



| | |
|------------------|---|
| Title | CONTRIBUTIONS TO THE KNOWLEDGE OF GRACILARIACEAE FROM JAPAN : . On a new species of the genus Gracilariopsis, with some considerations on its ecology |
| Author(s) | OHMI, Hikoei |
| Citation | 北海道大學水産學部研究彙報, 6(4), 271-279 |
| Issue Date | 1956-02 |
| Doc URL | http://hdl.handle.net/2115/22935 |
| Type | bulletin (article) |
| File Information | 6(4)_P271-279.pdf |



[Instructions for use](#)

CONTRIBUTIONS TO THE KNOWLEDGE OF GRACILARIACEAE FROM JAPAN

II. On a new species of the genus *Gracilariopsis*, with some considerations on its ecology

Hikoei OHMI

Faculty of Fisheries, Hokkaido University

In 1949, Dawson erected a new genus, *Gracilariopsis*, taking *Gracilaria Sjoestedtii* KYLIN as its type species. His separation of this new genus from *Gracilaria* was chiefly based upon the differences in the internal structure of the cystocarps. In *Gracilariopsis*, the cystocarp is provided in its center with a small-celled, broad-based gonimoblast parenchyma, and it is destitute of the nutritive filaments connecting gonimoblast parenchyma with the pericarp. On the other hand, the cystocarp in *Gracilaria* is furnished in its center with a large-celled, usually small-based gonimoblast parenchyma bearing accessory nutritive filaments.

Dawson placed seven species in his *Gracilariopsis*. Later, Börgesen (1952) added one species from Mauritius, and Dawson (1953a) reported the occurrence of the genus in collections from Cuba and from Caribbean Sea and adjacent Atlantic coasts.

Toward the end of September 1955, the present writer had a chance to collect a pretty good amount of fertile specimens of gracilariaceous plants at Lake Akkeshi, Prov. Kushiro, Hokkaido, a lagoon 24.15 km in circumference, 31.99 km² in area and 6.9 m in the greatest depth. The lagoon is renowned in Japan for its abundant production of gracilariaceous agarophytes, which are harvested in a short season ranging from the end of September to early October. The yield in 1954 was estimated as much as 108000 *kan* (1 *kan* approximates 3.75 kg) in dry weight and in 1955 it is expected to be as much as 80000 *kan*. *Gracilaria confervoides* reported by Y. Yamada & T. Tanaka (1944) is, up to the present, the only species of the agarophyte that has been known to occur there.

The gracilariaceous plant found in this lagoon is used as an industrial material in manufacturing agar-agar. It is a dominant type. It grows adrift being deposited and half-buried on the muddy bottom or entangled among the bushes of *Zostera marina* together with *Chaetomorpha Linum*, *Laminaria longipedalis*, *Polysiphonia* sp. and *Laurencia* sp. etc. This type has always been found sterile. On the other hand, the fertile plant recently collected by the writer, which is always found attached to the substratum, has not been used as a material for agar-agar manufacture.

After careful examinations the writer concluded that the plant under consideration is a *Gracilariopsis* new to science. The diagnosis and a description of the anatomical characteristics of the plant are given below.

Gracilariopsis vermiculophylla OHMI, spec. nov.

Frondibus 4–30 cm, raro usque 80 cm altis, cylindricis, gracilibus, usque 3 mm diam. magnis; ramis in seriebus 2–4 ordinatis irregularibus, indeterminatis, in apice attenuatis; cystocarpiis subglobosis, 1200 μ vel minus diam., domoideis, basi paullo constrictis, subrostratis; gonimoblasto ipso e cellis quasi evacuolatis constante denseque protoplasmaticis composito, de quibus carposporangia radiant; neque gonimoblasto ut in *Gracilaria* conjugato cum pericarpio cellis nutrientibus; carposporis ovoideis, 30–50 μ longis; antheridiis in infundibulis apertis, profundis, conceptacularibus 70–150 μ altis, 45–120 μ latis in cortice impositis, nonnunquam super inflatas frondes vermiformas positos; terasporangiis ovatis, ad 60 μ longis, 42 μ latis per corticem passim dispersis, cruciatim divisus.

Japanese name: *Ogo-modoki*.

Habitat: At Lake Akkeshi, growing on oyster shells at Gomejima and on stones at the Tōbai coastal region, southeastern side of the lake, both facing tide-way, attached to the substratum by a discoid holdfast in the intertidal zone. Thus the present species shows a difference in habitat as compared with other types which grow luxuriantly, lying loose in more or less stagnant water protected by gregarious growths of *Zostera marina* at such places on Lake Akkeshi as Yamatosaki, Ikuraushi, and from Tōbai to Horonitai. At the Tōbai coast, mature tetrasporophytes of the present species are found most abundantly in the beginning of July and the mature carposporophytes somewhat later, whereas at Gomejima their period of most abundance comes nearly a month later.

Frond solitary or tufted, arising from a very small callous disc, usually 4–30 cm but sometimes up to 80 cm in length, cylindrical throughout, slightly flexuous; main axis percurrent; branches long-attenuated, arising alternately on all sides from the main axis or sometimes one-sidedly, mostly with patent, sometimes even rectangular axils, branching up to four times, usually alternately but sometimes also subdichomously; branches of every type tapering toward apex, hardly constricted at the bases except those at the lower portion of the plant, 4.2–17 cm in length in the first order branches, 0.5–4 cm in the second, and shorter than 0.5 cm in the third order, the last one being simple, very short ramuli.

The main axis in the middle portion of the frond, in transverse section, consists in the medulla of 12–13 layers of large, round subsodiametric cells, up to 350 μ diam, with walls 5–7 μ to 15 μ thick; outer cells of the medulla merging gradually into a 2–3 layered subcortex composed of ovoidal cells, 30 μ high, 12–15 μ thick. Medullary cells contain several transparent, highly refractive globules, round or pod-like in shape, up to 75 $\mu \times 60 \mu$ in dimension. The nature of the globules was examined without useful results by the writer by means of various chemical reagents. Cortical cells, pigmented, are roundish, or more or less polygonal in shape as seen from the surface, 5 μ diam.

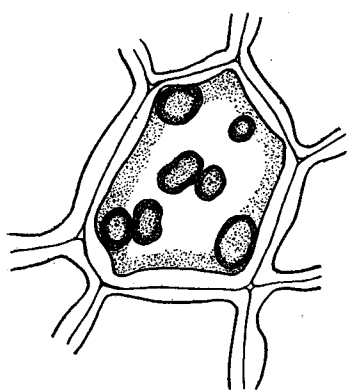


Fig. 1. A medullary cell in transverse section of a branch, showing several globules in the content $\times 380$

or $4\mu \times 6\mu$, in section essentially arranged anticlinally in two layers, $12-15\mu$ to 20μ high, $3-6\mu$ thick; surface jelly transparent, $6-12\mu$ thick.

Cystocarps subglobose, protruding up to 1200μ diam., somewhat rostrate, ostiolate and a little basally constricted, scattered on all sides of branches, often aggregated, with a large gonimoblast parenchyma or placenta of small, densely massed, richly protoplasmic cells producing dense, radiating chains of ovoid carpospores almost fully filling the cystocarpic cavity; carpospores roundish or more or less elongated, measuring $30-50\mu$ in length, containing a conspicuous stellate, central body, nourished only by the gonimoblast, without nutritive filaments; placenta elongated and not lobed. Pericarp $130-150\mu$ thick, its cortex being composed of two layers

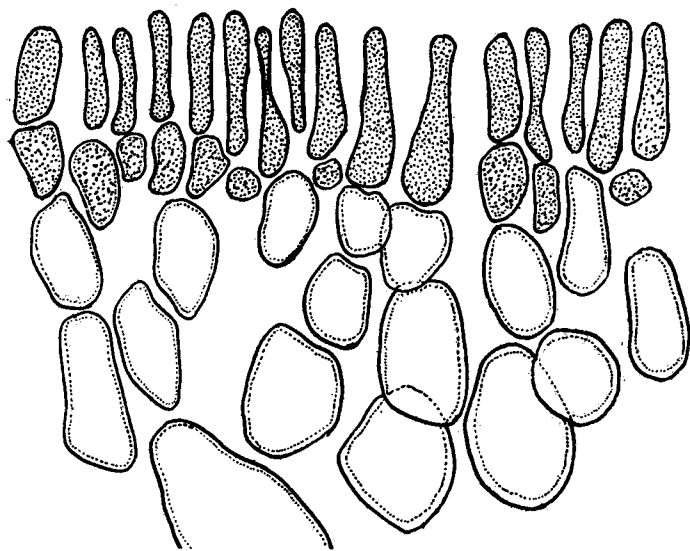


Fig. 2. Transverse section through a vegetative portion of frond, showing pigmented cortex $\times 760$

of cells, outermost one is $9-15\mu$ high, $3-5\mu$ thick, while inner one is usually flat in shape, $8-12\mu$ high, $4-6\mu$ thick. Antheridia formed in cavities all over the surface of frond, but occasionally on slightly swollen, somewhat vermiform upper branches; cavities deep, open, conceptacular pockets mostly with a broad opening, $70-150\mu$ deep and $45-120\mu$ wide, well-separated by mediately anticlinally modified cortex; in surface view, mostly elongated longitudinally along the frond

axis. Tetrasporangia scattered over the surface of frond, circular in shape as seen from surface, up to 42μ diam., cruciately divided, rose-red in color, borne in a somewhat nemathecially modified cortex with elongated outer cortical cells which are up to 60μ high

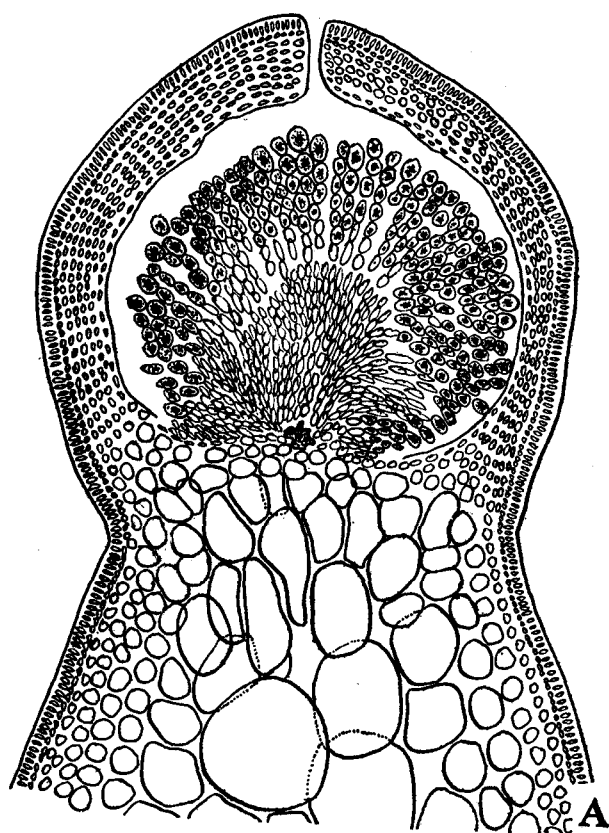


Fig. 3. A. Vertical section through a mature cystocarp $\times 74$

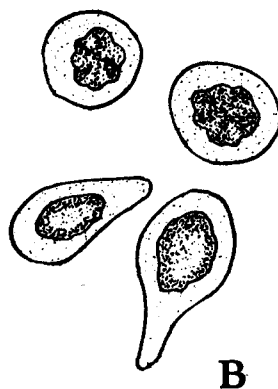


Fig 3. B. Carpospores showing a stellate central body $\times 760$

and $42\ \mu$ thick in transverse view; they stain deep red with iron alum acetic carmine against other feebly stained tissues. These three kinds of reproductive organs are, of course, ordinarily formed on different plants.

In some specimens, tetrasporangia and antheridia occurred mixed together. These were scattered over the surface of the

frond separately or gathered in small irregular groups which show no elevation above surface. When placed solitarily the antheridial cavity is broadly urn-shaped or deep pocket-like, well-separated from others by somewhat modified cortical cells, but when packed together, oblong. They have a somewhat narrowed opening and are about $45\ \mu$ to $70\text{--}150\ \mu$ deep, $24\ \mu$ to $45\text{--}120\ \mu$ wide in transverse section and $90\text{--}150\ \mu$ deep, $50\text{--}60\ \mu$ wide in longitudinal section.

The occurrence of sexual and asexual organs on one and the same individual has been frequently observed in Florideae by various investigators as mentioned by Fritsch (1945, pp. 723-725), and in the genus *Gracilaria* by Church (1916) and Børgesen (1950).

In the present species, however, both kinds of reproductive organs were abundantly present and mixed rather densely together, e. g., 5-7 or even over ten antheridial cavities were observed together with many tetrasporangia in a single microscopic field, $330\ \mu$ in diam. Yet after all, such a coexistence of different kinds of reproductive organs on one

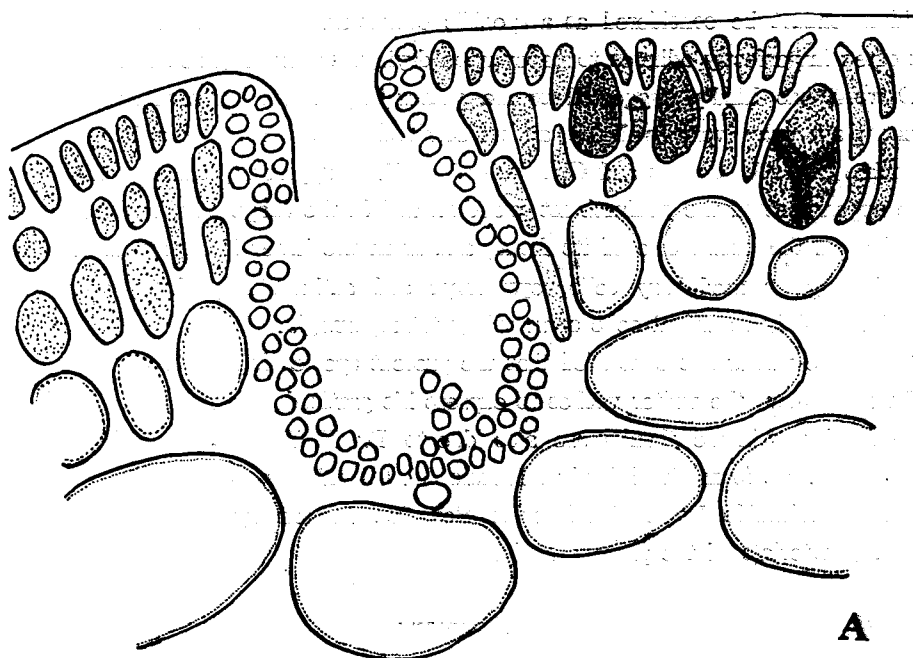


Fig. 4. A. Transverse section through a tetrasporic frond, showing three tetrasporangia together with an antheridial conceptacle $\times 420$

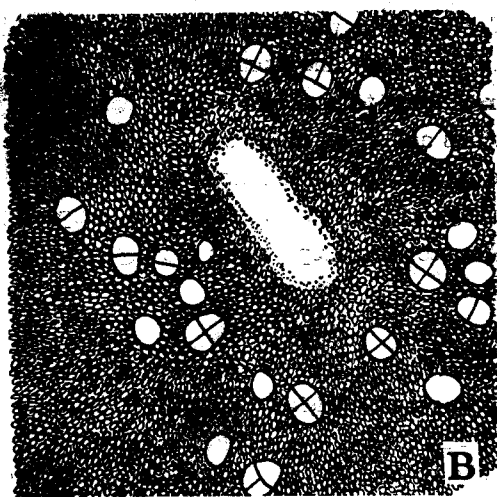
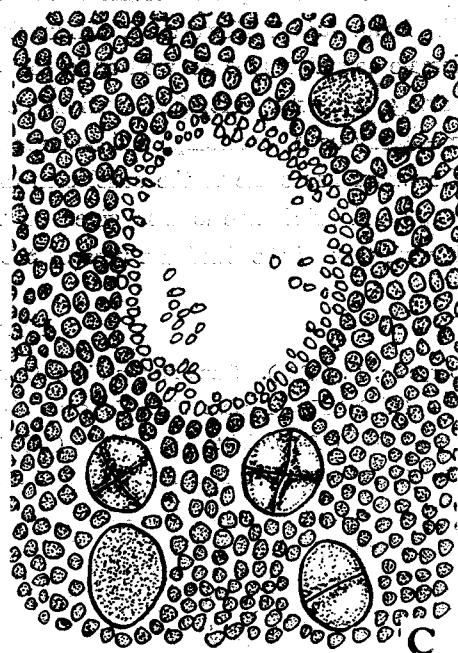


Fig 4. B. Surface view of the same frond as in A $\times 127$

C. Surface view of the same, more highly magnified $\times 420$



individual cannot be considered as a specific character. Substance cartilaginous and the plant often imperfectly adheres to paper upon drying. Color dark red or rather blackish.

Dawson has kindly suggested to the writer in personal communication that, "the present plant may very well be an undescribed *Gracilariopsis* although the plant approaches both *G. robusta* and *G. rhodotrichia*". It apparently differs from the former in the appearance of the gonimoblast placenta and in the shape of the antheridial cavity as well as in the small size of its frond, and from the latter in its rather robust frond, in having larger medullary cells, cystocarps and antheridial pockets, as well as in somewhat modified cortical cells surrounding tetrasporangia.

Thus, the writer has concluded that the present species is new to science.

In conclusion, the writer wishes to express his gratitude to Prof. Jun Tokida for his kind direction. Sincere thanks are also due to Dr. E. Y. Dawson for his kindness in various ways. He is much obliged to Messrs. H. Okesaku and S. Sasaki of the Kushiro Station of Hokkaido Regional Fisheries Research Laboratory for their assistance in collecting materials of the present study.

Summary

1. The discovery of a new species of *Gracilariopsis*, *G. vermiculophylla* is herein reported on the basis of the material from Lake Akkeshi, Prov. Kushiro, Hokkaido. This is also the first record of the genus in Japan.

2. The new species seems to be somewhat related to *Gracilariopsis robusta* and *G. rhodotrichia*. However, it differs from *G. robusta* in the texture of both male and female sexual organs as well as in the size of the frond, and from *G. rhodotrichia* in having somewhat modified cortical cells surrounding tetrasporangia, in having larger medullary cells, cystocarps and antheridial cavities and in its rather robust frond. Hence the writer has come to the conclusion that the present species is new to science.

3. A brief note is also given on the ecology of the species in question comparing it with that of the dominant type of the gracilariaceous agarophytes in the lagoon.

Literature cited

- Børgesen, F. (1950). Some marine algae from Mauritius. Additions to the parts previously published II. *Det Kgl. Danske Videnskabernes Selskab. Biologiske Meddelelser*. **18** (11), 1-46, 22 figs.
 ——— (1952). Ditto IV. *Ibid.* **18** (19), 1-72, 33 figs. 5 pls.
 Church, A. H. (1916). Historical review of the Florideae II. *Jour. Bot. British and Foreign* **57**.
 Dawson, E. Y. (1949). Studies of northeast Pacific Gracilariaceae. *Allan Hancock Found. Pub. Occ. Paper* (7), 54p. 25 pls. Univ. South. Calif.
 ——— (1953a). On the occurrence of *Gracilariopsis* in the Atlantic and Caribbean. *Bull. Torrey Bot. Club* **80** (4), 314-316.
 De Toni, J. B. (1900). *Sylloge algarum omnium hucusque cognitarum* **4**. Florideae, Sectio **2**.

387-776. Patavii.

- Fritsch, F. E. (1945). *The structure and reproduction of the algae* 2, 939p. Cambridge Univ. Press.
- Greville, R. K. (1830). *Algae Britannicae, or the descriptions of the marine and other inarticulated plants of the British Island, belonging to the order algae, with plates illustrative of the genera*. Edinburgh.
- Kylin, H. (1930). Ueber die Entwicklungsgeschichte der Florideen. *Lunds Univ. Årsskr. N. F., Avd. 26* (6), 1-104, 56 text figs.
- Okamura, K. (1916). *Icones of Japanese Algae* 4 (1). Tokyo.
- Smith, G. M. (1944). *Marine algae of the Monterey Peninsula, California*. 622p. Stanford Univ. Press.
- Yamada, Y. & Tanaka, T. (1944). Marine algae in the vicinity of the Akkeshi Marine Biological Station. *Sci. Pap. Instit. Alg. Res., Fac. Sci. Hokkaido Univ.* 3 (1), 79-98.

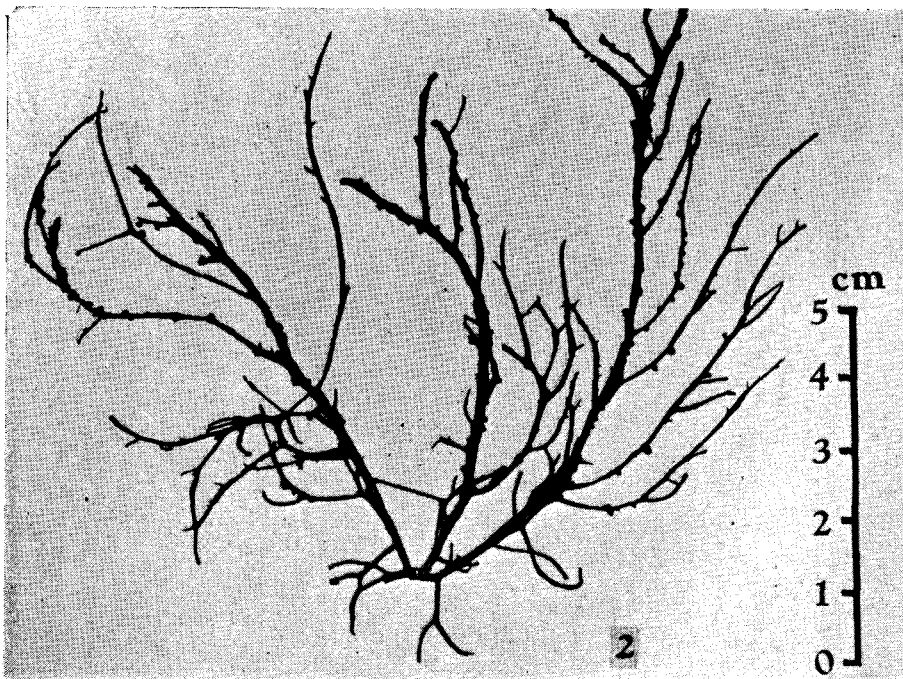
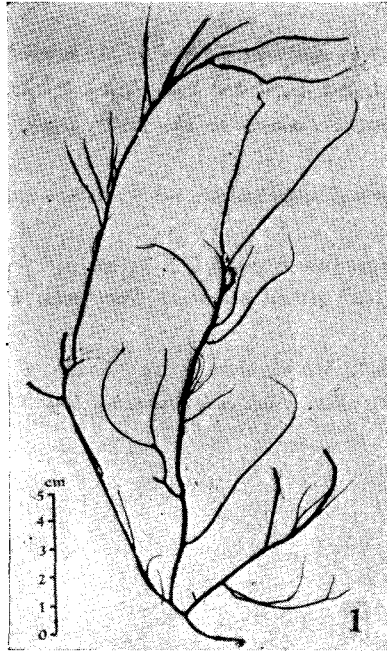


Plate I. Fig. 1. Habit of a tetrasporic plant
Fig. 2. Habit of a female plant

