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# The marine Chlorophyceae from Ryukyu, especially from the vicinity of Nawa

By

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(With 55 Text-figures)

The first report on the marine algae of the Ryukyu Islands is, so far as I am aware, that of Harvey, who studied the material collected by C. Wright in the North Pacific Exploring Expedition under Captain John Rodgers. Since then no one has attempted to make a general study of the marine algae from this district, and nothing has been published except some short or fragmentary notes by Heydrich, Okamura, Yendô, etc.

Last spring I made a collection of marine algae in the vicinity of Nawa, and brought back some fairly rich material. The present study is based chiefly on this material but, beside it, some specimens sent by Messrs. S. Inoh, Y. Okada, S. Sakaguti and T. Teramati were used. This study will furnish a list of the marine algae in the vicinity of Nawa together with the parts of the Phaeophyceae and the Rhodophyceae which will appear later on. At the same time this list may be looked upon as a forerunner of a more complete list of the marine algae of the south of Japan, including those of the Ryukyu Islands, the Ogasawara-jima (Bonin Islands) and Formosa.

This part includes 59 species of the Chlorophyceae, being referred to 26 genera and 11 families. Two species and three forms among them are described as new, and, beside them, three species are newly added to the Japanese flora. Moreover, one new genus is established, being based on an alga which I have formerly referred to the genus *Vaucheria*.

I wish here to return my sincere thanks to Dr. K. Okamura who allowed me to use some books in his library, and to Mr. T. Kuriyama who made drawings, especially most of the habit illustrations, and also to Messrs. S. Inoh, Y. Okada, S. Sakaguti and T. Teramati for sending me the several specimens.

My thanks are also due to Mr. K. Awaya, president of the Fishery School, and other gentlemen in Nawa who helped me in various ways.

## ULOTRICHALES

### ULVACEAE

#### *Monostroma*

##### ***Monostroma nitidum* Wittrock**

Monogr. Monost. (1866) p. 41, pl. 2, fig. 7, a-c; De Toni, Syll. alg. vol. 1 (1889) p. 100; Okamura, On Alg. from Ogasawara-jima (Bot. Mag. Tokyo, Vol. 11, 1897) p. 1; Yamada, Stud. über Meeresalg. von Ins. Formosa, Chlorophyc. (Bot. Mag. Tokyo, Vol. 39, 1925) p. 78.

Japanese name. Hitoe-gusa.

Hab. Nawa.

In our specimens the fronds attain about 9 cm in height in the largest one, and are about 20–25 $\mu$  in thickness. They are always expanded and usually split into many laciniae having fairly crisped margins. At the base of the frond the cells send long thin rhizoids downward, by means of which the fronds attach to the substratum. The cells constructing the frond are polygonal and slightly rounded at the corners in the surface view, and grouped mostly in twos. In the cross section they are nearly round in shape and their cavity is about 10–13 $\mu$  deep. The colour is yellowish green and the substance so lubricous that the frond adheres very closely to paper in drying.

As mentioned above, in habit as well as in anatomical character our specimens answer fairly well to the description of this species.

As cited above, Dr. Okamura has reported this species from the Ogasawara Islands; I have collected it myself in Formosa. The present species seems, therefore, rather common in the south of Japan.

In the vicinity of Nawa *M. nitidum* Wittr. grows abundantly on rocks and coral blocks in the upper littoral belt in May.

#### *Ulva*

##### ***Ulva reticulata* Foskal**

Flora alg. arab. (1775) p. 187; J. Agardh, Till alg. syst. IV. p. 166; De Toni, Syll. alg. vol. 1 (1889) p. 113; Heydrich, Beitr. zur Kenntn. der Algenfl. von Ostasien (Hedwigia vol. 33, 1894) p. 272; Okamura, Icon. of Japan. alg. vol. 2 (1912) p. 182, pl. 100, figs. 1–6; Weber van Bosse, Liste des alg. du Siboga, vol. 1 (1913) p. 52; Yamada, Stud. über Meeresalg. von

Ins. Formosa, Chlorophyc. (Bot. Mag. Tokyo, vol. 39, 1925) p. 78.

Syn. *Phycoseris reticulata* Kg. Tab. Phyc. vol. 6 (1856) pl. 29.

Japanese name. Ami-aosa.

Hab. Nawa.

This species is very common along the shore of Nawa. It grows in great quantity in rather deep pools, entangling itself among other larger algae, *Sargassum* etc., or floating.

***Ulva pertusa* Kjellman.**

Mar. Chlorophyc. fr. Japan (1897) p. 4, pl. 1, figs. 1-5, pl. 3, figs. 1-8; Okamura, Icon. of Japan. alg. vol 4 (1921) p. 79, pl. 170.

Japanese name. Ana-aosa.

Hab. Nawa.

Very common in the upper littoral zone.

***Enteromorpha***

***Enteromorpha intestinalis* Link**

in "Nees Hor. Phys. Berol. (1820) p. 5"; Greville, Alg. Brit. (1830) p. 179; Harvey, Phyc. Brit. (1846-51) pl. 154; Collins, Green alg. of North Amer. (1909) p. 204.

Japanese name. Awonori.

Hab. Tokasiki (K. Teramati).

***Enteromorpha spec.***

Hab. Nawa.

The frond entangles itself among other low lying algae, forming a woolly tuft, and attains the length of about 8 cm. It is very thin and of extreme delicacy, even the thick parts scarcely exceeding  $500\mu$ . It frequently ramifies rather irregularly. The branches are very long and taper very gradually upwards, and, in the upper portion consist of a single row of cells. Near the very end of the branches, the cells are 1.5-2 times as long as broad, but much shorter cells follow, which are,  $2/3-1/2$  times as long as the diameter. Among those long branches there are some short ramuli here and there.

The cells of which the frond is composed are almost always rectangular, rarely polygonal and still less frequently rounded. They are about  $16-28\mu$  across and arranged in rather regularly longitudinal series. The frond is often twisted, and when the branches are composed of four series of cells, it becomes hollow in the center.

## SIPHONOCLADIALES

## VALONIACEAE

*Valonia**Valonia Forbesii* Harvey

Fig. 1-2

Alg. Ceylon exsic. no. 75, Char. of new alg. etc. (1859) p. 333; J. Agardh, Till alg. Syst. VIII. p. 96; De Toni, Syll. alg. vol. 1 (1889) p. 374,

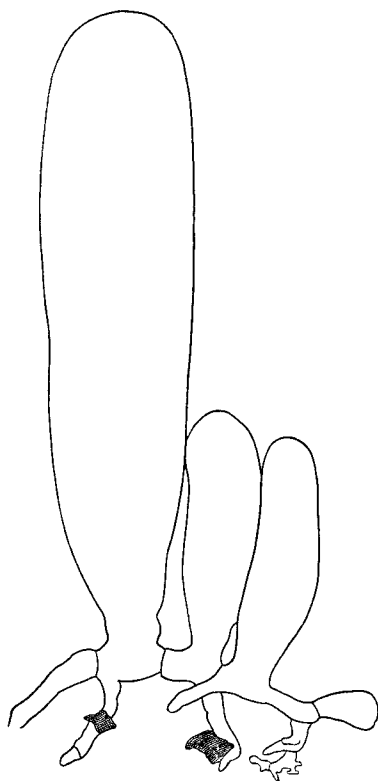


Fig. 2. *Valonia Forbesii* Harv.  
A young plant.  $\times 15$ .



Fig. 1.  
*Valonia Forbesii* Harv.  
 $\times 1.5$ .

Phyc. Jap. nov. (1895) p. 62; Heydrich, Beitr. zur Kenntn. der Algenfl. von Kaiser Wilhelmsland (Ber. deut. Bot. Gesel. vol. 10, 1892) p. 465; Okamura, On alg. from Ogasawara-jima (Bot. Mag. Tokyo, vol. 11, 1897) p. 2; Weber van Bosse, Liste des alg. du Siboga, vol. 1 (1913) p. 59; Yamada, Stud. über Meeresalg. von Insel Formosa, Chlorophyce. (Bot. Mag. Tokyo, vol. 39, 1925) p. 79.

Japanese name. Magatamamo.

(nov.)

Hab. Tomari near Nawa.

The present species is found growing on the sandy bottom of littoral pools, and very often its fronds are covered with sand so deep that only their tips are seen from above.

Some years ago I collected a few specimens of this species at Kaidô, Formosa, and described them in my short paper above cited. In every characteristic they agree quite well with the specimens at hand from Ryukyu, except on one point. In the Formosan specimens I observed some corrugations near the base of the large frond, but the Ryukyu specimens do not show such a feature obviously. This character, therefore, does not

seem to be an important one.

After finishing the study of the Formosan Chlorophyceae I have had the opportunity to see Harvey's specimens of the present species and am now quite certain about the identity of our specimens with *V. Forbesii* Harv.

I give here some illustrations of the Ryukyu specimens of which Fig. 1 shows the basal portion of a young plant.

**Valonia utricularis** (Roth?) Agardh.

Fig. 3

Spec. alg. vol. 1 (1821) p. 431; J. Agardh, Till alg. system p. 98; Kuckuck, Ueber den Bau u. die Fortpfl. von *Halicystis* u. *Valonia*, (Bot. Zeit. 1907)



Fig. 3. *Valonia utricularis* Ag. ×1.5.

p. 166; Börgesen, Mar. alg. of West Ind. vol. 1 (1913) p. 30; Weber van Bosse, Liste des alg. du Siboga, vol. 1 (1913) p. 60; Yendo, Notes on alg. new to Japan, II. (Bot. Mag. Tokyo, vol. 28, 1914) p. 268.

Syn. *Conferva utricularis* Roth, Cat. Bot. vol. 1. (1797) p. 160, tab. 1. fig. 1., vol. 2. (1800) p. 187.

Japanese name. Baronina.

Hab. Nawa.

The present species has been met with only once among other algae in the littoral zone, forming a rather dense mass.

The utricles of our specimens appear to be much shorter than the figures given by Kuckuck.

**Valonia aegagropila** Agardh.

Fig. 4

Spec. alg. (1824) p. 429; J. Agadh, Alg. med. (1842) p. 24, Till alg. system. VIII. p. 99; Kützig, Spec. alg. (1849) p. 505, Tab. phyc. vol. 6. (1856) pl. 87, fig. 1; De Toni, Syll. alg. vol. 1. (1889) p. 377; Kuckuck, Ueber den Bau u. Fortpfl. von *Halicystis* u. *Valonia* (Bot. Zeit. 1909) p. 174; Weber

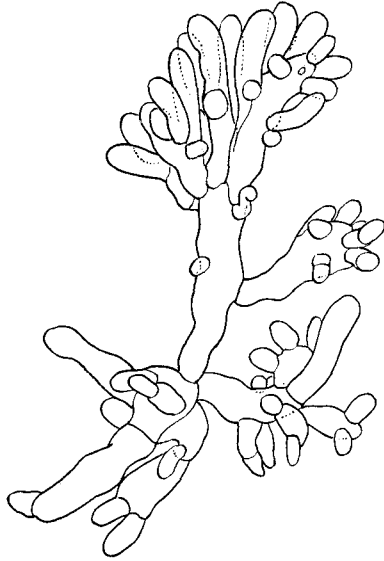


Fig. 4. *Valonia aegagropila* Ag.  
× 4.

van Bosse, Liste des alg. du Siboga, vol. 1. (1913) p. 60; Yamada, Stud. über Meeresalg. von Ins. Formosa (Bot. Mag. Tokyo, vol. 39, 1925) p. 80.

Japanese name. Tama-baronia.  
(nov.).

Hab. Nawa.

This species of *Valonia* is found rather commonly in the littoral zone, forming a very dense ball. It answers well to the description and figures of Kueckuck's forma *typica*.

Heydrich enumerates in his list of Loo-choo algae<sup>1)</sup> *V. utricularis* f. *aegagropila* Ag. Though I cannot at present examine his specimen, it is probably the same as ours.

### *Dictyosphaeria*

#### *Dictyosphaeria bokotensis* Yamada

Fig. 5

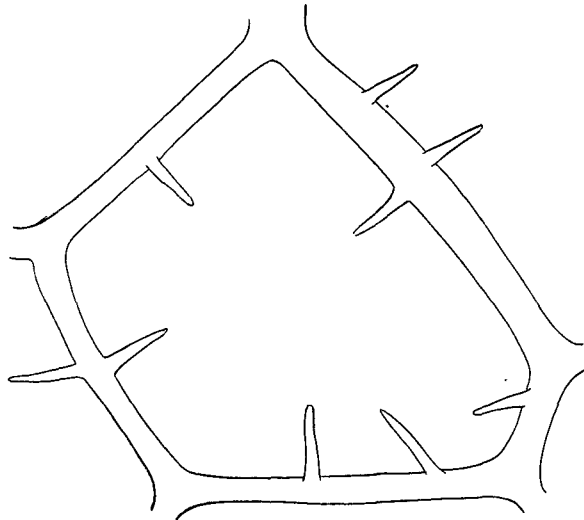


Fig. 5. *Dictyosphaeria bokotensis* Yamada.  
A cell cavity showing spine-like bodies. × 140.

1) Heydrich: Einige Algen von den Loochoo- oder Riu-kiu-Inseln. (Ber. d. deut. Bot. Gesel. Bd. 25, 1907) p. 101.

Stud. über Meeresalg. von Ins. Formosa, Chlorophyc. (Bot. Mag. Tokyo, vol. 39, 1925) p. 81, fig. 1.

Japanese name. Toge-kikkôgusa (nov.).

Hab. Nawa; Tomari; Itoman.

In habit this species closely resembles *D. favulosa* Deesne., which is also very common in this locality. But in *D. bokotensis* the size of the cells is fairly regular, the cells becoming gradually smaller upwards.

In the specimens from Formosa, I found spine-like bodies of cellulose, mostly in cells in the lower part of the frond, but in the specimens at hand those bodies of cellulose are found in almost all the cells in the lower parts of the frond as well as in the upper, and usually they are met with on the sides of the cell-wall on which the cells face each other.

Very common on rocks, coral blocks, etc. in the littoral zone.

#### **Dictyosphaeria favulosa** Decaisne

“Class. des alg. calcif. p. 32”; Harvey, Ner. Bor. Amer. part 3 (1857) p. 50, pl. 44, B; Weber van Bosse, Note sur gen. *Dictyosphaeria* (Nouva Notarisia vol. 16, 1905) p. 143, Lists des alg. du Siboga, vol. 1. (1913) p. 63; Heydrich, Einige Alg. von den Loochoo- od. Riu-kiu-Inseln (Ber. d. deut. Bot. Gesel. vol. 25, 1907) p. 101; Okamura, Icon. of Japan. alg., vol. 1. (1908) p. 205, pl. 40, figs. 13-24.

Japanese name. Kikkô-gusa.

Hab. Nawa; Itoman.

Very common in the upper littoral zone, growing on coral blocks, etc.

### Fam. BOODLEACEAE

#### **Cladophoropsis**

##### **Cladophoropsis fasciculata** (Kjellman) Börgesen

Contr. a la connais. du gen. *Siphonocladus* (1905) p. 288; Okamura, Icon. of Japan. alg., vol. 4. (1921) p. 75, pl. 169, figs. 1-7, On mar. alg. from Kôtôsho (Bull. of Biogeogr. Soc. Japan, vol. 2, 1931) p. 97; Yamada, Stud. über Meeresalg. von Ins. Formosa, Chlorophyc. (Bot. Mag. Tokyo, vol. 39, 1925) p. 85.

Syn. *Siphonocladus fasciculatus* Kjellman, Mar. Chlorophyc. fran Japan (1897) p. 36, pl. 7, figs. 10-17.

Japanese name. Midorige.

Hab.

One specimen of this species was sent by Mr. S. Sakaguchi who

collected it probably in the vicinity of Nawa.

### ***Boodlea***

#### ***Boodlea siamensis* Reinbold**

In Schmidt's Flora of Koh Chang, part 4, (1901) p. 107, in Weber van Bosse's Liste des alg. du Siboga, vol. 1. (1913) p. 68; Børgesen, Mar. alg. of Dan. West Ind., vol. 1. (1913) p. 49, Some Ind. green and brown alg. (Journ. of the Indian Bot. Soc. vol. 1930) p. 153.

Japanese name. Yuru-aomogusa (nov.).

Hab. Nawa; Itoman; Tomari.

If I refer our specimens to the present species, it is mainly because of the irregularity of the ramification and size of cells, facts emphasized by Reinbold. In fact, branches as well as branchlets are sometimes alternate, sometimes opposite and often secund. The length of the cells is also strikingly variable; in some cases they are about 12 times as long as the diameter. The sponge-like mass which the frond makes up is rather loose and the tenaculæ are few in number.

I have also observed some zoosporangia which answer well to Børgesen's figure.

This alga is very common in the upper littoral zone.

## **ANADYOMENACEAE**

### ***Anadyomene***

#### ***Anadyomene Wrightii* Gray**

Journ. of Bot. (1866) p. 48, pl. 44, fig. 5; J. Agardh, Tell alg. system., VIII. p. 124; De Toni, Syll. alg., vol. 1. (1889) p. 367; Okamura, Icon. of Japan. alg., vol. 1. (1908) p. 198, pl. 40, figs. 1-6; Weber van Bosse, Liste des alg. du Siboga, vol. 1. (1913) p. 73.

Japanese name. Ukiorisô.

Hab. Nawa.

The present species has been met with rather rarely, sheltering itself under other larger algae.

### ***Microdictyon***

#### ***Microdictyon Okamurai* Setchell.**

Fig. 6-7

Notes on *Microdictyon* (Univ. Calif. Publ. Bot. vol. 13, 1925) p. 107, Notes on *Microdictyon*, II. (Ibid. vol. 13, 1926) p. 149, The genus *Microdictyon* (Ibid. vol. 14, 1929) p. 553, figs. 76-84.

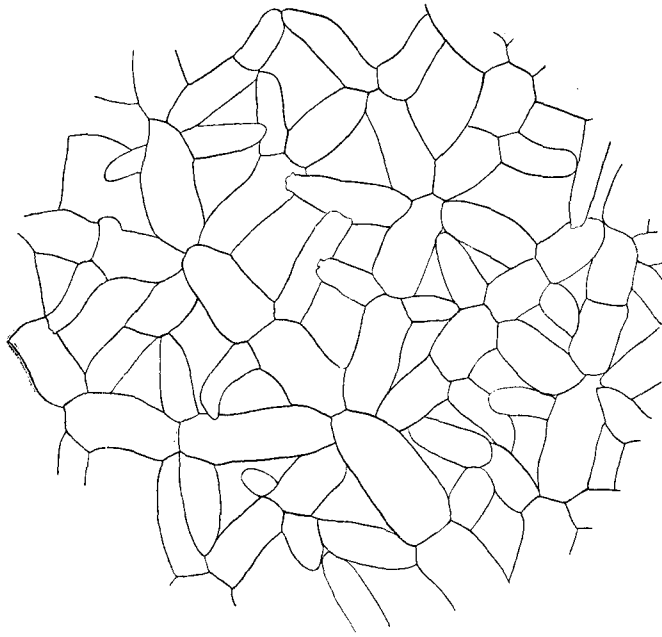


Fig. 6. *Microdictyon Okamurai* Setch.  
A portion of the interior of the frond.  $\times 18$ .

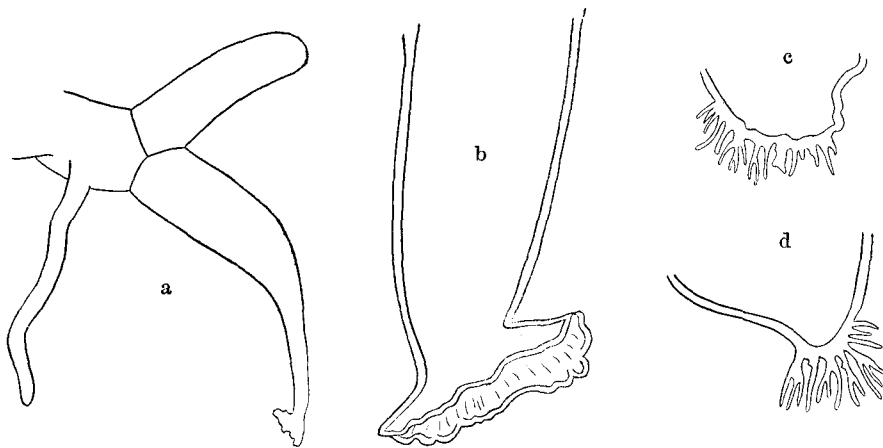


Fig. 7. *Microdictyon Okamurai* Setch.  
a. Basal portion of the frond.  $\times 28$ .  
b.-d. Three segment-tips with fibulae.

Syn. *Microdictyon pseudohapteron* Okamura (non A. & E. S. Gepp)  
Icon. of Japan. alg., vol. 2. (1910) p. 105, pl. 80, figs. 8-12 (in part).

Japanese name. Tanomogusa.

Hab. Tomari; Itoman.

This species grows on shells or corals in the littoral zone. The natural form of the frond is just like that of *M. Velleyanum* Decne. which is well shown in a photograph in Setchell's last work cited above. The Ryukyu specimens at hand are erect, being 2-5 cm high, undulate, sinuous and confluent into a rosulate cluster. They fasten themselves to the substratum at the basal part by means of roots ending often in a hapter-like swelling. The diameter of the filaments in the basal as in the upper parts is above  $400\mu$  while the walls are very thin, being about  $4\mu$  thick. The fibulae are rather difficult to see in the attached state, but after being detached their true state is often very clearly seen. They are usually crenellate, but often the crenae become so long that they appear like rhizoids.

## CLADOPHORACEAE

### *Chaetomorpha*

#### **Chaetomorpha Linum** (Müller) Kützing.

Phyc. germ. (1845) p. 204, Spec. alg. (1849) p. 378; De Toni, Syll. alg., vol. 1. (1889) p. 269; Yendo, Notes on alg. new to Jap., IV. (1916) p. 48.

Japanese name. Usuiro-judumo (nov.).

Hab. Nawa.

#### **Chaetomorpha crassa** Kützing.

Phyc. germ. (1845) p. 204, Spec. alg. (1849) p. 379; De Toni, Syll. alg., vol. 1. (1889) p. 270.

Japanese name. Hosojudumo.

Hab. Nawa.

#### **Chaetomorpha basiretrorsa** Stechell(?)

Tahitian algae (Univ. Cal. Pub. Bot. vol. 12. 1926) p. 72, pl. 8, figs. 4-6.

Japanese name. Tyabo-judumo (nov.).

Hab. Tomari near Nawa.

The frond of this species is usually very densely caespitose, but is sometimes found nearly solitary. It is about 1-2-3 cm in length (rarely 4 cm.) and almost always curved, mostly downward. The diameter of the frond is 500-1000 $\mu$ , but it becomes very gradually thinner downwards. The cells are somewhat barrel-shaped and their length varies between once

and twice their width, but the basal cell lengthens extraordinarily, usually in retroflex fashion, and at the very end divides into some irregularly ramified thin rhizoids by means of which the frond is fastened to the substratum. The membrane of the cells is thick and stratified, especially in the basal cell. The frond is dark green in colour, and iridescent in water. Börgesen observed small swellings upon rhizoids of *C. media* Kg. as well as *C. pachynema* Mont. which shows the young stage of the new frond. I have also met with the same thing in our specimens as the figure given by Börgesen.

It is sometimes observed that near the base of the frond a thin elongation issues from the base of a cell and this elongation ends in a rhizoid-like attaching organ. In such a case this elongation is not separated by any wall from the cell from which it is sent off.

As can be seen from the description given above, our specimens agree rather well with the Tahitian ones, yet there are some divergences in several points. Setchell measured the segment as 400–600 $\mu$  across, while in ours it often attains 1000 $\mu$ . Moreover the rhizoid of the Tahitian plant seems more simply ramified than ours.

The present species was found on stones and small coral blocks lying in shallow pools in the littoral zone, and seems to be a rather rare species.

### *Cladophora*

#### *Cladophora fastigiata* Harvey

Char. of new alg. (1859) p. 333.

Japanese name. Tyabo-siogusa (nov.).

Hab. Nawa.

Among my collection of Ryukyu algae there is one tuft of *Cladophora* which corresponds fairly well with the description of *C. fastigiata* Harv.

The tuft is about 1.7 cm. in height and very dense. Every characteristic answers quite well to Harvey's diagnosis which is brief but to the point.

#### *Cladophora fuliginosa* Kützing

Fig. 8

Spec. alg. (1849) p. 515; De Toni, Syll. alg., vol. 1. (1889) p. 347; Collins, Green alg. of North Amer. (1909) p. 348; Börgesen, Mar. alg. of West Ind., vol. 1. (1913) p. 22; Howe, in Britton and Millspaugh's Bahama fl. (1920) p. 601; Taylor, Mar. alg. of Florida (1928) p. 62, pl. 4, fig. 5; Yamada, Notes on some Japan. alg., IV (Journ. Fac. Sci. Hokkaido Imp. Univ. Ser. V. vol. 2, 1932) p. 268.

Japanese name. Kabi-siogusa (nov.).

Hab. Nawa.

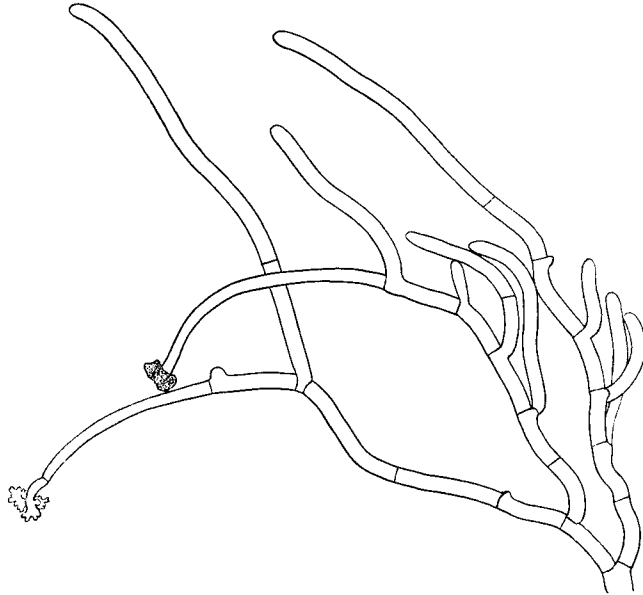


Fig. 8. *Cladophora fuliginosa* Kg.

As I have mentioned (l. c.), one dried specimen of the present species is preserved in the Herbarium of Prof. K. Yendo, Tokyo, and in 1924 I collected it in Formosa. In the vicinity of Nawa this species is found rather in abundance on rocks in the littoral belt, forming a rather dense cushion-like tuft.

The frond is about 1-2 cm high and ramifies densely, the branches often bending downwards. Branches or branchlets are often disposed in a second manner, and the latter sometimes show no cross wall at the base even when the branches are not very short. The cells in the branches are  $250-300\mu$  thick and usually 4-6 times as long as the diameter, but often they become much longer, especially the cells situated at the end of branches or branchlets are very much longer; and some of them are provided with a rhizoid which attaches to the substratum. The tip of the branches or branchlets is obtuse. The cell wall is rather thick, measuring about  $17\mu$ .

Our specimens are richly infested by an endophytic fungus *Blodgettia Borneti* Wright. The diameter of hyphae is about  $3-4\mu$  and that of conidia about  $12\mu$ .

**Cladophora japonica** Yamada

Notes on some Japan. alg., II. (Journ. Fac. Sci. Hokkaido Imp. Univ. Ser. V. vol. 1. 1931) p. 65, pl. 16.

Japanese name. Ô-siogusa (nov.).

Hab. Nawa.

The Ryukyu specimens of this species are generally smaller than those from Japan proper. The basal long cell emits some short rhizoids which ramify irregularly.

**Cladophora (Aegagropila) Sibogae** Reinbold

Einige neue Chlorophyc. aus dem Ind. Ozean (Nouva Notarisia Ser. 16, 1905) p. 146, in Weber van Bosse's Liste des alg. du Siboga, vol. 1 (1913) p. 81; Yamada, Phyto-geogr. relation between Chlorophyc. of Marian. Carol. and Marshall Isl. and those of Malay archipel., Austr. and Jap. (Proceed. of the 3. Pan-Pacif. Sci. Congr. 1926) p. 964 & 965; Okamura, On the mar. alg. from Kôtôsho (Bull. of Biogeogr. Soc. of Japan., vol. 2, 1931) p. 96.

Japanese name. Nedasi-siogusa (nov.).

Hab. Nawa.

Our specimens answer rather well in every characteristic to the descriptions of Reinbold. But there is some difference in dimension of branches, our specimens being thicker than Siboga's. The ultimate branchlets in our specimens often reach  $100\mu$  while Reinbold measures them as  $40-60\mu$ .

The present species seems to be distributed widely in the southern parts of the Pacific Ocean. In 1925 I found it in the Caroline Islands, and recently it was reported from Kôtôsho, Formosa, by Dr. Okamura.

**SIPHONOCLADIACEAE**

***Struvea***

***Struvea tenuis*** Zanardini.

Fig. 9

Phyc. Papuanæ novæ (Nouvo Giornale Botanico Italiano, vol. 10, 1878) p. 39; Murray et Boodle, A struct. and syst. account of the gen. *Struvea* (Ann. of Bot., vol. 2, 1888) p. 281, pl. 16, fig. 5; De Toni, Syll. alg., vol. 1. (1889) p. 366; Heydrich, Beitr. zur Kenntn. der Algenfl. von Kaiser-Wilhelms-Land (Ber. d. deut. Bot. Gesel., vol. 10, 1892) p. 461.

Japanese name. Amiha.

Hab. Tomari.

The fronds are loosely caespitose and each one divides into 2-4

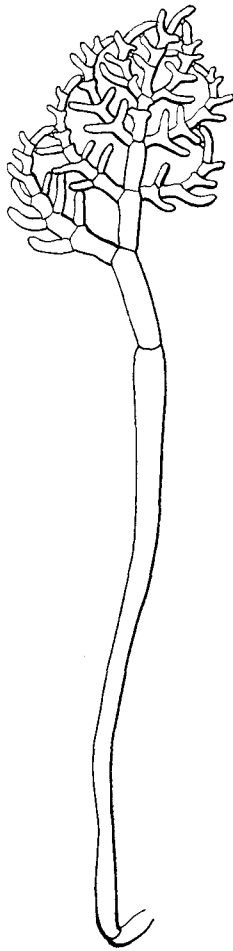


Fig. 9.  
*Struvea tenuis* Zanard.  
× ca. 13.

*Struvea* (Ann. of Bot. vol. 2, 1888) p. 281, pl. 16, fig. 6; De Toni, Syll. alg., vol. 1. (1889) p. 366; Heydrich, Beitr. zur Kenntn. der Algenfl. von Ostasien (Hedwigia, vol. 1894) p. 281; Okamura, Icon. of Japan. alg., vol. 1. (1908) p. 203, pl. 40, figs. 9–12, On the mar. alg. from Kôtôsho. (Bull. of the Biogeogr. Soc. of Jap. vol. 2, 1931) p. 97, On the alg. from the isl. Hatidyô (Records of Oceanogr. Works in Japan, vol. 2, 1930) p.

“stipes” near the base. At the base the frond sends some irregularly branched small hapter-like roots, by means of which it fastens itself to the substratum. The height of one specimen measures about 8 mm. The stipe is rather long, being about 6 mm. It is composed of two cells except at the very base, the roots, and while the upper cell remains rather short, the lower one is very long. Neither show any transverse corrugation. The stipe is simple, not ramified. The diameter of its cells is 350–550  $\mu$ . The leaves are ovate in outline, about 2 mm long, bipinnate; the pinnae are opposite and always curved upward sending out again opposite pinnules. The pinnules are obtuse at the apex and some of them attach at their apex to the cell-wall of neighbouring pinna or pinnules by means of small haptera. Many of the pinnules have no septum at their base.

Okamura<sup>1)</sup> gives a fine illustration of a specimen also collected in the Ryukyu Islands, which he tentatively referred to the present species. As he noticed, his specimen has a tripinnate leaf instead of bipinnate and might be a young form of *S. delicatula* Kg., as he supposed.

I have found the present species only once, and then only a few specimens. They grow on a small coral block together with *Boodlea* sp. and *Chaetomorpha* sp.

### ***Struvea delicatula* Kützing**

Fig. 10.

Tab. Phyc., vol. 16. (1866) p. 1, pl. 2, figs. e–g; Murry & Boodle, A struct. and syst. account of the gen.

1) Okamura: Icon. of Japan. alg., vol. 1. (1908) p. 201, pl. 40, figs. 7–8.

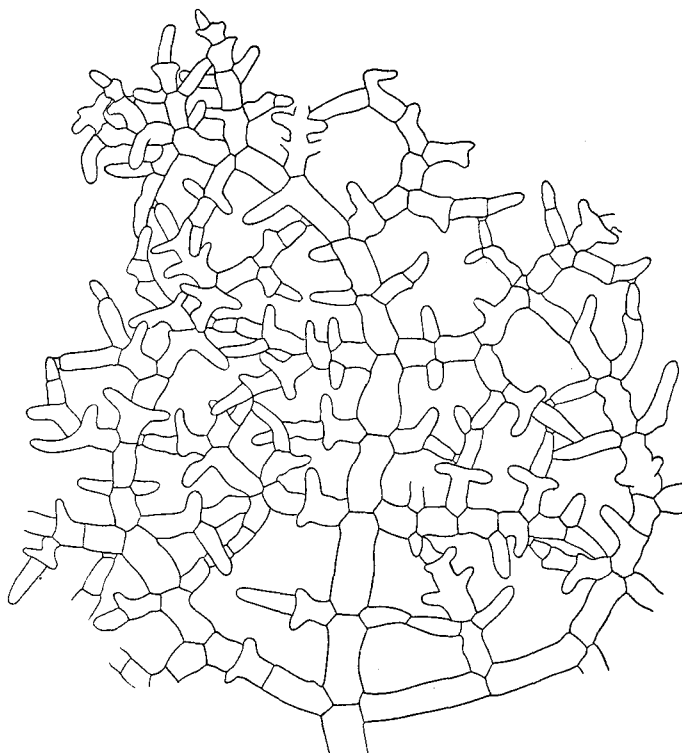


Fig. 10. *Struvea delicatula* Kg.  $\times 25$ .

103; Reinhold, in Weber van Bosse's Liste des alg. du Siboga, vol. 1. (1913) p. 65; Yamada, Stud. über Meeresalg. von Ins. Formosa, Chlorophyc. (Bot. Mag. Tokyo, vol. 39, 1925) p. 82.

Japanese name. Sainome-amiha.

Hab. Tomari.

In the same shallow pool as where *St. tenuis* was found, I found a tuft of another *Struvea* on a small coral block which corresponds well to *St. delicatula* Kg. The specimens at hand are caespitose, forming an entangled mass consisting of about five specimens, of which two are nearly complete. The larger one is nearly two cm. high; the stipe is simple, 1.2 cm. long and composed of two cells. The upper cell is about  $400\mu$  thick and remains much shorter than the other. The latter becomes gradually slenderer downwards and issues some roots at its base. They show no transverse corrugation. The leaf is almost in one plane and nearly round in outline, about 8 mm in diameter. It ramifies usually tripinnately, but in some

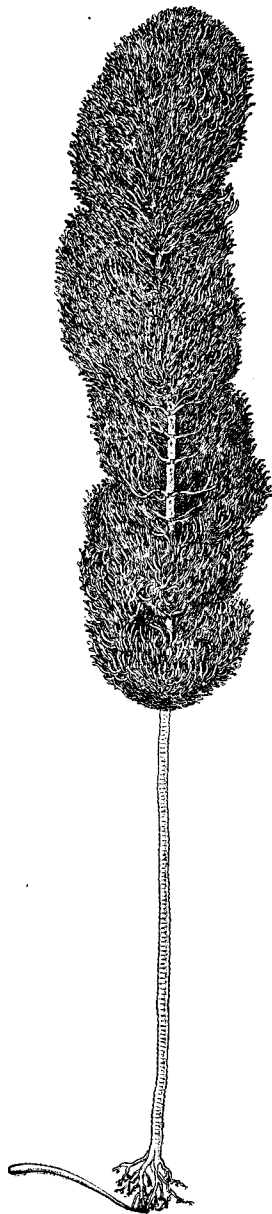


Fig. 11.  
*Chamaedoris orientalis*  
Okam. et Higashi (?)  
Slightly reduced.

places the ramuli divide once more, making the ramification quadripinnate. The ramuli always curve upwards and the ultimate ones are obtuse at the apices. Some of them are provided with a small tenaculum by means of which they attach to the membrane of other cells.

The present species seems to be distributed very widely in the tropical and warmer temperate waters. Okamura reported it from Hatijô Island, which probably marks the northern limit of distribution.

In our specimens the root is not composed of fibrous processes, and this is well shown in the illustration of Dr. Okamura above cited.

#### *Chamaedoris*

Fig. 11

***Chamaedoris orientalis*** Okamura et Higashi (?)  
On mar. alg. Kôtôsho (Bull. of Biogeogr. Soc. of Jap., vol. 2, 1931) p. 98, pl. 10.

Japanese name. Tanpoyari.

Hab. Itoman.

There are two specimens at hand, one being nearly complete and large, while in the other the capitulum is broken and the frond is much smaller than in the former. The complete specimen is about 17 cm high and the length of the capitulum alone measures nearly 10 cm., while the length of the stem does not exceed 7 cm. According to the original description of the present species, the stem is always longer than the capitulum, but here the proportion is quite different.

The stem is simple, about 1.2 mm in diameter, provided with shallow annulation, ending downwards in irregularly branched rhizoids. Some simple shoot-like body which is figured by Börgesen in *C. penicillum* O. Kuntze is also found on the uppermost rhizoid coming out of the stem.

The capitulum is cylindrical in outline, nearly 10 cm. long, about 2.3 cm. in diameter. The central

axis of the capitulum is septated in 28 articulations from whose shoulders verticillate filaments arise, which are arranged in 3-5 whorls. The authors of *C. orientalis* state in the original description that the number of the articulations in the central axis of the capitulum seems to be definite, because they counted always the same number in their specimens, 14, both small and large ones. But in the specimen at hand it is just twice as large as in the original description.

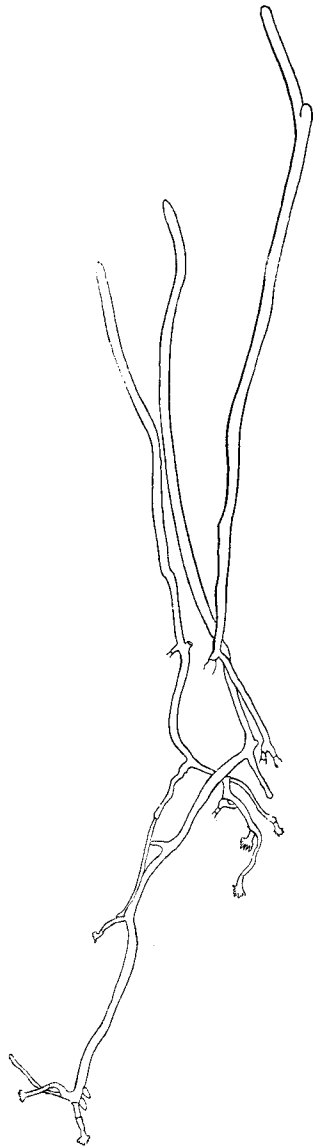


Fig. 12.  
*Spongoeladia vaucheriaeformis*  
Aesch.  $\times$  ca. 13.

The filaments are about  $400\mu$  thick, and ramify pseudodichotomously, often alternate-secund, and near the end they are always curved. There are some tenaculæ by means of which the filaments attach to each other. Some are just like those of *C. orientalis* figured by Okamura and Higashi, but others are slightly elongated, thus approaching to Börgesen's figure (Mar. alg. of West Ind., p. 58, f. 41, h.). The chromatophores are in a net-like arrangement, but in some places (joint places?) they are in an irregularly polygonal outline with the corners running out into shorter or longer thin prolongations forming a reticule. Thus the net is very fine. In the cell-cavity there are many needle-shaped crystals.

The specimens of this species were picked up by a diver from the coral reef at a depth of about 2 fathoms. When the diver brought them up, he was instructed on the spot to collect more of them but his search was fruitless. When living they are yellowish green in colour, but iridescent. The wall of the stem as well as the filaments is infested by some Cyanophyceae, Molebesiæ, etc.

As mentioned above the specimens at hand show some divergence in characteristics from the original description, especially in the number of articulations forming the central

axis of the capitulum is septated in 28 articulations from whose shoulders verticillate filaments arise, which are arranged in 3-5 whorls. The authors of *C. orientalis* state in the original description that the number of the articulations in the central axis of the capitulum seems to be definite, because they counted always the same number in their specimens, 14, both small and large ones. But in the specimen at hand it is just twice as large as in the original description.

axis of the capitulum. So our plant is tentatively to be referred to the present species until more abundant material can be obtained.

### *Spongocladia*

***Spongocladia vaucheriaeformis*** Areschoug. in "Oefvers. of Kongl. Vetensk. Akad. Förhandl. vol. 1, p. 201"; Murray et Boodle, On the struct. of *Spongocladia* with an account of new forms (Ann. of Bot., vol. 2. 1888) p. 175; Weber van Bosse, "Etudes sur les algues de l'Archip. Malaisien, I. (Ann. du Jardin bot. de Buitenzorg, vol. 8. 1890) p. 85", Liste des alg. du Siboga, vol. 1. (1913) p. 86; Okamura, Icon. of Japan. alg., vol. 5. (1928) p. 189, pl. 250, figs. 5-12.

Japanese name. Kitunenowo.

Hab. Nawa; Itoman.

The present species grows in abundance in the littoral zone among see-phanerogams.

Areschoug found zoospores germinating in situ figures of which are reproduced by Murray and Boddle l. c. In our specimens preserved in Formalin I have also met with cells in which there are many such small bodies as those Areschoug observed. Such a cell is provided with a terminal pore when the cell is situated at the top of a filament, but when it is located intercallary, pores are produced on the side of the cell.

Fig. 12-13

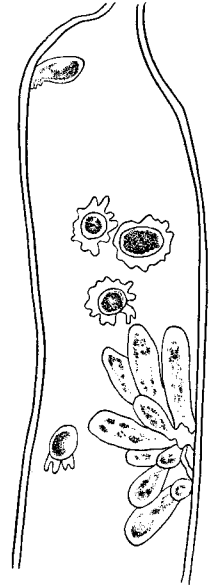


Fig. 13.  
*Spongocladia vaucheriaeformis* Aresch.  
Zoospores germinating  
in situ.  $\times 230$ .

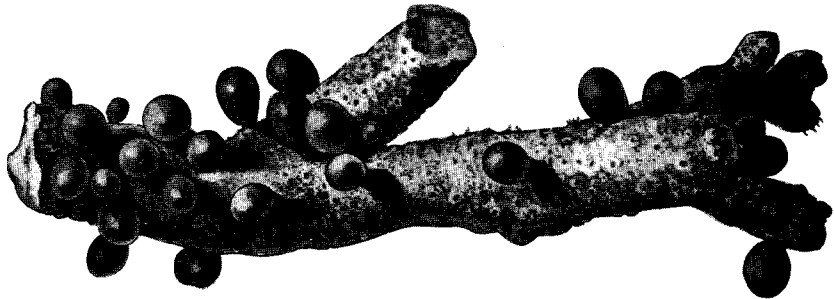


Fig. 14. *Bornetella ovalis* Yamada  
Algae growing on a coral block.  $\times$  ca. 1.

## DASICLADACEAE

### *Bornetella*

***Bornetella ovalis*** Yamada Fig. 14-15  
Notes on some Japan. alg., V. (Journ. Fac. Sci. Hokkaido Imp. Univ., Ser. V, vol. 2, 1933) p. 277.

Syn. *B. capitata* Okamura (non *J. Agardh*), Icon. of Japan. alg., vol. 1. (1908) p. 225, pl. 44, figs. 1-10.

Japanese name. Midutama.

Hab. Nawa; Tomari; Itoman.

In my "Notes" I have already mentioned the reasons why the present plant must be separated specifically from *B. capitata* in a *J. Agardh's* sense.

*B. ovalis* Yam. grows in great abundance on coral blocks, stones, etc., lying in shallow pools.

It seems to prefer sheltered locations.

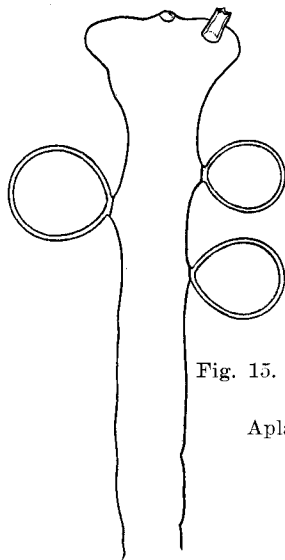


Fig. 15. *Bornetella ovalis*  
Yamada.  
Aplanosporangia.  
× ca. 60.

### *Neomeris*

***Neomeris annulata*** Dickie. Fig. 16-17  
"On the alg. of Mauritius (Journ. Linn.

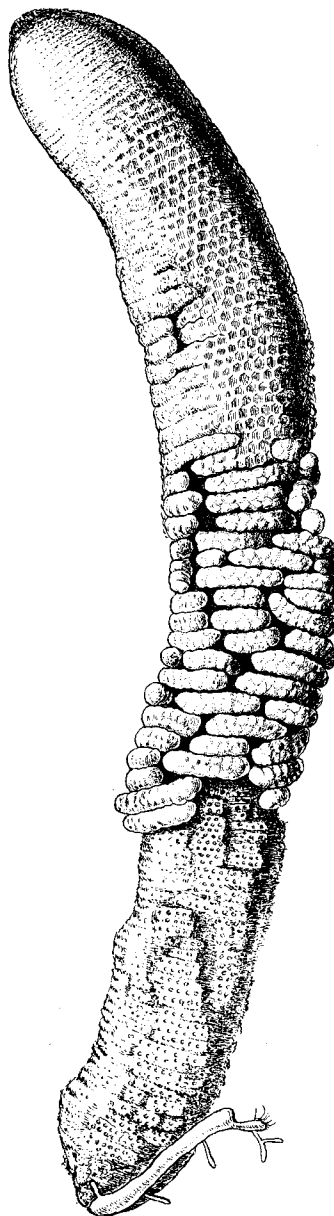


Fig. 16. *Neomeris annulata*  
Dickie. × ca. 14.

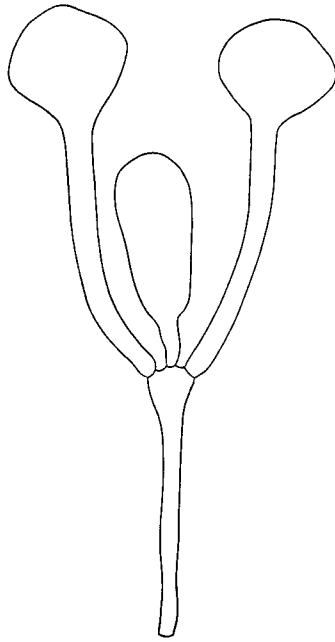


Fig. 17. *Neomeris annulata*  
Dickie.  
Sporangium.  $\times 135$ .

Soc., vol. 14, 1876) p. 198''; Solmes-Laubach, Ueber die Algengen. *Cymopolia*, *Neomeris* u. *Bornetella* (Ann. du Jard. bot. de Buitenz., vol. 11, 1893) p. 62 etc.; Børgesen, Some Chlorophyc. from the Dan. West Ind., II. (Bot. Tidrsks., vol. 32, 1912) p. 271, Mar. alg. of Dan. West Ind., vol. 1. (1913) p. 71; Howe, Phyc. studies, IV, (1909) p. 87, pl. 1, fig. 1; Gepp, Mar. alg. and mar. Phanerog. of the Sealark exped. (1908) p. 169; Weber van Bosse, Liste des alg. du Siboga, vol 1. (1913) p. 88.

*Neomeris Kelleri* Cramer, Ueber die verticil. Siphon. besond. *Neomeris* u. *Cymopolia*, (1887) pp. 3, 39, pl. 1, pl. 2, figs. 1-12, pl. 3, figs. 1, 2., Ueber die verticil. Siphon. besond. *Neomeris* u. *Bornetella*. (1890), p. 9, pl. 1, figs. 1-12, pl. 2, fig. 1-6, pl. 4, f. 15-24; Vickers, Phyc. Barbado., vol. 1. (1908) pl. 46.

Japanese name.

Hab. Tomari.

All specimens at hand show clearly the characteristics of the present species; the sporangia, especially, are coherent laterally, and the lower fertile parts of the frond appear transversely annulate. The transverse rings thus formed are not complete, but interrupted into many portions.

The present species was found growing rather scattered on small blocks of coral or on stones lying in shallow pools, together with *Cymopolia van Bossei* Solm. and *Acetabularia* spp.

### *Cymopolia*

#### *Cymopolia van Bossei* Solmes

Fig. 18-19

Ueber Algengen. *Cymopolia*, *Neomeris* u. *Bornetella*. (Ann. du Jard. Bot. Buitenz., vol. 11, 1892) p. 78, pl. 8, figs. 9-10, 14-16; Weber van Bosse, Liste des alg. du Siboga, vol. 1, (1913) p. 89.

Japanese name. Usugasane.

Hab. Tomari.

This is a very small species of *Cymopolia*. The frond is always simple and rarely exceeds 1 cm. in height and consists of about 5-10 articulations,

at the top of the uppermost one there being a hair bush. Articulations are shortly cylindrical, slightly barrel-shape, sometimes shorter than the diameter and sometimes longer. Their diameter is rather variable, usually becoming larger upwards; thus the thickest articulation is usually 1 mm. thick or a little more.

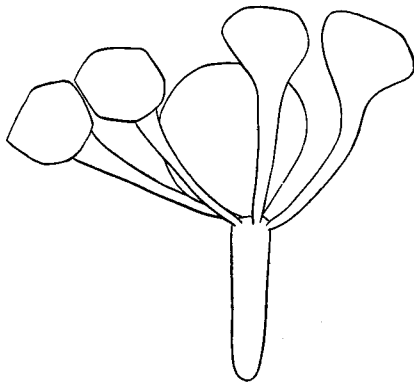


Fig. 19. *Cymopolia van Bossei* Solmes.  
Sporangium.  $\times 140$ .

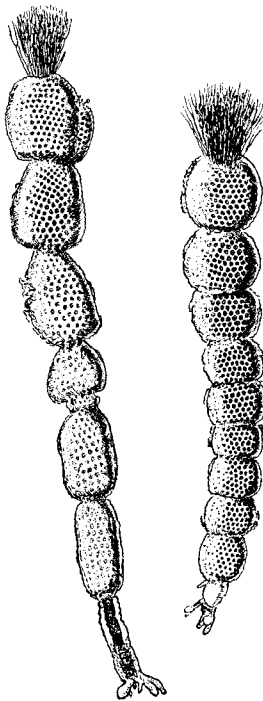


Fig. 18. *Cymopolia van Bossei* Solmes.  $\times$  ca. 10.

The number of the secondary ramelli varies between 4 and 8, showing an inflated head, which is hexagonal as seen from the surface. The gametangia are round, always sessile, as emphasized by Solmes Laubach, and their diameter is about  $170\mu$ .

The present species grows on small coral blocks in shallow pools. It is found rather scattered.

### *Acetabularia*

***Acetabularia ryukyuensis*** Okamura et Yamada

Fig. 20

Okamura; Icon. of Japan. alg., vol. 6. (1932) p. 71, pl. 285, figs. 5-12.

Syn. *Acetabularia mediterranea* Ito (non Lamouroux).

Syn. *Acetabularia mediterranea* Okamura (non Lamouroux), Nippon Sorui Meii (1916) p. 247.

Japanese name. Kasanori.

Hab. Nawa; Itoman.

This species grows abundantly on stones and small coral blocks in shallow pools.

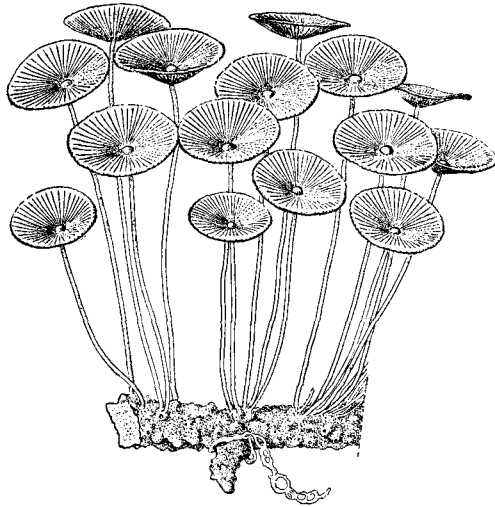


Fig. 20. *Acetabularia ryukyuensis*  
Okam. et Yamada.  $\times 1$ .

T. Itô has reported *A. mediterranea* Lamx. from the Ryukyu Islands. His report is based upon specimens collected by Prof. Matsumura. One of the specimens which was collected by him at the same time is now kept in the herbarium of the Tokyo Imperial University. It is nothing but the present species, and it seems to me most probable that Dr. Itô's specimens are the same as it. I doubt the occurrence of *A. mediterranea* Lamx. in our territory.

***Acetabularia dentata* Solmes**

Monogr. of Acetabulariac. (Transac. of Linn. Soc. London, vol. 5, 1895)  
p. 23, pl. 1, fig. 11.

Fig. 21

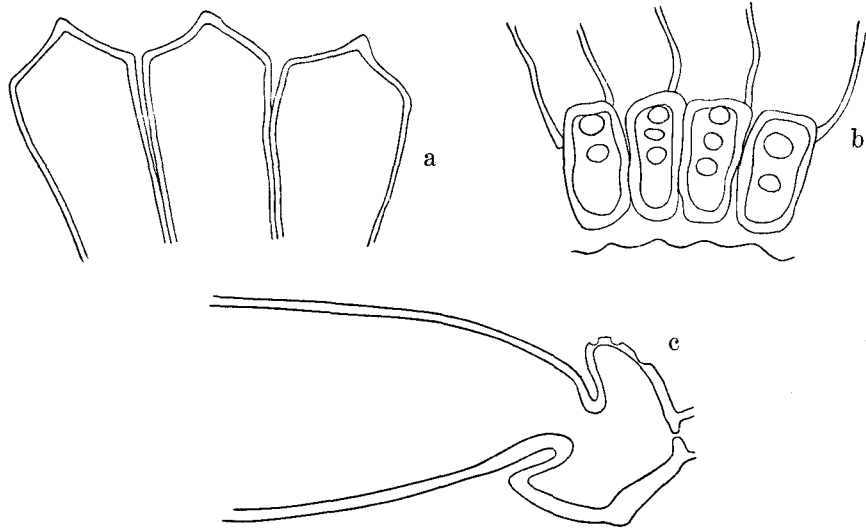


Fig. 21. *Acetabularia dentata* Solmes.  
a. Tips of three aplanosporangia.  $\times 140$ .  
b. Corona superior with hair-scars.  $\times 140$ .  
c. The side view of the base of an aplanosporangium.  $\times 180$ .

Japanese name. Ryukyu-gasa (nov.).

Hab. Tomari; Nawa.

The plant is small, its frond being about 1 cm in height. The stem is solitary and calcified strongly and bears a disc at the top. The disc is round in outline, very shallowly dish-shape and rather heavily incrustated with chalk. It is composed of about 28 rays or more with a diameter of 2–3 mm. The rays are coherent with each other, but after decalcification they are very easily separable. At the end they are triangular, and sharply pointed at the very extremity. The corona superior is lengthily ovate or irregularly rectangular when seen from above, about  $110\mu$  long, about  $55\mu$  wide, and provided with two or three hair-scars. The corona inferior is lobed at the apex. Aplanospores are unknown.

Very unfortunately all our specimens are sterile; the content of the rays is very dense, but not yet divided into aplanospores.

This is a rather common *Acetabularia* in the vicinity of Nawa, growing on small stones or blocks of coral in shallow pools, and, owing to the deep green colour of the disc, it catches the eye in spite of its small size.

#### ***Acetabularia (Polyphysa) exigua* Solmes**

Monogr. of Acetabulariac. (Transac. of Linn. Soc. London, vol. 5, 1895) p. 28, pl. 2, figs. 1, 4; Weber van Bosse, Liste des alg. du Siboga, vol 1. (1913) p. 91.

Japanese name. Hosigata-kasanori (nov.).

Hab. Nawa.

No specimen at hand has a basal part, and the stalk measures 1.5–3 mm and is well calcified. In the upper part there are many annular parallel rings which are very densely arranged. The disc is very shallowly dish-shape, about 2 mm in diameter and composed of 7–13 rays. The rays are spindle-shape, pointed, calcified on the whole surface except for their apices, but are free from each other. There is no corona inferior. The corona superior is about  $60\mu$  in maximum diameter in the side view and bears three hairs or hair scars.

There are some seven specimens collected in May and all are sterile.

The present species was encountered on small blocks of coral lying in shallow pools together with *Neomeris annulata* Dickie, *Cymopolia van Bossei* Solmes etc.

#### ***Acetabularia (Polyphysa) parvula* Solmes(?)**

Fig. 22–23

l. c. p. 29, pl. 2, figs. 3, 5; Weber van Bosse, l. c. p. 91.

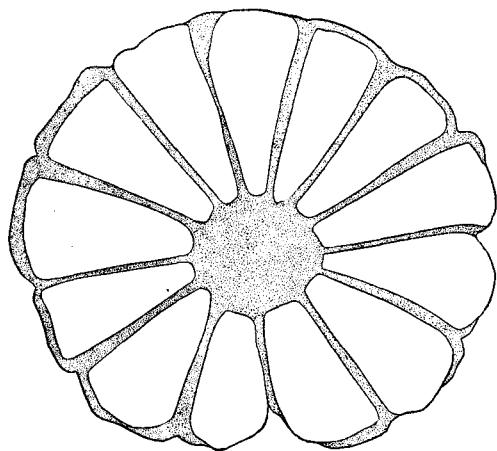


Fig. 22. *Acetabularia parvula* Solmes (?)  
The disc seen from above.  $\times 20$ .

nearly 1 mm in length and thickened upwards. In the upper portion it is provided with numerous densely arranged transverse annulations. The disc is flat, being composed of 12-13 rays which are obovoid-clavate in shape, and nearly truncated or more usually somewhat rounded at the apex. The coroneae superior are shortly cylindrical, slightly enlarged at the top and appear oricular in the surface view. Their height is about 100-110  $\mu$  and the diameter in

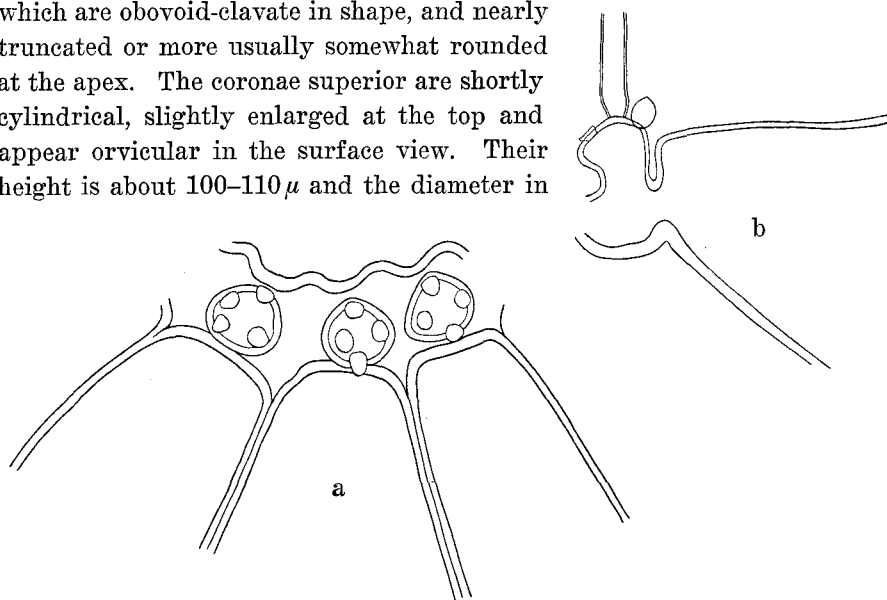


Fig. 23. *Acetabularia parvula* Solmes (?)

a. Corona superior with hair-sears.  $\times$  ca. 50.

b. The side view of the base of an aplanosporangium.  $\times$  ca. 50.

Hab. Tomari.

Together with small species of *Acetabularia* mentioned above I found four specimens belonging to the same genus, which agree with the description of the present species in most points.

The frond is solitary, simple, very low, and thinly incrustated with chalk except in places between the rays of the disc where chalk is deposited rather heavily, so that rays attach side by side rather closely. The stipe is very short,

the surface view measures 80–100 $\mu$ . The number of hairs, hair rudiments or hair-scars on the corona superior is almost always four, very rarely three. A corona inferior is wanting.

Very unfortunately the four specimens are all sterile, so that the characteristics of sporangia are completely unknown.

As above mentioned, the present specimens agree rather well with the description of *A. parvula* Solm. The size of the corona superior, however, is much larger in our specimens than in Solmes's description. Solmes gives it as 42 $\mu$  (radial breadth) while I measured it as 80–100 $\mu$ . Moreover, the corona superior of Solmes's plant bears three hair-scars, but in ours there are usually four, three being found in rare cases.

In spite of the differences mentioned above, I think it is more reasonable tentatively to refer our specimens to the present species than to describe them as a new species.

***Acetabularia (Polyphysa) clavata* sp. nov.**

Fig. 24–25

Frons minutissima, a stipite breve et disco minuto robustoque composita. Stipes simplex, vix 2 mm attingens, leve incrustata, tote annulata.

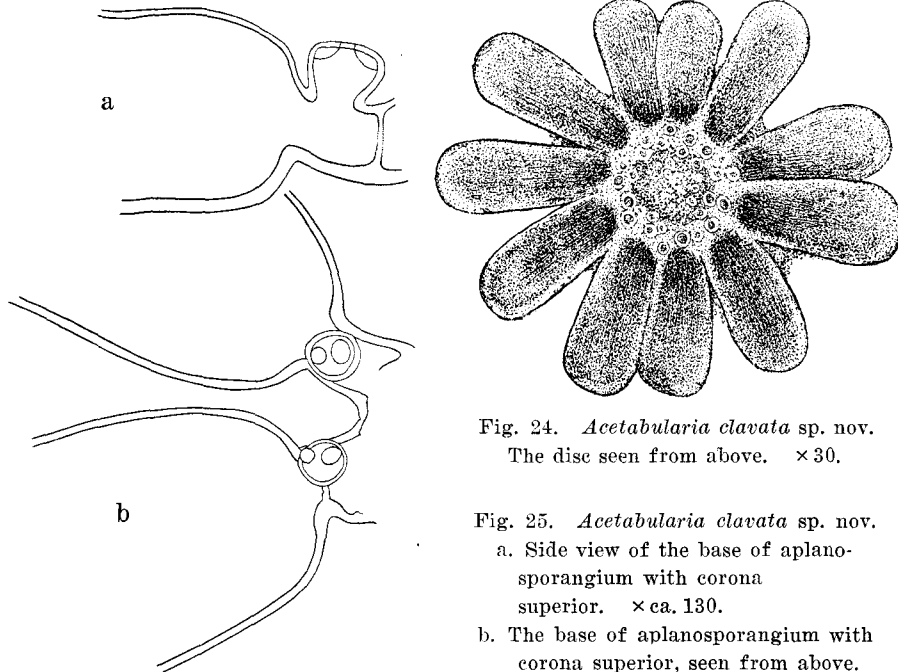


Fig. 24. *Acetabularia clavata* sp. nov.  
The disc seen from above.  $\times 30$ .

Fig. 25. *Acetabularia clavata* sp. nov.  
a. Side view of the base of aplanosporangium with corona superior.  $\times$  ca. 130.  
b. The base of aplanosporangium with corona superior, seen from above.  $\times$  Ca. 130.

Discus solitarius, diametro 1.5–2.0 mm, fere planus, a 7–11 aplanosporangiis compositus. Aplanosporangia robustiora, libera, levissime incrustata, obovoideo-clavata, 2.5–3-plo diametro longiora, apice rotundata vel leve truncata. Corona superior 50–60 $\mu$  diametro, rotundiuscula, duobus vel raro tribus pilis (vel calcaribus) ornata. Corona inferior abest.

Japanese name. Hanaregasa (nov.).

Hab. Tomari.

On examining specimens of *Acetabularia exigua* Solm., *A. dentata* Zan. preserved in alcohol, I found three specimens of a peculiar *Acetabularia* species among them, which clearly differ from the others. When I collected those specimens I confused them with those of other species.

The frond is very small, consisting of a short stipe and a small but rather robust disc. The stipe is simple and scarcely attains two mm in length, is thinly calcified, and marked with annular corrugations throughout the whole length. Unfortunately all three specimens are destitute of the very basal part where they attach to the substratum. The disc is solitary, 1.5–2 mm in diameter, nearly flat. The number of the rays varies between 7 and 11. They are free from each other and scarcely calcified. Each ray is obovoid-clavate, 2.5–3 times as long as the greatest width, and rounded or slightly truncated at the apices. They appear to be robust

rather than delicate. The corona superior is nearly round when seen from above and provided with two, rarely three, hairs or hair-scars. Their diameter varies between about 50 $\mu$  and 60 $\mu$ . A corona inferior is wanting.

All specimens are unfertile, so that to get an exact conception of aplanospores is impossible, but in rays of one specimen the content is separated into some round portions which seem to be an early stage in the formation of aplanospores. Some appear spherical and others elliptical, leading one to imagine that aplanospores may be elliptical in shape when mature.

The present species is very peculiar for its small size, there being annular corrugations throughout the whole length of the stipe and robustly appearing rays. *A. pusillum* Howe from Jamaica and Bahama comes near to the present species, but in the characteristics of the



Fig. 26.  
*Halicoryne Wrightii* Harv.  
× 1.5.

disc they clearly differ from each other.

### *Halicoryne*

#### **Halicoryne Wrightii** Harvey

Fig. 26

Char. of new alg. from Japan (1859) p. 333; Cramer, Ueber *Halic. Wrightii* (1895) p. 1-13, figs. 1-9; Solmes Laubach, Monogr. of Acetabularieae. (Transac. of Linn. Soc. London, vol. 5. 1895) p. 31; Okamura, Icon. of Japan. alg., vol. 1. (1908) p. 217, pl. 43.

Japanese name. Isosugina.

Hab. Nawa; Itoman; Tomari; Yonabara.

The present alga grows in abundance on coral blocks or stones lying in calm places in the upper littoral zone. Excellent figures of this interesting plant are to be found in Okamura's "Icones", cited above.

## SIPHONALES

### BRYOPSISIDACEAE

#### *Bryopsis*

#### **Bryopsis ryukyuensis** spec. nov.

Fig. 27-29

Frons densissime caespitosa, mollis, lubrica, ca. 18 cm. alta, ad basim 300-500  $\mu$  crassa. Stipes principalis in parte inferiore aliquantum nudus, superiore ramellis pilosis dense obtectus. Rami sparsi, in quidque latus stipitis principalis emittenti, graciles, fastigiati, in parte superiore ramellis pilosis obtecti. Ramelli ultimi ad quoque latere ramulorum dispositi, ca. 30-50  $\mu$  crassi, apice obtusi.

Japanese name. Wata-hanemo (nov.).

Hab. Itoman.

Fronde caespitose, forming a very dense tuft, very soft, lubricous, iridescent, somewhat brownish green when living, but becoming yellowish green after drying, attaining about 18 cm. in height, 300-500-750  $\mu$  (rarely 1 mm) thick near the base of the main stem. Main stem nearly nude in the lower portion, but in the upper giving out some slender branches, and near the tip covered with numerous short hairly ramenta. Branches rather few in number, on every side of the main stem, slender, fastigiate, in the upper portion provided with hairy ramenta, taking often an obelisk-like outline. Ramenta cylindrical issuing from every side of the branches, about 30-50  $\mu$  thick, obtuse at the apex.

At the base the frond of the new species divides into a small number of rhizoids which are often inflated here and there, and ramify irregularly

and attach to the substratum or entangle with those of other individuals. The chromatophores are roundish in shape.

The new species stands near to *Bryopsis Duchassaingii* J. Agardh but can be distinguished from it by a less branched main stem, fastigiate



Fig. 27. *Bryopsis ryukyuensis* spec. nov. Slightly reduced.

branches, and, judging from the specimen of J. Agardh's species in Phyc. Bor. Amer. no. 474, ramenta of this specimen are softer than those of the present species. In addition, both species are different in colour.

The present species was collected by a diver on a coral reef at a depth of 2-3 fathoms.

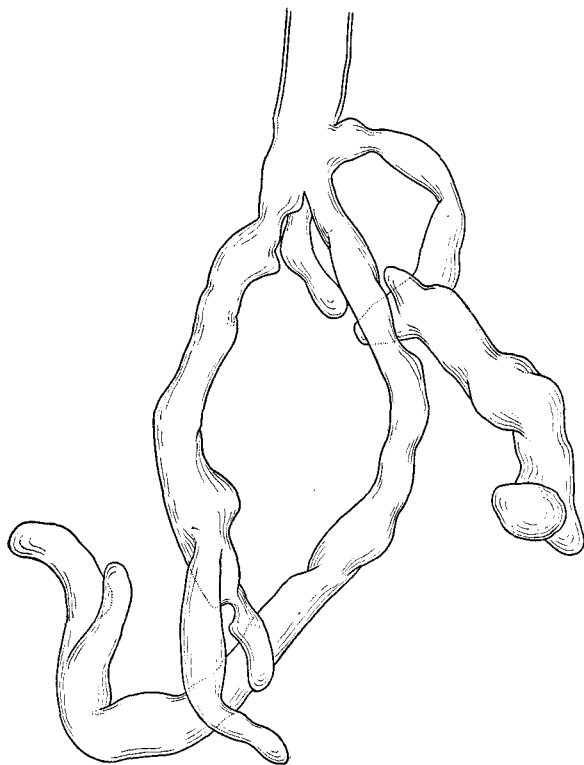


Fig. 28. *Bryopsis ryukyuensis* spec. nov.  
The base of the frond  $\times$  ca. 6.

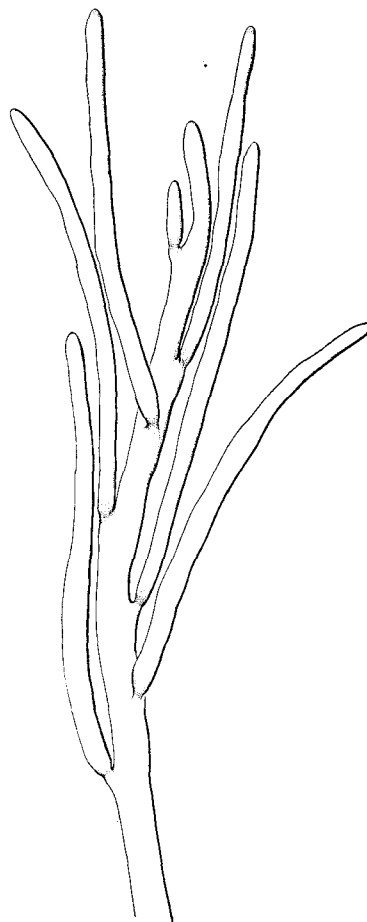


Fig. 29. *Bryopsis ryukyuensis* spec. nov.  
The tip of the frond.  $\times$  ca. 85.

***Bryopsis indica* A. & E. S. Gepp**

Fig. 30

Mar. alg. and mar. Phanerog. of the Sealark expedition (Transac. of the Linn. Soc. London, vol. 7, 1908) p. 169, pl. 22, figs. 10-11; Weber van Bosse, Liste des alg. du Siboga, vol. 1. (1913) p. 93

Japanese name. Indo-hanemo (nov.).

Hab. Nawa.

This alga grows on the frond of *Halimeda Opuntia* f. *intermedia*



Fig. 30. *Bryopsis indica* Gepp.

b. Upper portion of the frond.

a.  $\times$  ca. 6. b.  $\times$  28.

The stem and ramenta near their base are about  $500-700\mu$  and  $50-70\mu$  respectively.

This is a rather rare species of *Bryopsis* in this district; I have collected it only once, and then in small quantity.

Gepp reported that the arrangement of ramenta is disturbed by the occasional presence of either one or two single or double rows of ramenta arising in the intermediate space between the original rows. But in our specimens I have often observed such a case where ramenta on one side are torn off, thus giving the appearance of secund ramification.

## CAULERPACEAE

### *Caulerpa*

#### *Caulerpa verticillata* J. Agardh.

Fig. 31-32

“*Nya* alg. fran Mexico (1847) p. 6”, Till alg. syst. I. p. 6; Weber van Bosse, Monogr. des Caulerpes. (1888) p. 267. pl. 20, figs. 7-10; Svedelius, The Ceylon species of *Caulerpa* (1906) p. 108; Reinke, Ueber *Caulerpa* (1900) p. 7; Børgesen, An ecolog. and syst. account of *Caulerpas* of the Dan. West. Ind. (1907) p. 355, Mar. alg. of the Dan. West. Ind., vol. 1. (1913) p. 121.

Japanese name. Utiwa-duta (nov.).

Hab. Nawa.

The frond of our specimens is rather small in comparison with that of the West Indian specimens described by Børgesen in detail. Their “leaves”

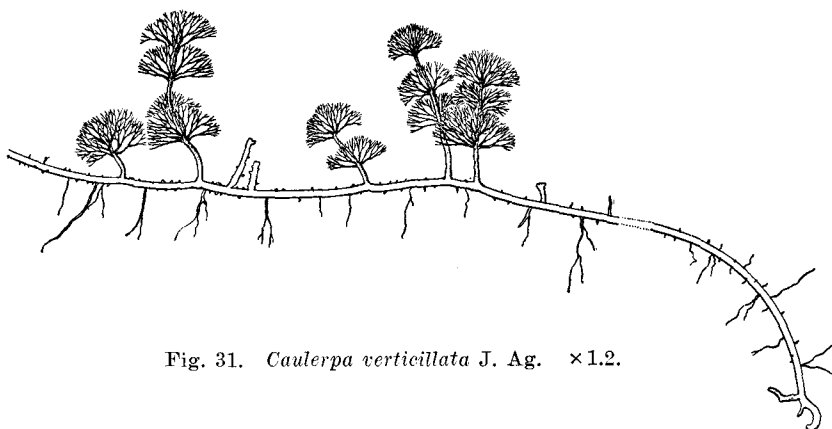


Fig. 31. *Caulerpa verticillata* J. Ag.  $\times 1.2$ .

scarcely exceed 2 cm. in height. But the presence of the creeping rhizoid is very clear and besides the ordinary roots it sends numerous short hair-like roots in every direction from its surface.

The leaves are sometimes single-storied, assuming a funnel-like form, or sometimes arranged in many stories. Among specimens I have met with some forms correspond to the forma *Charoides* (Harvey) Weber v. Bosse. The leaves ramify in a dichotomous manner, but some ramuli are dichotomo-pinnate, and usually the ultimate ramuli end in a rather sharp point. According to the descriptions and figures cited above, the ramuli of leaves of the present species attenuate at the tip, but they do not seem to be pointed as in our specimens. In this point we may distinguish them from the specimens of the West Indies as well as of the Malay archipelago as forma *acuta*.

This delicate small *Caulerpa* was found among a felted mass of *Caulerpa Webbiana* Mont. together with a few specimens of *Caulerpa ambigua* Okam.

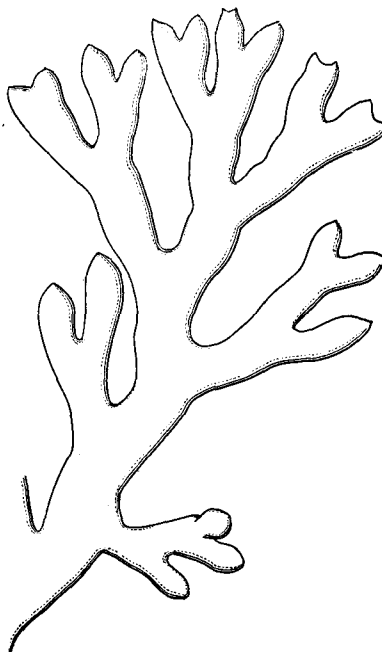


Fig. 32. *Caulerpa verticillata* J. Ag.  
An upper portion of a branch.

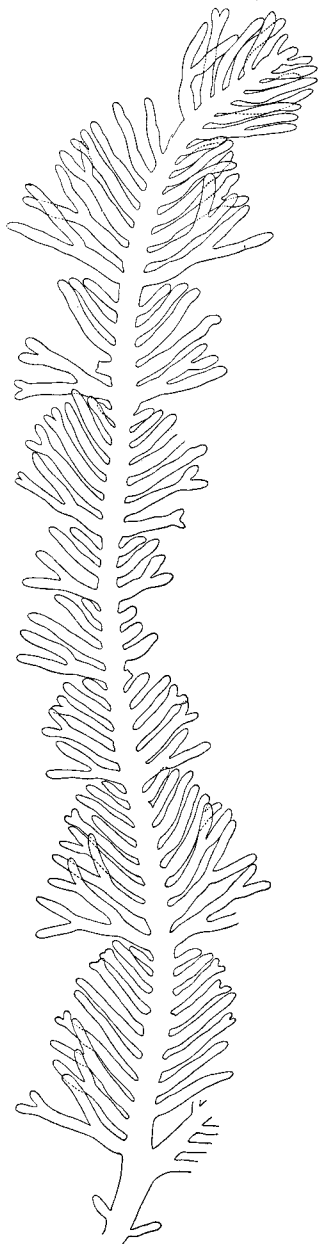


Fig. 33.  
*Caulerpa ambigua*  
Okam.  $\times 16$ .

### **Caulerpa Webbiana** Montagne

“De l’organisation et du mode de reproduction des Caulerpes, et en particulier du *C. Webbiana*, espèce nouvelle des Iles Canaries (Ann. des sciences naturelles, 2. Sér., t. 9, botaniques, (1838) p. 129”, Histoire naturelle des Iles Canaries (1840) pl. 9, p. 178; J. Agardh, Till alg. syst. I. p. 7; Weber van Bosse, l. c. p. 269, pl. 21, figs. 1–2; Reinke, l. c. p. 9; Börgesen, Mar. alg. of Dan. West Ind., vol. 1. (1913) p. 125.

Syn. *Chauvinia Webbiana* Kützing, Sp. alg. (1849) p. 499, Tab. Phyc., vol. 7. (1857) pl. 16, fig. 3.

f. **tomentella** Weber van Bosse, l. c. p. 270; Okamura, Icon. of Japan. alg., vol. 3. (1913) p. 69, pl. 119, figs. 6–9.

Japanese name. Koke-iwaduta.

Hab. Nawa.

The present species was found rather rarely on the sandy bottom of the littoral zone. Among dense tufts of this species I have found *C. peltata* Lamx., *C. verticillata* J. Ag., *C. ambigua* Okam. and *C. parvifolia* Harv. (?)

### **Caulerpa ambigua** Okamura Fig. 33–34

On the alg. from Ogasawara-jima (Bot. Mag. Tokyo, vol. 11, 1897) p. 4, pl. 1, figs. 3–10, Icon. of Japan. alg., vol. 3. (1915) p. 168, pl. 139, On the mar. alg. from Kôtôsho (Bull. of Biogeogr. Soc. of Jap. vol. 1, 1931) p. 101; Weber van Bosse, l. c. p. 388, Liste des alg. du Siboga, vol. 1. (1913) p. 97, fig. 24; Reinke, l. c. p. 42.

Syn. *C. Vickersiae* Börgesen, Some Chlorophyc. from Dan. West Ind., I, (Bot. Tidskrift 28 Bind. 1911) p. 129, fig. 2, Mar. alg. of Dan. West. Ind., vol. 1. (1913) p. 119; Vickers, Phyc. Barb. (1908) pl. 37.

Japanese name. Hime-iwaduta.

Hab. Nawa.

This small inconspicuous but lovely species of *Caulerpa* was found growing among a tuft of *Caulerpa Webbiana* Mont. together with *Caulerpa verticillata* J. Ag. Four specimens were all I could find in my material.

The frond measures about 2.5 cm in height; the lower part is not clearly creeping, but rather standing, and issues some root-like hairs. The upper part ramifies dichotomously once or twice and is covered densely by ramuli. Of four specimens, three show a distichous arrangement of ramuli, coinciding well with the figures of Vickers and Börgesen. But in one specimen the ramuli are arranged very irregularly, in some places nearly verticillately or multiseriately, in others irregularly distichously. When the ramuli are arranged multiseriately or irregularly verticillately, they are comparatively short and more divided than when distichous.

There are always some places on the frond where the ramuli become shorter and are suddenly followed by long ones, showing probably periodical growth of the frond, as already noticed by Börgesen.

#### ***Caulerpa brachypus* Harvey**

Char. of new alg. from Japan (1859) p. 332; Weber van Bosse, Monogr. des Caulerpes (1888) p. 280, pl. 22, fig. 2; Yendo, On *Caulerpa anceps*, Harv. (Bot. Mag. Tokyo, vol. 17, 1903) p. 153.

*C. anceps* Harvey, "List of Friendly Isl. alg. no. 67"; Okamura, Icon. of Japan. alg., vol. 3. (1914) p. 94, pl. 125, figs. 1-8.

Japanese name. Hera-iwaduta.

Hab. Nawa.

I have met with the present species rather often in the vicinity of

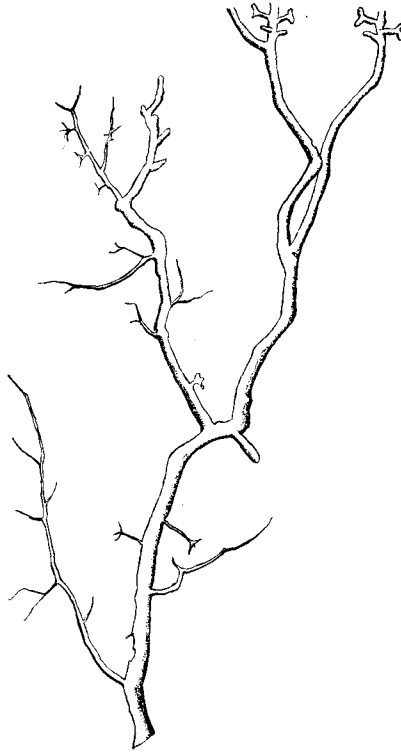


Fig. 34. *Caulerpa ambigua* Okam.  
The basal portion of the frond.  $\times 9$ .

Nawa, and the specimens show no distinction from those occurring in Misaki and other localities of Honsyû (Japan proper). In alcoholic specimens from Nawa, at the base of "leaves" are found some bullations mentioned by Yendô. But it is exceedingly difficult to find them in dried specimens.

**Caulerpa parvifolia** Harvey(?)

Fig. 35

Phyc. Austr. vol. 3. (1860) pl. 172; J. Agardh, Till alg. system I, p. 10;

Weber van Bosse, l. c. p. 281, pl. 22, fig. 5, Liste des alg. du Siboga, vol. 1. (1913) p. 98; Okamura, On the alg. from the Isl. Hatidyô (Records of Oceanogr. Works in Jap., vol. 2, 1930) p. 105, On the mar. alg. from Kôtôsho (Bull. of Biogeogr. Soc. of Jap., vol. 2, 1931) p. 101, Icon. of Japan. alg., vol. 6, (1931) p. 58, pl. 280, fig. 1.

Japanese name. Hina-iwaduta.

Hab. Nawa.

Among a mass of *Caulerpa Webbiana* I found one fragmentary specimen which

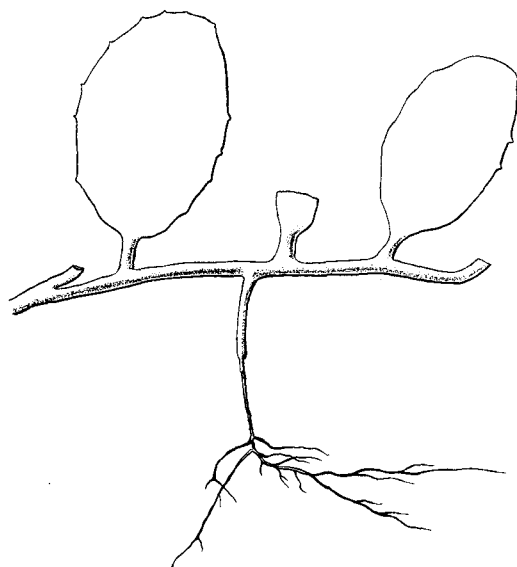


Fig. 35. *Caulerpa parvifolia* Harv.(?) ×7. is most probably to be referred to *C. parvifolia* Harv.

This specimen represents a creeping smooth frond of a length of about 2.5 cm. It bears two leaves and a young leaf (?) on the upper side while, downwards, the roots are given off nearly perpendicularly. Leaves are typically elliptical, about 5 mm long and 2.5–3 mm wide, and provided with a short pedicel. At their margin there are scattered a few minute but rather sharp dentations. Comparing it with the illustrations given by Harvey as well as by Weber van Bosse, the shape of leaves of the present specimen is somewhat different from that of *C. parvifolia* Harv. It is for this reason I put a query after the specific name.

The present species of *Caulerpa* seems to be rather widely, if not abundantly, distributed on our coasts, Okumura having reported it from Kôtôsho, Formosa and even from the Island Hatidyô and Seto, Kii Prov.

**Caulerpa subserrata** Okamura

On the alg. from Ogasawara-jima (Bot. Mag. Tokyo, vol. 11, 1897) p. 3, pl. 1, figs. 1-2, Icon. of Japan. alg., vol. 3. (1914) p. 97, pl. 125, figs. 9-10; Weber van Bosse. Monogr. des Caulerpes (1898) p. 283; Reinke, Ueber Caulerpa (1900) p. 13.

Japanese name. Kizami-duta.

Hab. Nawa.

The present species of *Caulerpa* was found only once, creeping on a rock in the littoral zone, and then in small quantity. On the other hand, this species seems to grow in abundance in Ogasawara-jima where the type specimen was collected, one of our students having collected a fair number of specimens there.

So far as the specimens at hand from Ryukyu as well as from Ogasawara-jima are concerned, *C. subserrata* Okam, *C. parvifolia* Harv. and *C. brachypus* Harv. can be distinguished from each other with clarity and certainty.

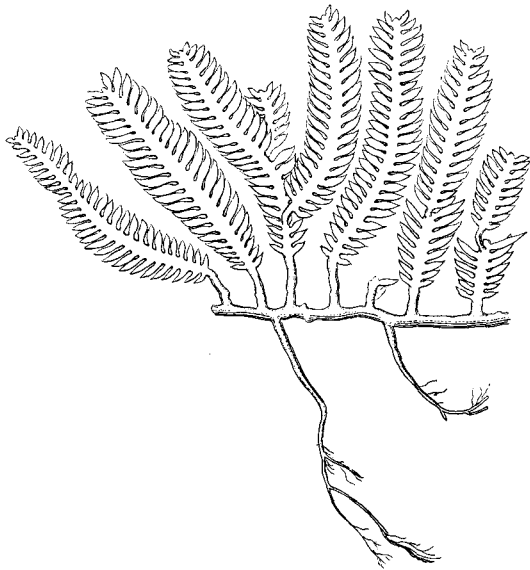


Fig. 36. *Caulerpa taxifolia* Ag.  $\times 1.5$ .

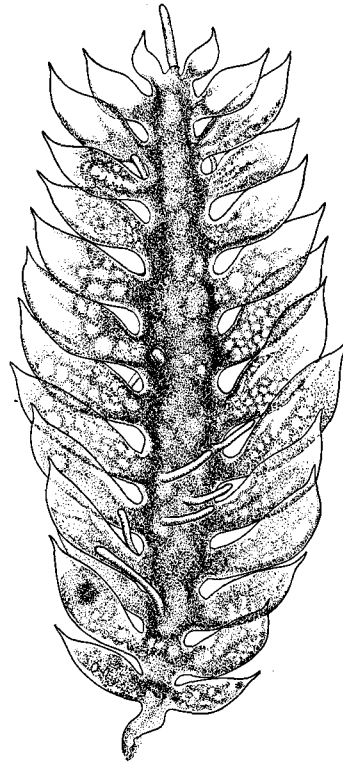


Fig. 37. *Caulerpa taxifolia* Ag.  
A leaf showing reticulate  
arrangement of the content  
and papillae.  $\times 8$ .

**Caulerpa taxifolia** (Vahl.) Agardh Fig. 36-37

Spec. alg. (1823) p. 435; Harvey, Phyc. austr., vol. 3. (1863) pl. 178;

Weber van Bosse, Monogr. des Caulerpes (1898) p. 292; Reinke, l. c. p. 15; Svedelius, Ecolog. and syst. studies of the Ceylon spec. of Caulerpa (1906) p. 112; Børgesen, An ecolog. and syst. account of the Caulerpes (1907) p. 563, Some Ind. green and brown alg. especially from the shores of the Presidency of Bombay, II. (Journ. of the Ind. bot. Soc., vol. 11, 1932) p. 58; Okamura, Icon. of Japan. alg., vol. 3. (1913) p. 38, pl. 110, figs. 4-5.

Syn. *Fucus taxifolius* Vahl, "Skrioter of Naturhistorie-Selskabet, t. 5. (1802) p. 36".

Syn. *Caulerpa falcata* Kützting, Tab. Phyc., vol. 7. (1857) pl. 5, fig. 5.  
Japanese name. Itii-duta.

Hab. Nawa.

I have found this species only once in the littoral zone. It coincides with the description of the form *typica* given by Svedelius. Among specimens preserved in alcohol I found some which show the state of zoospore formation according to Dostal and Schussnig. The protoplasmic contents in pinnules as well as the main axis assume a reticulate appearance, and are greenish brown in colour, while the corresponding meshes remain pale yellow. The papillae, measuring about 1.-1.5 mm long and about 150  $\mu$  in diameter, are found here and there on both surfaces of the leaves; they come out always from the main axis and never from pinnules in our specimens. They are not yet opened.

As was recently summed up by Børgesen,<sup>1)</sup> there are different opinions among the authors as to the true nature of the state mentioned above. Though I cannot touch on this question from my own observation of alcoholic specimens, it is really without interest that the reported cases of such a state are being increased in the different species.

#### **Caulerpa sertularioides** (Gmelin) Howe

Phyc. stud., II. (1905) p. 576; Svedelius, l. c. p. 114; Okamura, Icon. of Japan. alg., vol. 3. (1913) p. 36, pl. 110, figs. 1-3; Børgesen, Some Ind. green and brown alg. etc. (Journ. of Ind. Bot. Soc., vol. 11, 1932) p. 59.

Syn. *Fucus sertularioides* Gmelin, Hist. Fuc. (1768) p. 151, pl. 15, fig. 4.

Syn. *Fucus plumaris* Forskal, Fl. Aegypt.-Arab. (1775) p. 190.

Syn. *Caulerpa plumaris* Agardh, Spec. alg., vol. 1. (1822) p. 436;

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1) Børgesen; Some Indian green and brown algæ, especially from the shores of the Presidency of Bombay, II. (Journ. of Ind. bot. Soc. vol. 11, 1932) pp. 52-54.

Weber van Bosse, l. c. p. 294; Reinke, l. c. p. 17, figs. 21-22.

Japanese name. Takanoha-duta.

Hab.

Among the specimens sent by Mr. S. Sakaguti there is one which represents the present species. It was collected in the Ryukyu archipelago, but without noting the exact locality.

**Caulerpa Freycinetii** Agardh var. **typica** Weber van Bosse f. **lata**

Weber van Bosse.

Monogr. des Caulerpes (1898) p. 312; Okamura, Icon. of Japan. alg., vol. 3. (1913) p. 18, pl. 105, figs. 1-3.

Japanese name. Yore-duta.

Hab. Nawa.

The present species of *Caulerpa* does not occur in abundance, at least in the vicinity of Nawa; I have met with it only once and obtained only a few specimens. Some other specimens however, were found by both Messrs. S. Inoh and T. Teramati. They agree very well with the descriptions of the present form.

Okamura gives an excellent illustration of his Ryukyu specimen in the above mentioned number of his Icones.

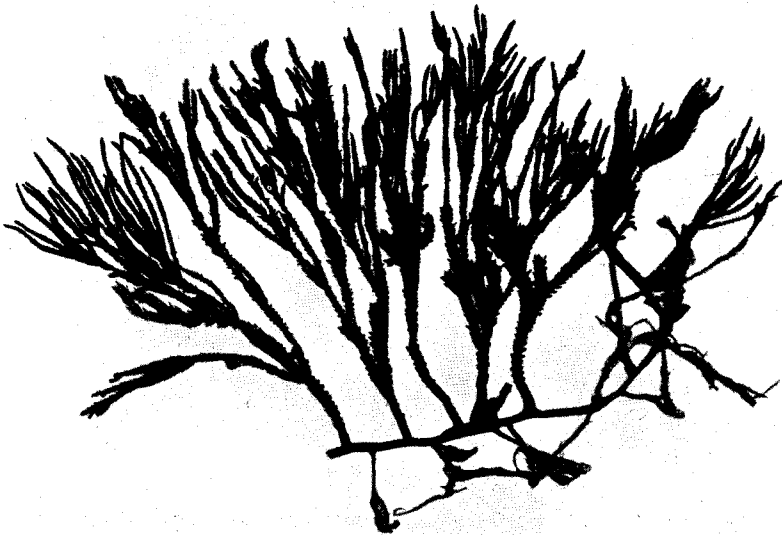


Fig. 38. *Caulerpa cupressoides* Ag. var. *lycopodioides* f. *amicum*  
Web. van Bos. × ca. 3.



Fig. 39. *Caulerpa cupressoides* Ag. var. *lycopodioides* f. *elegans* Web. van Bos.  $\times$  ca.  $\frac{3}{2}$ .

***Caulerpa cupressoides*** (Vahl) Agardh Fig. 38-39  
Spec. alg., vol. 1. (1823) p. 441, Syst. alg. (1824) p. 183; Harvey, Ner.

Bor. Amer., part 3 (1857) p. 21, pl. 39, B.; J. Agardh, Till alg. system. p. 21; Weber van Bosse, l. c. (1898) p. 323; Börgesen, Mar. alg. of the Dan. West Ind., vol. 1. (1913) p. 135.

In the Ryukyu Islands this species is represented in var. *lycopodioides* Weber van Bosse., and in two forms; *f. amicorum* and *f. elegans*.

var. **lycopodioides** *f. amicorum* Weber van Bosse.

l. c. p. 337, pl. 27, fig. 13, pl. 28, figs. 10–12; Okamura, Icon. of Japan. alg., vol. 4. (1916) p. 16, pl. 155, figs. 1–4.

Japanese name. Byakusin-duta.

Hab. Nawa.

This form is one of the commonest littoral algae in this district. They are found mostly creeping on sandy bottoms, often together with some sea-phanerogams.

var. **lycopodioides** *f. elegans* Weber van Bosse.

l. c. p. 336, pl. 27, figs. 8–9; Okamura, l. c. vol. 4. (1923) p. 194, pl. 200, fig. 3.

Japanese name. Utukusi-duta (nov.).

Hab. Nawa.

I have found this beautiful form only once, in a shallow pool. They grow creeping on the rocky bottom and occupy a rather wide area. The erect parts are very long, attaining about 25 cm. in height, but in other characteristics they agree fairly well with the description of the present form.

**Caulerpa racemosa** Weber van Bosse var. **clavifera** Weber van Bosse.

l. c. (1898) p. 361; Börgesen, Mar. alg. of Dan. West Ind., vol. 1 (1915) p. 147; Okamura, Icon. of Japan. alg., vol. 3 (1913) p. 66, pl. 119, fig. 1.

Syn. *Fucus Clavifer* Turner, Fuci, vol. 1 (1808) p. 126, pl. 57.

Syn. *Caulerpa clavifera* C. Agardh, Spec. alg., vol. 1. (1823) p. 437; Svedelius, Ecolog. and syst. stud. of Ceylon spec. of *Caulerpa* (1906) p. 120.

Japanese name. Sennari-duta.

Hab. Nawa.

Our specimens represent two forms: **macrophysa** and **microphysa** Weber van Bosse.

I have often found the present variety on shallow sandy bottoms among sea-phanerogams, though Börgesen reported that it is to be considered as a rock and coral reef form in the West Indies.

**Caulerpa peltata** Lamouroux

“Journ. de Bot., vol. II. (1809) pl. 3, fig. 2”; Weber van Bosse, l. c. p. 373, pl. 31, figs. 9–11, pl. 32, fig. 9; J. Agardh, Till alg. system p. 37;

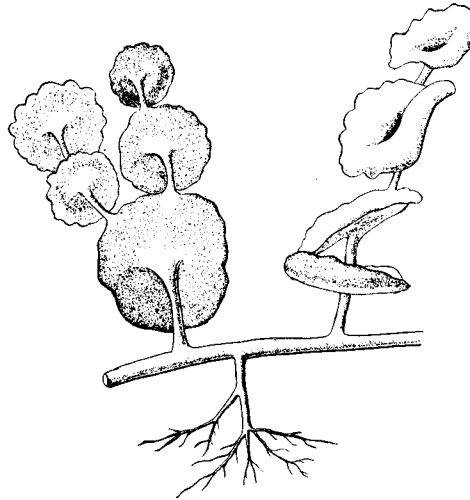


Fig. 40. *Caulerpa peltata* Lamx.  
var. *nummularia* Web. van Bos.  
× ca. 3.5.

Fig. 40  
Reinke, l. c. p. 39; Svedelius, Ecolog. and syst. account of the Ceylon spec. of *Caulerpa* (1906) p. 131; Börgesen, Mar. alg. from the Canary Isl., vol. 1. (1925) p. 112.

var. **nummularia** Weber  
van Bosse.

l. c. p. 377.

Syn. *C. nummularia* Harvey, “List of Friendly Isl. alg. No. 77”; Okamura, Leon. of Japan. alg., vol. 6. (1931) p. 61, pl. 280, figs. 13–14.

Japanese name. Suzukakeduta.

Hab. Nawa.

Entangling with the dense frond of *Amansia glomerata* this small *Caulerpa* was found two or three times on the walls of rather deep crevices in rocks, agreeing well with the description of Börgesen, l. c.

In our specimens the disc-shaped leaves are crenulate and shallowly infundibuliform; their diameter varies around 4 or 5 mm. Often they bear other leaves over themselves, and in such cases the stalk of the upper leaves almost always comes out of the margin of the lower ones.

The length of the stalks originating from the margin of other leaves remains usually shorter than the diameter of the leaves.

In my opinion it is more reasonable to consider this plant as a variety of *C. peltata* Lamx. than to give a specific rank to it.

**CODIACEAE*****Chlorodesmis******Chlorodesmis comosa*** Bailey et Harvey

in Harvey's Nereis Bor. Amer., part 3 (1857) p. 29; A. & E. S. Gepp, Codiaceae of Siboga Exped. (1911) p. 14; Okamura, Illustr. of the mar. alg.

of Jap. (1900) p. 13, pl. 5.

Japanese name. Mayuhakimo.

Hab. Nawa.

Very common on rocks in the upper littoral zone.



Fig. 41. *Avrainvillea erecta* A. et E. S. Gepp. Slightly reduced.

### *Avrainvillea*

***Avrainvillea erecta*** (Berkeley) A. et E. S. Gepp. Fig. 41  
Codiac. of Siboga Exped. (1911) p. 29, pl. 9, figs. 84–85, pl. 10, figs. 86–89.

Syn. *Avrainvillea papuana* Murray et Boodle, A syst. and struct. account of the genus *Avrainvillea* (Journ. of Bot., vol. 28, 1889) p. 71, pl. 289; Heydrich, Einige alg. von den Loochoo Inseln (Ber. der deut. Bot. Gesel. vol. 25, 1907) p. 101.

Japanese name. Ko-tengunohautiwa (nov.).

Hab. Nawa.

Among specimens sent by Mr. T. Teramati, there are two, good dried specimens which agree very well with the description of the present species given by A. et E. S. Gepp.

### ***Avrainvillea riukiensis*** Yamada

Notes on some Japan. alg., IV. (Journ. of Fac. Sci. Hokkaido Imp. Univ., vol. 2, 1932) p. 267, pl. 3.

Japanese name. Tengunohautiwa (nov.).

Hab. Nawa.

### *Udotea*

### ***Udotea javensis*** (Montagne) Gepp.

*Rhipidosiphon* and *Callipsygma* (Journ. of Bot., vol. 42, 1904) p. 364, pl.

467, figs. 1-4, Codiac. of Siboga exped. (1911) p. 110, pl. 5, fig. 36; Okamura, Icon. of Japan. alg., vol. 1. (1908) p. 228, pl. 45, figs. 1-7.

Syn. *Rhipidosiphon javensis* Montagne, "Prodr. phyc. antarct. (1842) p. 14"; Kützing, Spec. alg. (1849) p. 493; De Toni, Syll. alg., vol. 1. (1889) p. 518.

Japanese name. Hime-ityô.

Hab. Tomari.

This is a dweller of the littoral pools growing on small stones or coral blocks.

I found the specimens growing rather solitary in the above locality, but later some specimens of the same species were sent me by Mr. K. Hamana. He collected them in the littoral pools at Makurazaki, Satuma Prov., Kyûsyû, where they grow very densely caespitosely.

Excellent illustrations of the Japanese specimens are to be found in Okamura's Icones, cited above.

**Udotea orientalis** A et E. S. Gepp

Fig. 42-43

Codiac. of Siboga Expedition (1911) p. 119, pl. 1, figs. 1 & 4, pl. 6, figs. 47-48.

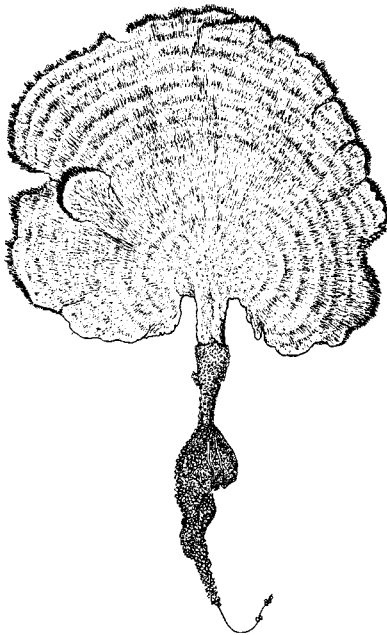


Fig. 42. *Udotea orientalis*  
A. et E. S. Gepp. × 1.

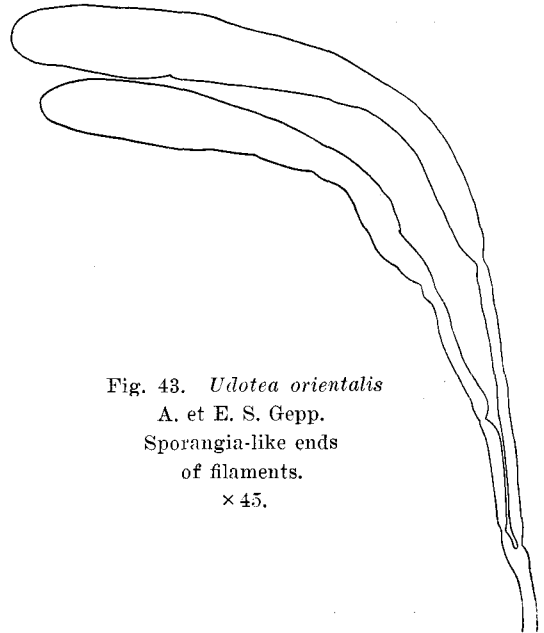


Fig. 43. *Udotea orientalis*  
A. et E. S. Gepp.  
Sporangia-like ends  
of filaments.  
× 45.

Syn. *Udotea conglutinata* Okamura (non Lamour.) Icon. of Japan. alg., vol. 1. (1908) p. 231, pl. 44, figs. 11-12, pl. 45, figs. 8-13.

Japanese name. Hagoromo.

Hab. Nawa; Tomari.

The present species is very common in the upper littoral zone, growing among several sea-phanerogams. They grow always on sandy bottoms, their roots penetrating downwards rather deeply. It is highly interesting to notice that they are found very abundantly but almost solitary. Moreover, all individuals in one place are disposed in one and the same direction. It is possibly due to the influence of the current, because they are always disposed parallel to the current's direction.

The Ryukyu specimens are very well figured by Okamura in the above cited work. Among several specimens I found some marked with dark coloured fringe of papillate nature, mostly at the margin, but often also marked in irregular rows on the surface in the upper part of the frond. Under the microscope it proves to be composed of the ends of filaments which construct the frond. Near the end, the filaments become inflated very conspicuously, assuming a lengthily clavate shape. Their diameter reaches about  $210\mu$  and inside they contain a dense substance intensely green in colour. Near the base of those bodies there is usually a constriction but I have never seen any dissepiments. This body is very much like the sporangia of *Avrainvillea* described and figured by Howe<sup>1)</sup> and A. & E. S. Gepp.<sup>2)</sup> But it is rather difficult to determine it before examining living specimens.

#### ***Udotea argentea* Zanardini.**

Fig. 44

Plantarum in mari rubro hucusque collectarum enumeratio (1858) p. 82, pl. 10, fig. 1; J. Agardh, Till alg. system., V. p. 76; A. & E. S. Gepp, l. c. p. 125, pl. 2, figs. 21-22 c, pl. 3, fig. 22 d, pl. 7, figs. 57-60.

Japanese name. Ô-hagoromo (nov.).

Hab. Itoman; Nawa.

In the description of the present species A. & E. S. Gepp state that the frond is sometimes zonate, and give a habit illustration of such a specimen. But in the Ryukyu specimens the frond is very rarely zonate.

Our specimens were mostly found on sandy bottoms at a depth of

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1) Howe: Phycological studies, III. (Bull. of the Torrey Bot. Club, vol. 34, 1907) pl. 28, figs. 8-25.

2) Gepp: The Codiaceae of the Siboga Expedition (1911) pl. 10, fig. 89.



Fig. 44. *Udoea argentea* Zanard. Slightly reduced.

about 5 fathoms off Itoman. They agree fairly well with the description of A. & E. S. Gepp.

### *Codium*

#### ***Codium adhaerens*** (Cabrera) Agardh.

Fig. 45

Spec. alg., vol. 1. (1822) p. 457; Okamura, Icon. of Japan. alg., vol. 3. (1915) p. 140, pl. 134, figs. 1-3; Schmidt, Beitr. zur Kenntn. der Gattung *Codium* (1923), p. 26; Börgesen, Mar. alg. from the Canary Isl., vol. 1. (1925) p. 89.

Syn. *Agardhia adhaerens* Cabrera, in "Phys. Sällsk. Årsber."

Japanese name. Hai-miru.

Hab. Nawa.

In our specimens the frond is brackish green and its surface very lubricous. The utricles are cylindrical or clavate, being often slightly constricted below the top. At the end they are usually round but often flattened. The membrane usually becomes thick at the apices and many longitudinal striations can be seen. Hair scars are present. The diameter of the utricles varies usually around  $85\mu$ , but it is not rare to find cases where there are some utricles which are of exceedingly large size, whose diameter often reaches  $220\mu$ . Medullary filaments are around  $23\mu$  in diameter. Gametangia are fusiform and their common size is around  $270\mu$  by  $75\mu$ , but larger ones are  $400\mu$  long and  $100\mu$  thick.

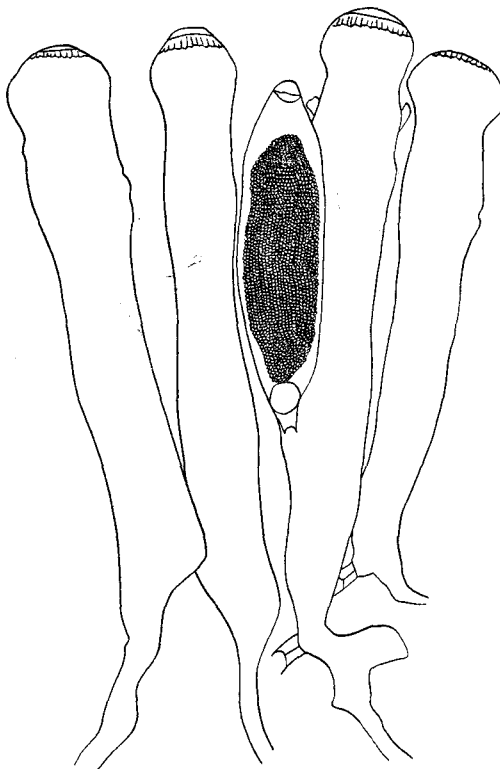


Fig. 45. *Codium adhaerens* Ag.  
Utricles and a gametangium.  $\times 140$ .

As is seen from the above description, the size of utricles as well as of gametangia is larger than that in the description on *Cod. adhaerens* Ag. given by O. C. Schmidt. But it seems to me more reasonable to refer our plant to *C. adhaerens* Ag. than to *C. difforme* Kg.

**Codium repens** (Crouan) Vickers Fig. 46-47  
in An. Sc. nat. bot. 9. Sér. (1905) p. 56, Phyc. Barb. (1908) pl. 29;  
Schmidt, l. c. p. 43; Yamada, Stud. über Meeresalg. von Ins. Formosa,  
Chlorophyc. (Bot. Mag. Tokyo, vol. 39, 1925) p. 94; Okamura, On the  
mar. alg. from Kôtôsho (Bull. of the Biogeogr. Soc. of Japan, vol. 2, 1931)  
p. 100.

Syn. *Codium tenue* var. *repens* Crouan, in Mazé and Schramm, Alg.  
de Guadeloupe (1870-1877) p. 107.

Japanese name. Yasegata-moture-miru (nov.).



Fig. 46. *Codium repens* Vickers.  $\times$  ca. 3.

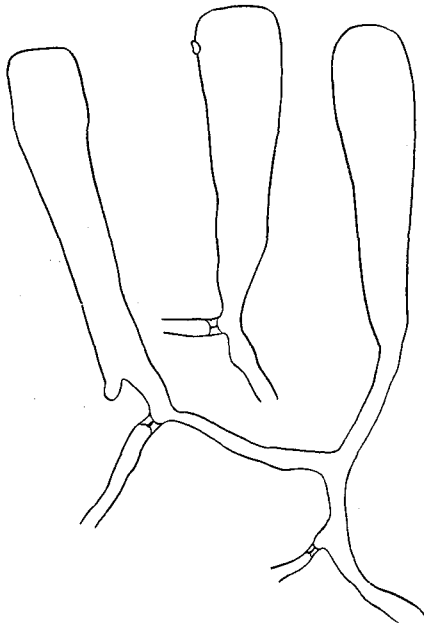


Fig. 47. *Codium repens* Vickers.  
Three utricles.  $\times$  65.

Hab. Nawa.

Some years ago I collected a specimen of *Codium* in Formosa which was determined as the present species. At that time there was only one specimen for determination. But this time I collected a large number of specimens for closer examination and have come to the same conclusion as previously.

The frond of this species is cylindrical and rather slender, being about 2-3 mm in diameter. It branches repeatedly in a dichotomous manner with a wide angle and makes a dense, but not very dense tuft. The upper parts of the branches are not usually erect, but bend somewhat. They attach here and there to the coral blocks or other

things near by and also adhere to each other.

The utricles are cylindrical or clavate, and their diameter varies usually between  $150\mu$  and  $200\mu$ , but often it exceeds this limit, attaining about  $250\mu$ – $300\mu$ . The length is about 4–6 times the diameter of the utricles. Their apices are mostly flattened, and it is rather a rare case where the rounded apices are met with. Hairs are inserted below the top of the utricles, the membrane of each utricle is rather thin and usually not thickened at the apices. But sometimes it is slightly thickened at the apices. The central filaments are  $25$ – $50\mu$  thick.

It is regrettable that our specimens do not bear any gametangium.

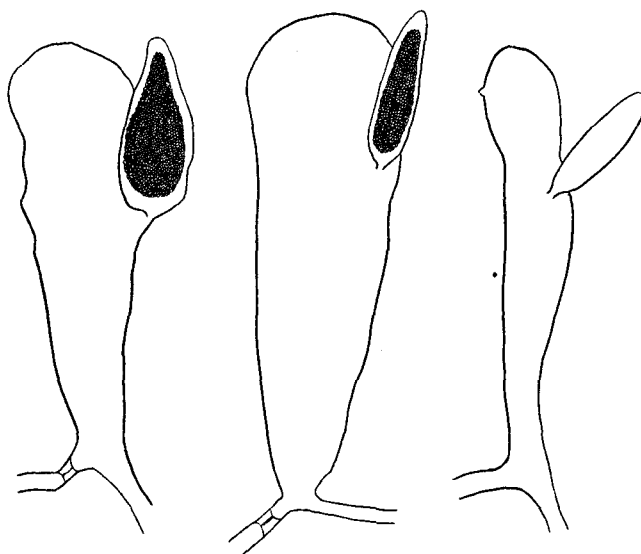


Fig. 48. *Codium intricatum* Okam.  
Three utricles with sporangia.  $\times 65$ .

***Codium intricatum* Okamura**

Fig. 48

Icon. of Japan. alg., vol. 3. (1913) p. 74, pl. 120, figs. 9–13, On the alg. from the Isl. Hatidyô (Records of Oceanogr. Works in Jap., vol. 2, 1930) p. 104.

Japanese name. Moture-miru.

Hab. Nawa.

According to the original description, the utricles in this species attain  $770$ – $1500\mu$  in diameter in the broadest part. But in the specimens at hand I have never seen so great a diameter, the utricles being mostly  $250$ – $300\mu$  in the largest diameter, though it is not a rare case when they reach about

500 $\mu$  in diameter. The habit and the shape of the utricles, however, answer so well to the original description that I consider our specimens as a form of *Cod. intricatum* Okam.

### *Halimeda*

#### *Halimeda cuneata* Hering

Fig. 49

in "Flora (1846) p. 214"; Barton, the genus *Halimeda* (1901) p. 15, pl. 1 & 2, figs. 7-14; Okamura, Icon. of Japan. alg., vol. 3. (1915) p. 202, pl. 147.

Japanese name. Utiwa-sabatengusa.

Hab. Nawa.

This is rather a rock dweller in Ryukyu, while *H. incrassata* f. *typica* Barton is mostly found on sandy bottoms, as will be mentioned below. This fact can be easily seen from the difference between the basal parts of both plants, those of the present species being cushion-like ("bulbous", after Barton) while those of the other form a nearly cylindrical mass together with sand particles, etc.

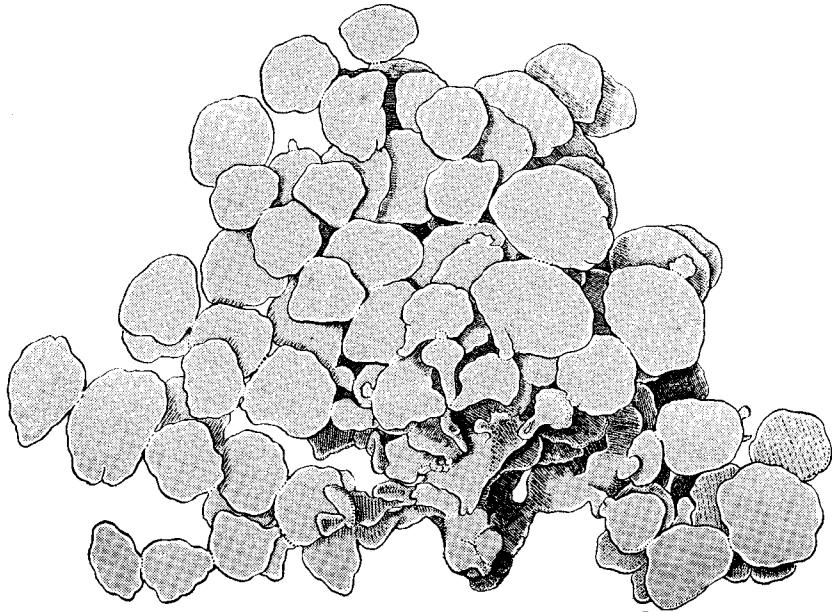


Fig. 49. *Halimeda cuneata* Hering.  $\times$  ca.  $\frac{3}{2}$ .

#### *Halimeda Opuntia* Lamouroux

Fig. 50-51

"Sur la crassif. Polyp. corall. etc."; Barton, l. c. p. 18, pl. 2, figs. 19-27; Vickers, Phyc. Barbud (1908) pl. 35.

**f. *typica*** Barton  
l. c. p. 20, pl. 2, fig. 19.  
Japanese name.  
Hab.

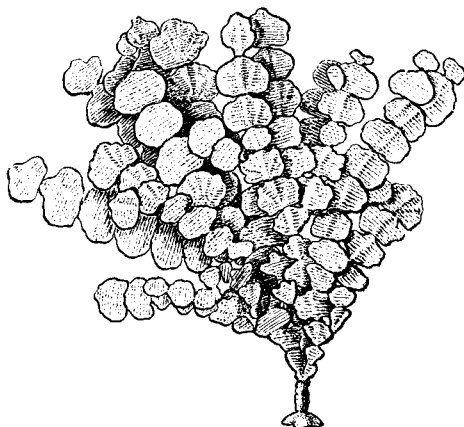


Fig. 50. *Halimeda Opuntia* Lamx.  
f. *intermedia* f. nov.  
Slightly reduced.

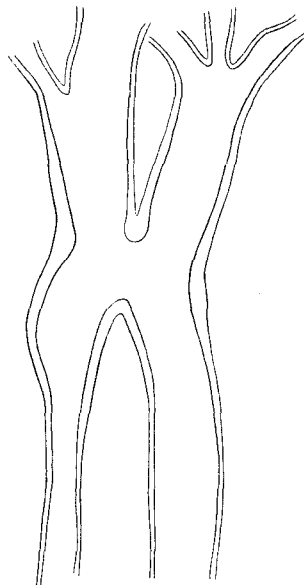


Fig. 51.  
*Halimeda Opuntia* Lamx.  
f. *intermedia* f. nov.  
Two filaments showing  
mode of fusion.  $\times 100$ .

**f. *intermedia*** form. nov.  
Japanese name. Hira-sabotengusa (nov.).  
Hab. Nawa; Itoman.

Our specimens prove to be rather intermediate between f. *Renschii* and f. *typica*, the shape of the joints being about the same as that of f. *Renschii*, while they are about of the same size as f. *typica*. But some joints showing slightly cordate bases occur sometimes.

Filaments of the central strand incompletely fuse in pairs, but often fuse in threes or even in fours, though less often.

This is a very common species of *Halimeda* near Nawa, growing near the low tide mark, being often found on the perpendicular walls of deep pools.

***Halimeda incrassata*** Lamouroux  
f. ***typica*** Barton.

Fig. 52

l. c. p. 27, pl. 4, fig. 39; Okamura, Icon. of Japan. alg., vol. 3. (1915) p. 213, pl. 150.  
Japanese name. Mitude-sabotengusa.  
Hab. Nawa; Itoman.

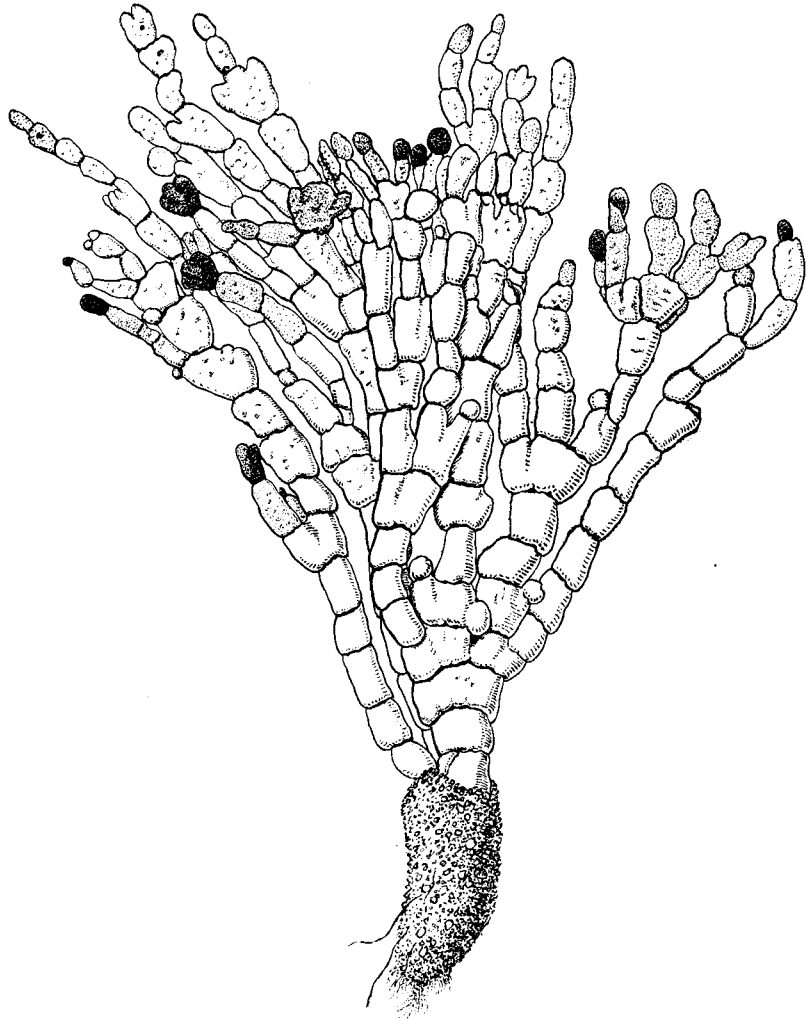


Fig. 52. *Halimeda incrassata* Lamx. f. *typica* Barton.  
Slightly reduced.

The present form of *Halimeda* is found in abundance on shallow sandy bottoms often together with some sea-phanerogams, *Cymodoce*, etc. They all stand erect with a stout basal portion even when they are exposed in low water. A tuft of thin root filaments grasps at numerous sand particles, fragments of shells and corals, etc.

f. **ovata** Barton.

l. c. p. 27, figs. 42, 47.

Japanese name. Ko-sabotengusa (nov.)

Hab. Itoman.

In comparison with the figure of the present form given by Barton, our specimens are much longer, attaining about 15 cm in height. The filaments of the central strand do not usually fuse in the node. The peripheral cells are rounded at the corners in the surface view; in the side view they are mostly pear-shaped, often with a very narrow base.

This form has been collected only once, at a depth of about 2 fathoms off Itoman.

### VAUCHERiaceae

#### **Pseudodichotomosiphon** gen. nov.

Planta erecta, caespitosa, per filamenta rhizoidea dichotome divisa, inter se intertexta adfixa. Frons simplex vel dichotome ramosa, ramis fastigiatis, hic illic constrictis membranis levissime incrassatis ornatis. Filamenta rhizoidea simplicia vel raro ramosa.

Antheridia lateraria, sessilia, solitaria vel 2-3 aggregata, ovata et erecta. Oogonia nunquam terminalia, sessilia, sphaerica, ad apicem ostioli ornata, fulvescentia.

**Pseudodichotomosiphon constricta** (Yamada) comb. nov. Fig. 53-55

Syn. *Vaucheria constricta* Yamada, Notes on some Japan. alg., III.



Fig. 53. *Pseudodichotomosiphon constricta* Yamada.

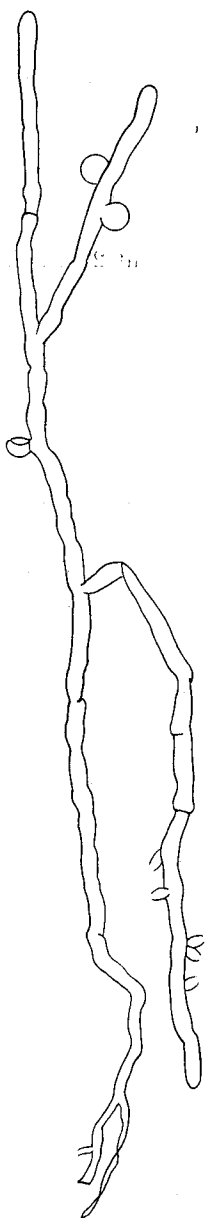


Fig. 54.  
*Pseudodichotomosiphon*  
*constricta* comb. nov.  
A monoecious plant.

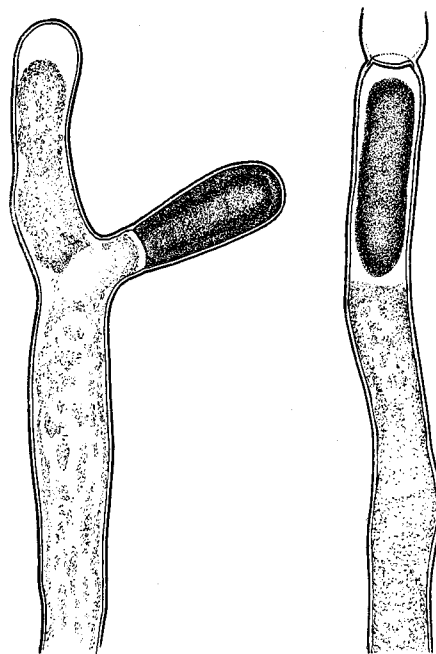


Fig. 55. *Pseudodichotomosiphon constricta*  
Yamada.  
Two zoosporangium-like portions of  
filaments.

(Journ. Fac. Sci. Hokkaido Imp. Univ., Ser. V, vol. 1, 1932) p. 110.

Japanese name. Kubiremidoro (nov.).

Hab. Nawa.

*Vaucheria constricta* Yamada was described from a tuft of specimens brought back from Ryukyu by Inoh in 1931. In the next year I myself collected this species near Nawa, and using this rich material I was able to ascertain some new facts which had not been revealed before.

As I have previously pointed out, the present species shows many characteristics different from those of other species of *Vaucheria*, and judging from the characteristics newly ascertained and those mentioned above it seems to me that this species is to be referred neither to *Vaucheria* nor to *Dichotomosiphon*. It represents a new genus.

The presence of constrictions on the frond and of cell wall thickenings at some constrictions, though not always, and not remarkable even if present, the possession by the frond of a rhizoidal part at the base, and dichotomous ramification, all show the close relation of the present genus to *Dichotomosiphon*. Yet the oogonia are never produced terminally, being situated laterally on the frond.

*Pseudodichotomosiphon constricta* Yamada grows in shallow, muddy places, forming small rising tufts (see photo). Each tuft is made up of numerous individuals entangling one another with their thin rhizoids. Among specimens from one and the same tuft there are mixed both male and female individuals. In my rich material I have met with an individual with both antheridia and oogonia, though only once, and also with some individuals showing a zoosporangium-like body. The top of the branches is separated by a thin wall and the content of the separated place is rounded, showing a blackish colour. Often the top of such places is provided with decaying remnants of cell wall which creates the impression that the zoosporangia are made in succession.

In all specimens collected by myself the frond is thinner than in the type specimen, the former measuring around  $200\mu$  in thickness.

**Index of Species, Varieties and Forms**  
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