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A New Variety of *Sargassum miyabei* Yendo (Sargassaceae, Phaeophyta) from the Sea of Japan[1]

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A new variety of *Sargassum miyabei* Yendo, *Sargassum miyabei* var. *okiense* var. nov. (Sargassaceae, Phaeophyta) is described from the Oki Islands, the Sea of Japan.

This new variety is usually 1–3.7 m in length of thallus, provided with crookednesses and spiral twists in the principal branch, male receptacles of 3–18 mm, 0.5–1 mm in length and diameter, and the female receptacles of 3–11 mm, 0.5–1 mm in length and diameter.

Key Index Words: *Phaeophyta, Sargassaceae,* Sargassum miyabei *var.* okiense, *the Sea of Japan.*

Introduction

Yendo (1907) described *Sargassum miyabei* Yendo independently from his another species *Sargassum kjellmanianum* Yendo from Hokkaido, Japan at the same time. On the other hand, Yoshida (1978) considered *Sargassum miyabei* as a synonym of *Sargassum kjellmanianum,* and he chose the name *Sargassum miyabei* for avoiding confusion though the name of *Sargassum kjellmanianum* appeared in the previous page to *Sargassum miyabei* in Yendo's monograph on the Fucaceae of Japan (1907).

Sargassum miyabei had been reported from middle to northeastern part of the west coast and northeastern part of the east coast of Honshu as well as Hokkaido and western part of the Kurile Islands in Japan, Sakhalin and Ussuri Bay on Siberian Coast (Yoshida 1983). On the other hand, the present writer recently reported the present plant as *Sargassum miyabei* newly for the Oki Islands (Kajimura 1990).

The result of the present detailed study, however, has led the present writer to a conclusion that the Oki plant which he reported as *Sargassum miyabei* in 1990 is a new variety of it, and this new variety is described in this paper.

Materials and Methods

Many mature specimens as well as the sterile used for this study were collected by the present writer from Fuku-ura, the Oki Islands in the past five years extending from

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1987 to 1992.

Most of the specimens are deposited in the Phycological Herbarium of the National Science Museum, Tokyo (TNS).

Fresh specimens as well as those dried or preserved in formalin-seawater were used for this study. Various parts of the plant were sectioned with a freezing microtome but hand sections were also made for anatomical examinations.

Observations and Discussion

Sargassum miyabei Yendo var. ***okiense*** Kajimura, var. nov.

Thallus usque ad 1–3.7 m alt. Ramus primarius circum nodum saepe flexus atque plus minusque torsivus. Receptaculum masculinum 3–18 mm longum et 0.5–1 mm latum, receptaculum femineum 3–11 mm longum et 0.5–1 mm latum.

Holotype collection: 0.5 m depth at Fuku-ura, the Oki Islands on 12 May, 1989.

Holotype (female) OS 10031-A, isotype (male) OS 10031-B, both deposited in the Phycological Herbarium of the National Science Museum, Tokyo (TNS).

Additional specimens examined: The following additional collections are all from the type locality.

1) OS 10003, sterile (22 specimens), M. Kajimura, 29 December, 1987.
2) OS 10004, sterile (25 specimens), M. Kajimura, 11 March, 1988.
3) OS 10005, sterile (18 specimens), M. Kajimura, 4 April, 1988.
4) OS 10006, sterile and fruiting (8 specimens), M. Kajimura, 27 April, 1988.
5) OS 10007, fruiting (28 specimens), M. Kajimura, 18 May, 1988.
6) OS 10008, fruiting (5 specimens), M. Kajimura, 28 May, 1988.
7) OS 10009, fruiting (3 specimens), M. Kajimura, 29 May, 1988.
8) OS 10010, fruiting (10 specimens), M. Kajimura, 9 June, 1988.
9) OS 10011, fruiting (10 specimens), M. Kajimura, 27 June, 1988.
10) OS 10012, sterile (8 specimens), M. Kajimura, 25 July, 1988.
11) OS 10013, sterile (5 specimens), M. Kajimura, 11 August, 1988.
12) OS 10014, sterile (7 specimens), M. Kajimura, 21 August, 1988.
13) OS 10015, sterile (11 specimens), M. Kajimura, 30 August, 1988.
14) OS 10016, sterile (8 specimens), M. Kajimura, 2 September, 1988.
15) OS 10017, sterile (6 specimens), M. Kajimura, 17 September, 1988.
16) OS 10018, sterile (6 specimens), M. Kajimura, 17 October, 1988.
17) OS 10019, sterile (4 specimens), M. Kajimura, 21 October, 1988.
18) OS 10020, sterile (5 specimens), M. Kajimura, 27 October, 1988.
19) OS 10021, sterile (6 specimens), M. Kajimura, 7 November, 1988.
20) OS 10022, sterile (6 specimens), M. Kajimura, 19 November, 1988.

21) OS 10023, sterile (9 specimens), M. Kajimura, 29 December, 1988.
22) OS 10024, sterile (10 specimens), M. Kajimura, 9 January, 1989.
23) OS 10025, sterile (11 specimens), M. Kajimura, 9 March, 1989.
24) OS 10026, sterile (17 specimens), M. Kajimura, 18 March, 1989.
25) OS 10027, sterile (9 specimens), M. Kajimura, 6 April, 1989.
26) OS 10028, sterile (10 specimens), M. Kajimura, 18 April, 1989.
27) OS 10029, fruiting (4 specimens), M. Kajimura, 28 April, 1989.
28) OS 10030, sterile (4 specimens), M. Kajimura, 7 May, 1989.
29) OS 10031, fruiting (7 specimens), M. Kajimura, 12 May, 1989.
30) OS 10032, fruiting (20 specimens), M. Kajimura, 23 May, 1989.
31) OS 10033, fruiting (7 specimens), M. Kajimura, 31 May, 1989.
32) OS 10034, fruiting (11 specimens), M. Kajimura, 23 June, 1989.
33) OS 10035, fruiting (6 specimens), M. Kajimura, 1 July, 1989.
34) OS 10078, sterile (10 specimens), M. Kajimura, 25 July, 1989.
35) OS 10079, sterile (6 specimens), M. Kajimura, 31 July, 1989.
36) OS 10080, sterile (4 specimens), M. Kajimura, 9 January, 1990.
37) OS 10081, sterile (5 specimens), M. Kajimura, 11 April, 1990.
38) OS 10082, sterile (3 specimens), M. Kajimura, 25 December, 1990.
39) OS 10083, fruiting (25 specimens), M. Kajimura, 23 May, 1992.

Distribution: Known only from the type locality.

Etymology: Varietal epithet refers to the Oki Islands, which is the type locality.

Vegetative structure

Thalli are usually 1–3.7 m in length (Figs 1, 2). Perennial holdfast is a small disc and less than 1 cm in diameter, which produces marginally some perennial prostrate rhizoidal filaments (Fig. 3) of 1–1.5 mm in diameter and 1–3 cm in length. Vegetative propagation of thallus frequently occurs from the prostrate rhizoidal filament (Fig. 3). The perennial stout main axis (Fig. 3) is cylindrical, erect, simple, short, 2–4 mm in diameter and 1–2 cm in length, which produces several annual principal branches (Fig. 3) in spiral order of arrangement. Principal branches are a few mm in diameter with 4–5 longitudinal grooves (Fig. 5), blunt edges, the frequent crookedness (Fig. 4) and spiral twists (Fig. 5). Principal branches leave their vestiges on the main axis after their perishing. The crookedness in the principal branch is usually positioned at nodes (Fig. 4). Lateral branches of the principal branch (Figs 1, 2, 4) are formed sparsely or frequently, arranged in spiral order and usually less than 15 cm in length. Numerous branchlets are formed also spirally on the lateral branch (Fig. 4). Leaves (Fig. 6) are shortly petiolate, lanceolate to linear, frequently asymmetrical by a longitudinal plane, gradually attenuated towards their base, frequently curved horizontally, less than 2.5 cm

in length, 4 mm in width, blunt at the apex, with no midrib, entire margin or sparse minute dentation which is more frequent in distal part of the leaf, arranged in spiral order in usual phyllotaxis of 1/3 throughout the plant, leave their vestiges after their perishing. Cryptostomata are evident in receptacles as well as in leaves and vesicles. Vesicles (Fig. 6) are formed abundantly, pyriform to fusiform, up to 6 mm in length and 3 mm in diameter, with a perishable filiform coronal leaf.

Reproduction

The plant is dioecious. Receptacles are cylindrical, simple, tapered towards the apex, shortly petiolate and arranged racemosely (Figs 7, 8) in distal part of principal branches as well as in lateral branches or branchlets. All the receptacles of both sexes are provided with a linear bracteal leaf. The male receptacles (Figs 7, 9) are 3–18 mm, 0.5–1 mm in length and diameter, but the female receptacles (Figs 8, 10) are 3–11 mm, 0.5–1 mm in length and diameter. Ostioles of the male conceptacles are irregularly shaped in surface view and 25–40 μm in diameter but those of the female conceptacles are orbicular to oval in surface view and 85–105 μm in long diameter. There is, however, frequently no external morphological distinction in receptacles between both sexes except the ostioles. The male conceptacles are 180–220 μm in long diameter, and the female conceptacles are 120–200 μm in long diameter containing some oogonia of *ca.* 80 μm in diameter (Figs 9, 10). Fruiting season of this new variety ranges from late April to early July.

Habitat

This new variety was growing on tuff bottom, stones and concrete surface at the depths ranging from 0.3 to 2 m in sublittoral region restrictedly to a completely

Figs 1–4. *Sargassum miyabei* var. *okiense* var. nov.

Fig. 1. Habit of female holotype specimen. Rule measuring 30 cm.

Fig. 2. Habit of male isotype specimen. Rule measuring 30 cm.

Fig. 3. Basal part of a fresh specimen collected on 23 May, 1992, showing a main axis (large arrow), a young main axis (small arrow) arising from rhizoid, rhizoids (arrowheads) and two principal branches (pb).

Fig. 4. Part of a fresh specimen collected on 23 May, 1992, showing the crookedness (arrowheads) in a principal branch.

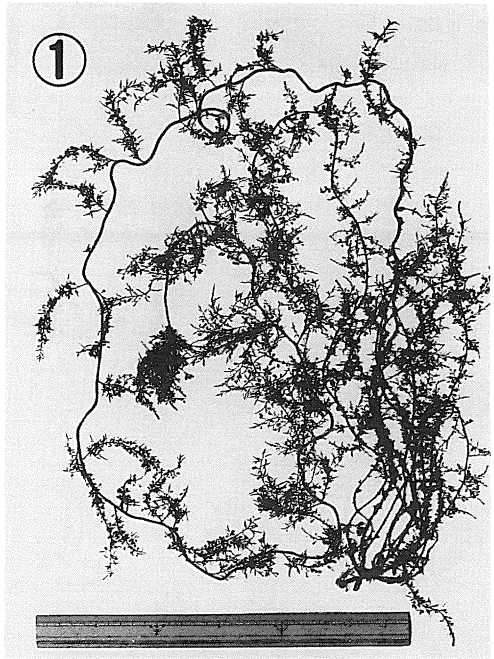
Figs 5–8. *Sargassum miyabei* var. *okiense* var. nov.

Fig. 5. Part of a fresh specimen collected on 23 May, 1992, showing the spiral twist and longitudinal grooves (arrowheads) in a principal branch.

Fig. 6. Part of a dried specimen collected on 1 January, 1989, showing the lanceolate leaves (large arrowheads) and vesicles with a filiform coronal leaf (small arrowheads).

Fig. 7. Part of a fresh male specimen collected on 23 May, 1992, showing male receptacles (arrowheads) arranged racemosely.

Fig. 8. Part of a fresh female specimen collected on 23 May, 1992, showing female receptacles (arrowheads) arranged racemosely.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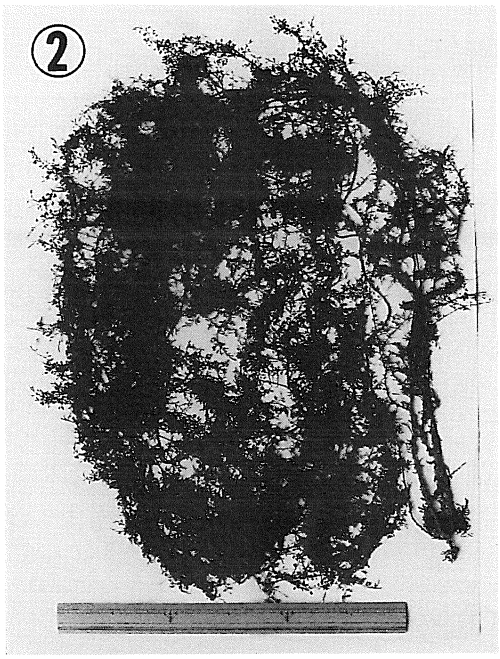
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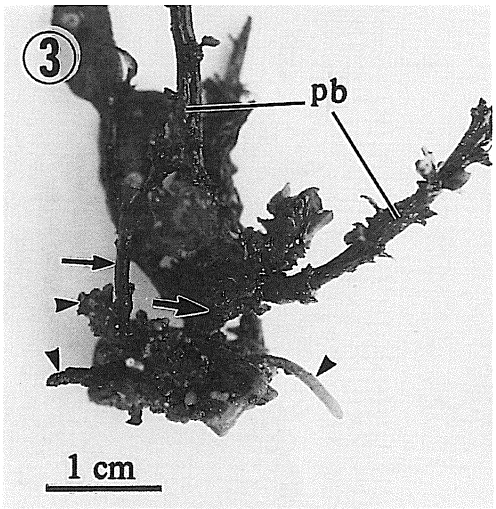
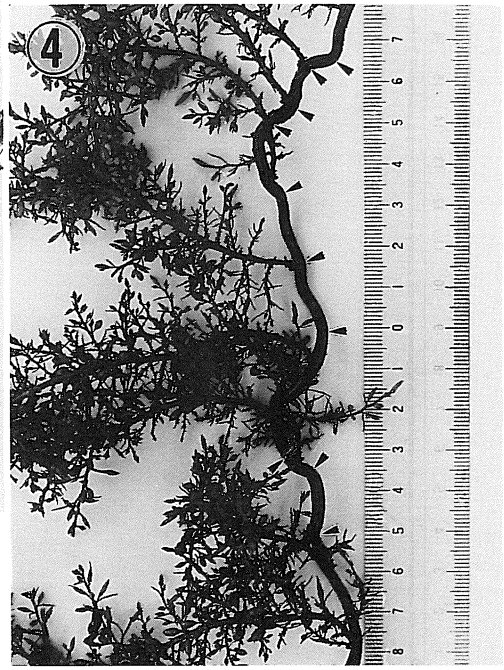

3
pb
1 cm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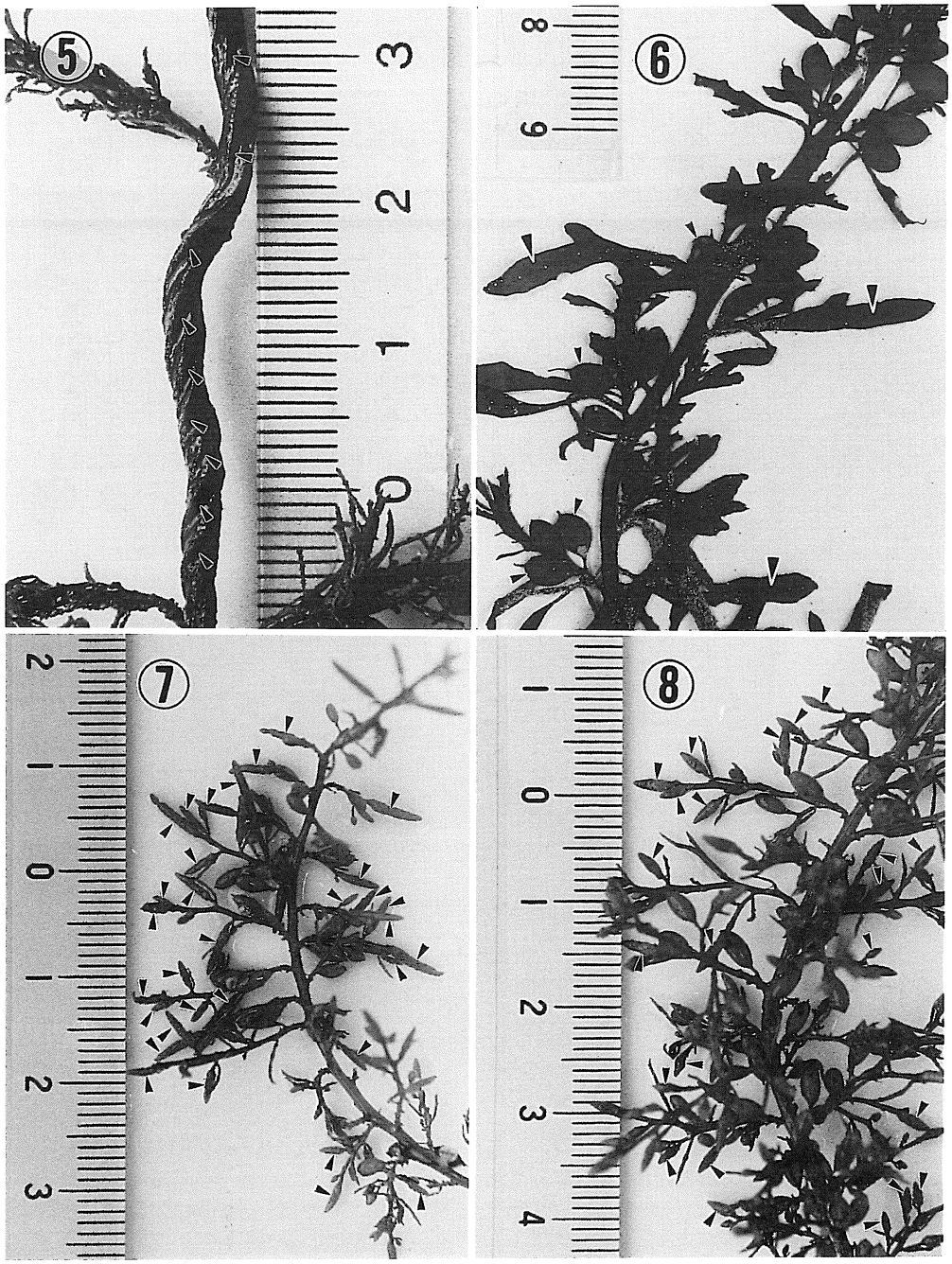
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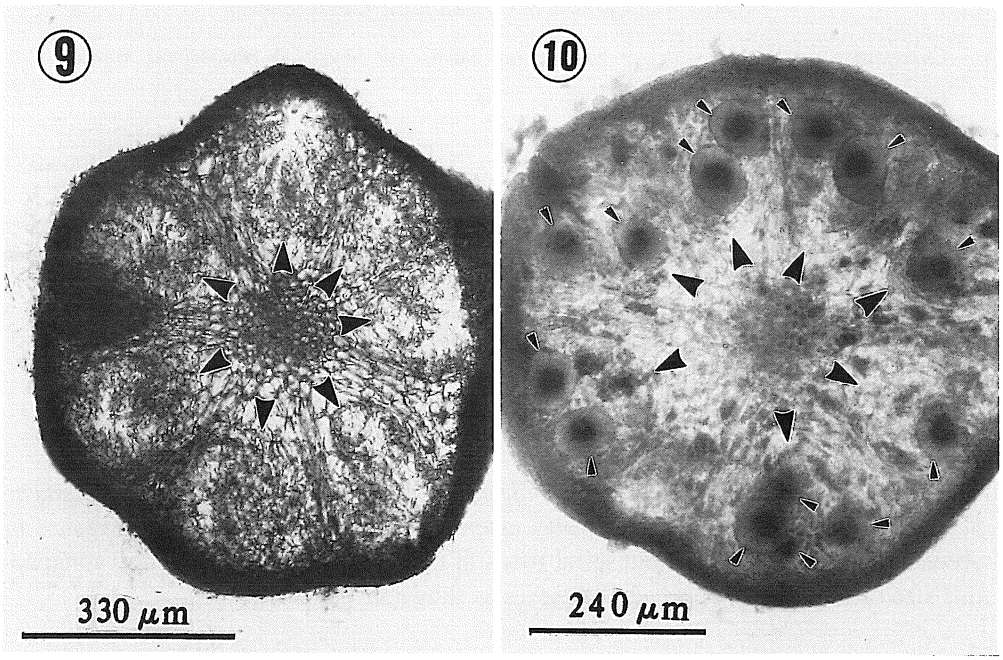

Figs 9, 10. *Sargassum miyabei* var. *okiense* var. nov.
Fig. 9. Part of the same specimen as Fig. 7, showing seven male conceptacles (arrowheads) in a cross section of a fresh male receptacle.
Fig. 10. Part of the same specimen as Fig. 8, showing seven female conceptacles (large arrowheads) containing one to several oogonia (small arrowheads) each in a cross section of a fresh female receptacle.

protected area where no evidence of underwater current was detected.

Remarks

Sargassum miyabei var. *okiense* var. nov. conforms to Yoshida's concept of *Sargassum miyabei* Yendo (Yoshida 1983) in that the holdfast is a small disc which produces prostrate rhizoidal filaments; the vegetative propagation occurs from the prostrate rhizoidal filament; the perennial main axis is cylindrical, erect, simple, short, which produces several principal branches in spiral order; the principal branch is angular and produces many lateral branches; leaves are shortly petiolate, at least lanceolate, also asymmetrical by a longitudinal plane, gradually attenuated towards their base, with no midrib and entire margin or sparse minute dentation which is more frequent in distal part of the leaf, and arranged spirally in phyllotaxis of 1/3 at least; vesicles are fusiform, attain the length of 6 mm, with filiform coronal leaf; cryptostomata are present at least in leaves and vesicles; the plant is dioecious; receptacles are cylindrical, tapered towards the apex and arranged racemosely.

Table I. Comparison of varieties in *Sargassum miyabei*.

Character	*S. miyabei* var. *okiense* var. nov.	*S. miyabei* var. *miyabei*[1]
Length of thalli	Usually 1–3.7 m	Less than 1 m
Crookednesses in principal branches	Present	Absent
Spiral twists in principal branches	Present	Absent
Size of receptacles	Male receptacles 3–18 mm in length and 0.5–1 mm in diameter; female receptacles 3–11 mm in length and 0.5–1 mm in diameter	Male receptacles 15–20 mm in length and less than 1.2 mm in diameter; female receptacles up to 10 mm in length and 1.2 mm in diameter

[1] Based on Yendo (1907) as *S. kjellmanianum,* Yoshida (1983) as *S. miyabei.*

However, *Sargassum miyabei* var. *okiense* var. nov. is, distinct from the autonym *Sargassum miyabei* Yendo var. *miyabei* essentially in the length of thalli, presence or absence of the crookedness and spiral twists in the principal branch, and also comparative size of receptacles between both sexes as shown in Table I.

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