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The Genus Hypnea from Japan

By

TAKESI TANAKA

With Plates LIII–LIV.

The genus Hypnea, the one and only genus of the family Hypneaceae, was established by LAMOUROUX in 1813 (Ann. du Muséum XX, p. 131). He listed five species viz. *H. musciformis* LAMX., *H. spinulosa* LAMX., *H. wighii* LAMX., *H. hamulosa* LAMX., and *H. charoides* spec. nov., most of them having been removed from the genus Fucus. KUETZING, in Phycologia Generalis (1843, p. 404–405) established the genus Hypnophycus and listed two species, *Hypnophycus musciformis* KUETZ., and *H. spicifera* KUETZ., but he revised this generic name to a synonym of Hypnea in his Species Algarum (1849, p. 758). In Tabulae Phycologicae vol. 18 (1868), he again enumerated twenty-five species and gave figures of each species.

The first systematic arrangement was made by J. G. AGARDH in his Species Genera et Ordines Algarum, vol. 2 in 1852, in which he divided the genus into three sections, namely, Virgatae, Spinuligerae, and Pulvinatae, and enumerated nineteen species and three "Species inquirendae"; he also listed twenty species and ten "Species inquirendae" in his Epicrisis in 1876. Since then no one has attempted to study the genus systematically, but some additional species have been described.

In 1887, HAUCK[1] reported that several species formerly considered by J. AGARDH, KUETZING and others to be independent species should be referred to one species, for instance, *H. seticulosa* J. AG., *H. divaricata* KUETZ., *H. charoides* LAMX., and others should be referred to *H. Valentiae* (TURN.) MONT.

After J. AGARDH's works (1852, 1876), several authors have described species or varieties new to the genus. Among these authors the names of HOLMES (1895), DE TONI (1895), OKAMURA (1909), SETCHELL (1924), SETCHELL and GARDNER (1924, 1925), WEBER VAN BOSSE (1928), and KYLIN

1) F. HAUCK, Ueber einige von J. M. HILDEBRANDT in Rothen Meere und Indischen Ocean gesamelte Algen, Hedwigia, 1887.

(1938), may be mentioned.

For some years the present writer has been studying systematically the Japanese species of Hypnea under the direction of Prof. YUKIO YAMADA in the Botanical Institute, Faculty of Science, Hokkaido Imperial University. In treating this genus the inner characters, especially the central axis of the frond, and lenticular thickenings of the medullary cells, as well as the outer characters were used in this revision. In the present paper fourteen species and two varieties from the Japanese coast are enumerated.

Here the writer wishes to express his best thanks to his teacher, Prof. Y. YAMADA, who gave most valuable suggestions and kind guidance. Thanks are also due to Dr. F. BOERGESEN in the Botanical Museum, University of Copenhagen, who gave suggestions and kindly sent abundant valuable specimens, and to Dr. Anna WEBER VAN VOSSE at Eerbeek, Holland, who allowed the writer to examine her valuable specimens of Siboga's Expedition. The writer wishes to express his great thanks to Dr. JOSE TH. KOSTER, who kindly lent WEBER's specimens of the Rijksherbarium at Leiden.

An analytical key to the Japanese species of Hypnea

Frond consisting of main axis and dense lateral branchlets, caespitose, erect, not intricate ..... Section **Virgatae** J. AG.

I. Frond generally complanate ..... *H. variabilis* OKAMURA

II. Frond cylindrical.

A. Main axis of the frond often naked ..... *H. chordacea* KUETZ.

B. Main axis of the frond issuing lateral branchlets excepting in the basal part ..... *H. flagelliformis* GREV.

C. Main axis of the frond densely issuing lateral branchlets throughout the frond ..... *H. Boergesenii* TANAKA

Frond intricate-caespitose, alternately branched, branches and branchlets beset with short spine-like branchlets ..... Section **Spinuligerae** J. AG.

I. Apex of the branches often hamate ..... *H. japonica* TANAKA

II. Apex of the branches straight.

A. Frond generally complanate ..... *H. Saidana* HOLMES

B. Frond terete or subterete.

a. Principal axis not percurrent ..... *H. cervicornis* J. AG.

b. Principal axis percurrent.

1. Stellate spinous process present ..... *H. cornuta* (LAMX.) J. AG.

2. Stellate spinous process absent.

i. Frond slender and small ..... *E. Esperi* BORY

ii. Frond membranaceous; spinous branchlets slender and long ..... *H. charoides* LAMX.

iii. Frond rigid; spinous branchlets thick and short
.....*H. hamulosa* (TURN.) MONT.

Frond consisting of lower intricate cushion-like portion and fertile, upper branches
.....Section **Pulvinatae** J. AG.

I. Frond loosely intricate; nemathecia saddle shape .....*H. nidulans* SETCHELL
II. Frond densely intricate; tetrasporangia generally borne on one side of branchlets
.....*H. pannosa* J. AG.
III. Frond densely intricate; tetrasporangia borne around the branchlets
.....*H. Cenomyce* J. AG.

Enumeration of Species

Section **VIRGATAE**

Hypnea variabilis OKAMURA Text-fig. 1.

Icon. Japan. Alg., vol. II (1909) p. 21, pl. 56, On Alg. from Island Hatidyō (1930) p. 97.

Japanese name: *Tati-ibara.*

Hab.: Onahama and Yotukura, Iwaki Prov.; Hitati Prov.; Simohusa Prov.; Awa Prov.; Kazusa Prov.; Hayama, Zusi, Enosima and Misaki, Sagami Prov.; Hatidyōzima; Kasiwazima, Tosa Prov.; Bungo Prov. Growing on rocks in the lower littoral belt.

Distribution: Endemic.

Frond erect, caespitose, 4–13 cm high, 1.5–3 mm broad, not intricate, often forming a rounded mass, standing with fibrous roots, virgately branched with the ramification between pinnate and dichotomous, subcartilaginous, complanate, rarely slightly canaliculate, subterete in slender branches; branches patent, not constricted at the base, rarely naked, usually more or less furnished with teethlike spinous branchlets, often in dense aggregation; spinous branchlets acute at the apex, often elongate into ordinary branches; tetrasporangia around the middle or lower, swollen part of branchlets; tetraspore irregularly zonate; cystocarps almost globular, sessile, 500μ–1 mm in diameter, on the upper portion of the branches; lenticular thickenings in the walls of the medullary tissue rarely present. Colour purplish red.

The present species is very changeable in ramification. In some specimens at hand, the main branches are chiefly pinnate, in others mainly dichotomous with thicker branches disposed in pinnate manner, and in others dichotomo-decompound. The frond is erect and rigid, and rather subcartilaginous. Some specimens from Enosima remind the writer of *Gigartina tenella* HARV. in external appearance.

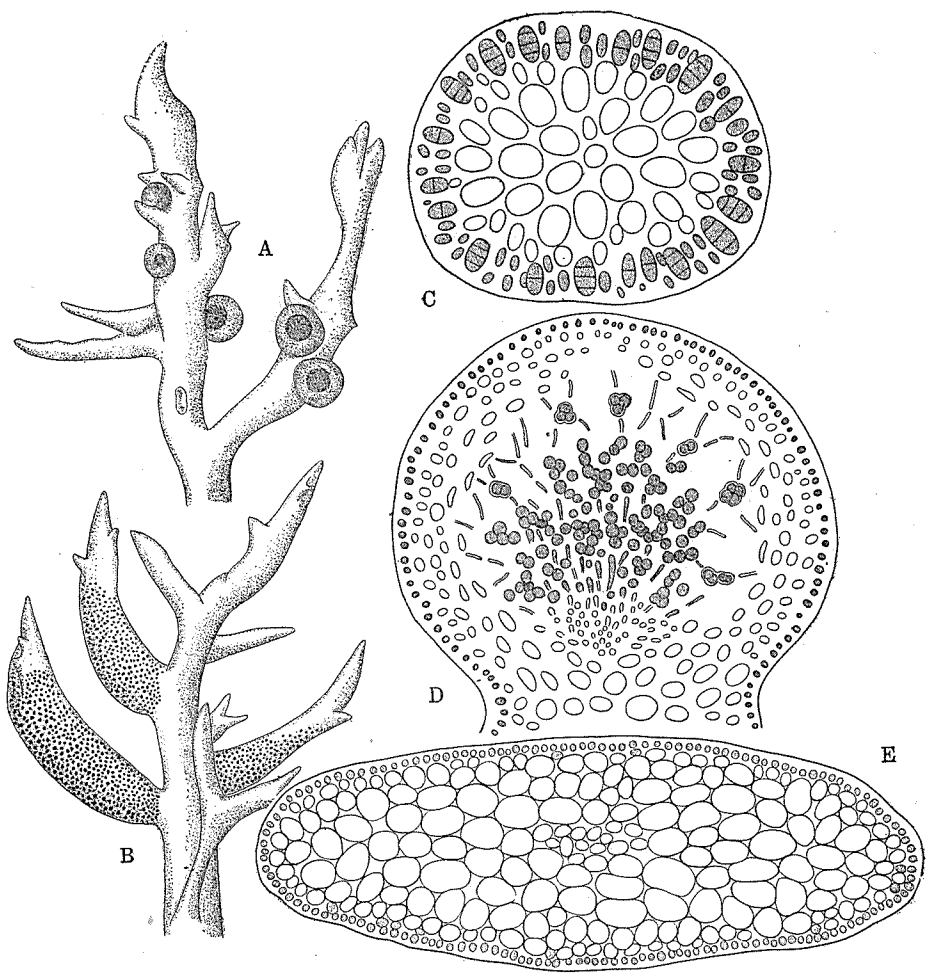


Fig. 1. *Hypnea variabilis* OKAMURA.
A. A branch with cystocarps. ×8. B. A branch with tetrasporangia. ×8. C. Transverse section of the stichidium. ×150. D. Transverse section of the cystocarp. ×75. E. Transverse section of the frond. ×50.

Hypnea chordacea KUETZING Text-figs. 2–4.

"Regensb. Fl. (1847)", Spec. Alg. (1849) p. 760, Tab. Phyc., Bd. 18 (1868) pl. 29, figs. e–g; WEBER VAN BOSSE, Liste alg. Siboga, IV (1929) p. 448.

Japanese name: *Himo-ibara.*

Hab.: Kelung, Formosa.

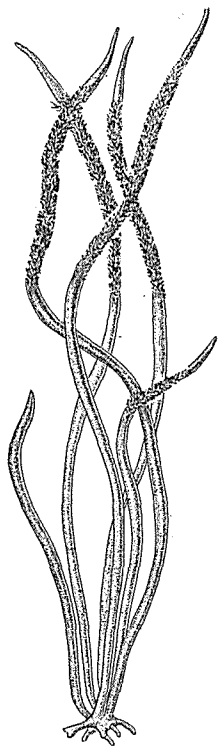


Fig. 2.
H. chordacea KUETZ.
×1.5.

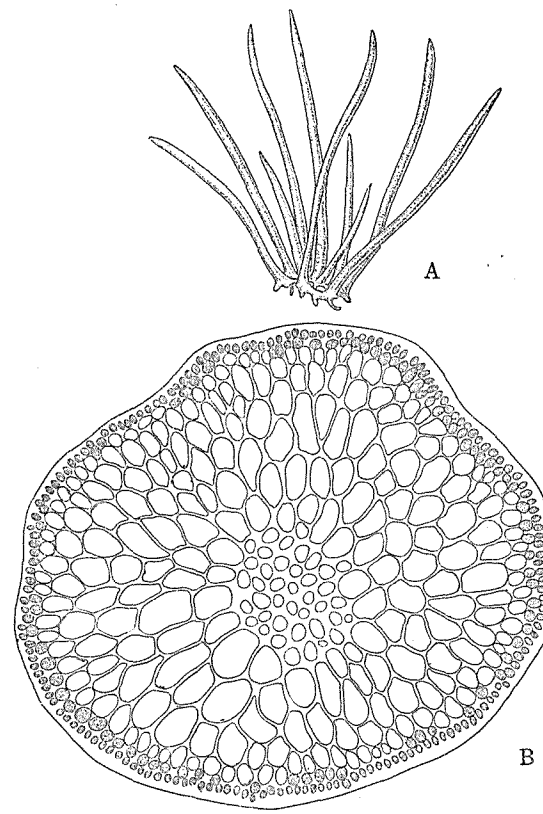


Fig. 3. *H. chordacea* KUETZ.
A. Young plant. ×1. B. Transverse section of the frond. ×50.

Distribution: Java.

Frond caespitose, erect, 3–10 cm high, 1–2.5 mm thick, subcartilaginous, subterete, persistent, standing with fibrous roots, rarely dichotomously branched; main axial stem often naked; branchlets very short, 2–7 mm long, ca. 300μ broad, single or divided, not very acute at the apex, often intricate each other; tetrasporangia around the middle or lower, swollen part of the branchlets; tetraspore irregularly zonate; lenticular thickenings in the walls of the medullary cells almost absent. Colour purplish red, but darker when dried.

The writer has been able to examine the topotype specimens from Java collected by ZOLLINGER. In outer appearance and anatomical structure of the frond, Japanese plants quite agree with the Java specimen. The outer

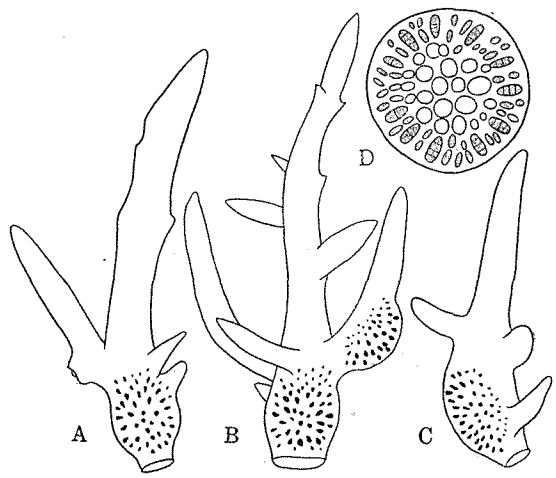


Fig. 4. *H. chordacea* KUETZ.
A–C. Stichidia ×16. D. Transverse section of the stichidium. ×75.

appearance of the present species is characteristic on account of the naked main axial stem (Fig. 2). In a transverse section of the branches of the frond (Fig. 3, B), the central tissue is generally clearly seen, consisting of small and rather thin-walled cells.

f. **simpliciuscula**
(OKAMURA) comb. nov.
Pl. 53, fig. 2.

Syn. *Hypnea simpliciuscula* OKAMURA, in DE TONI Sopra tre nuove Alghe mar. Giappon (1895) p. 345, Phyc. Japan. novae (1895) p. 28, n. 58, t. 2, figs. 26–30; DE TONI, Syll. Alg., IV (1900) p. 483.

Japanese name: *Ko-himo-ibara.*

Hab.: Enosima, Sagami Prov.; Miyakezima; Omaezaki, Tōtōmi Prov.; Taito, Formosa.

Distribution: Endemic.

Frond 2–6 cm high, ca. 1.5 mm thick, caespitose, subcartilaginous, subterete, dichotomously branched, standing with slender fibrous roots, often intricate at the lower part; branchlets 2–5 mm long, ca. 250μ broad, single or divided, not acute at the apex, intriacte sometimes each other; tetrasporangia around the middle or lower swollen portion of the branchlets; tetraspore irregularly zonate; lenticular thickenings in the walls of the medullary tissue absent (?); central part of the frond consisting of more or less robust tissue. Colour purplish red.

The present variety represents a slender and a much ramified form. The basal part of the frond is sometimes intricate.

Hypnea flagelliformis GREVILLE Text-fig. 5.

in J. AGARDH Alg. Lieb., p. 14; J. AGARDH, Spec. Gen. et Ord. Alg., II (1852) p. 446, Epicr. (1876) p. 562; DE TONI, Syll. Alg., IV (1900) p. 476; YENDO, Notes on Alg. Japan (Bot. Mag., vol. 31, 1917) p. 85, fig. 3.

Japanese name: *Suzi-ibaranori.*

Hab.: Etigo Prov.; Himi, Etyu Prov.; Tusima Prov.

Distribution: India.

Frond erect, caespitose, ca. 10 cm high, 1–3 mm thick, subcylindrical, subcartilaginous, not intricate, standing with fibrous roots, alternately ramified; main axis of the lower part of the frond almost naked; ultimate branchlets 1.5–3 mm long, ca. 0.5 mm broad, long and vermiform, often intricate each other at the apex, single or sometimes divided; tetrasporangia in swollen part of the branchlets; no lenticular thickenings in the walls of the medullary cells. Colour yellowish red.

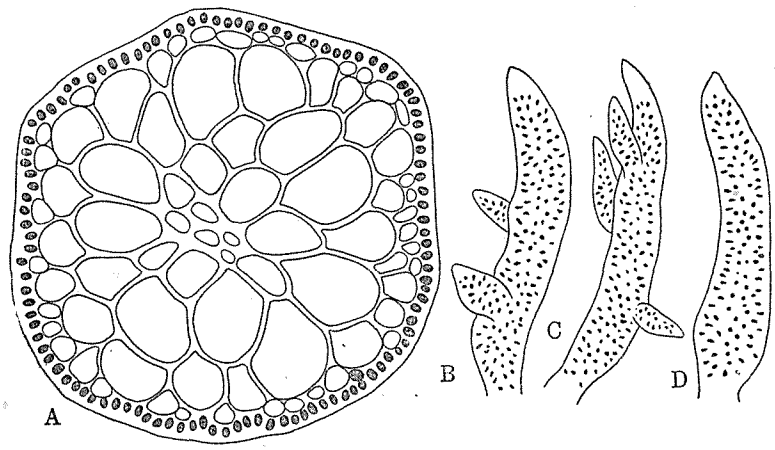


Fig. 5. *H. flagelliformis* GREV.
A. Transverse section of the frond. ×50. B–D. Stichidia. ×15.

Of this species the writer has found a few specimens only, and unfortunately they were dried. But Japanese plants seem to agree quite well with the description of J. AGARDH (loc. cit.).

The present species seems to possess some resemblance to *H. chordacea f. simpliciuscula* TANAKA, but it differs from the latter by the shape of its stichidial branchlets.

Hypnea Boergesenii spec. nov. Pl. 53, fig. 1, and Text-figs. 6–8.

Frons caespitosa, 6–13 cm alta, 1–2.5 mm lata, erecta, virgato-ramosa, cylindracea, non nudiuscula; radice fibrosa, laxe intricata; ramulis ultimis 0.7–2 mm longis, ca. 0.5 mm latis, densissime quoquoversum egredientibus patentibus utrinque attenuatis; parietibus cellularum medullarum partem incrassatam lenticulatam ostendentibus; tetrasporangiis in ramulis ultimis

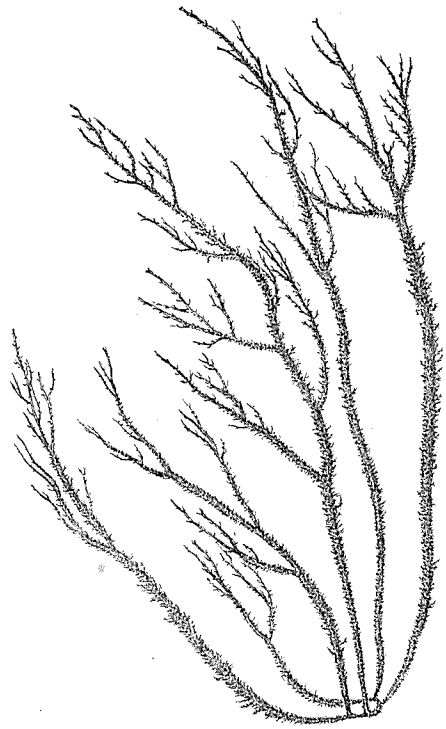


Fig. 6. *H. Boergesenii* TANAKA. × 2/3.

conformibus situatis; cystocarpiis globoso-urceolatis, sessilibus, ca. 550μ diam., singulis vel 2–3 aggregatis, infra apicem ramulorum inflatis; antheridiis in ramulis conformibus situatis; colore fusco-purpureo, nigrescenti in statu sicco; substantia subrigida; spinis stellatis non observatis.

Japanese name: *Nankai-ibara*.

Hab.: Kelung, Tairi, Formosa.

Frond caespitose, 6–13 cm high, 1–2.5 mm thick, erect, cylindrical, virgately branched, standing with fibrous roots; axial stem issuing densely lateral branchlets, gradually attenuate at the apex; branchlets 0.7–2 mm long, ca. 0.5 mm broad, single or divided, clavate or spinous at the apex; central axis of the frond consisting of only few cells; cell wall thick; lenticular thickenings in the walls of medullary cells always present at basal portion; tetrasporangia in the basal or middle, swollen part of the ultimate branchlets; tetraspore irregularly zonate; cystocarps urceolate-globose, ca. 550μ in diam., solitary or 2–3 aggregate, borne on the branches; anteridia around the basal, swollen part of the ultimate branchlets. Colour purplish red, but more darker when dried. Stellate spinous process not present.

The new species is to be placed in the section Virgatae, and seems to stand near *H. spicifera* HARV. in habit, but it can be distinguished from the latter by its axial stem and the shape of spinous branchlets. The present species is characterized by possessing an axial stem and issuing densely lateral branchlets throughout the frond (Fig. 6).

A transverse section of the frond (Fig. 7, C) shows a few central cells which are surrounded by a medullary layer of thick walled cells. The lenticular thickenings in the walls of the medullary cells occur only at the basal portion of the frond, but not in the small branchlets. The plant was found on the rocks near the low tide mark in rather exposed places.

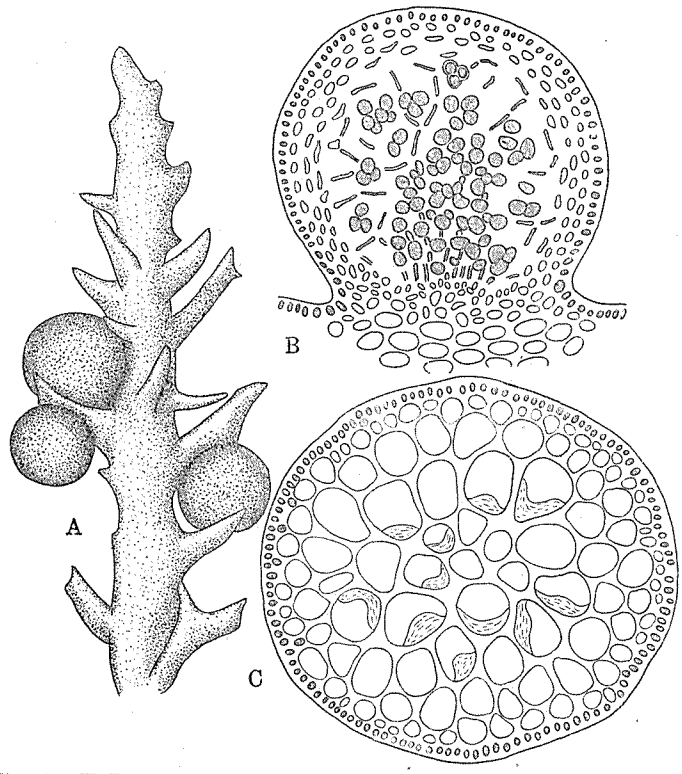


Fig. 7. *H. Boergesenii* TANAKA. A. A branch with cystocarps. ×17.
B. Transverse section of the cystocarp. ×46.
C. Transverse section of the lower part of the frond with lenticular thickenings. ×46.

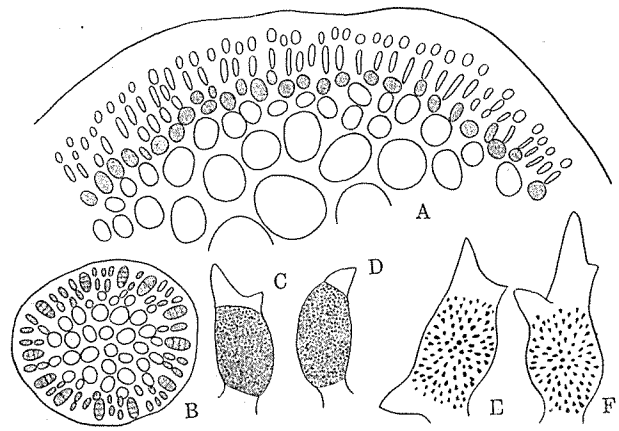


Fig. 8. *H. Boergesenii* TANAKA. A. Transverse section of the antheridial branchlet. ×465. B. Transverse section of the stichidium. ×75.
C–D. Antheridial branchlets. ×16. E–F. Stichidia. ×16.

Section **SPINULIGERAE**

Hypnea japonica spec. nov. Pl. 54, and Text-figs. 9–10.

Syn. *H. musciformis* (non LAMOUROUX) OKAMURA Icon. Japan. Alg., vol. 2 (1909) p. 35, pl. 59, fig. 7, pl. 60, figs. 7–11.

Frons 7–20 cm alta, 1.5–3 mm lata, rare laxe intricata, cylindrica, cartilaginea vel subcartilaginea, irregulariter vel plus minus pinnatim ramosa, axi centrale non percursa; ramis ramulisque saepe hamatis in parte superiore; ramulis ad basin leviter constrictis; parietibus cellularum medullarum partem incrassatam lenticulatam saepe ostendentibus; tetrasporangiis ad ramulos siliquaeformes in ramis inferioribus; cystocarpiis et antheridiis ignotis; colore rubro vel bruneo-rubro.

Japanese name: *Kagi-ibaranori.*

Hab.: Kazusa Prov.; Amatura, Awa Prov.; Hayama, Misaki and Enosima, Sagami Prov.; Susaki, Izu Prov.; Irakozaki, Mikawa Prov.; Wagu, Sima Prov.; Seto, Kii Prov.; Hatidyōzima; Noto Prov.; Izumo Prov.; Tosa Prov.; Bungo Prov.; Nomozaki, Hizen Prov.; Amakusa, Higo

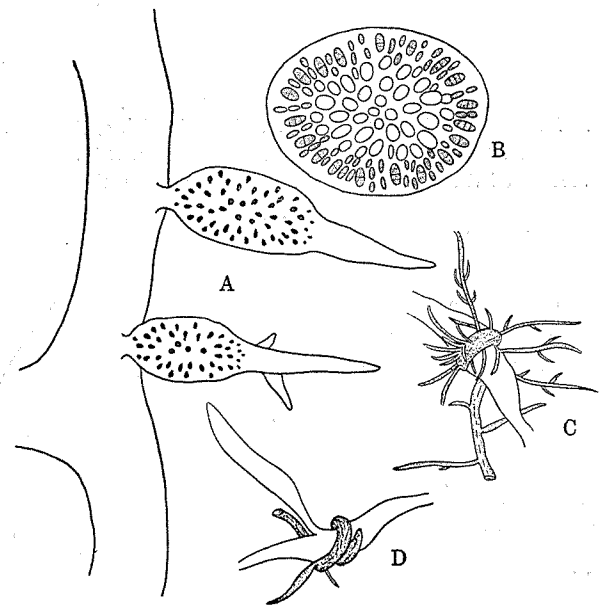


Fig. 9. *H. japonica* TANAKA. A. A branch with tetrasporangia. ×17.
B. Transverse section of the stichidium. ×50.
C–D. Portions of uncinate-branchlets. ×1.

Prov.; Kosikizima, Satuma Prov.; Ryūkyū; Kelung and Tairi, Formosa. Growing on other algae in the low tide mark.

Frond 7–20 cm high, 1.5–3 mm thick, cylindrical, rarely loosely intricate, forming a rounded mass entangled among other algae, subcartilaginous or cartilaginous, irregularly or somewhat pinnately ramified, no percurrent axis; primary branches mainly standing at right angles to the axis; branches and branchlets slightly constricted at the base and often forming tendrils at the apex; tetrasporangia in swollen part of the ultimate branchlets; tetraspore irregularly zonate; central axis of the frond robust, consisting of a large number of small, thick wall cells; lenticular thickenings in the walls of the medullary cells often present. Colour bright red or brownish red.

The present species is always an epiphyte upon other algae (especially Sargassum spp.) and occurs entangled among other algae to which it fixes itself by means of the tendrils. Previously the new species has been referred by the late Dr. K. OKAMURA (loc. cit.) to *H. musciformis* LAMX. provisionally. He already expressed doubt about the identity of the present alga with *H. musciformis* LAMX. suggesting that this alga should

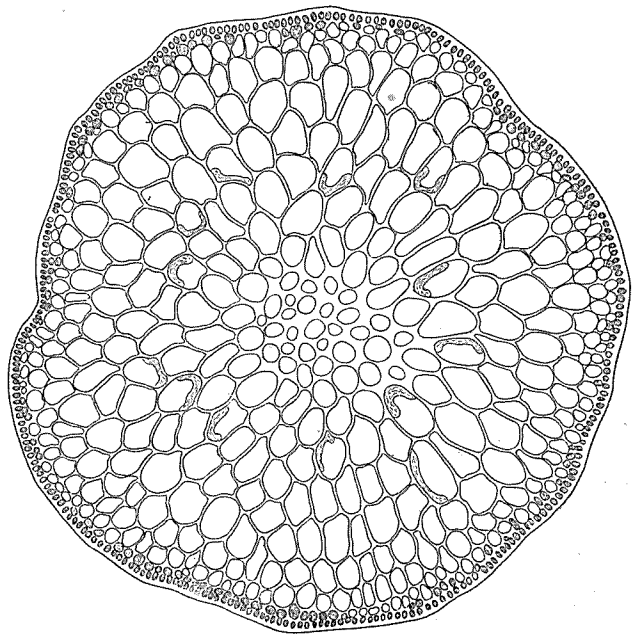


Fig. 10. *H. japonica* TANAKA.
Transverse section of the frond with lenticular thickenings. ×45.

be described as a new species after careful study in the future. This new species has some resemblance to *H. musciformis* LAMX., but it is large and cartilaginous while in *H. musciformis* LAMX. the frond is membranaceous and slender. A large number of specimens were examined and no sexual organ could be found, only once a specimen was found with a few nearly ripe tetrasporangia (Fig. 9, A). Stichidia are 1.5–2 mm long and 420μ thick.

Upon a transverse section of the frond (Fig. 10) three different layer are visible. In the middle a central tissue is present which is composed of several smaller roundish polygonal thick-walled cells; a longitudinal section shows that the cells in the middle are 5–15 times longer than broad. Then follows a parenchmatic tissue, whose innermost cells are comparatively large, but becoming gradually smaller outwards. In this parenchymatic tissue lenticular thickenings are often found here and there. The cortical layer is composed of about two layers of cells. These cells are almost always longer than broad, but short ones also occur. This species appears to be rather common in the warmer sea of Japan. In water it gives off a blue iridescence near the base of the branches.

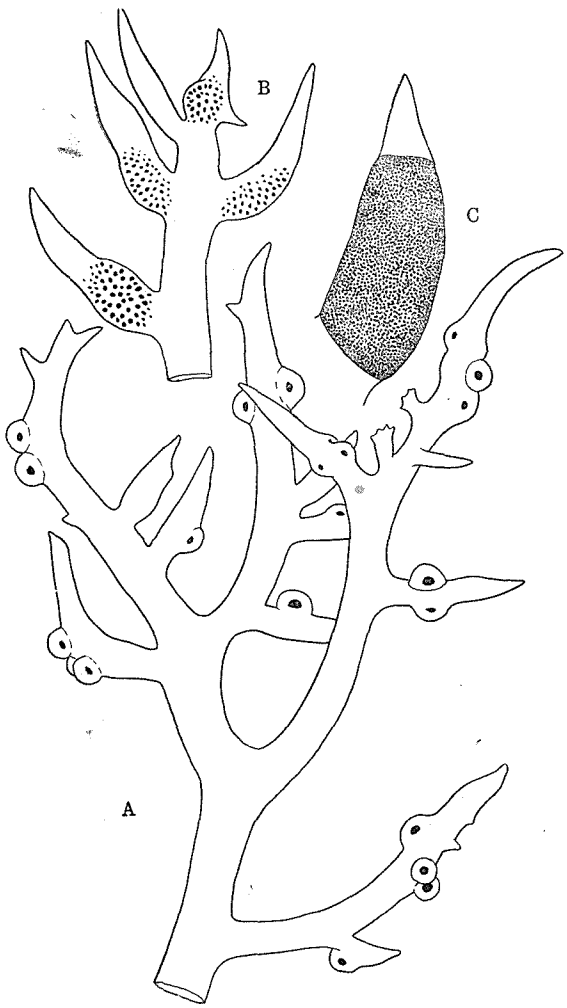


Fig. 11. *H. Saidana* HOLMES.
A. Part of female plant. ×7. B. Part of tetrasporic plant. ×7. C. Antheridial branchlet. ×15.

Hypnea Saidana HOLMES Text-figs. 11–12.

New Mar. Alg. Japan. (Journ. Linn. Soc. Bot., vol. 31, 1895) p. 256, pl. 11, fig. 3; DE TONI, Syll. Alg., IV (1897) p. 483, Syll. Alg., VI (1924) p. 281; OKAMURA, Icon. Japan. Alg., vol. 2, no. 2 (1909) p. 24, pl. 57, figs. 1–10.

Japanese name: *Saida-ibara.*

Hab.: Onahama, Iwaki Prov.; Kazusa Prov.; Awa Prov.; Enosima, Zusi, Misaki and Hayama, Sagami Prov.; Mikawa Prov.; Sima Prov.

Distribution: Endemic.

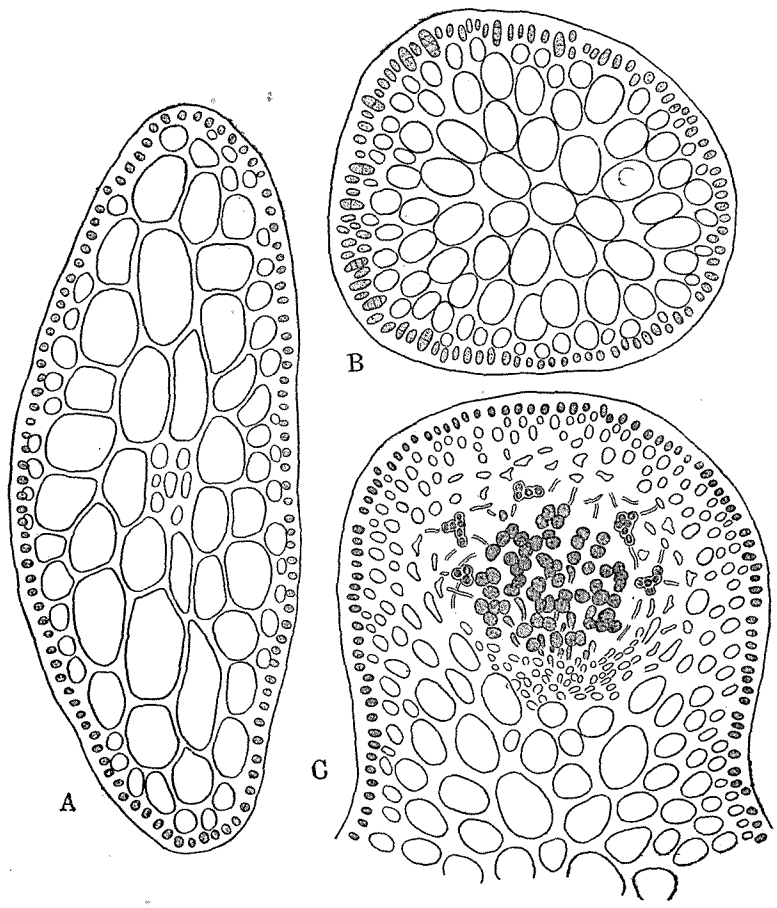


Fig. 12. *H. Saidana* HOLMES.
A. Transverse section of the frond. ×50. B. Transverse section of the stichidium. × 85. C. Transverse section of the cystocarp. × 85.

Frond intricate-caespitose, forming a rounded mass, 6–10 cm high, 1–2 mm wide, complanate, membranaceous or slightly cartilaginous; main branches flexuose, more or less dichotomous with alternate branches which are mostly curved and loaded with short, secund very patent, thorn-like branchlets; branchlets 10–15 mm long, tapering to sharp point and not constricted at the base; tetrasporangia forming mostly around the basal swollen part of branchlets; tetraspore irregularly zonate; cystocarps hemispherical and sessile, ca. 650μ in diameter, borne on the branchlets; antheridia in basal swollen part of the branchlets; lenticular thickenings in the walls of the medullary tissue rarely present. Colour blood-red or yellowish red.

According to HOLMES, the present species is rather stouter than the majority of species of the genus. But it seems to the writer that it is not as stout as *H. variabilis* OKAM., *H. japonica* TANAKA, etc. The plant occurs on rocks low water mark in somewhat exposed places.

f. **gracilis** f. nov. Pl. 53, fig. 3.

Frons 3–5 cm alta, ca. 0.5 mm crassa, compresso-plana, laxe intricato-caespitosa, flexuosa, parce dichotoma; ramulis gracilibus, saepe secundis; tetrasporangiis ad ramulis siliquaeformibus in ramis superioribus; cystocarpiis et antherdiis non visis.

Japanese name: *Ko-saida-ibara.*

Hab.: Sibagaki, Note Prov.; Hayama, Sagami Prov.

Found 3–5 cm high, ca. 0.5 mm broad, complanate, loosely intricate-caespitose, flexuose, more or less dichotomous, gracilis; branchlets patent, secund; stichidia long and pod-shaped; cystocarps and antheridia unknown.

The present variety represents a rather small and slender form and is common in the warmer parts of Honshū.

Hypnea cervicornis J. AGARDH Text-fig. 13.

Spec. Alg., II (1852) p. 451, Epicr. (1876) p. 564; HARVEY, Nereis Boreali-Americana, II (1853) p. 125; DE TONI, Syll. Alg., IV (1900) p. 480; OKAMURA, Icon. Japan. Alg., vol. 4 (1916) p. 35, pl. 159, figs. 6–9, pl. 160, figs. 1–5; COLLINS and HERVEY, The Alg. of Bermuda (1917) p. 112; BOERGESEN, Mar. alg. Danish West Indies (1920) p. 383, Mar. alg. Canary Islands (1929) p. 84; TAYLOR, Mar. Alg. Florida (1928) p. 156, pl. 22, fig. 11; WEBER VAN BOSSE, Liste alg. Siboga, IV (1928) p. 454.

Syn. *H. spinella* KUETZING, Tab. Phyc., Bd. 18 (1868) t. 26.

Japanese name: *Kazuno-ibara.*

Hab.: Common along the Pacific coast from Prov. Iwaki to Ryūkyū. Growing on rocks near the low-tide mark.

Distribution: Brazil; West Indies; Mexico; Atlantic Ocean; Indian Ocean.

Frond loosely intricate-caespitose, membranaceous or rarely cartilaginous, subdecumbent(?), forming a globular or slightly depressed mass, irregularly branched in divaricato-dichotomous manner, attaching at basal branches to gravels, stones, etc. by means of disk-like attachments; branches

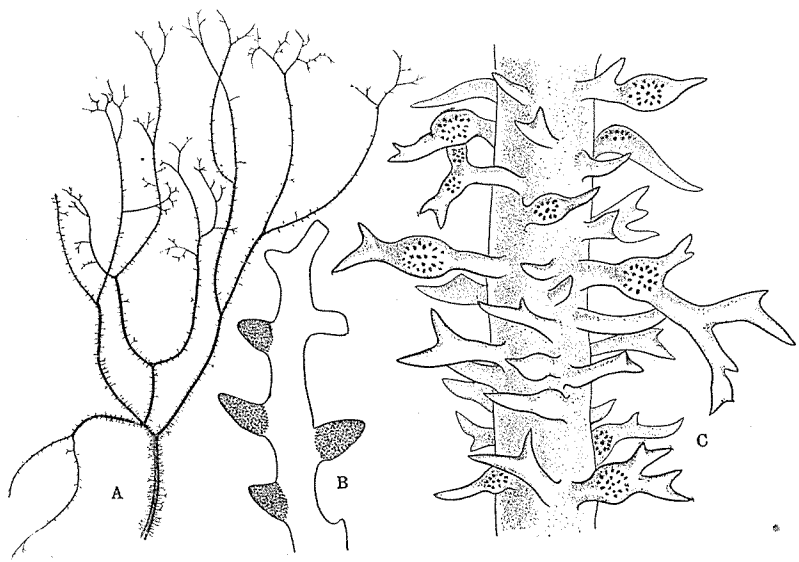


Fig. 13. *H. cervicornis* J. Ag.
A. Part of the branch. ×⅔. B. Part of the antheridial branch. ×11.
C. Part of the frond with tetrasporangia. ×11.

very patent with rounded axilis, often almost horizontal, making in upper portion the ramification like cervis-horn here and there with pinnate segments and densely loaded on all sides with minute or elongated, single or divided spinous branchlets; branchlets 3–10 mm long, tapering to sharp point; tetrasporangia around the middle or basal swollen part of the branchlets; cystocarps ovate or globular, sessile, solitary or 2–3 aggregate, on branches or branchlets; antheridia in the basal swollen part of the ultimate branchlets; lenticular thickenings in the walls of the medullary cells often present. Colour purplish red or brick-red.

In general appearance, this species has much resemblance to *H. nidifica* J. Ag. from which, however, it differs in its ramification and stichidial

branchlets. The present species is distributed very widely in the warmer parts of the Pacific.

Hypnea cornuta (LAMOUROUX) J. AGARDH Text-fig. 14.

Spec. Alg., II (1852) p. 449, Epicr. (1876) p. 563; DE TONI, Syll. Alg., IV (1900) p. 478; YENDO, Notes alg. new Japan (Bot. Mag. vol. 31, 1917) p. 84; BOERGESEN, Mar. alg. Danish West Indies (1920) p. 382, fig. 368; WEBER VAN BOSSE, Liste alg. Siboga, IV (1928) p. 453; TAYLOR, Mar. Alg. Florida (1928) p. 156, pl. 22, fig. 12.

Syn. *Chondroclonium cornutum* KUETZ., Spec. Alg. (1849) p. 741.

Japanese name: *Hosigata-ibara.*

Hab.: Goto, Hizen Prov.; Nagato Prov.; Ohara, Kazusa Prov.; Moan, Bōkōtō, Formosa.

Distribution: Atlantic Ocean; Pacific Ocean; Danish West Indies.

Frond caespitose or loosely intricate-caespitose, 5–10 cm high, ca. 1 mm thick, alternately ramified, subcylindrical, membranaceous; branches loosely clothing with spinous branchlets and stellate spinous process; spinous branchlets 1–3 mm long and 300–500μ thick, acute at the apex; stellate spinous process small, with 2–5 rays, conical, ca. 500μ in diam., peltately fixed on the branches or branchlets; stichidia pod-shaped and almost slightly curved, 1–2 mm long and 350μ thick; no lenticular thickenings in the walls of the medullary cells(?). Colour light red or dark red.

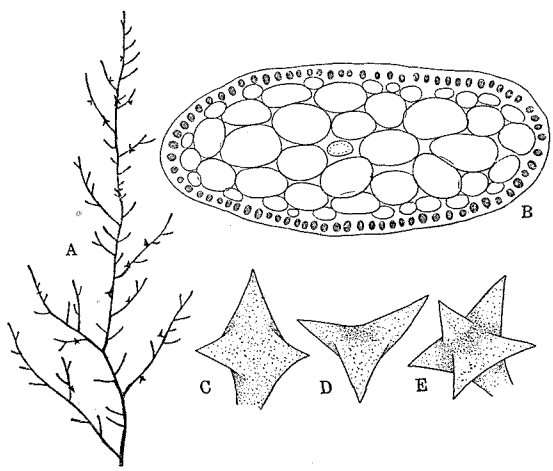


Fig. 14. *H. cornuta* (LAMX.) J. AG.
A. Part of the branch with stellate spinous processes. ×1. B. Transverse section of the frond. ×65. C–E. Stellate spinous processes. ×40.

The upper part of the branches of the present species has a good number of characteristic stellate spinous process. According to YENDO (loc. cit.), the type specimen of the present species and *H. Valentiae* MONT. at the Herbarium of Lund, Sweden appear to belong to one and the same species.

The writer has been able to compare his specimens with WEBER'S from

the Siboga Expedition.

Hypnea Esperi Bory Text-fig. 15.

"Voyage de la Coquille, p. 157"; Kuetzing, Spec. Alg. (1849) p. 759, Tab. Phyc., 18 (1868) pl. 26, figs. a–c; Grunow, Alg. von Novara (1868) p. 79; Boergesen, Mar. alg. Easter Island (1924) p. 306, fig. 48.

Japanese name: *Hime-ibaranori.*

Hab.: Uzina, Aki Prov.; Kosikizima and Makurazaki, Satuma Prov.; Ryūkyū; Formosa; Caroline Islands.

Distribution: Easter Island; Brazil; Chile; Australia; Pacific Ocean.

Frond 1.5–3 cm high, 300–500μ broad, loosely intricate-caespitose, forming entangled mass, gracilis and filiform, membranaceous, attached to the substratum by means of rather discoidal hapters; branches subdichotomous or irregular, with short or long spinous branchlets; ultimate branchlets very short and small, tapering to sharp point; lenticular thickenings in the walls of the medullary cells sometimes present; tetrasporangia in the basal or apical, swollen part of the ultimate branchlets. Colour light red or scarlet.

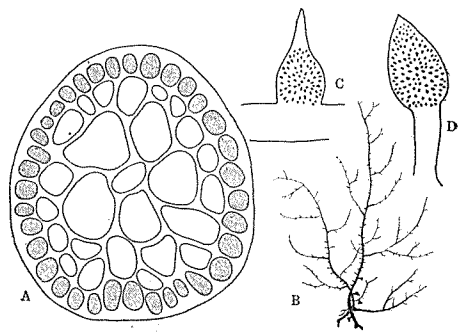


Fig. 15. *H. Esperi* Bory.
A. Transverse section of the frond. ×350.
B. Habit of the plant. ×1.
C–D. Stichidia. ×30.

H. Esperi Bory is the most characteristic, smallest and most slender species in the genus. The present species shows some resemblance to *H. spinella* J. Ag., but the frond of the former is not so rigid as that of the latter. The plant was found growing upon the rocks or other algae near the low tide mark.

Hypnea charoides Lamouroux Text-fig. 16.

Essai de classification sur les Genres de la fam. des Thalassiophytes (1813) p. 44, pl. 10, figs. 1–3; Kuetzing, Spec. Alg. (1849) p. 758, Tab. Phyc. (1868) Bd. 18, t. 22; Weber van Bosse, Liste des Algues du Siboga, IV (1929) p. 449.

Syn. *H. seticulosa* J. Agardh, Spec. Alg., II (1852) p. 446, Epicrisis (1876) p. 562; De Toni, Syll. Alg., vol. IV (1900) p. 476.

Japanese name: *Ibaranori.*

Hab.: Very common along the southern Pacific and Japan sea coast. Growing on rocks, stone etc. in the lower littoral belt.

Distribution: Australia, Tasmania, Indian Ocean.

Frond caespitose, 5–15 cm high, alternately branched, subcylindrical or filiform, loosely intricate at the base, membranaceous, attenuate at the apex; branches loosely or densely clothed with spinous branchlets in all directions beset at intervals of about 1 mm, acute at the apex from broader base; ultimate branchlets long and slender; lenticular thickenings in the walls of the medullary cells rarely present; tetrasporangia in basal or middle, swollen part of the pod-shaped branchlets; cystocarps subglobose and sessile, solitary or 2–3 aggregate, ca. 600μ in diam., borne on the branchlets near the apex; stellate spinous process not present. Colour greenish red or darkish deep red.

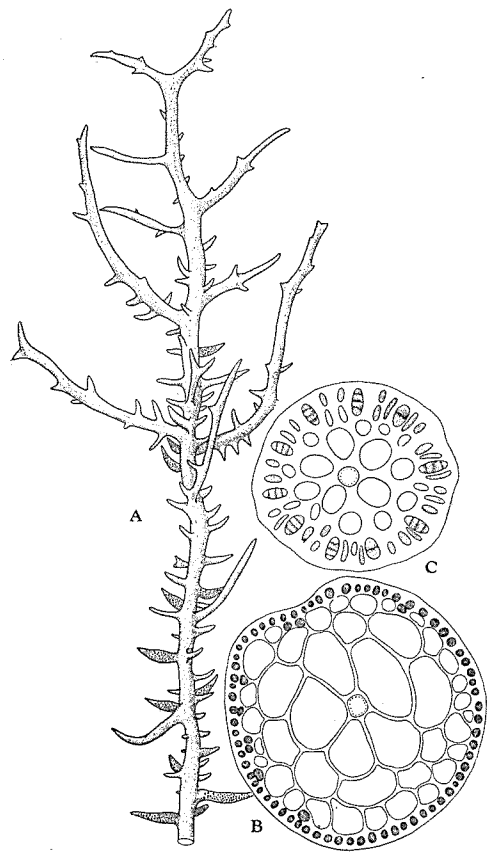


Fig. 16. *H. charoides* LAMX.
A. Part of the branch with stichidia. ×8. B. Transverse section of the frond. ×30. C. Transverse section of the stichidium. ×110.

In referring the specimens at hand to this species, the writer has not been able to compare them with any authentic specimens. According to HAUCK (Hedwigia, 26, 1887, p. 20) some species formerly considered separate, namely *H. seticulosa* J. AG., *H. divaricata* J. AG., *H. charoides* LAMX. etc. are to be referred to *H. Valentiae* (TURN.) MONT.

Dr. WEBER VAN BOSSE reported that *H. seticulosa* J. AG. should be a synonym of *H. charoides* LAMX. The difference between the two species

H. seticulosa J. Ag. and *H. charoides* Lamx. seems to the writer to be entirely a matter of individual variations. Therefore he has combined the two here as *H. charoides* Lamx. following Weber van Bosse, under the one specific name.

Hypnea hamulosa (Turner) Montagne Text-fig. 17.

"Pug. Alg. Yemens. n. 16"; J. Agardh, Spec. Alg., II (1852) p. 447, Epicr. (1876) p. 563; Zanardini, Pl. Mar. Rubr. (1858) p. 270, n. 97; Grunow, Algen der Fidschi-Tonga- und Samoa-Inseln (1874) p. 39; De Toni, Syll. Alg., IV (1900) p. 477; Weber van Bosse, Liste alg. Siboga, IV (1928) p. 453, fig. 191.

Syn. *Fucus hamulosus* Turner, Hist. Fuc., t. 79.

Japanese name: *Mosa-ibaranori.*

Hab.: Tairi and Kelung, Formosa.

Distribution: Red Sea; Cape of Good Hope; Pacific Ocean.

Frond densely caespitose, 3–10 cm high, 1–1.5 mm thick, cylindrical, intricate only at the lower part, branches alternately or irregularly branched, with long and short spinous branchlets; ultimate branchlets thick and short, ca. 2.5 mm long, and ca. 1 mm thick, acute at the apex from very broader base; very rarely imperfect stellate spinous process present; tetrasporangia in the basal, swollen part of the short branchlets; lenticular thickenings in the walls of the medullary cells present at only lower part of the frond. Colour blackish red on drying. Substance subcartilaginous.

The writer has been able to compare the Japanese plant with a duplicate of Weber's material of the Siboga Expedition. In the specimens

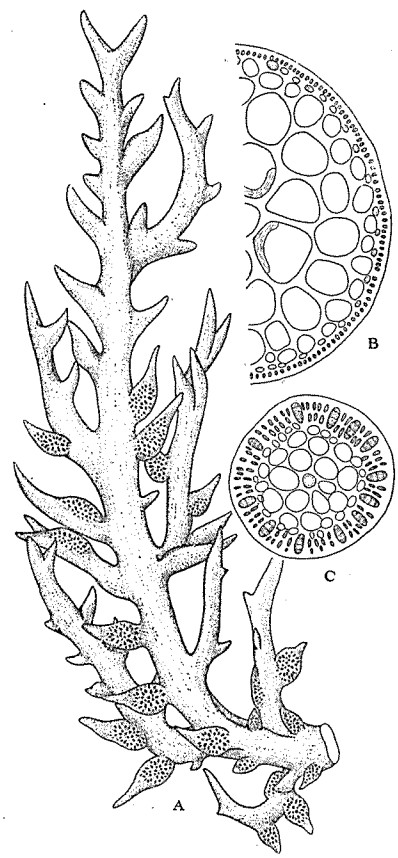


Fig. 17. *H. hamulosa* (Turn.) Mont. A. Part of the branch with tetrasporangia. × 9. B. Transverse section of the frond with lenticular thickenings. × 85. C. Transverse section of the stichidium. × 165.

at hand the frond is more dark and larger than those of WEBER's specimen. The present species was found in the lower littoral belts.

Section **PULVINATAE**

Hypnea nidulans SETCHELL Text-fig. 18–19.

American Samoa, part. 1, Vegetat, Tutuila Islands (1924) p. 161, Tahitian algae (1926) p. 100; WEBER VAN VOSSE, Liste alg. Siboga, IV (1928) p. 454, fig. 192; OKAMURA, On Mar. Alg. Kōtōshō (1931) p. 114.

Japanese name: *Murasaki-koke-ibara.*

Hab.: Sagami Prov.; Susaki, Izu Prov.; Kii Prov.; Simizu, Tosa Prov.; Kosikizima and Akune, Satuma Prov.; Ryūkyū; Tairi, Kelung, Garanbi, Agincoat and Kasyōtō, Formosa; Saipan Island; Palau Island.

Distribution: Samoa; Ceylon; Friendly Islands; Chagos Archipelago; Tahiti Islands; East India.

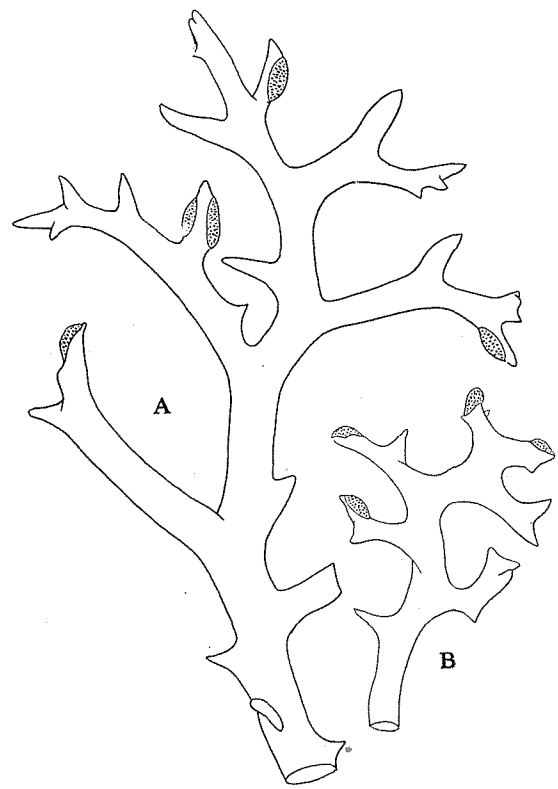


Fig. 18. *H. nidulans* SETCHELL.
A–B. Parts of branches with tetrasporangia × 8.

Frond loosely intricate-caespitose, membranaceous, 5–6 cm high, 0.5–2 mm broad, slightly compressed or rarely subterete; principal axis more or less percurrent; branches almost alternate and often branched, primary branches long or short, single or divided, acute at the apex; cells of the inner layer, excepting central axis, large, gradually smaller towards periphery; lenticular thickenings in the walls of the medullary cells present; nemathecia saddle shaped on one side of the branchlets; tetraspore irregularly zonate; cystocarps and antheridia

unknown. Colour purplish red.

It has been possible to examine one of the co-type specimen (No. 1084, tetrasporic plant) from Tutuila Island; a good number of the lenticular thickening were found in the walls of the medullary cells.

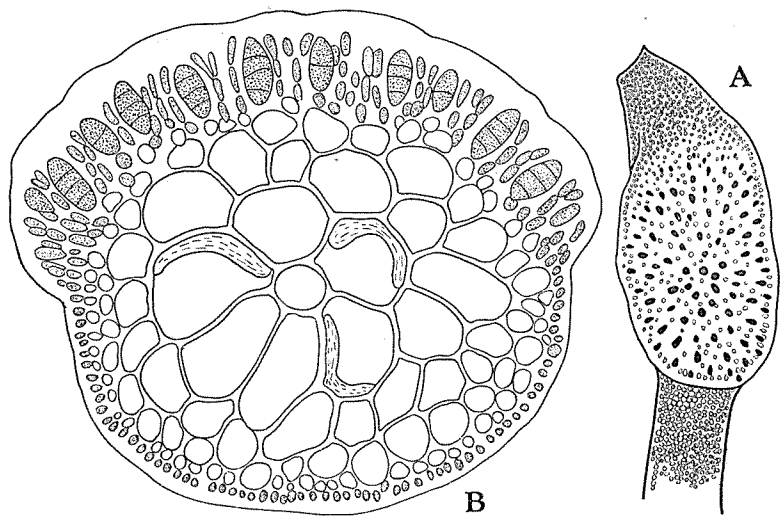


Fig. 19. *H. nidulans* SETCHELL. A. Stichidium. ×53.
B. Transverse section of the stichidium with lenticular thickenings. ×168.

In outer appearance and anatomical structure of the frond, the specimens at hand quite agree with the co-type specimen. The most characteristic feature of the present species are the saddle-shaped stichidia, which indicate at once the present species. The plant is peculiarly purplish red in colour. It is found near the low tide mark in exposed or sheltered places.

Hypnea pannosa J. AGARDH Text-fig. 20.

"Alg. Lieb. p. 14", Spec. Alg., II (1852) p. 453, Epicr. (1876) p. 565; HARVEY, Nereis Boreali-Americana (1853) p. 125; KUETZING, Tab. Phyc., Bd. 18 (1868) tab. 27, i–k; GRUNOW, Algen der Fidschi-Tonga- und Samoa-Inseln (1874) p. 39; DE TONI, Syll. Alg., IV (1900) p. 482; OKAMURA, On alg. Ogasawarazima (Bot. Mag. Tokyo, vol. XI, 1897) p. 12, Icon. Japan. Alg., vol. 1, no. 2 (1907) p. 47, pl. 10, figs. 18–20, On Mar. Alg. Kōtōshō (1931) p. 114; WEBER VAN BOSSE, Mar. Alg. 'Sealark' Expedition (Trans. Linn. Soc., vol. 8, part 3, 1913) p. 118, Liste des alg. Siboga, IV (1928) p. 455, fig. 193; TAYLOR, Mar. Alg. Florida (1928) p. 156;

BOERGESEN, Mar. alg. Ceylon (1936) p. 84, Contrib. south Ind. mar. alg. Flora, II (1937) p. 326, Mar. alg. from Iranian Gulf (1936) p. 112.

Japanese name: *Koke-ibara.*

Hab.: Susaki, Izu Prov.; Tairi, Formosa; Titizima, Ogasawarazima; Ryūkyū.

Distribution: Mexico; Pacific Ocean; Indian Ocean.

Frond densely intricate-caespitose, 2–4 cm high, ca. 1 mm thick, subterete, subcartilaginous, consisting of small compact tufts on rocks, often irregularly densely branched; upper branches patent, ca. 2 mm long, ca. 1 mm thick, spinous and acute at the apex, not constricted at the base;

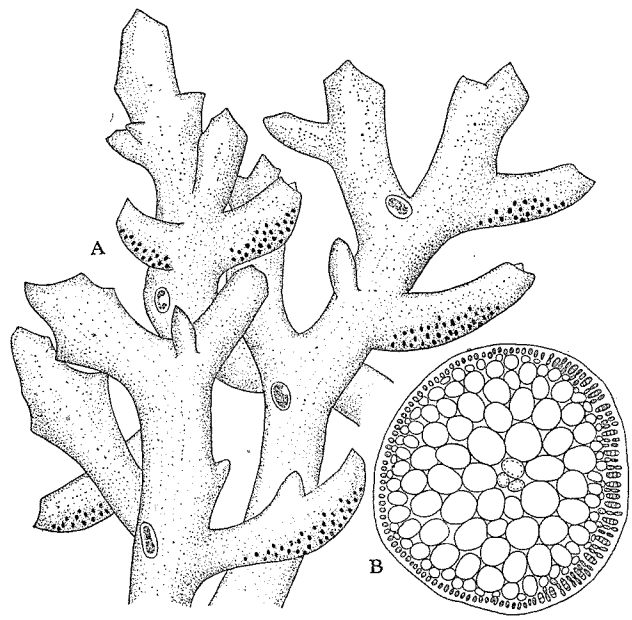


Fig. 20. *H. pannosa* J. AG. A. Part of the frond with tetrasporangia. ×12. B. Transverse section of the stichidium. ×58.

tetrasporangia on one side (afterwards gradually around) of somewhat swollen part of upper branches; tetraspore irregularly zonate; lenticular thickenings in the walls of the medullary tissue seldom present. Colour purplish red, but more darker when dried.

The present species often grows together with *H. nidulans* SETCH. and is distributed very widely in the warmer parts of the Pacific. The plant is very irregularly ramified (Fig. 20, A) and branches are issued in all directions.

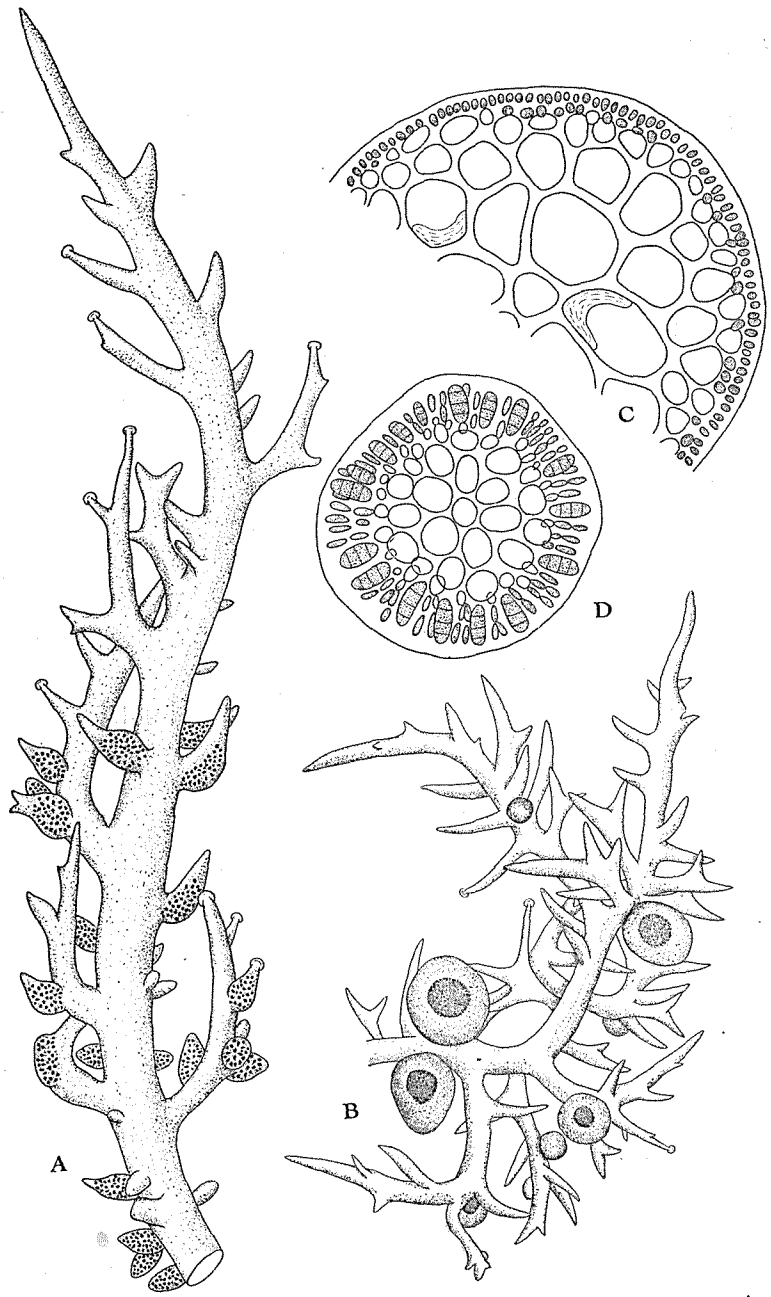


Fig. 21. *H. Cenomyce* J. Ag. A. Part of the branch with tetrasporangia. ×14. B. Part of the branch with cystocarps. ×14. C. Transverse section of the frond with lenticular thickenings. ×130. D. Transverse section of the stichidium. ×240.

Hypnea Cenomyce J. AGARDH Text-fig. 21.

Spec. Alg., II (1852) p. 452, Epicr. (1876) p. 564; DE TONI, Syll. Alg., IV (1900) p. 481.

Japanese name: *Ō-koke-ibara.*

Hab. Tairi, Formosa; Titizima, Ogasawarazima.

Distribution: Australia.

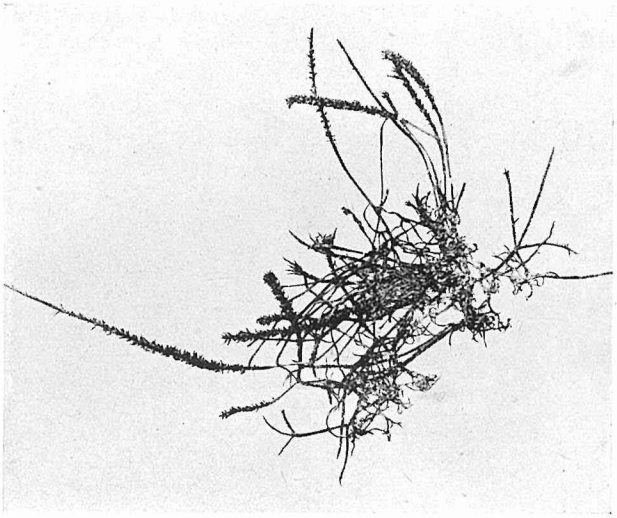
Frond 3–5 cm high, 0.5–1 mm thick, consisting of basal cushion-shaped part and upper branches; basal cushion-shaped part densely intricate-caespitose, expanding on the coral, rocks etc.; upper branches 2–3 cm high, 0.5 mm thick, cylindrical, not intricate, irregularly branched or more or less subpaniculate; ultimate branchlets about 1 mm long, 0.5 mm thick, spinous and acute at the apex but often discoidal; tetrasporangia in basal swollen part of branchlets; cystocarps subcylindrical, 600μ–1 mm in diameter, solitary or 2–3 aggregate on the branches or branchlets; lenticular thickenings in the walls of the medullary cells often present. Colour yellowish red.

The present species stands near *H. spinella* J. AG. but it differs from the latter in its ramification and shape of branchlets. The upper branches of the frond of the present species seem to show some likeness to those of *H. hamulosa* J. AG. The present species has a cushion-like mass at the base, while in *H. hamulosa* J. AG., this is not the case. The apex of the ultimate branchlets is almost acute but rarely discoidal. The writer has not been able to examine any authentic specimens.

PLATES LIII–LIV

PLATE 53

1. *Hypnea Boergesenii* TANAKA. ×1.
2. *Hypnea chordacea* KUETZ. f. *simpliciuscula* TANAKA. ×1.
3. *Hypnea Saidana* HOLMES f. *gracilis* TANAKA. ×1.



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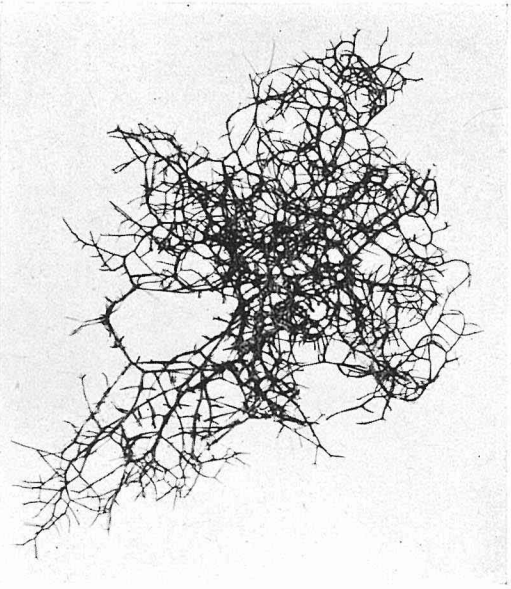

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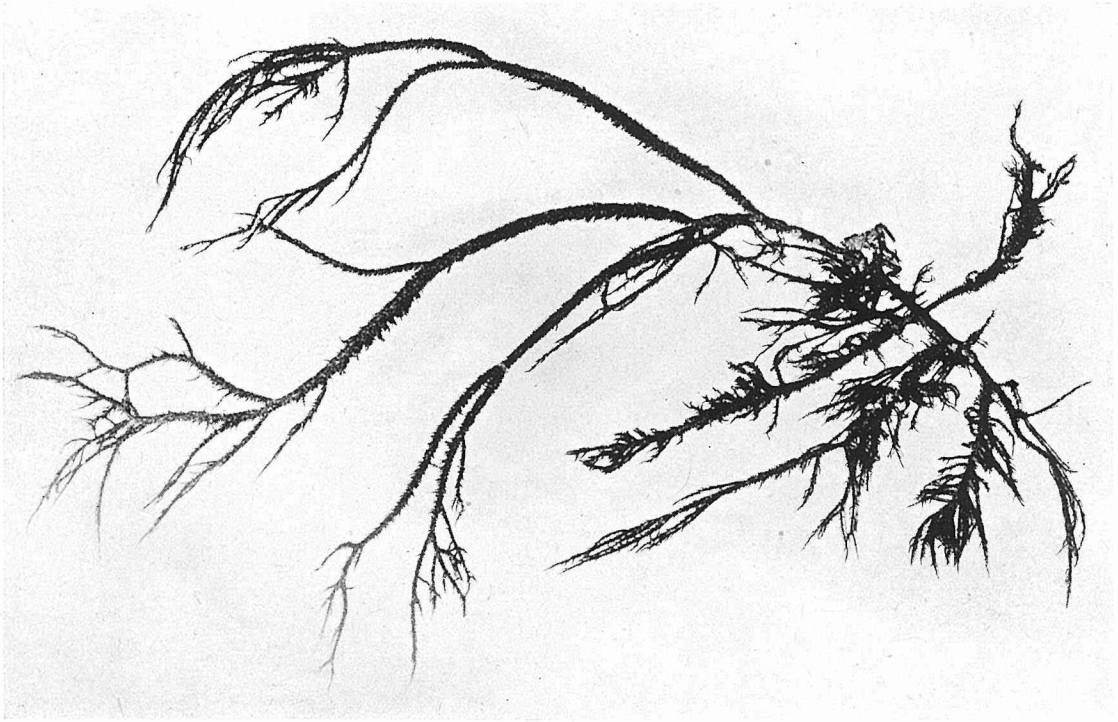

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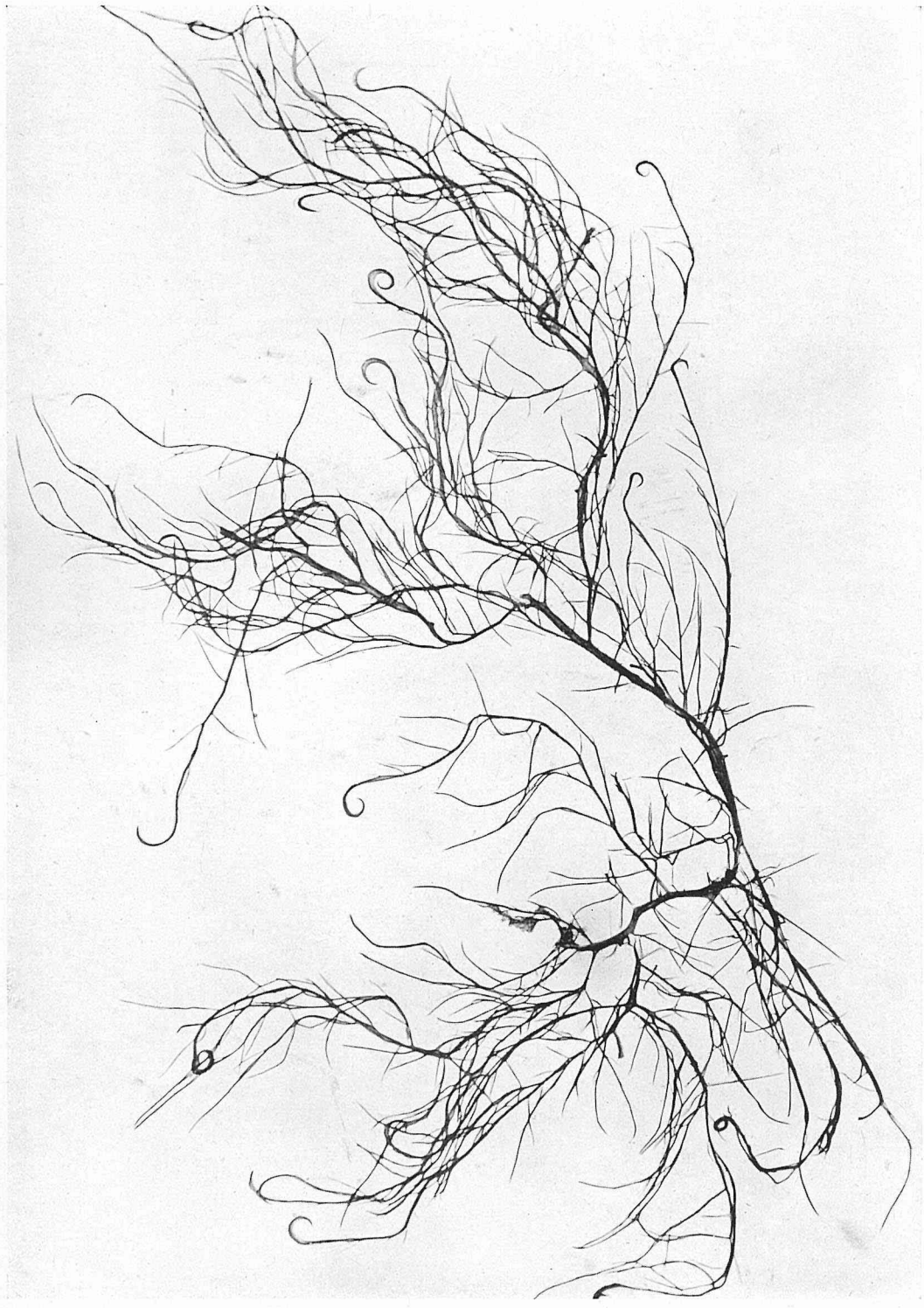
PLATE 54

Hypnea japonica TANAKA. × ca. 1.