

Toshinori KONNO\* & Tadao YOSHIDA\*\*: **Observations on  
*Sargassum ammophilum* Yoshida et T. Konno, sp. nov.  
(Phaeophyta, Fucales)**

今野敏徳\*・吉田忠生\*\*: 褐藻ホンダワラ属の1新種スナビキモク

In the course of our study on the genus *Sargassum* of Japan, we recognized a new alga of *Sargassum* subgenus *Bactrophyucus* with its unique holdfast and sand-loving habit. It was first found in Chiba Pref. and ascertained to be distributed along the Pacific coast of middle Honshu, Japan. We describe here it as a new species:

***Sargassum ammophilum* Yoshida et T. Konno, sp. nov. (Figs. 1-11)**

*Discus adhaerens applanatus, magnus, margine processibus digitiformibus cylindricis prostratis ornatus. Caules teretes, plures e disco applanati enascenti. Rami principales a parte terminali caulis enati, trigoni, saepe tortiles, spinulis in parte inferiori ornati. Folia prope partem basalem rami principalis horizontaliter expansa, crassiora, obovoidea, elliptica versus spathulata vel lanceolata, margine integra vel irregulariter serrata. Costa evanescens ad partem basalem folii. Folia partium mediarum superiorumque rami principali et rami lateralis tenuiora, obovoidea, elliptica, spathulata, lanceolata versus oblanceolata vel hemiphylla, costa fere deficienti. Cryptostomata in foliis fere desunt. Vesiculae prope partem inferiorem stipitibus brevibus, sphaericae vel pyriformes, apice mucronatae vel muticae, raro corona parva lineari vel alis brevibus ornatae. Vesiculae prope partem superiorem pyriformes vel fusiformes. Planta dioica. Receptacula teretia, superne decrescentia, supra ramulos composito-racemose orta.*

Holotypus: Futomi, Chiba Prefecture, May 25, 1978, leg. T. Konno, in SAP (no. 041891). Isotype in the herbarium of Tokyo University of Fisheries.

Japanese name: Suna-biki moku (nov.).

Other specimens examined: Ena, Fukushima Pref., Jul. 1, 1981, leg. K.

\* Laboratory of Phycology, Tokyo University of Fisheries, Minato-ku, Tokyo 108. 東京水産大学 藻類研究室.

\*\* Department of Botany, Faculty of Science, Hokkaido University, Sapporo 060. 北海道大学 理学部 植物学教室.

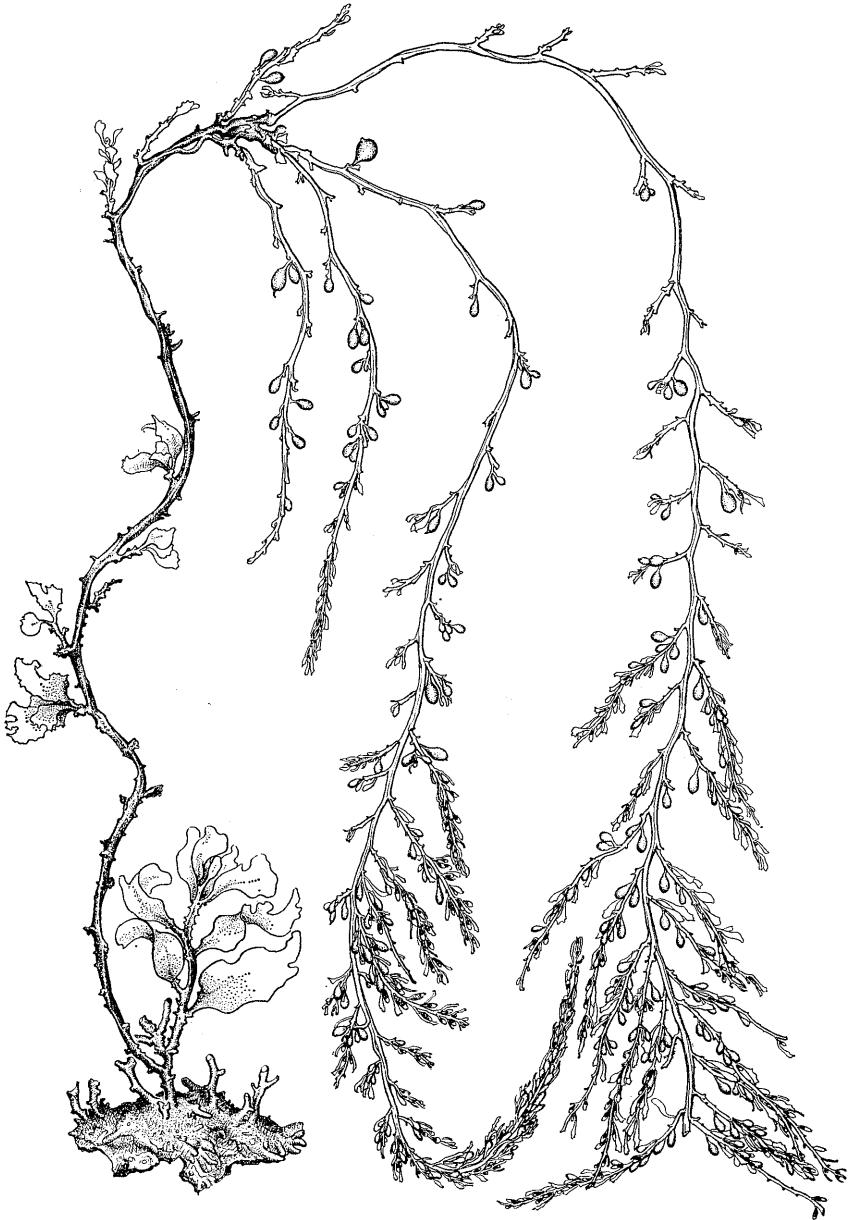


Fig. 1. Holotype of *Sargassum ammophilum* Yoshida et T. Konno, sp. nov.  $\times 0.5$ .

Taniguchi, in SAP (no. 041892); Shichiriga-hama, Kanagawa Pref., Apr. 4, 1981, leg. T. Yoshida, in SAP (no. 041893); Enoshima, Kanagawa Pref., May 15, 1933, leg. K. Okamura, in SAP (no. 034225); Omae-zaki, Shizuoka Pref., Jun. 5, 1981, leg. F. Hayashida, in SAP (no. 041896).

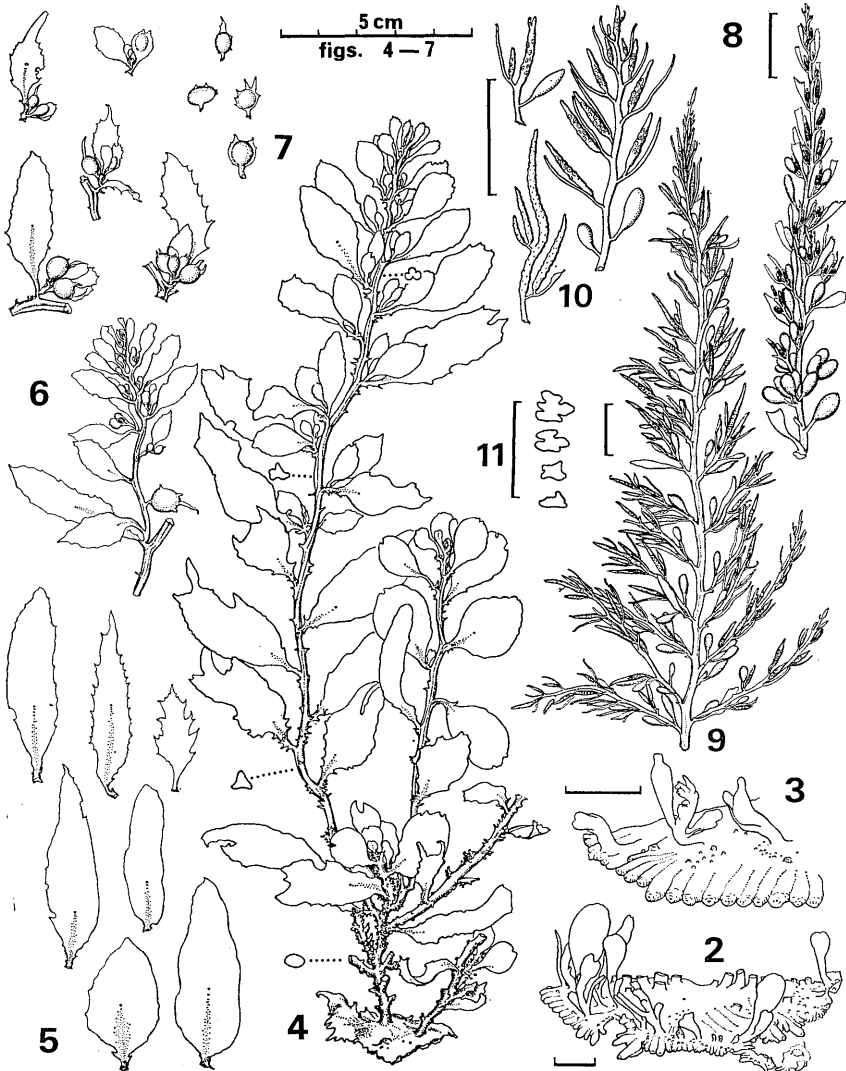
**Observations and discussion** This new species has a very peculiar type of holdfast, by which it is easily distinguished from other known species of the genus. In the juvenile stage, the holdfast is small discoid with radial striation. Growth in diameter of the holdfast is assured by finger-like terete protuberances about 2 mm in diameter radiating horizontally, with a growing point located in an apical depression like other growing apices (Figs. 2, 3). The protuberance occasionally grows out singly or in groups. From the lateral sides of these projecting protuberances, develop smaller processes laterally to fix firmly on the substratum. Although the holdfast is flat except growing margin by the growth of meristoderm of the protuberances, the tangential section of holdfast clearly shows the remnant of cylindrical protuberances by pigment deposition and arrangement of the cells. The holdfast persists for several years. In well grown individuals the holdfast is usually 2-3 mm thick, 5-8 cm (rarely exceeding 10 cm) in diameter.

New growing points differentiate on the surface of the holdfast in large number. Some of them further grow into new shoots as shown in Fig. 3. This mode of shoot formation occurs all seasons of the year giving rise to many shoots with different ages on the same disc.

The stem is terete, up to 3-4 cm long and 2.5-3.5 mm in diameter, and usually without branching. Three to six main branches are formed in spiral succession near the apex of the stem, leaving scars of fallen main branches on it. The longevity of the stem is estimated to be 2 or 3 years.

The main branches are terete or compressed at the base, but become triangular in cross section (Figs. 4, 11), 3-5 mm in width, reaching 1.5-2.5 m or more in length, twisting loosely or strongly. The main branches have spinal processes 1-3 mm long on their ridges (Fig. 4). The spines are numerous in the lower part of the main branch and become sparse above. Lateral branches are shorter on the lower part of the main branch, and attain its longest length of about 20-30 cm in the middle part, then becoming gradually shorter above.

Leaves are formed 1-5 cm apart with a phyllotaxis of 1/3. Lateral branches are issued axillary to the leaves. Later, these basal leaves fade off. Leaves



Figs. 2-11. *Sargassum amphilum* Yoshida et T. Konno. 2. Well developed holdfast issuing many shoots. Larger stems are cut off at the base. 3. Marginal part of holdfast. 4. An individual with young main branches in winter. 5. Leaves on lower and middle parts of a main branch. 6. Branchlets. 7. Vesicles with a coronal leaf or wings. 8. Branchlet bearing young female receptacles. 9. Branchlet with fully developed male receptacles. 10. Male receptacles (left below) and female receptacles (others). 11. Cross sections of a well grown main branch. Scales for Figs. 2, 3, 8-11, represent 1 cm.

are shortly stipitate, very variable in shape according to season, age or position on the branch. Leaves on the basal part of main branch are thicker and bigger, obovoid, elliptical, spatulate or lanceolate in shape with entire or irregularly serrate margin, measuring 3-6 cm long, 1-2 cm wide, often armed with a few, small, spinous processes on the stipe. The stipe continues with a thickening along the median line of the leaf blade and is hardly discernible at the lower half of the blade. These leaves spread horizontally in direction. Leaves on the distal part of main branch or on lateral branches are thinner in texture, obovoid, elliptical, spatulate, lanceolate, oblanceolate or hemiphyllous in shape, and become smaller in size towards the apex of main branch or of lateral branch (Figs. 4-9). Small dots are scattered on the leaves, but cryptostomata are absent.

Vesicles are formed singly or in groups in the axile of leaves or on branchlets. Vesicles in the lower part of the thallus are spherical or pyriform in shape, 5-7 mm long and 4-6 mm in diameter, with a short stipe of 1/2 to 1/4 length of the vesicle, mucronate or with round apex, rarely with a small coronal leaf or wings, smaller and pyriform to fusiform in shape in the upper part of the thallus.

The plant is dioecious. Receptacles are terete, tapering upwards, with a short stipe, formed singly in the axile of stipule-like leaves, arranging in composed racemose manner. Female receptacles are 9-12 mm long and 0.8-1.0 mm in diameter. Male ones are longer than the female, measuring 15-18 mm long. Receptacles are usually simple, but smaller receptacles or vesicles are rarely proliferating from the side. Observation made at Futomi, Chiba Pref., shows that the formation of receptacles begins in April, and eggs are liberated from late May to early July with its maximum in June. Liberated eggs are  $138 \times 108 \mu\text{m}$  in size (average of 100 measurements made in July). Primary rhizoids are 8 in number.

At maturity, most of the larger leaves and vesicles on the lower part of branches fall off, leaving receptacles, smaller long-elliptical or linear leaves and small vesicles (Figs. 8, 9). After shedding reproductive bodies in late June or early July, main branches fall off at their bases, leaving a few juvenile main branches usually shorter than 10 cm long.

The habitat of this species is a transitional zone between rocky shore and sandy beach or an area mixed with rocky and sandy bottoms on the open

coast with good exchange of sea water, often neighbouring bathing places. Substratum is a horizontal or slightly inclined rock surface, often covered by drifting sand, from the low water mark of spiring tide to 1-2 m deep. Upper limit of growing zone is nearly coincident with the lower limit of growth of *Hizikia fusiformis* (Harvey) Okamura or *Sargassum thunbergii* (Mertens) Kuntze. This species usually forms a pure community, but somewhere it grows intermingled with *S. ringgoldianum* Harvey and *Myagropsis myagroides* (Turner) Fensholt. As this species grows on flat rock surface, its basal parts are often covered by drift sand. When it forms a dense community, the presence of the community itself causes the deposition of drift sand, sometimes depth of the sand becoming up to 30 cm. When the covering by sand lasts long, holdfast and stem darkened to die out, and the plants are easy to detach from the substratum. However, the marginal part of the flat holdfast with finger-like protuberances persists retaining the ability to maintain the individual vegetatively. By this sand-loving habit, we gave a species epithet *ammophilum*.

In the subgenus *Bactrophycus* of *Sargassum*, this new species can be easily distinguished by its unique holdfast. As shown in Figs. 2-3, the expanded holdfast constructed by the adhesion of many finger-like creeping protuberances is a distinguishing characteristic of this species. In natural habitat, however, the basal part of the thallus is usually buried in sand and difficult to observe. By the expansion of rather thinner holdfast, easy to break, it is usually impossible to collect the intact plant as a whole, so that the specimens obtained are very often imperfect as to its holdfast. The specimens without a holdfast are somewhat similar to *S. muticum* (Yendo) Fensholt and have been often referred to it, according to the specimens deposited in SAP. On younger main branches, this species has leaves much larger than those of *S. muticum*. Another distinction is that the stem is provided with spines in this new species. In *S. muticum*, newly formed short main branches are covered by smaller scale-like leaves as in *S. thunbergii*, but this is not the case in the present new species. Nearly complete absence of cryptostomata in this species is another discriminating feature in the sterile state. Individuals collected in the maturation season are rather difficult to be distinguished from *S. muticum*, especially when only distal portion of the thallus is compared. Receptacles are similar in both species in form, size and occasional proliferation of smaller receptacles or vesicles (Fig. 10). But in contrast to the fact that *S. muticum* is monoecious (Inoh 1930)

and androgynous (Fensholt 1955), this species is dioecious. In winter, the young shoot of this species is somewhat similar to *S. fulvellum* (Turner) C. Agardh in the shape of leaves and vesicles, and to *S. confusum* C. Agardh with a spinous main branch. But, *S. fulvellum* has a thicker main branch without spines. *S. confusum* has a longer thick stem with alternately arising thicker main branches, and has larger leaves with a conspicuous midrib.

Geographical distribution of this species is confined to the middle part of Pacific coast of Honshu, from Fukushima Pref. to Shizuoka Pref. This range overlaps with those of *S. muticum* and *S. fulvellum*, but not with that of *S. confusum* which is distributed mainly in the Sea of Japan.

Sincere thanks are due to Prof. Minoru Katada, Tokyo University of Fisheries and to Prof. Munenao Kurogi, Hokkaido University, for their kindness in giving us valuable advices and in reading the manuscript. We thank Prof. Hideo Toyokuni, Shinshu University, for his kindness in the preparation of Latin description.

### References

- Fensholt, D.E. 1955. An emendation of the genus *Cystophyllum* (Fucales). Amer. J. Bot. 42: 305-322. Inoh, S. 1930. Embryological studies on *Sargassum*. Sci. Rep. Tohoku Imp. Univ. ser. 4, 5: 423-438.

\* \* \* \*

表日本中部に分布するホンダワラ属の1新種をスナビキモクと名付けた。この種は外海に開いた漂砂に被われやすい岩盤上によく生育する。基部の附着器はこの種に特徴的で、基物上を匍匐する放射状に多数並んだ指状の突起が融合してできる平たい盤状の構造で、その表面より新条を次々に生ずる。主枝下部に刺をもち、中肋の明瞭でない葉、西洋梨形ないし紡錘状の気胞をもつ葉体で、円柱状の生殖器床をもっている。近似のタマハハキモクとは雌雄異株であること、主枝基部の葉が大型であることでも異なり、ホンダワラ、フシスジモクとも基部形態等で明らかに区別される。