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Corallinæ veræ Japonicæ,

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With 7 Plates.

Introduction.

During these five years spent in the collection of Marine Algae along the coast of northern and middle Japan, I have paid special attention to the family Corallinaceae. I took for my own study the subfamily Corallinae and sent the specimens of Melobesiae to Mr. M. Foslie of Norway, begging his collaboration on the group. He detected among them a dozen species, several of which are new to science. His papers based on the study of this material have been published in Det Kgl. Norske Videnskabers Selskabs Skripter[1]. In the Corallinae I examined as many as thirty species, which are enumerated in the present work. Lately a few species of Corallinae have been sent to our Institute from Loochoo and elsewhere in the

1). New or critical Calcareous Algae. 1899, No. 5.
Five new Calcareous Algae. 1900, No. 3.
Revised systematical survey of the Melobesiae. 1900, No. 5.

southern part of Japan, but they are not included here, being left for future publication.

During the past fifty years, the Marine Algae of Japan have attracted the notice of several European botanists, and the literature relating to them is not inconsiderable. Yet the calcareous algae seem to have been neglected by these collectors and investigators, only a few species being mentioned in their writings.

Georg von Martens enumerated[1] 6 species of Corallinae which were collected on the coast of Japan and its vicinity. Afterwards a few more species were reported from Formosa collected by Warburg and determined by Heydrich[2]. De Toni[3], Wildeman[4], and others compiled a list of Algae reported from Japan and Eastern Asia, in which 11 species of Corallinae are assigned to Japan.

Among these 11 species, some are limited to Formosa and Loochoo, upon which I do not touch at this time, and of others it has been impossible for me to verify the existence. Cheilosporum (Arthrocardia) frondescens, Corallina (?) filicula, and Corallina officinalis v. mediterranea, reported by Martens to have been collected at Yokohama, are especially doubtful to me. When we set these members aside, we have left only two or three species which I feel justified in incorporating in the present studies.

The figures in the accompanying plates have been made from sections of the dried materials, if not otherwise stated. The author found Perény's fluid answers best for the decalcification of the material. In the case of more delicate plants acetic-sublimate or Flemming's fluid may also be used. For staining he preferred

1) Preussische Expedition nach Ostasien. Tange. 1866—1868.

2) Heydrich: Beitrage zur Kenntniss der Algenflora von Ostasien. Hedwigia, Bd. XXXIII. 1894.

3) De Toni: Phyceae Japonicae Novae. 1898.

4) Wildeman: Prodrome de la flore Algologique des Indes Neélandaises. 1897.

Böhmer's Hematoxylin for 20–40 minutes, and then Fuchsin (0.3 gr. in 100 cc. 50% alc.) for one hour. The genicular cells and spores stain in red, and the cellwall in purple. Decalcifying, fixing and staining at the same time with Schneider's Aceto-carmin, and afterwards staining the section with Böhmer's Hematoxylin also answers pretty well.

The writer wishes to express his hearty thanks to Prof. Dr. J. Matsumura under whose direction he executed the work; also to Mr. M. Foslie who generously spared him the specimens which he got from the late Prof. Areschoug, Le Jollis and others; and to Dr. K. Okamura, Prof. Dr. K. Miyabe, Major Th. Reinbold, and Prof. Dr. M. Miyoshi, for their kind gifts of specimens and for valuable advice.

CORALLINAE VERAE JAPONICAE.

Amiphiroa, Lamx.

1. Amphiroa valonioides, sp. nov.

Pl. I. fig. 1—3 : Pl. IV. fig. 1.

Fronde pulvinato-cæspitosa; ramis paucis, patentibus, lateralibus, pseudo- sympodialibus vel irregulariter dichotomis ; articulis exacte cylindraceis, equicrassis, 0.2–0.3 mm. latis, 0.6–0.8 mm. longis, apice obtusis ; geniculis superioribus obsoletis, inferioribus articulorum diametrum æquantibus ; conceptaculis verrucæformibus.

The articuli are homogeneously cylindrical, measuring 0.2–0.3 mm. in diameter and 0.6–0.8 mm. in length, becoming a little thicker and shorter toward the base. Branches are few in number and generally proceed laterally from the top of an articulus without geniculum, in a sympodial manner.

The conceptacles are ellipsoidal warty protuberances, often covering the whole surface of an articulus. The genicula are very insignificant especially at the upper portions, owing to the durability of the cortical part after they have been completed (Pl. I. fig. 3).

I can not not find any appropriate description referable to the present plant, although it has some resemblance to *Amphiroa setacea, Kütz* : but the character " ramulis oppositis plerumque tuberculatis patentibus " is hardly applicable to our plant.

Found in the sublittoral region at the coast of the Prov. of

Hiuga in the summer of 1900; At Misaki, in the autumn of the same year.

2. Amphiroa rigida, Lamx.

Pl. I. fig. 5–6 : Pl. IV. fig. 4.

Amphiroa rigida, Lamx. Polyp. Coral. p. 297. Pl. II. fig. I.
Aresch : in J. Ag. Spec. Alg. II. p. 533.
Zanard : Icon. Phyc. Adr. III. p. 79. T. 99. B.
Kütz : Spec. Alg. p. 701.
Id : Tab. Phyc. VIII. T. 42. fig. IV.
Solms : Corall. p. 6.
Hauck : Meeresalgen. p. 276. fig. 113.
? A. lucida, Lamx. l. c. p. 297.
A. verruculosa, Kütz. Phyc. Gen. p. 387.
Id : Spec. Alg. p. 700.
Id : Tab. Phyc. VIII. Taf. 39. fig. II.
Solms : Corall. p. 8.
A. cladoniæformis, Menegh. Kütz : Spec. Alg. p. 700.
Id : Tab. Phyc. VIII. T. 42.
A. spina, Kütz. Phyc. Gen. p. 387.
Id : Spec. Alg. p. 700.
Id: Tab. Phyc. VIII. Pl. 41. fig. 1.
A. amethystina, Zanard. Kütz : Spec. Alg. p. 700.
A. irregularis, Kütz. Phyc. Gen. p. 389.
Id : Spec. Alg. p. 700
Id : Tab. Phyc. VIII. Taf. 41. III.
A. inordinata, Zanard : Icon. Phyc. Adr. III. 79.
Aresch : in J. Ag. Spec. Alg. p. 542.
Kütz : Spec. Alg. p. 701.

This species, common in the Gulf of Naples, is rather rare in Japan; being restricted to the southern coast of Kiushū Island and hitherto not found in the main island (Honshū): in the low side mark and below.

3. Amphiroa cretacea, Endl.

Pl. I. fig. 4: Pl. IV. fig. 2.

Fronde lapidescente, irregulariter di-trichatome ramosa, superne attenuata; ramis ramulisque divaricato-deflexis, saepe insignis; articulis 4–8 mm. longis, 2–3 mm. latis; geniculis sublineæformibus; conceptaculis verrucæformibus prominentibus diametro 0.8 mm.

Corallina cretacea, Post. et Rupr. Ill. Alg. p. 2. Taf. XL. fig. 104.

Amphiroa cretacea, Endl.

Aresch: in J. Ag. spec. Alg. II p. 533.

Kütz: spec. Alg. p. 701.

Id: Tab. Phyc. VIII. Taf. 45.

Harv: Ner. Bor. Amer. p. 86.

? A. californica, J. E. Tilden. Amer. Alg. IV. no. 301.

f. rosariformis. nov. form. Pl. IV. fig. 3.

Ramis longis, sursum attenuatis, articulis brevissimis diametrum subæquantibus rotundis.

It is stout and robust in its appearance and attains the height of 5–12 cm.; the colour is rosy purple while living. The articuli are thoroughly cylindrical, except the ramiferous ones which are sub-compressed cuneate. The conceptacles are large, measuring 0.8 mm. in diameter.

A side branch is often found prolonged to form a sort of fastening

disc, by which it attaches to a pebble or a rock as shown in the photograph (fig. 2). This is remarkable in the case of *f. rosariformis.*

A dwarfed form, found in the southern limit of the cold current, is very similar in its appearance to the well grown forms of *Ampliroa rigida*, from which, however, can be distinguished by having the large conceptacles and the rosy purple tint.

This plant is one of the flora of the cold Siberian current. The current washes the whole coast of Hokkaido (Yesso) and runs southward as far as Kinkwa-san Island in the prov. of Rikuzen. So also the plant is distributed. It is generally found deeper than 2 feet below the low tide mark, usually where a few other plants grow. Prov. Rikuzen : Hakodate : Otaru : Rishiri Island. *f. rosariformis* is hitherto known only from Kaifu, a rocky coast in the western side of the main island (Honshū).

4. Amphiroa ephedræa, (Lamk.) Aresch.

Pl. I. fig. 7–10 : Pl. IV. fig. 5–8.

Fronde elata regulariter dichotoma, flabellata, sursum attenuato-tereti vel compresso-subdilatata ; ramis ramulisque patentibus ; articulis inferioribus brevioribus, superioribus diametro 3plo—5plo longioribus ; geniculis inferioribus diametrum subæquantibus, superioribus brevioribus ; conceptaculis numerosis.

β. fronde inferne tereti vel subtereti, superne sensim compressa vel subcomplanata.

Corallina ephedræa, Lamk. Mem. Mus. II. p. 238.

Amphiroa ephedræa, Aresch. b. in J. Ag. Spec. Alg. II. p. 534.

A. Gaillonii, Lamx. Polyp. Coral. p. 298. t XI. 3.

Kütz : Tab. Phyc. VIII. Taf. 47. I.

A. Guenzii, Harv. Ner. Austr. p. 95.

Kütz : Tab. Phyc. VIII. Taf. 48. I.

A. ephedræa, Lamx. Sonder : in Frag. Phyt. Austr. XI. Supl.

γ. fronde pulvinato-caespitosa, inferne tereti vel subtereti, superne subattenuata; articulis cylindraceis, ultimis mucronatis.

Forma β has its articuli cylindrical at the lower portions, somewhat compressed in the middle, but the terminal articuli are long cylindrical, subattenuating toward the apex. Dense tufts are sometimes found, and sometimes isolated form ; in the latter case the frond generally assumes a larger size (Pl. IV. fig. 5).

The second form γ always occurs in tufts, the terminal articuli being homogeneously cylindrical often attenuating toward the base.

Although I refer our plant to the present species, the original descriptions are not satisfactorily applicable to it. In ours the genicula are rather small when compared with a specimen ex Herb. Areschoug. Nevertheless, A. ephedræa, (Lamk.) Aresch. seems to be, at any rate, a variable and inconstant species ; and there is no little danger to claim an independent position for our plant. *Amphiroa Gaillonii, Lamx.* is mentioned in the list of Algae collected by Martens [1] ; and a fragmental specimen doubtedly identified to it was collected in the "Challenger Expedition" [2], on the shore of Oshima harbour near the Kiushū Island. These specimens might have been either of the above mentioned forms.

Boshū ; Misaki ; Shimoda ; Prov. of Hiuga ; Prov. of Mikawa : in the low side marks and below.

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1) Preussische Expedition nach Ostasien. Tange. p. 131.

2) Dickie : Journ. of Linn. Soc. Bot. vol. 15. p. 450.

5. Amphiroa zonata, sp. nov.

Pl. I. fig. 11–14 : Pl. IV. fig. 9.

Fronde 2–5 cm. alta, tereti-compressa, latitudine equali vel sursum latiore, dichotoma ; ramis ramulisque patentibus ; articulis infimis brevissimis, mediis 0.8–1.0 mm. latis, 4.0–6.0 mm. longis, supermis compressis linearibus, apice latioribus obtusis, pulcherrimis transversis striis ; geniculis inferioribus diametrum æquantibus, superioribus poriformibus ; conceptaculis verrucæformibus oblongis.

The present plant is distinguished from others by having regularly and "indirectly"[1] dichotomous, flabellate branches. The articuli of the middle and upper portions are compressed with round edges, and the terminal articuli have always remarkable transverse striations. In a dried specimen we see a deep transverse furrow parallel to the apical margin, in the place of the terminal striation. This furrow is of a secondary importance owing to the contraction of the part in the exsiccation.

In the vicinity of the Marine Laboratory at Misaki, we find two forms of plants referable to this species. One is always found at the littoral region and the other in 5–20 feet deep water. The former has more patent branches of rosy purple colour, and the terminal articuli are much more compressed : the latter is of greyish purple, with the branches more fastigiate and the terminal articuli less compressed. But the general characters are similar in several respects and sharp

1) In the dichotomous branching of Corallinae, I distinguish three types, viz :—

I. Indirect dichotomy : articulus diverging before it had a geniculum.

II. Direct dichotomy : articulus having two genicula at the end, from which the successive articuli arise.

III. Decussate dichotomy : one order of dichotomy in the plane at right angles to that of the adjacent order.

These expressions would be repeated in the present work.

boundary is hard to draw. The shallow water form has very often the terminal articuli cylindrical and approaches to a form of the preceding species.

Usually found at the depth of 5–20 ft. below low water mark : the shallow water form, however, often found at the low tide mark. Misaki : Shimoda : Sunosaki.

6. Amphiroa echigoensis, sp. nov.

Pl. I. fig. 15-16 : Pl. IV. fig. 10.

Fronde subcompressa latitudine equali, dichotoma : articulis nfimis cylindraceis, brevissimis, mediis subcompressis equicrassis, 0.6–0.9 mm. latis, 3–5 mm. longis, superioribus plus minus compressis, haud transverse striatis, ultimis apice rotundis ; geniculis diametrum æquantibus majoribusque ; conceptaculis minutis subprominentibus.

The articuli are somewhat compressed except near the base. Their breadth is homogeneous throughout the entire frond, measuring 0.6–0.9 mm. in diameter. But those in the ultimate portion are slightly compressed and broader. The genicula are equal in breadth ito the articuli looking as the brown bands on the dried specimens. In this species neither the transverse striation nor the furrow near the apical margins can be seen.

This species undoubtedly stands near to the former, but differs widely in its internal structures ; the cortical part consists of several layers of the parallelopedal cells, compactly arranged in an anticlinal direction, thickly covering the zonal arrangement of the periclinal cells ; conceptacles are slightly prominent but frosted over the whole surface of the articuli. It has some resemblance with *Amphiroa algeriensis*, *Kütz.* and *Amp. exilis*, *Harv.* Yet differs from the former by

the mode of ramification, and from the latter by its remarkable genicula.

Found on a rock at sublittoral region: not very common. Kaifu: Matsushima.

7. Amphiroa dilatata, Lamx.

Pl. I. fig. 17–21 : Pl. V. fig. 4.

Amphiroa dilatata, Lamx. Polyp. Coral. p. 299.
Harv: Ner. Austr. p. 97.
Kütz: Spec. Alg. p. 703.
Id: Tab. Phyc. VIII. Tab. 50. fig. III.
De Toni: Phyc. Jap. Nov. p. 41.
Aresch: in J. Ag. Spec. Alg. II. p. 536.
Amphiroa galaxauroides, Sond. Plant Preiss. vol. II. p. 188.
Martens: Preus. Exp. n. Ostasien. p. 29.
Kütz: Spec. Alg. p. 704.
Id: Tab. Phyc. VIII. Taf. 51. fig. I.

The large genicula on the lowermost portion give the frond a flexible character: this circumstance, no doubt, is the cause of the frond's being always found spreading radially while living. The conceptacles are found mostly on the shaded side of the fronds. They are sometimes densely frosted over an articulus, and sometimes arranged in two irregular rows in the periclinal direction. The diagramatic as well as more minute details of a meridional section of an articulus of the former case are shown in the plate. (Pl. I. fig. 17 and 18).

About the transverse striations Areschong does not give any particular description. Kützing remarks "non striae" in the diag-

nosis of *A. dilatata*, and "transversim et subtiliter zonatis" in that of *A. galaxaurοides* (Spec. Alg. l.c.) Our plant has always plain transverse zones and much more applies to the latter than to the former.

Martens enumerates *A. galaxaurοides* in the list l.c. He does not acknowledge the reduction of the species by Areschong on the ground that his plant has the articuli "alle flach und ziemlich gleich breit," while in *A. dilatata* "sind die untersten Glieder stielrund." I could not find any species of *Amphiroa* whose articuli were flattened already at the base, provided that it had been a complete specimen.

At the depth of 4–10 ft. below low water mark. Misaki : Sanosaki : Shimoda : Prov. of Hiuga.

8. Amphiroa pusilla, sp. nov.

Pl. I. fig. 22–23 : Pl. V. fig. 11–13.

Fronde 1.5–3.0 cm. alta, decumbenti saepe erecta, ima basi subtereti, superne compressa, di-trichotoma ; articulis infimis subteretibus, mediis compressis 1.0–1.5 mm. latis 3.0–4.0 mm. longis, superioribus complanatis vel planis sursum attenuatis, ecostatis, non transverse striatis ; geniculis brevibus inferioribus, angustioribus superioribus ; conceptaculis numerosissimis.

This species stands very near to *Amphiroa dilatata, Lamx.* But the articuli are always much more rounded and in every proportion small. The attenuity of the terminal articuli, ending finally in a blunt point, is its special character. Conceptacles are generally found on the shaded surface, but in the erect form on both surfaces.

In the low water mark : Misaki.

9. Amphiroa misakiensis, sp. nov.

Pl. I. fig. 24–25 : pl. VI. fig. 1.

Fronde ima basi tereti, superne complanata, di-trichotoma ; ramis patentibus ; articulis infimis subteretibus, mediis lato- vel obovato-cuneatis subplanis, tum saepe attenuatis, superioribus foliiformibus obovato-clavatis vel palmatis medio subcostato-elevatis, marginibus plus minus utrinque undulatis ; geniculis inferioribus latitudine 3-plo brevioribus, superioribus subpunctiformibus; conceptaculis.....

It has thin and short articuli at the basal portion ; but the upper articuli are very broad and foliaceous, giving rise to several flat ramuli so as to form a digitate branch. The ventral surface of the articuli is convex and the other slightly canaliculated at both margins—the cross section, therefore, lunate. No transverse striation could be seen.

It is not very common, only a few specimens have been collected at low tide mark : Misaki.

10. Amphiroa canaliculata, Martens.

Pl. I. fig. 26 : Pl. IV. fig. 14–15.

Fronde maxima, basi tereti, superne compresso-complanata, irregulariter dichotoma ; articulis compresis lineari-oblongis, dorso convexis, ventre bi-canaliculatis, ultimis attenuatis ; geniculis brevissimis ; conceptaculis dorso numerosissimis.

Amphiroa canaliculata, Martens. Preus. Exp. n. Ostas. p. 28. Taf. VI.

Our specimen is somewhat fragmentary and the entire aspect can not be fully known : but the convexity of the dorsal surface and canaliculation in the ventral very well coincide with Marten's description. One peculiarity in this plant is that the flat articuli may give rise at their edges to a lot of tiny branchlets. This character is cleary shown in Marten's plate as well as in the accompanying photograph.

By trawling on the coast of the Prov. of Kazusa ; rare. (Dr. K. Okamura).

11. Amphiroa declinata, sp. nov.

Pl. I. fig. 29 : Pl. VI. fig. 4.

Fronde declinata, ima basi teréti, superne compresso-complanata, di-trichotoma ; ramis patentibus, pinnatis saepe bipinnatis ; pinnis pinnulisque sursum sensim brevioribus ; articulis inferioribus cylindraceis diametro sesqui-vel 2-plo longioribus, mediis subscutiformibus vel hexagonis, apicalibus rotundis, pinnarum pinnularumque sublineæ-scutiformibus ; geniculis linearibus ; conceptaculis numerosissimis conicis in marginibus articulorum insitis.

The articuli in the middle and the upper portions are always compressed, more or less plainly costated. The branches are regularly pinnated with their general outlines rhomboidal. The fronds measure 4–6 cm. in length ; the average articuli 1.5–2.5 mm. wide, 2.5–3.0 mm. long. They grow upright at the beginning but soon spread horizontally with the upper parts bending downwards. The conceptacles, 0.5 mm. in diameter, are found mostly growing in a row on the edge of an articulus, pointing obliquely toward the ventral side.

Below low tide mark. Misaki : Prov. of Hiuga : Prov. of Echigo : Prov. of Wakasa (Mr. R. Tsuge) : Matsushima Bay.

12. Amphiroa crassissima, sp. nov.

Pl. I. fig. 27–28 : Pl. V. fig. 5–6.

Fronde crassissima, ima basi tereti superne comprsso-complanata, di-trichotoma, irregulariter pinnatis ; articulis inferioribus cylindraceis diametrum æquantibus, mediis scutiformibus vel obtrapezoidibus, superioribus compressis plus minus costatis, oblongo-obcordatis vel sagittatis, lobis patentibus ; articulis ultimis clavatis ovatisque vel sagittatis ; apice albis, levite transverse striatis ; geniculis inferioribus linearibus superioribus obscuris ; conceptaculis paucis in marginibus articulorum insitis.

The fronds measure 5–7 cm. high spreading widely upwards. By the virtues of the thick articuli and the insignificant genicula, the fronds assume a very robust appearance. The terminal articuli are often digitated, and sometimes the lobes of a sagittate articulus are prolonged into lacineated broad wings. The fertile articuli are irregularly cylindrical or sublinear with one or two rows of conical conceptacles.

Below low tide mark. Misaki : Shimoda : Prov. of Boshū.

13. Amphiroa aberrans, sp. nov.

Pl. II. fig. 1–5 : Pl. V. fig. 1–3.

Fronde maxima, ima basi subtereti, superne compressa, di-trichotoma ; ramis ramulisque oppositis patentibus ; articulis infimis teretibus, inferioribus compressis scutiformibus, medio elevatis, utrinque adpressis, mediis superioribusque eramiferis sagittatis plus minus costatis, lobis projectis, articulis ultimis obovatis ; geniculis linearibus ;

conceptaculis aliis in mediis articulorum aliis saepe in apicibus loborum insitis.

The present species is large and beautiful plant often attaining the height of 12–20 cm. The articuli are sagittated with compressed and broad wings, without any indication of the zonal striation. Conceptacles are mostly found on the surfaces of the flat articuli, not seldom immersed in the projected angles of the articuli.

It is in this plant that the decussate branches are often proliferated from the surface of an articulus (fig. 1 & 2. Pl. II). In normal condition the proliferations are few in number and short in length. But when they are numerous and luxuriant the frond assumes quite a different form from the normal one ; and not seldom another species of *Corallinae* grows together with those aberrant branches, making the frond much more perplexing.

The decussate branches have the articuli normal but often linear, sometimes very broad spathulate ones. In the latter cases the terminal articuli are generally thin, broad and fan-shaped, concave as a watchglass.

I was not able to find any description satisfactorily referable to this plant. The figures of *Corallina frondescens*, *C. gonphonemacea* and *C. flabellata var.* in Kützing's Tab. Phyc. (Pl. 59. II ; Pl. 63. I ; Pl. 63. II) seem to have some relations with the plant in question. But the original descriptions of the above mentioned species are impossible to be applied to our plant.

It is rather common in the middle parts of Japan, on the Pacific coast as well as on the Japan Sea side : found in the sublittoral region often covering a good area of a rock. Misaki : Bōshū : Shimoda : Prov. of Hiuga : Prov. of Wakasa (Mr. R. Tsuge) : Prov. of Echigo.

Cheilosporum, (Aresch.) Schmitz.

1. Cheilosporum anceps, (Kütz).

Pl. II. fig. 6–8 : Pl. VI. fig. 2.

Fronde tenuiore, gracile, basi tereti, mox compresso-complanata, substipitata, densissime di-trichotoma ; articulis omnibus subcostatis, infimis cylindraceis diametro 0.5–1.0 mm., mediis eramiferis scutiformibus vel obcordatis, superioribus ramulorumque linearibus vel obcordatis vel sagittatis, lobis saepe laxe prominentibus ; conceptaculis in apicibus vel mediis loborum tumescentibus ; geniculis brevissimis.

Corallina anceps. Kütz. Phyc. Gen. p. 388.

Id : Tab. Phyc. Taf. 62. fig. I.

Id : Spec. Alg. p. 708.

The articuli in this species are highly variable in their form and size ; those of the branches as well as the upper portions are generally linear, measuring 0.5–1.0 mm. in breadth and 5.0–7.5 mm. in length ; those of the middle portion, cordate, reniforme or sagittate. The lobes of the sagittate articuli sometimes attain to 1. cm in length, very often giving rise to long branchlets at their apexes. The apical articuli are very small, cylindrical, linear or obovate in the shape. We have in many cases small protuberances at the top of the superior articuli and not seldom of the middle portion. These are abnormal decussate branches and may develope into the branches with cordate or sagittate articuli. Although the articuli are thus variable in the form, every lower end of them is always pointed, leaving a narrow space to admit the small geniculum. So the movement of the articuli is slightly restrained and the whole frond is extremely delicate.

Conceptacles one to three in each articulus ; in the middle or at the tops of the lobes, or the both cases taking places at the same time.

At low side mark : Hakodate.

var. modesta, nov. var.

Pl. II. fig. 9 : Pl. VI. fig. 3.

Fronde tenui ; articulis obcordatis vel sagittatis, longitudine inter genicula distantiam loborum subæquante vel sesquibreviori, ultimis rotundatis vel ovatis.

The form of the articuli in this variety is nearly constant ; the extraordinary prominent lobes of the sagittate articuli or the linearly prolonged ones are not found in this plant.

At low tide mark. Hakodate : Kaifu (Prov. of Echigo).

2. Cheilosporum yessoense, sp. nov.

Pl. II. fig. 12–13 : Pl. VI. fig. 5.

Fronde robusta, multicipiti, basi subtereti, mox compresso-complanata nudiusculo-stipitata, irregulariter dichotoma vel prolifera, basibus articulorum prominentibus ; articulis inferioribus scutiformibus utrinque compressis, superioribus approximatis obcordatis vel obreniformibus lobis patentibus rotundis adpressis, apicalibus flabellatis ; geniculis brevissimis ; conceptaculis in margine loborum superiori articulorum immersis vel in mediis loborum tumescentibus.

f. angusta. Pl. II. fig. 14–15 : Pl. VI. fig. 6.

Fronde angustiore, articulis obcordatis vel sagittatis, conceptaculis in mediis loborum tumescentibus.

In the typical form the articuli are compactly arranged and their form is highly regular: those of the upper portions have the lobes projecting obliquely upwards but gently turning into transversal direction. The former articuli, therefore, assume a form just like the wings of an acer fruit or a clock key; and the maximum breadth measures 4–6 mm., the inter-genicular distance 1.5–2.0 mm. The outline of a branch is without exceptional spathulate. The lower end, or the pedicel, as it were, of an upper or middle articulus is always prominent as in a bamboo node, but gently disappearing as we trace downwards. The conceptacles are generally immersed in the upper margins of the lobes.

The *f. angusta* has a similar character, but narrower articuli: The breadth measures 2.0–2.5 mm., the inter-genicular distance 1.5–2.0 mm. The conceptacles are immersed in the middle parts of the lobes and seldom at the apexes.

The description of *Amphiroa chiloensis, Dcne.*, *Amp. prolifera, Lamx.* etc., are with slight modifications applicable to *f. angusta.* But they are not sharply defined and we are afraid of confusing them more and more by applying our plant to either of them until we have had an authentic specimen to refer to.

Both typical and the narrow form have been collected at Hakodate; the former was also found in the Prov. of Boshū (Dr. K. Okamura): below low water mark.

3. Cheilosporum californicum, (Dcne.)?

Pl. II. fig 10: Pl. VI. fig. 8.

Amphiroa californica, Dcne. classif. d. Alg. et Cor. p. 112.
Kütz: Spec. Alg. p. 704.

Aresch : in J. Ag. Spec. Alg. II. p. 542.
? Harv : Ner. Bor. Amer. p. 86.

I have a collection of plants of somewhat dwarfed form. They are like *Cheilosporum yessoense* but much smaller in all respects, measuring neary 2 cm. in height and the other parts in proportion. They closely resemble the specimen of *Cheil.* (*Amphiroa*) *californicum*, (*Dcne.*) which is *ex herbario* of Dr. Farlow and kept in the herbarium of our Institute.

We can not say much about the present species as our specimens seem to be somewhat abnormal and incomplete. All we can here say is to mention a doubtful plant referable to the present species, collected on the Pacifie coast of Japan.

Low tide mark. Prov. of Boshū.

4. Cheilosporum latissimum, sp. nov.

Pl. II. fig. 16–17 : Pl. VI. fig. 7.

Fronde latissima, robusta, multicipiti, basi tereti, mox compresso-complanata, irregulariter ramosa ; articulis approximatis sagittatis lobis patentibus apice truncatis, plus minus subcostato-elevatis, longitudine inter genicula distantiam loborum 2 plo—3 plo breviori, basibus articulorum prominentibus ; conceptaculis binis vel quattuor in apicibus loborum immersis.

The plant attains to the height of 4–6 cm. with a short stipe. The articuli in the middle and upper portion are extremely thin and brittle, and compactly arranged : the maximum breadth measuring 6–8 mm. and the inter-genicular distance 2–5 mm. Two to four, often five conceptacles are found in one articulus at the upper portions.

They are immersed in the wings, with the opening pores at the external margins, ending at the projecting points.

Cast aschore on the coast of Prov. of Kazusa (Dr. K. Okamura).

5. Cheilosporum maximum, sp. nov.

Pl. II. fig. 18–19: Pl. VI. fig. 9.

Fronde maxima, robusta, multicipiti, ima basi tereti longe stipitata, superne compresso-complanata, irregulariter laterali-ramosa, pectinato-pinnata; articulis stipitis subcylindraceis diametro aequilongioribus, pinniferis hexagonis vel truncatis subcostatis; pinnis approximatis vel imbricatis, mediis inferioribusque linearibus, superioribus spathulatis; conceptaculis in apicibus pinnarum immersis vel per medios articulos prominentibus.

This plant, one of the most beautiful on our coast, is very common on the shore of the Sagami Bay. The fronds attain the height of 12–15 cm. with rather long stipes. The articuli at the basal part are short and cylindrical which gently flatten upwards and becomes provided with pinnule at each corner of the upper angles. The pinnae are flat and very regular in their shape, just like a pectoral fin of a common fish. But in the upper portions they are a little changed, being sometimes linear, spathulate, often bifurcating at the apex.

Conceptacles are generally solitarily immersed at the apexes of the pinnules, but not seldom in an axial articulus.

It is necessary to notice that this plant is a species somewhat apart from the ordinary *Cheilosporum*. *Cheilosporum*, strictly speaking, has no pinnules. Nevertheless, we often find the enormously prolonged and finally jointed lobes in those plants which belongs to the

genuine *Cheilosporum*. Our plant should be taken as an extreme case of this modification.

It is an inhabitant of the sublittoral region, often covering the whole surface of a reef to the exclusion of other plants. Prov. of Boshū : Prov. of Kazusa : Misaki : Shimoda.

Corallina, Lamx.

1. Corallina yenoshimensis, sp. nov.

Pl. II. 21–24 : Pl. VII. fig. 2.

Fronde decumbente, caespitosa, fastigiata, regulariter dichotoma, axillis acutis, ramis suberectis saepe apice subinflatis ; ramulis moniliformibus tenuissimis a basi proliferis : articulis ominibus compressis vel ancipitibus, ramiferis subcuneatis, eramiferis sublinearibus, dichotomiis superioribus ultimisque conceptaculiferis ; conceptaculis ovatis.

The frond is fastigiate and regularly dichotomous, the terminal portion more or less inflated. Articuli are compressed and measure 1.0–1.5 mm. in length, and 0.6–1.0 mm. in width : whole size of frond 2.0–2.5 cm. The terminal articuli as well as the horns are always linear and blunt. The conceptacles are oval or elliptical, slightly bulging out at the end of upper articuli. We find always in this plant some slender moniliform branchlets proliferating from the basal articuli.

Sublittoral region. Hakodate : Yenoshima (Dr. K. Okamura).

2. Corallina nipponica, sp. nov.

Pl. II. gg. 20 : Pl. VII. fig. 1.

Fronde erecta, caespitosa, dichotoma, axillis acutis, ramis erectis ;

articulis mediis superioribusque cylindraceis, inferioribus compressis ancipitibus truncatis, dichotomiis superioribus ultimisque conceptaculiferis ; conceptaculis subclavatis cornibus brevissimis.

The present plant bears some resemblance to *Cor. rubens*, *L.* But it is much thicker and has a more robust appearance. The cylindrical articuli are 0.6–0.8 mm. long and 0.18–0.2 mm. wide; the lower articuli being broader and shorter, and compressed. The conceptacles have generally blunt short horns of a single joint.

Low water mark. Kaifu.

3. Corallina adhærens, (Lamx.) mut. strict.

Pl. III. fig. 4 : Pl. VII. fig. 5.

Fronde irregulariter decussato-dichotoma, vel paniculata, ramis divaricatis intertextis, capillaceis ; articulis cylindraceis diametro 6 plo—10 plo longioribus, ultimis cylindraceis subattenuatis, conceptaculis urnæformibus apicalibus.

Jania adhærens, Lamx. Polyp. Coral. p. 270.
Kütz : Spec. Alg. p. 710.
Aresch : In. J. Ag. Spec. Alg II. p. 559.
Corallina adhærens, Kütz. Tab. Phyc. VIII. t. 83. p.p.
Heydrich : Beit. z. Kennt. (Hedwig. Bd. 33. p. 301.)
De Toni : Phyc. Nov. Jap. p. 42.

It has slender capillary articuli measuring 0.08 mm. in diameter and 0.5–0.8 mm. in length. The branches are irregularly decussate dichotomous, with ultimate articuli slightly attenuated. This way of branching makes the frond in a massive tuft ; and moreover lots of the decussate branches form fastening discs at their ends to fuse

together with the branches in contact. Thus a spongy mass of calcareous network are often found.

The original description of the present species is at once applicable to both the present and the next species. These two species have several characters worthy enought to separate one another.

Found in tufts, usually epiphytic on other algae, in the sublittoral region. Prov. of Boshū : Misaki : Shimoda : Prov. of Hiuga.

4. Corallina decussato-dichotoma, sp. nov.

Pl. III. fig. 1–3 : Pl. VII. fig. 3–4.

Fronde fragile, decussato-dichotoma, ramis divaricatis intertextis, articulis cylindraceis diametro 2 plo—5 plo longioribus ultimis cylindraceis acutis ; conceptaculis urnæformibus, cornibus longioribus.

Corallina adhærens Kütz. Tab. Phyc. VIII. t. 88. p.p.

The articuli in the present plant are thicker than in the preceding species, measuring 0.2–0.9 mm. in length and and 0.1–0.15 mm. in diameter. Conceptacles are rarely found ; and if present, they are provided with long, many articulated horns. The length of the articuli is variable according to the habit of the plant : When it grows epiphytically upon an alga, the articuli are comparatively long, and the mass is somewhat loose.

On rocks or epiphytic on other algae at low water mark. Misaki ; Prov. of Boshū : Prov. of Hiuga.

5. Corallina arborescens, sp. nov.

Pl. III. fig. 5 : Pl. VII. fig. 5.

Fronde 1 cm. alta, erecta, regulariter dichotoma ; ramis patentibus

sursum attenuatis; articulis inferioribus compressis ancipitibus, mediis superioribusque subcompressis diametro 3–4plo longioribus, ultimis linearibus vel scutiformibus; geniculis constrictis; conceptaculis.....

The lower articuli are compressed and truncated; the middle ones measure 0.6–0.8 mm. long, 0.15–0.2 mm. wide.

Epiphytic on other alga, at low tide mark. Kaifu: Akashi (Prof. J. Matsumura).

6. Corallina radiata, sp. nov.

Pl. III, fig. 6: Pl. VII fig. 7.

Fronde minima, flabellata, ramis radiato-fastigiatis, regulariter dichotoma; articulis infimis teretiusculis mox compresso-complanatis, lineari-clavatis, diametro 2plo–3plo longioribus; conceptaculis.....

The articuli are flat and linear, and measure hardly 0.3 mm. in width, 0.8 mm. in length. Several fronds arise from a common disc with the basal articuli apparently similar in shape and size to those of the other portions. The disc is round, and more or less convex on the upper surface, reminding us *Cor. Lenormandiana, Grun.* (*Cor. nana, Lenorm.*). No conceptacle is yet found.

Found epiphytic upon *Cystophora*, *Sargassum* or other brown algae, forming a rosy spot. Prov. of Shima (Mr. K. Tani): Kamakura: Misaki: Prov. of Kii.

7. Corallina ungulata, sp. nov.

Pl. III. fig. 7–8: Pl. VII. fig. 8.

Fronde tenuissima, compressa, dichotoma, ramis divaricatis

subintertextis ; articulis inæqualibus sursum attenuatis et brevioribus, mediis superioribusque cylindraceis omnibus diametro 8–13 plo longioribus, ultimis latis unguliformibus vel cylindraceis, dichotomiis superioribus ultimisque conceptaculiferis ; conceptaculis urnæformibus cornibus simplicibus.

f. brevior, f. nov. Pl. III. fig. 9. Pl. VII. fig. 9.

Fronde tenuiore, articulis brevióribus diametro 2–3plo longioribus, superioribus subclavatis, ultimis unguliformibus vel globosis.

The typical form has a similar habit to *Cor. adhærens*, *Lamx.* in forming a large mass of spongy network. *f. brevior* is more robust than the type in virtue of the shortness of the articuli. These two, however, approach one another and sharp boundary is impossible to draw.

The ultimate articuli of a sterile frond have a special character. They are broad and compressed at the apical margin, cylindrical at the base : the apparent shape, therefore, is like a horse's hoof, after which the plant has been named. This character is owing to the peculiar mode of ramification. An articulus tends to ramify when it is yet very short ; or one articulus is prolonged after it has given forth the successive articuli. The matured plant, as a consequence, has a few articuli of this sort and becomes difficult to separate from the loose form of *Cor. decussato-dichotoma.*

The typical form has been found in the Prov. of Wakasa (Mr. R. Tsuge), and at Misaki ; *f. brevior*, in the Prov. of Bōshū : both at low water mark.

8. Corallina sp.

Pl. III. fig. 10.

A tiny plant irregularly dichotomous, with patent branches ;

eramiferous articuli cylindrical, ramiferous clavate, 4–5 times longer than breadth : Conceptacles at the upper and the ultimate dichotomous points.

The present plant has its all branches fertile and disables us to determine the species. Found epiphytic on *Cheilosporum anceps*, (*Kütz.*) *var. modesta* collected at Kaifu.

9. Corallina officinalis, L.

Pl. III. fig. 11–13 : Pl. VII. fig. 10–13.

Corallina officinalis, L. Fauna Suec. n. 2234.
Harv : Phyc. Brit. Pl. 222.
Aresch : in J. Ag. Spec. Alg. II. p. 562.
Kütz : Spec. Alg. p. 705.
Id : Tab. Phyc. VIII. Taf. 66–68.
Kjell : Alg. of Arc. Sea. p. 86.
Hauck : Meeresalgen. p. 281.
Cor. densa, Kütz : Spec. Alg. p. 705.
Cor. spathulifera, Kütz. Spec. Alg. p. 709.
Id : Tab. Phyc. VIII. T. 65.
Cor. nana, Zanard. Icon. Phyc. Adr. III. T. 55.
Kütz : Spec. Alg. p. 709.
Id : Tab. Phyc. VIII. T. 86.
Aresch : in J. Ag. Spec. Alg. II. p. 564.

α : Pl. III. fig. 11 : Pl. VII. fig. 10. fronde brevi, tereti ; articulis ramorum compressiusculis clavatis, pinnarum cylindraceis vel linearibus, ultimis cylindraceis saepe laciniatis.

β : Pl. III. fig. 12 : Pl. VII. fig. 11. fronde crassiore, robusta ; articulis ramorum subcylindraceis clavatis diametro sesqui—2 plo

longioribus, pinnarum cylindraceis, elongatis, tenuissimis, ultimis cylindraceis.

γ: Pl. III. fig. 13: Pl. VII. fig. 12. fronde crassissima dense fastigiata; articulis ramorum subcomplanatis, mediis subcostatis, clavatis vel truncatis, pinnarum pinnularumque subcylindraceis, ultimis subcompressis.

δ: Pl. VII. fig. 13. fronde majore, parce ramosa; articulis infimis cylindraceis diametrum subæquantibus, axium ramorumque subcompressis, oblongo-obovatis vel subclavatis, pinnarum linearibus compresso-complanatis subcostato-elevatis, ultimis compressis ovatis.

The form α is widely distributed in the middle part of Japan as well as in Hokkaido (Yesso). It is found densely covering large patches of rocks from the high water mark to 2–3 feet below the surface. Under the influence of surrounding conditions it is generally bleached into a dirty white or greenish colour. It attains hardly to 2–4 cm. in height with the axial articuli 1 mm. long, 0.5 mm. or less wide; the pinnae being much thinner. Very often a laciniated articulus is found at the top of a branch.

The second form β accords in several respects with *f. flexilis* of Kjellman. But our plant is smaller than his, measuring only 4–8 cm. in height; its articuli are cylindrical throughout the whole part of the frond, gently attenuated toward the apex; the axial articuli measure 1.5 mm. in length and 1. mm. in width; the uppermost ones being only as thick as a brittle.

The form *c* of Areschong in J. Ag. Spec. Alg. l. c. might prove the same as our form γ. They accord very well on the points remarked by him, except in regards to the shape of the ramiferous axial articli, which are much more compressed and more or less costated in our specimens.

The form δ is a comparatively large plant. Its ramiferous axial articuli are subcompressed and clavate ; and those of pinnae much more flattened and edged : pinnules are mostly delicate and cylindrical. No conceptacle yet found. This form is somewhat uncertain of its position, as it wants the propagating organ. Yet, the general appearance shows to have a close relation to the present species.

α, common along the whole coast of Japan : β. Hakodate ; Otaru ; Matsushima : γ, Hakodate : δ, Hakodate ; Prov. of Wakasa (Mr. R. Tsuge).

10. Corallina pilulifera, Post. et Rupr.

Pl. III. fig. 14–16 : Pl. VII. fig. 14–16.

Corallina pilulifera, Post. et Rupr. Illustr. Alg. p. 20. t. XL. fig. 101.

Ruprecht : Tange d. Och. Meer. p. 344.

Kütz : Tab. Phyc. Taf. 64. fig. 1.

Aresch : in J. Ag. Spec. Alg. II. p. 563.

f. Sororia, Rupr. Pl. III. fig. 15 : pl. VII. fig. 15.

Corallina pilulifera, Post. et Rupr. f. Sororia, Rupr.

Tange d. Och. Meer. p. 344.

f. filiformis, Rupr. Pl. III. fig. 14 : pl. VII. fig 14.

Corallina pilulifera, Post. et Rupr. f. filiformis, Rupr.

Tange. d. Och. Meer. p. 344.

? Kütz : Tab. Phyc. VIII. Taf. 87. fig. II.

f. intermedia, f. nov. Pl. III. fig. 16 : Pl. VII. fig. 16.

Articulis ramorum truncatis vel deltoideo-obcordatis angulis non projectis, pinnarum brevissimis, subcylindraceis vel clavatis, ultimis obovatis compressis.

Corallina pilulifera is undoubtedly a variable plant seeming to approach *Cor. officinalis*, *L.* on one side and *Cor. squamata*, *Ellis et Sol.* on the other. Nevertheless, the descriptions of the forms given by Ruprecht l.c. sharply define the differences between them, two of which were quite applicable to our plants. *f. typica*, *Rupr.* could not he found in our coast, and I found another form hitherto not yet described, *f. intermedia*.

f. Sororia is a comparatively robust plant, easily separable from the other members. It is always found decumbent: the ventral surface of the articuli are highly elevated while the upper remain flat. This is characteristic of this form. When it has assumed a more delicate appearances, it becomes almost impossible to distinguish from *f. filiformis*.

f. filiformis is a very slender plant, with the characteristic long pedunculated conceptacles. The articuli of the main branches have no projecting shoulders. It has always laciniated broad articuli at the apexes of some branches, which was a character, according to the author, to separate *Cor. arbuscula* from *Cor. pilulifera*.

f. intermedia is just an intermediate form between the above mentioned two. In a case where all the pinnules were conceptaculiferous we are almost unable to separate it from *Cor. officinalis*, *L.* As has been already noticed by Ruprecht, the terminal articuli, complanated obovate, must not be neglected to distinguish from the latter. Besides, there may be found two minute cylindrical pinnules at each side of the conceptacles so as to form five articuli starting from one articulus. This character is rarely found in *Cor. officinalis*, *L.*

Found at the low tide mark, forming a dense tuft on rocks; also in tide pools. *f. Sororia*: Hakodate; Otaru; Matsushima; Misaki. *f. filiformis*: Prov. of Boshū; Wakanoura (Prof. J. Matsumura); Misaki; Yenoshima; Hakodate. *f. intermedia*: Hakodate.

11. Corallina squamata, Ellis et Sol.

Pl. III. fig. 17 : Pl. VII. fig. 17.

Corallina squamata, Ellis et Sol. p. 117.
Lamarck : Mem. du Mus. II. p. 232.
Lamx : Polyp. Cor. p. 287.
Kütz : Spec. Alg. p. 706.
Id : Tab. Phyc. VIII. Taf. 76.
Aresch : in J. Ag. Spec. Alg. II. p. 567.
Cor. squamata, Park. Harv : Phyc. Brit. Pl. 201.
Cor. compressa, Lamk. Mem. du Mus. II. p. 233.
Lamx : Polyp. Cor. p. 286.
Kütz : Spec. Alg. p. 706.
Amphiroa heterarthra, Trevis. Flora. no. 27. p. 416.

Among the collection from Hakodate, I have a plant densely tufted upon the shell of a muscle. The upper portion of its fronds is simple rosariform. On comparing it with the specimen kindly given me by Mr. M. Foslie, which is a part of a plant he got from the late Prof. Areschong, I found our plant to be an abnormal form of the present species. There is no uncertainty in mentioning *Cor. squamata* as an inhabitant of our coast.

At low tide mark, also in pools : Hakodate.

12. Corallina sessilis, sp. nov.

Pl. III. fig. 18 : Pl. VII. fig. 18.

Fronde complanata, nudiusculo-stipitata, pinnato-ramosa ; articulis inferioribus teretibus, superioribus ramorumque compressis

hexagonalibus, truncatis vel scutiformibus subcostato-elevatis, pinnularum brevibus subcylindraceis sursum attenuatis ; conceptaculis compressis sessilibus in apice pinnarum pinnularumque immersis, vel saepe brevissime pedunculatis.

It is comparatively small plant, measuring 3–5 cm. in height. The main articuli are evidently ribbed on the ventral surfaces and measure 1. mm. in the maximum breadth, with nearly equal length. The conceptacles are either sessil when they are inserted in the pinnae, or with short compressed peduncles when they take places of the pinnules. They are rather compressed, and two or three are often found in one pinna having the aspect of those of *Cheilosporum latissimum*. cfr. Pl. II fig. 16.

At low tide mark : Hakodate.

13. Corallina kaifuensis, sp. nov.

Pl. III. fig. 19 : Pl. VII. fig. 19.

Fronde irregulariter dichotome ramosa ; ramis pinnatis, circumscriptione rhomboidalibus, pinnis sursum sensim brevioribus ; articulis inferioribus subteretibus, ramiferis truncatis vel clavatis subcompressis, pinnarum tenuioribus cylindraceis vel linearibus ; conceptaculis terminalibus majoribus obovatis pedunculatis.

The frond measures 2–5 cm. in height with the axial and the apical articuli somewhat compressed. Those of the pinnae are generally cylindrical and thin, measuring 0.5–0.75 mm. in length. Conceptacle is found at the top of the terminal articulus ef each pinnule.

At low tide mark : Kaifu.

14. Corallina confusa, sp. nov.

Pl. III. fig. 20 : pl. VII. fig. 20.

Fronde tenuissima, subtrichotoma, irregulariter pinnata ; articulis infimis teretibus, superioribus compresso-complanatis, ramorum cuneatis vel deltoideis, pinnarum subimbricatis linearibus vel lanceolatis sursum dilatatis ; geniculis punctiformibus ; conceptaculis globosis longe pedunculatis vel sessilibus in apice agglomeratis.

It is hardly more than 3 cm. high, with all of its parts thin and weak. The conceptacles are either sessile or pedunculated and are found at the apical portion of the frond agglomerating in a confused manner, hence the name. The genicula are comparatively large seeming as the brownish spots over the fronds.

It covers large patches of rocks at high tide mark. At the first sight we perceive a granular mass on a rock, which after examing is known to be the agglomerated conceptacles wholy covering the vegetative portion of the fronds. Hakodate.

June, 1901.

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PLATE I.

Plate I.

Figs. 1—3. *Amphiroa valonioides.*

1 and 2. Two forms of the fronds, × Ca. 7.

3. A longitudinal section through a branching point: The cortical parts arround the genicula are not yet broken off. Zeiss. 2 × BB.

Fig. 4. *Amphiroa cretacea, Endl.*

A diagramatic figure of a longitudinal section of a frond: the medullary portion is bounded with a dotted line; a conceptacle bulging out from the cortical part.

Figs. 5—6. *Amphiroa rigida, Lamx.*

5. A diagramatic figure of a longitudinal section of a frond; six conceptacles are seen immersed in the cortical part. Zeiss. 2 × AA.

6. The geniculum of the same section more magnified; the genicular cells are intertwixed at the middle portion of the geniculum.

Figs. 7—9. *Amphiroa ephedræa, Lamk. β.*

7. An apical part of a branch of the isolated form. × Ca. $2\frac{1}{2}$.

8. The same of the tuft form. × Ca. $2\frac{1}{2}$.

9. A portion of a longitudinal section of an articulus of the isolated form; from fresh material, decalcified and fixed with chromic acid 4% sea water solution. Zeiss. 2 × DD.

Fig. 10. *Amphiroa ephedræa, Lamk. γ.*

An apical part of a branch. × Ca. $2\frac{1}{2}$.

Figs. 11—14. *Amphiroa zonata.*

11. A portion of branch magnified: The terminal furrows and the transverse zones are clearly seen.

12. A portion of a meridional section of an articulus: observe that the cortical layer is very thin. Zeiss. 4 × AA.

13. A longitudinal section of the terminal portion of a branch. The cellular arrangements are much disturbed at the furrow, and the

incompletely calcified cells are dissolved away during the process. Zeiss. 4 × AA.

14. A diagramatic figure of a cross section of an articulus ; the boundary between the cortical layer and medullary part is shown with a dotted line. Zeiss. 2 × AA.

Figs. 15—16. *Amphiroa echigoensis.*

15. A portion of a longitudinal section of an articulus bearing a conceptacle : the cortical cells are arranged in the anticlinal direction forming a thick layer. Zeiss. 4 × BB.

16. A diagramatic figure of the cross section of an articulus, compare with Fig. 14. Zeiss. 2 × AA.

Figs, 17—21. *Amphiroa dilatata, Lamx.*

17. Diagramatic figure of a meridional section of a fertile articulus, with numerous conceptacles. Zeiss. 2 × AA.

18. A part of the same magnified. The periclinal cells are interwoven like a mat. From a fresh material. Zeiss. 4 × BB.

19. A part of the cross section of an old geniculum. Zeiss. 4 × DD.

20. A longitudinal section of the same : transverse thickenings of the walls are highly developed, with connecting canals between newly formed intercellular spaces. Zeiss 4 × DD.

21. An upper portion of a frond, showing zonal arrangement of the periclinal cells ; the space bounded with a dotted line indicates the genicular area ; this area stains metachromatically with some staining reagents after decalcification. Zeiss 2 × AA.

Figs. 22—23. *Amphiroa pusilla.*

22. A cross section of a frond through a conceptacle ; from a fresh material. Zeiss. 2 × BB.

23. A diagramatic figure of a cross section of an articulus.

Figs. 24—25. *Amphiroa misakiensis.*

24 and 25. Diagramatic figures of the cross sections of the articuli.

Fig. 26. *Amphiroa canaliculata Mart.*

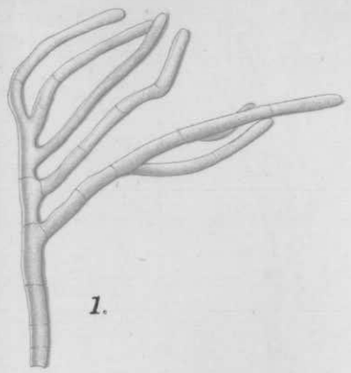
A diagramatic figure of a cross section of an articulus. Compare the ribs, depressions and canaliculations in 23, 24, 25 and 26. In *Amp. pussila* the dorsal surface is costated, while in the others the ventral is much more costated: in *Amp. misakiensis* it is canaliculated in the dorsal while in *Amp. canaliculata* in the ventral side.

Figs. 27—28. *Amphiroa crassissima.*

Diagramatic figures of the cross sections of the articuli. × Ca. 7.

Fig. 29. *Amphiroa declinata.*

A diagramatic figure of a cross section of an articulus. × Ca. 7. Compare 27, 28 and 29; also observe that the conceptacles are projecting obliquely toward the ventral side.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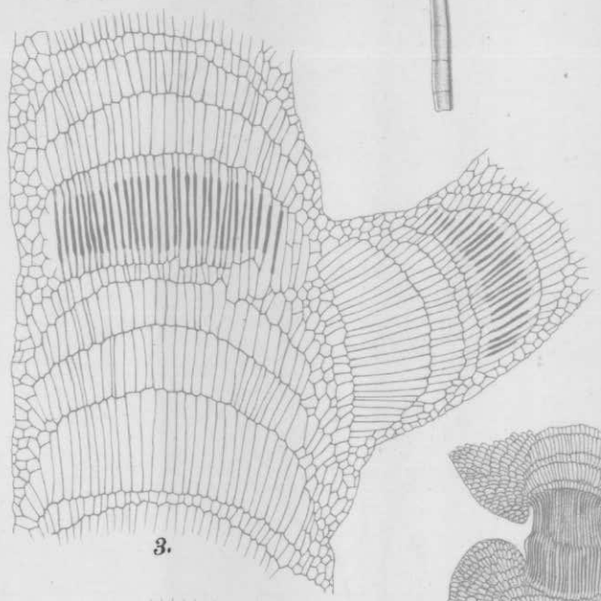
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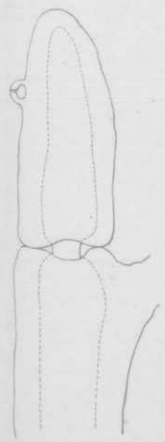
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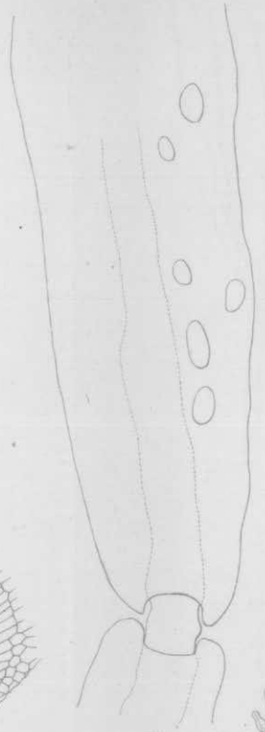
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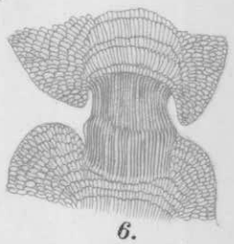
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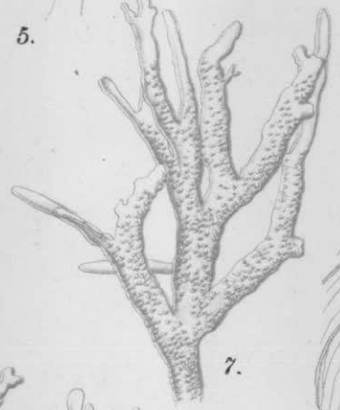
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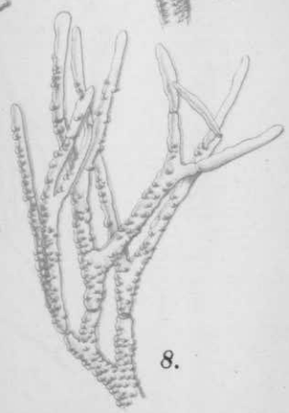
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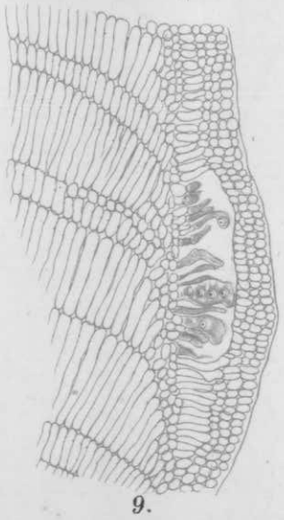
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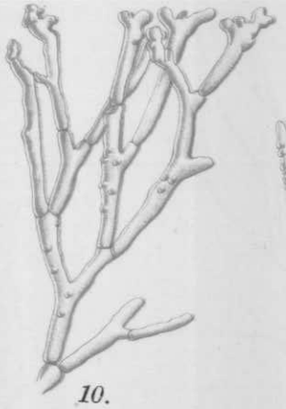
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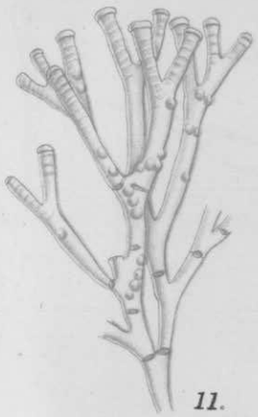
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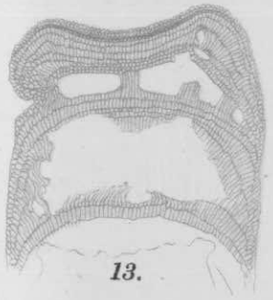
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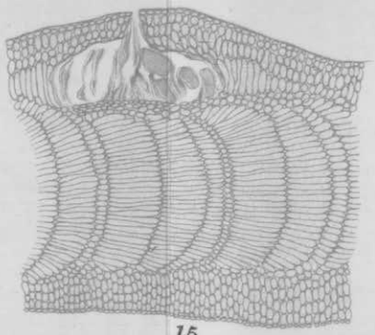
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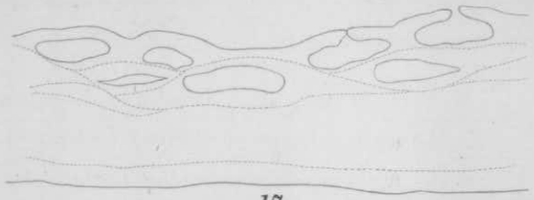
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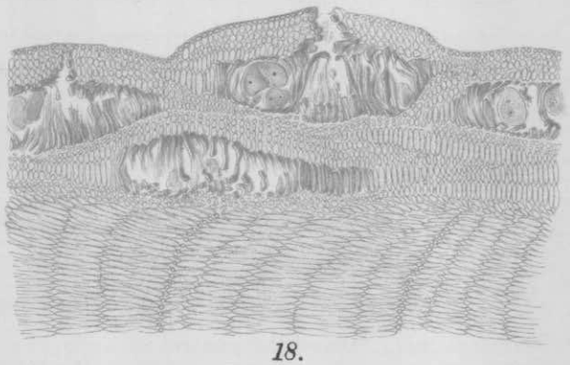
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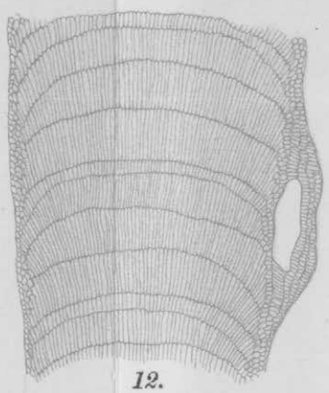
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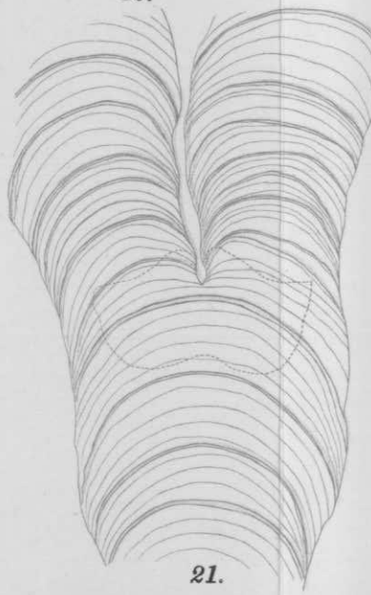
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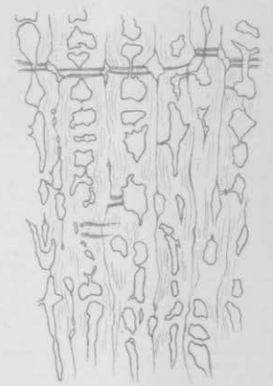
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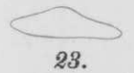
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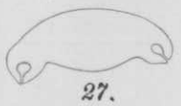
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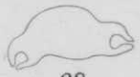
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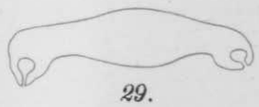
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K. Yendo del.

Yendo—Corallinae verae Japonicae.

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PLATE II.

Plate II.

Figs. 1—5. *Amphiroa aberrans.*

1 and 2. Portions of some abnormal branches, magnified; cylindrical proliferations and the spathulate branches are to be seen.

3. A meridional section of a solitary conceptacle, which is very often found immersed in the top a projected lobe. Zeiss. 4 × BB.

4. Cross section of an articulus bearing two conceptacles. Zeiss. 4 × BB.

5. A longitudinal section of a young frond with a geniculum; a part of the frond of a *Lithothamnion* is deep in the substratum; the geniculum is perhaps formed of several zones of periclinal cells, but only continuous filaments being observed in the section. Prepared by grinding. Zeiss. 2 × BB.

Figs. 6—8. *Cheilosporum anceps, (Kütz.).*

6. A portion of a conceptaculiferous branch. × Ca. 3.

7. Meridional section of a projected angle bearing a conceptacle; the periclinal cells are somewhat undulating. Zeiss 2 × BB.

8. A diagramatic figure of the cross section of an articulus bearing three concaptacles. × Ca. 7.

Fig. 9. *Cheilosparum anceps, (Kütz.). var. modesta.*

A cross section of an articulus for comparison with the typical species. × Ca. 7.

Figs. 10—11. *Cheilosporum californicum, (Dcne.)?*

10. A portion of branch. × Ca. 3.

11. Cross section of an articulus. × Ca. 7. Compare with 8 and 9.

Figs. 12—13. *Cheilosporum yessoense.*

12. An upper portion of a frond bearing conceptacles in the top of the wings. × Ca. 3.

13. Diagramatic figure of the cross section of an articulus. × Ca. 7.

Figs. 14—15. *Cheilosporum yessoense. f. angusta.*

14. A portion of a branch with cenceptecles; some are immersed in the top

of the wings, some in the middle of an articulus ; three conceptacles have their roofs broken off, and piercing holes are seen as its result. × Ca. 3.

15. A diagramatic figure of the cross section of an articulus. × Ca. 7.

Figs. 16—17. *Cheilosporum latissimum.*

16. Some of the fertile articuli ; each articulus bears four conceptacles in the figure, immersed in the external margins of the wings. × Ca. 3.

17. Diagramatic figure of the cross section of an articulus. × Ca. 7.

Compare 13, 15 and 17 ; and observe the proportions of the thickness and breadth of the articuli.

Figs. 18—19. *Cheilosporum maximum.*

18. A portion of a fertile branch with normal conceptacles, magnified.

19. Cross section of an articulus bearing two conceptacles on its surface. Their origins are deep in the medullary portion.

Fig. 20. *Corallina nipponica.*

A portion of a fertile branch. × Ca. 7.

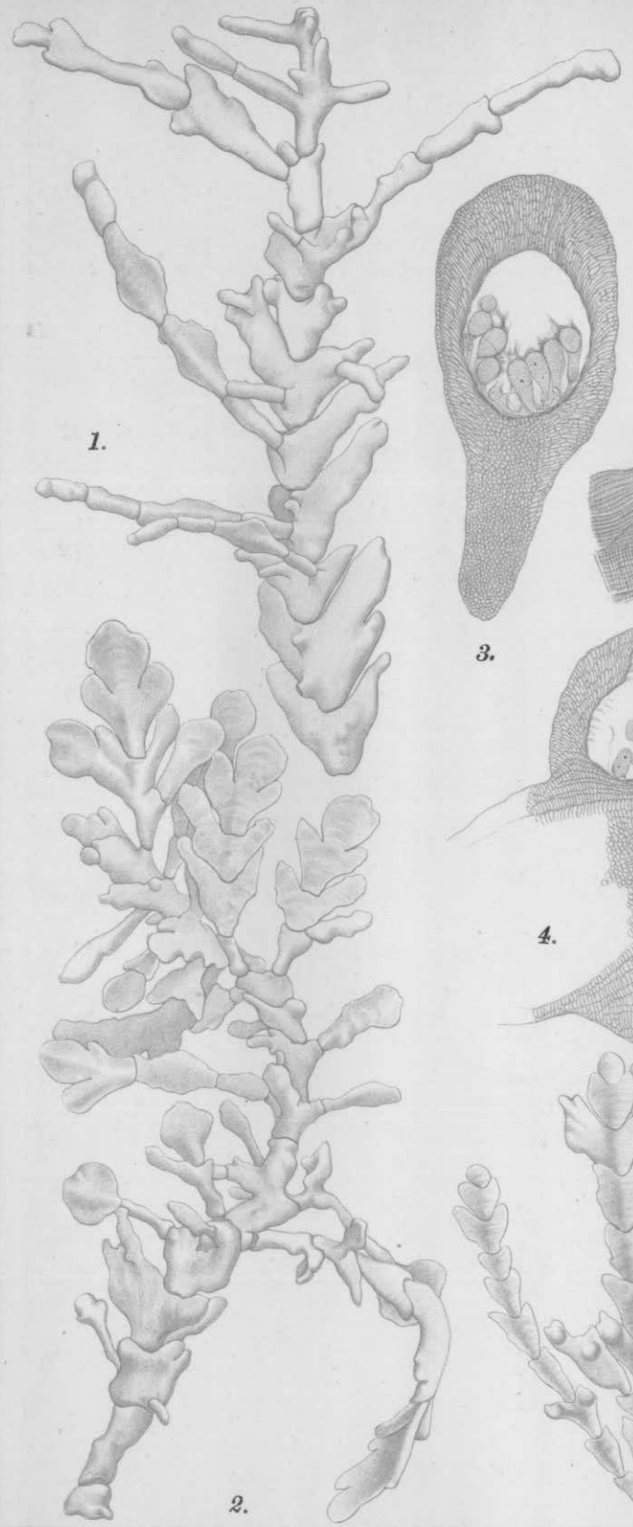
Figs. 21—24. *Corallina yenoshimensis.*

21. A portion of a fertile branch. × Ca. 7.

22. Diagramatic figure of the meridional section of a branch through a conceptacle. Zeiss. 2 × AA.

23. A portion of a longitudinal section of an articulus to show the cortical cells and the periclinal cells ; the latter have the large communicating canals in the cellwalls. Zeiss. 4 × DD.

24. A portion of a cross section of the same. Zeiss. 2 × DD.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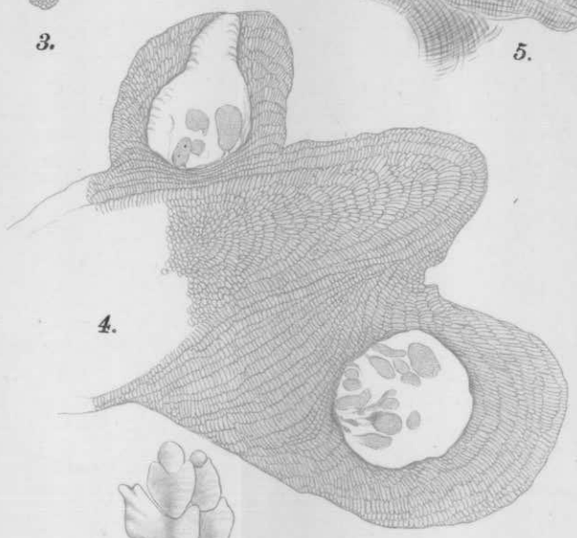
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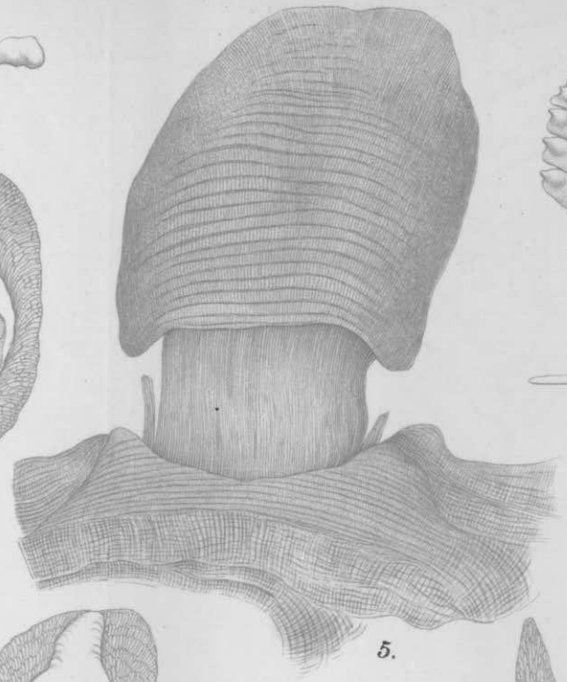
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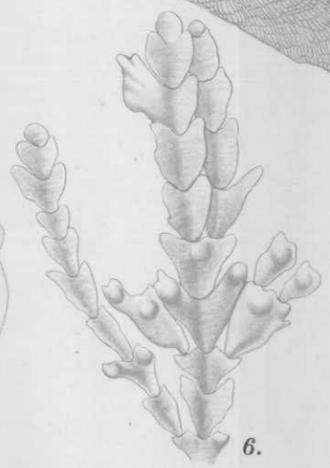
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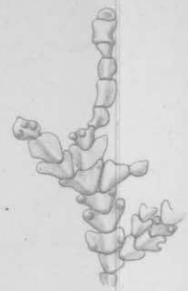
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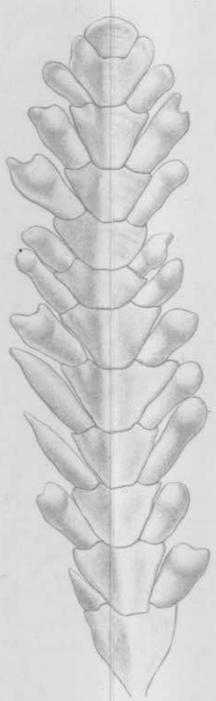
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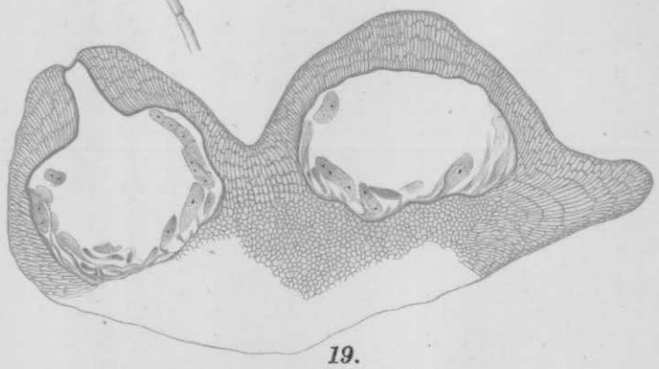
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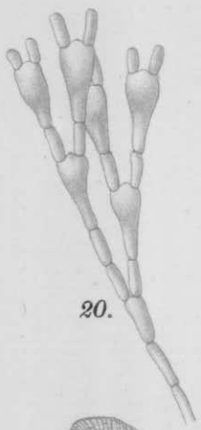
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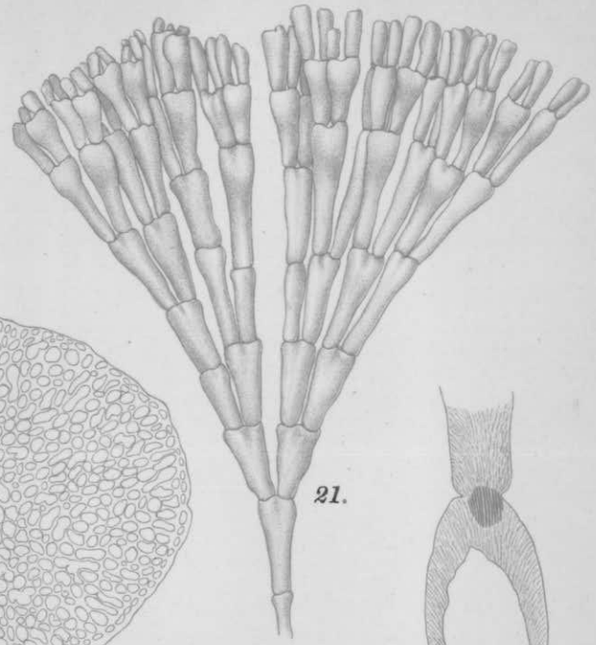
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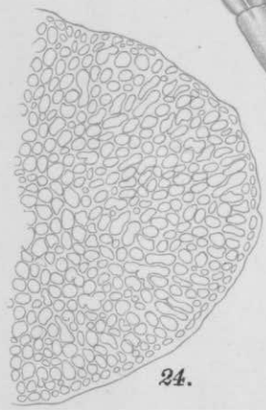
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Yendo—Corallinae verae Japonicae.

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PLATE III.

Plate III.

Figs. 1—3. *Corallina decussato-dichotoma.*

1. A portion of a branch attacked by *Choreonema Thureti, Schm.*, with its conceptacles frosted on the branches. × Ca. 10.
2. A portion of a branch without parasite. × Ca. 10.
3. Longitudinal section of a branch through a geniculum; the zonal arrangement of the periclinal cells is not clear in this species; *a*, portions of the penetrated frond of the parasite stained in the same degree as the genicular cells. Zeiss 2 × DD.

Fig. 4. *Corallina adhærens, Lamx.*

A portion of branch. × Ca. 10.

Fig. 5. *Corallina arborescens.*

A portion of branch. × Ca. 10.

Fig. 6. *Corallina radiata.*

A portion of branch. × Ca. 10.

Figs. 7—8. *Corallina ungulata.*

7. A portion of a sterile branch, the characteristic articuli are shown at the upper portions, × Ca. 10.
8. A fertile branch, with conceptacles at the terminal and the diverging points. × Ca. 10.

Fig. 9. *Corallina ungulata, f. brevior.*

A portion of branch. × Ca. 10.

Fig. 10. *Corallina sp.*

The fertile frond, without any sterile branch. × Ca. 10.

Figs. 11—13. *Corallina officinalis, L.*

11. A portion of the branch of *α*. × Ca. 4.
12. do. of *β*. × Ca. 4.
13. do. of *γ*. × Ca. 4.

Figs. 14—16. *Corallina pilulifera, Post. et Rupr.*

14. A branch of *f. filiformis Rupr.* × Ca. 7.
15. do. of *f. Sororia Rupr.* × Ca. 7.
16. do. of *f. intermedia* × Ca. 7.

Fig. 17. *Corallina squamata, Ellis et Sol.*

An abnormal branch with moniliform branches at the upper part. × Ca. 7.

Fig. 18. *Corallina sessilis.*

A portion of fertile branch. × Ca. 7.

Fig. 19. *Corallina kaifuensis.*

A portion of fertile branch, the conceptacles in the terminal articuli of the pinnules. × Ca. 7.

Fig. 20. *Corallina confusa.*

A portion of fertile branch. × Ca. 7.

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Yendo—Corallinae verae Japonicae.

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PLATE IV.

The figures in the following plates are all in natural size of the fronds.

Plate IV.

Fig. 1. *Amphiroa valonioides.*

Fig. 2. *Amphiroa cretacea, Endl.*

Fig. 3. *Amphiroa cretacea, Endl. f. rosariformis.*

Fig. 4. *Amphiroa rigida, Lamx.*

Figs. 5—6. *Amphiroa ephedræa, Lamk. β.*

Figs. 7—8. *Amphiroa ephedræa, Lamk. γ.*

Fig. 9. *Amphiroa zonata.*

Fig. 10. *Amphiroa echigoensis.*

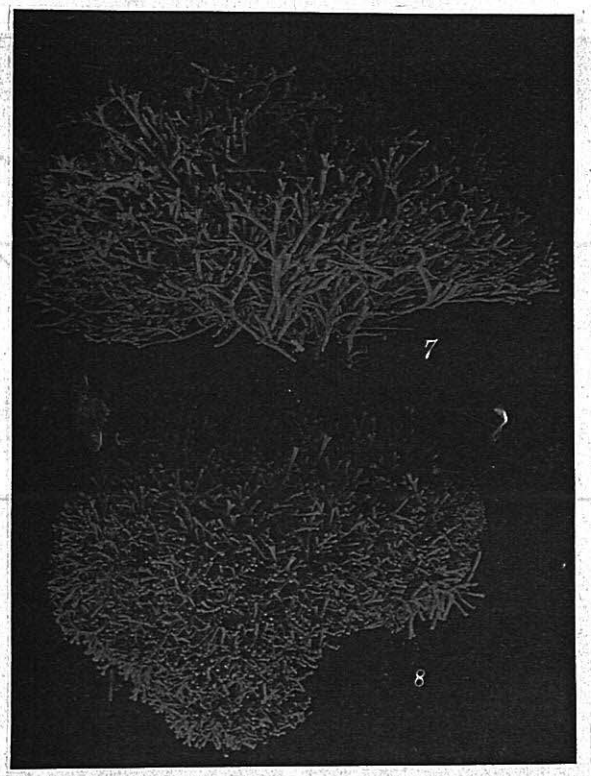
Figs. 11—13. *Amphiroa pusilla.*

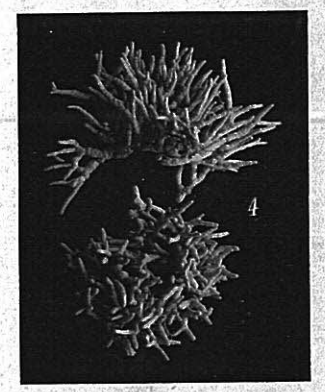
11. Decumbent frond from the ventral side, conceptacles are seen frosting on this side.
12. do. from the dorsal side.
13. A frond in vertical habit; the conceptacles are seen on both sides.

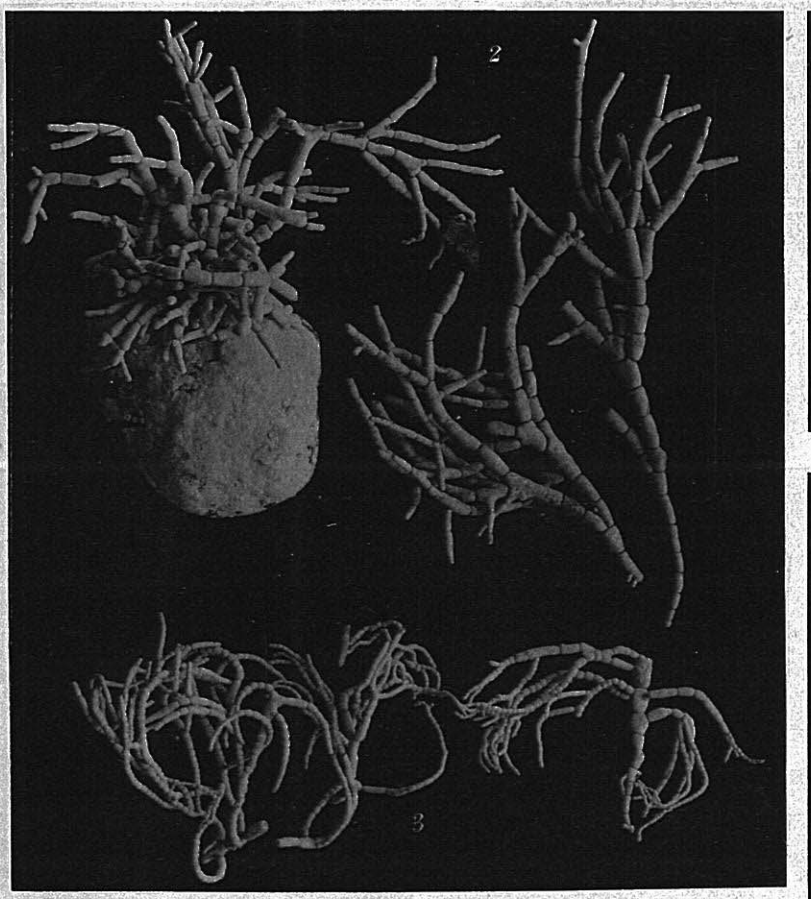
Figs. 14—15. *Amphiroa canaliculata, Mart.*

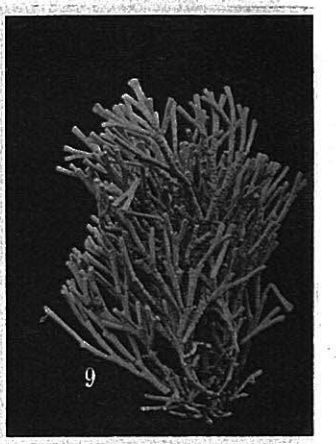
View from the dorsal side: conceptacles are seen frosting on this side.

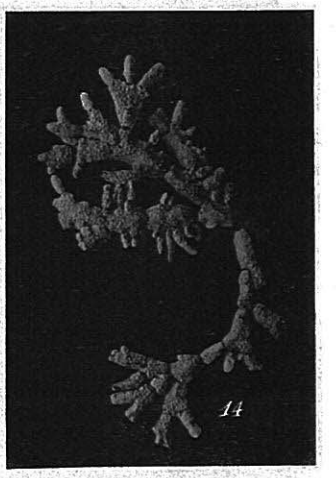
15. View from the ventral side: two canals are seen running along the edges of the articuli.

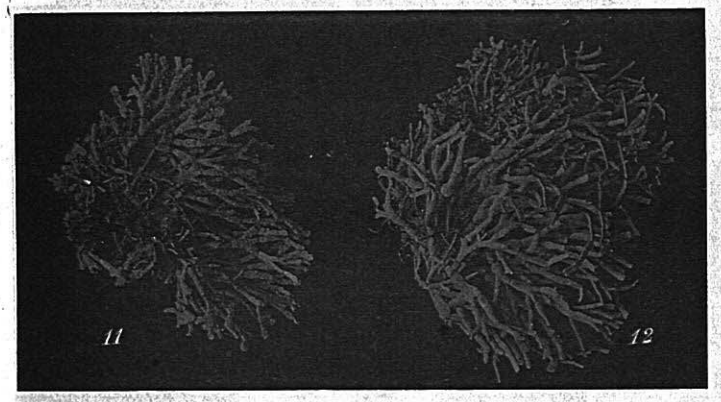


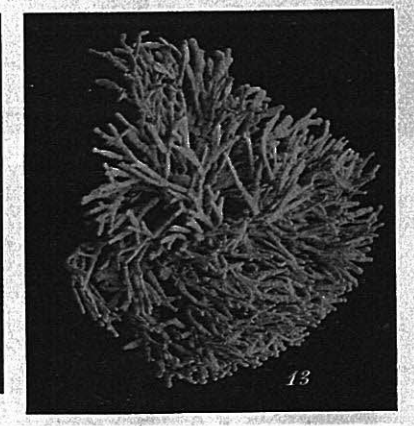


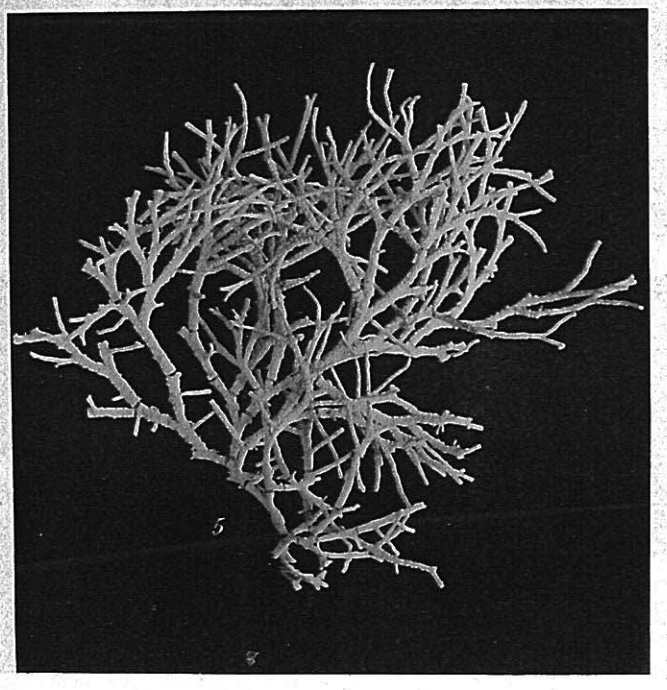


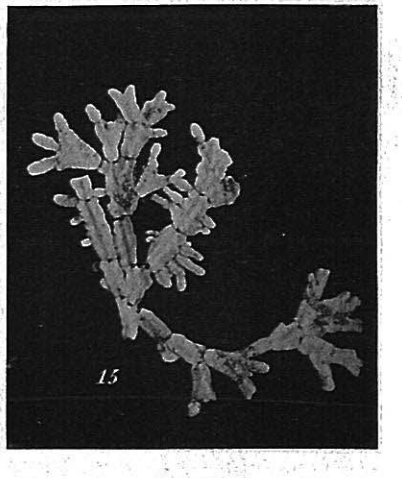


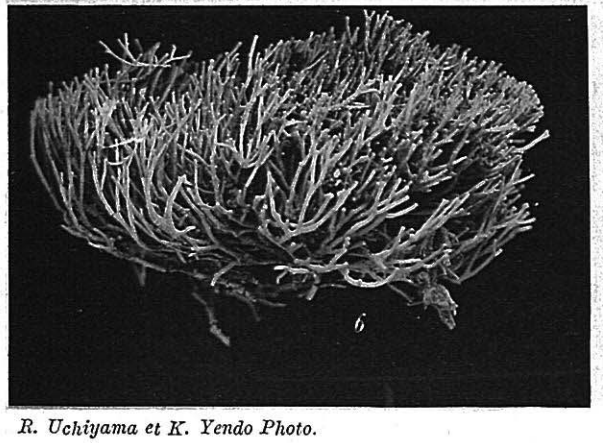












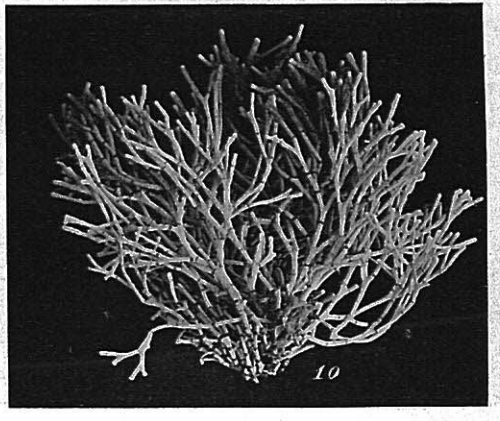


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PLATE V.

Plate V.

Figs. 1—3. *Amphiroa aberrans.*

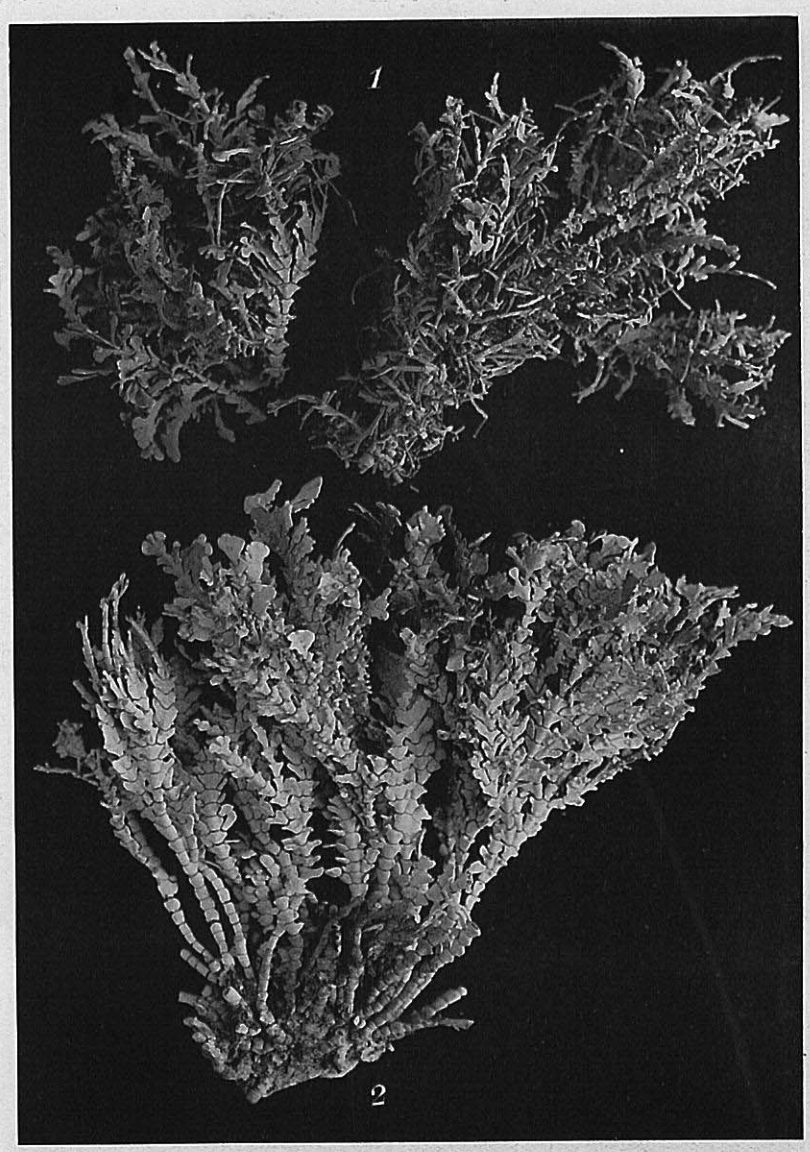
1. The abnormal forms, with proliferating decussate branches; an *Amphiroa* of different species is growing together with *Amphiroa aberrans* in the right hand tuft.
2. A frond in less aberrant form; broad, spathulate and thin articuli occurring at the apical portion of the frond.
3. Normal frond.

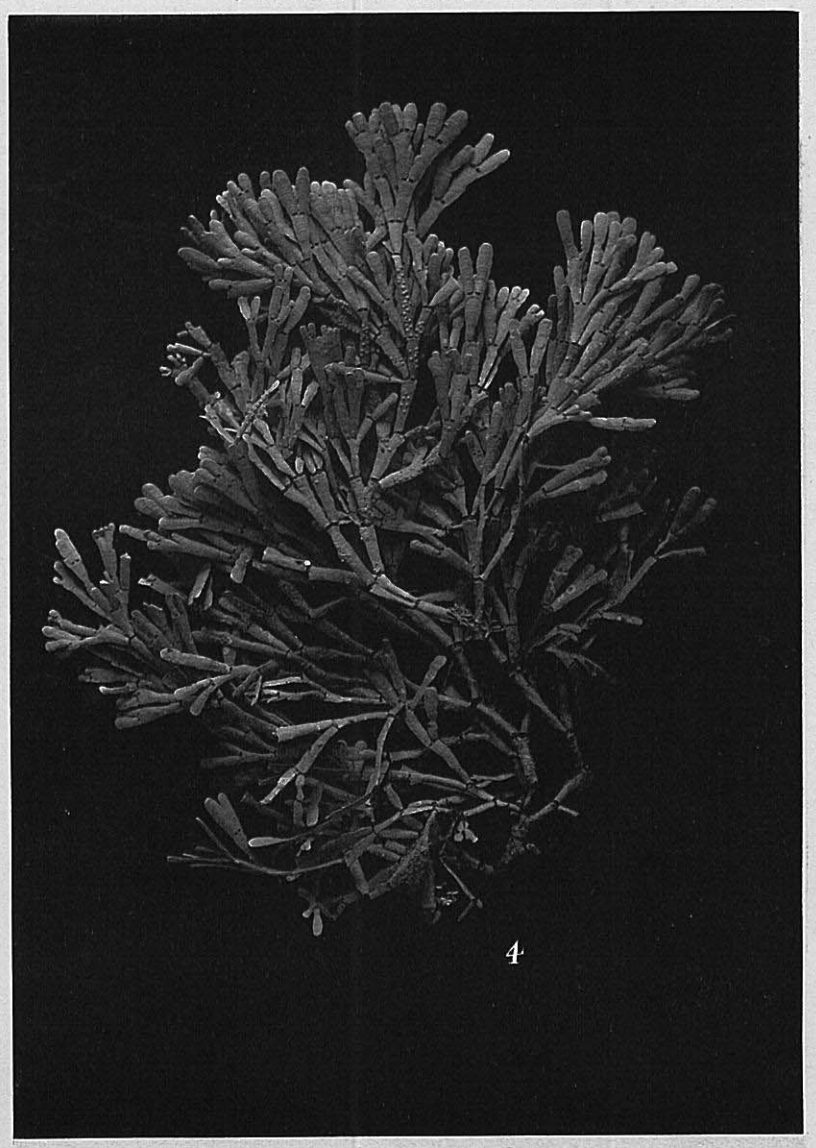
Fig. 4. *Amphiroa dilatata, Lamx.*

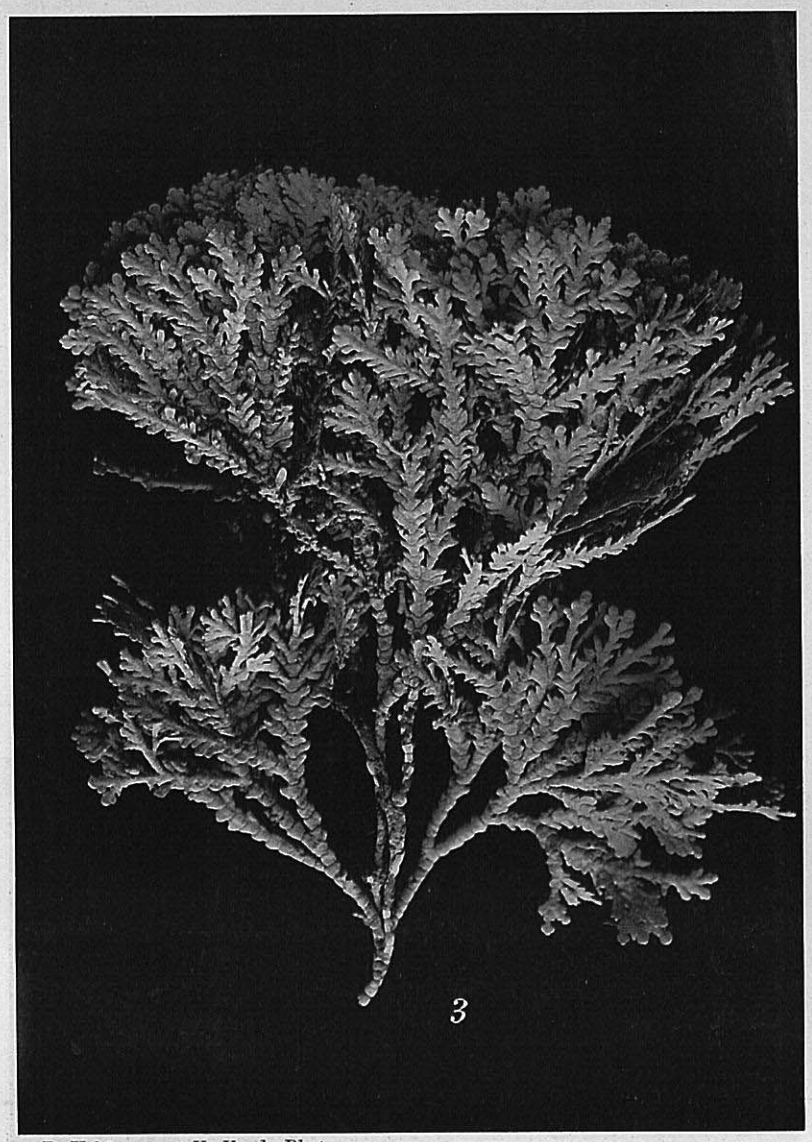
View from the dorsal side; some of the branches are overturned to show the conceptacles growing on the ventral side.

Figs. 5—6. *Amphiroa crassissima.*

5. The sterile fronds.
6. The fertile fronds; the right hand branch is seen from dorsal side, and the middle branch from ventral. Observe that the conceptacles are on the ventral margins of the articuli.







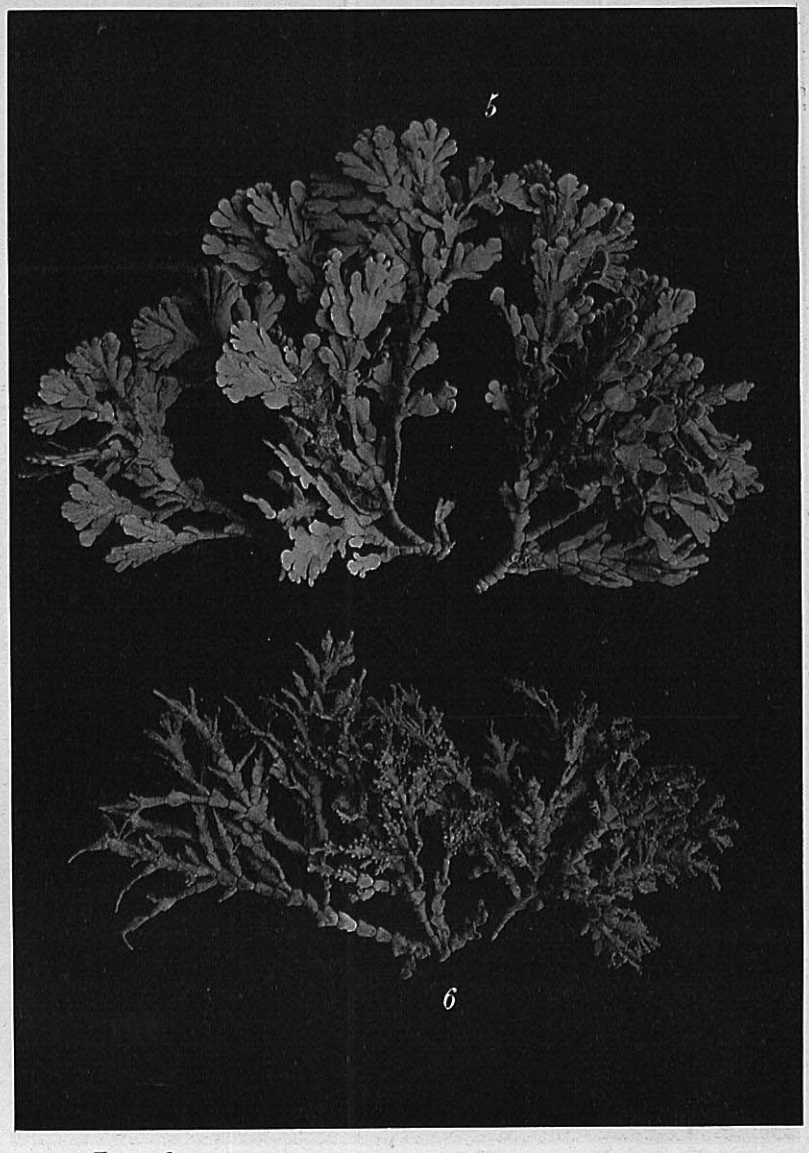


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PLATE VI.

Plate VI.

Fig. 1. *Amphiroa misakiensis.*

Fig. 2. *Cheilosporum anceps*, (*Kütz.*).

Fig. 3. *Cheilosporum anceps*, (*Kütz.*) *var. modesta.*

Fig. 4. *Amphiroa declinata.*

View from the dorsal side ; a branch in the lower side is overturned to show the attachment of the conceptacles at the ventral margins of the articuli.

Fig. 5. *Cheilosporum yessoense.*

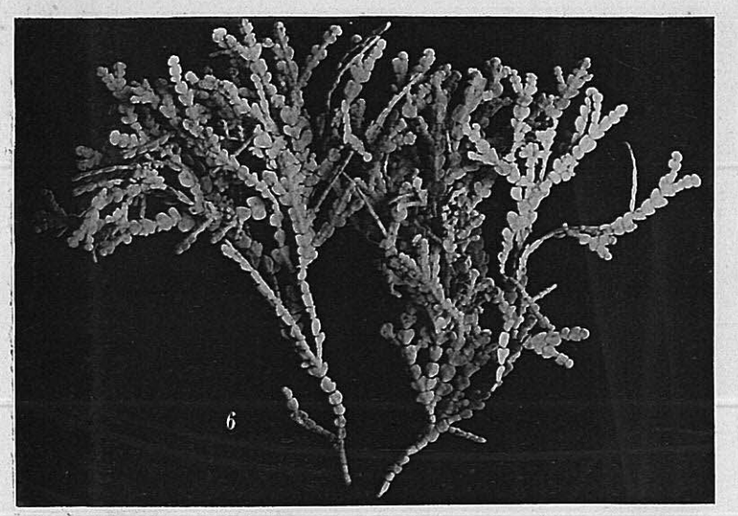
Fig. 6. *Cheilosporum yessoense. f. angusta.*

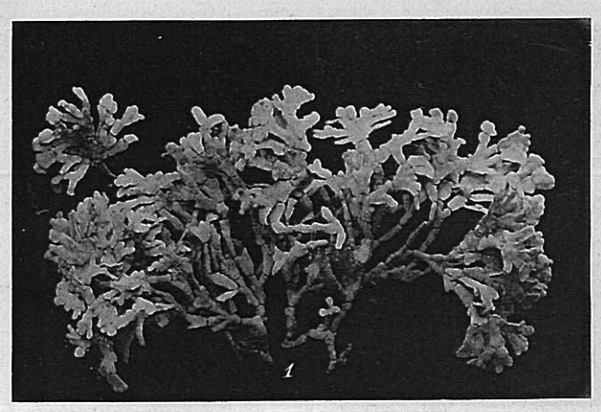
Fig. 7. *Cheilosporum latissimum.*

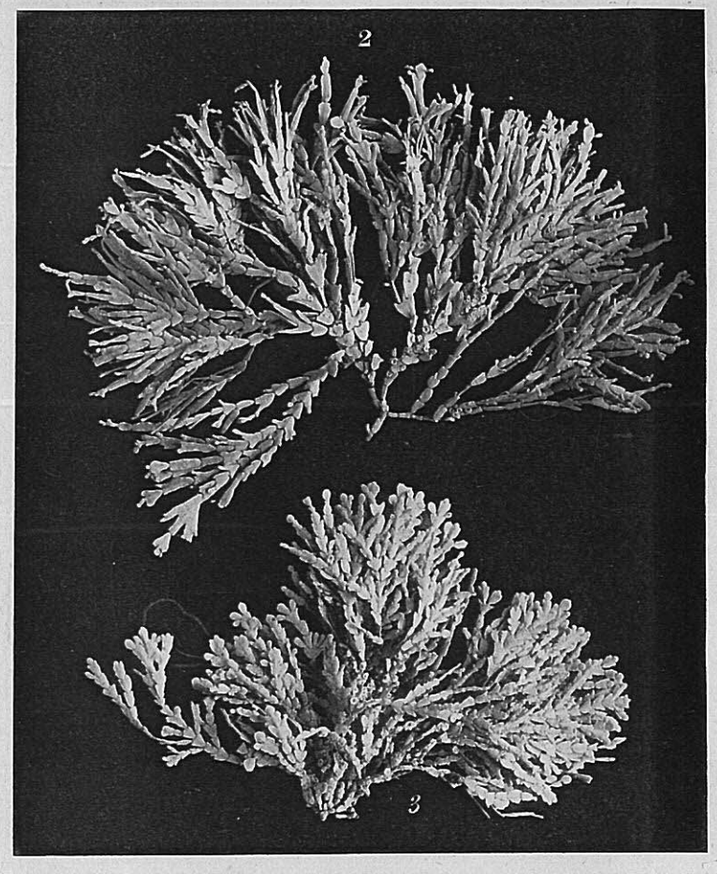
Fig. 8. *Cheilosporum californicum*, (*Dcne.*) ?

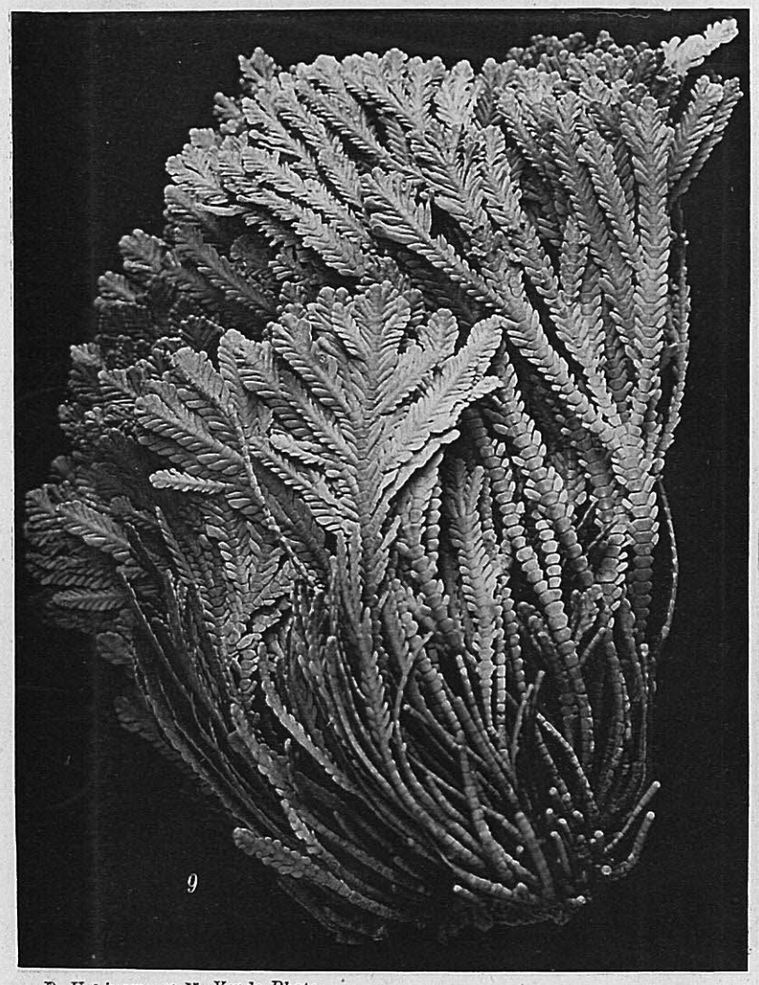
Fig. 9. *Cheilosporum maximum.*

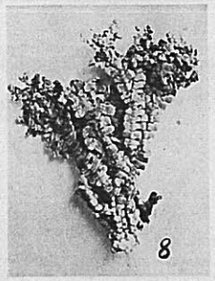
A branch is seen having conceptacles both immersed at the top of pinnae and bulged out on the surface of the articuli.

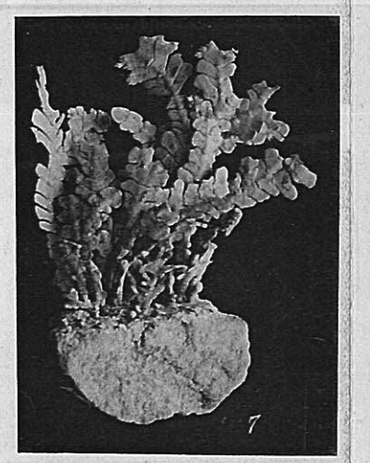


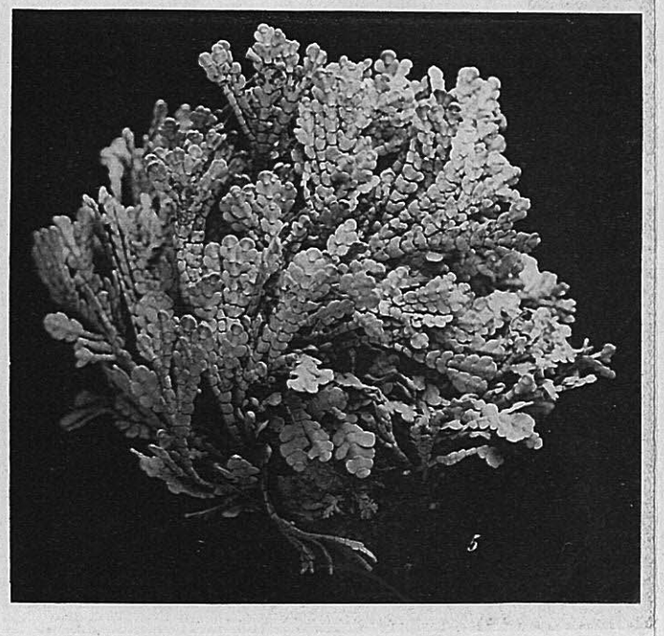


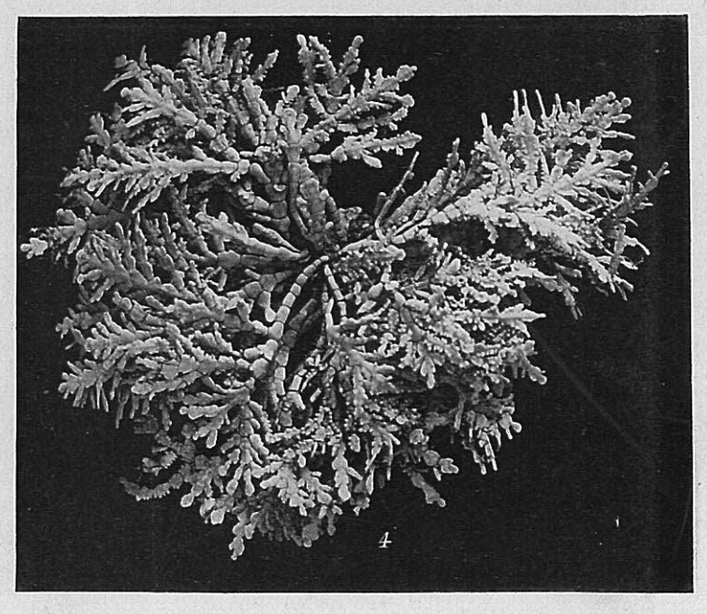












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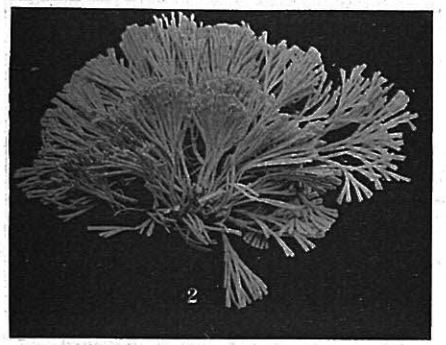

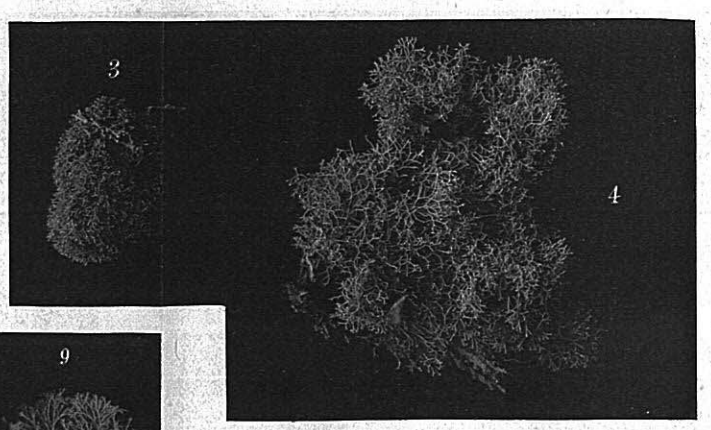

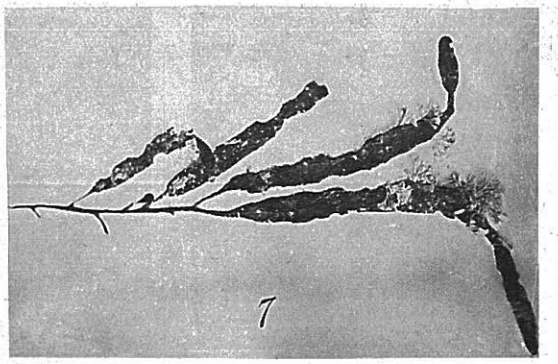

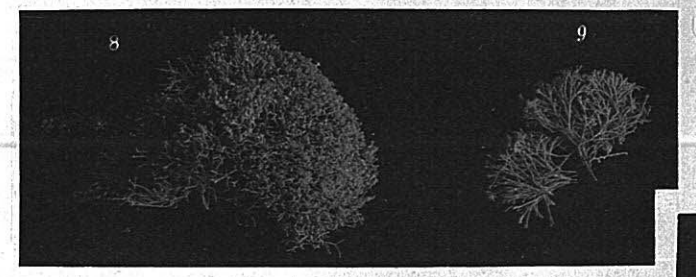

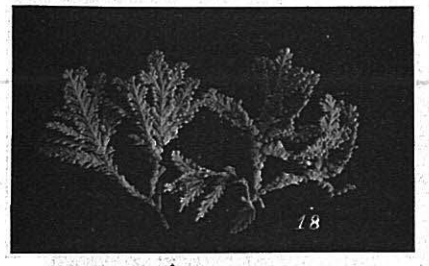

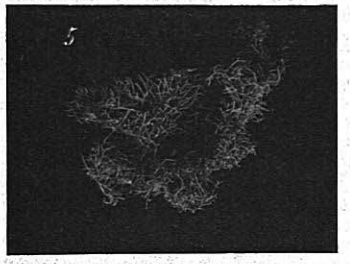

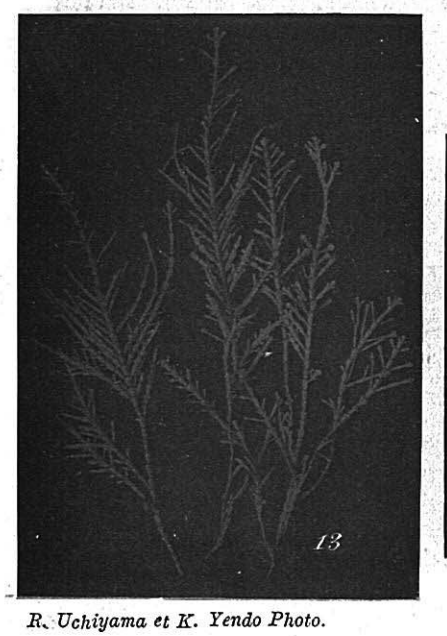

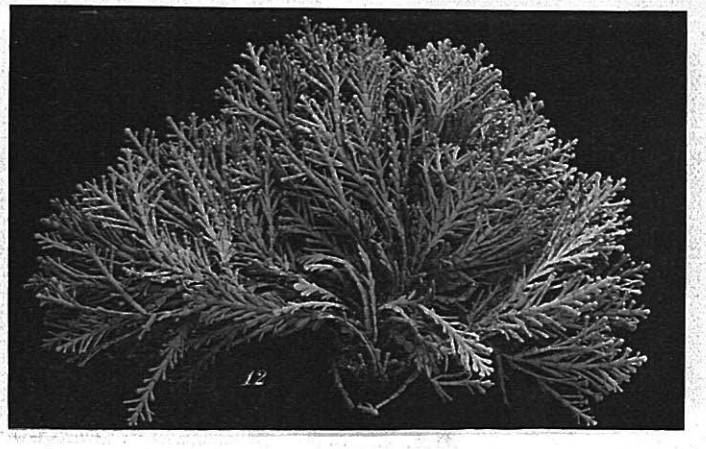

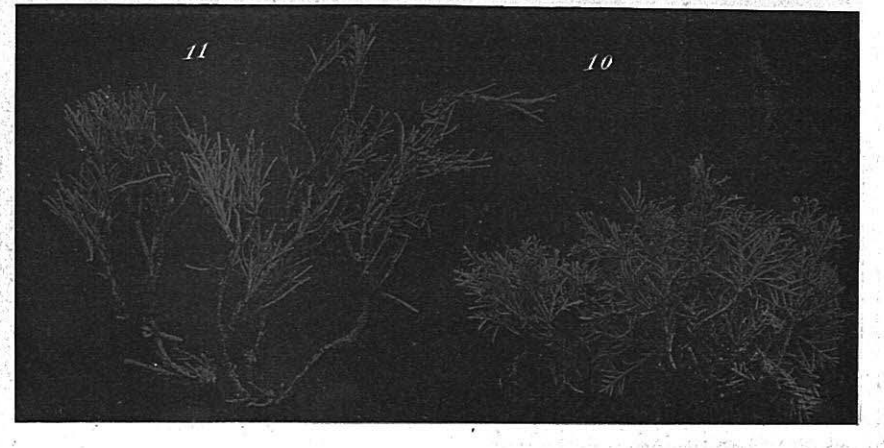

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