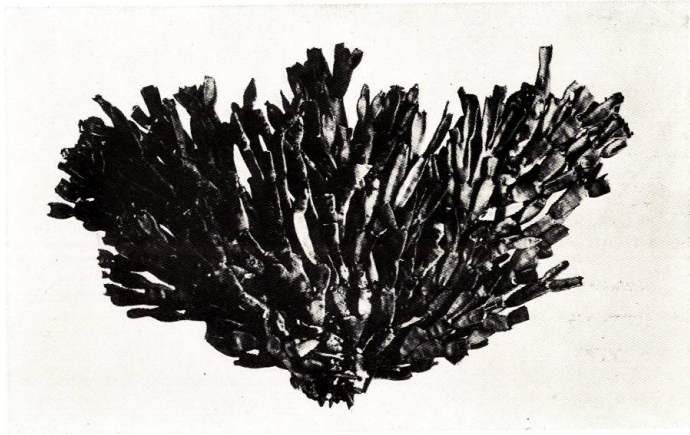


Fig. 1. *Rhodopeltis borealis*
The type specimen. $\times 1$

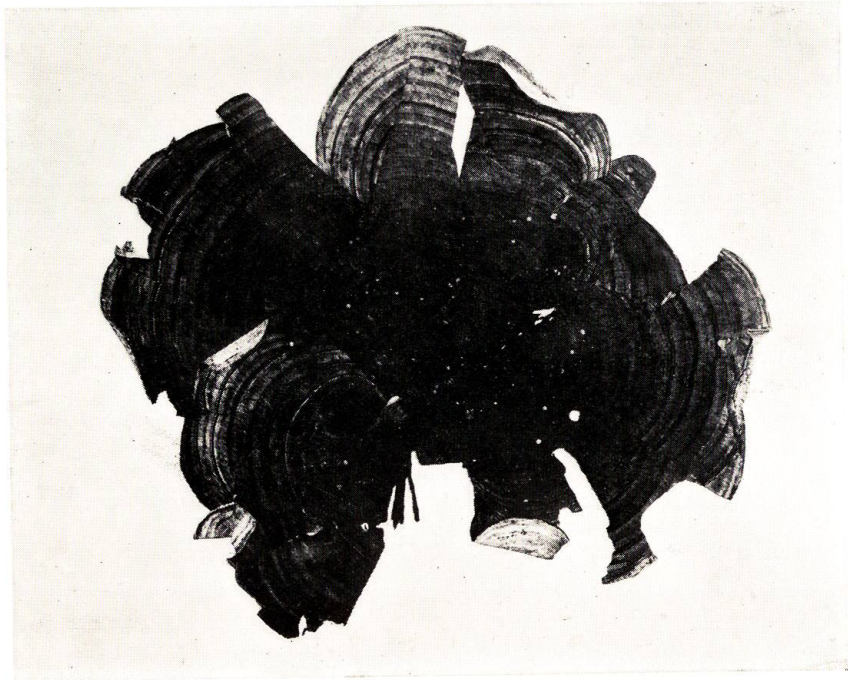


Fig. 2. *Padina japonica*
The type specimen. $\times 3/5$



Sargassum crispifolium

The type specimen. \times ca. 1/2