



Studies on four new species of the malacocarpic *Sargassum* (Sargassaceae, Heterokontophyta) in China

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Abstract

In this paper, four new species of malacocarpic *Sargassum* are described: *S. fuliginosoides* Tseng et Lu sp. nov. is characterized by its discoid holdfast, the presence of the bulbs on the basal parts of the primary branches and very thick, lanceolate leaves. *S. gemmiphorum* Tseng et Lu sp. nov. is characterized by its conical holdfast, usually branched axis and very long, narrow, thin, denticulate leaves. *S. shandongense* Tseng, Zhang et Lu sp. nov. is characterized by its discoid holdfast, flattened primary branches, its leaves mostly entire or wavy at the margins and its racemose to paniculate receptacles. *S. qingdaoense* Tseng et Lu sp. nov. is characterized by the presence of the glandular dots on the ultimate branches and elongated lanceolate, acute, mostly wavy leaves.

Introduction

Members of the Malacocarpiceae Section of the subgenus *Sargassum* are characterized by their subracemose or racemose arranged smooth receptacles. In China, 15 species of Malacocarpic *Sargassum* have so far been reported (Tseng & Lu, 1992). In this paper, four new species are described. All materials examined are deposited at the Herbarium of the Institute of Oceanology, Academy of Sciences (AST) in Qingdao, China.

Description of the new species

1. *Sargassum fuliginosoides* Tseng et Lu sp. nov. (Fig. 1; Plate I: 1)

Species nova, *S. fuliginoso* Kuetzing proxima. Differt bulbis basi ramorum primariorum; foliis magnis, crassis, coriaceis marginibus integris; vesiculis obverse-ovatis vel ovatis stipitibus teretibus; et receptaculis dioeciis.

Holotype: AST 70-0047, collected by Liu Qingchen on April 24, 1970, in Huilai, Guangdong Province. Growing on the subtidal rocks below 0.5 m.

Fronde dark brown, to 70 cm in height. Holdfast discoid, 1 cm in diameter. Main axes cylindrical, 2 cm

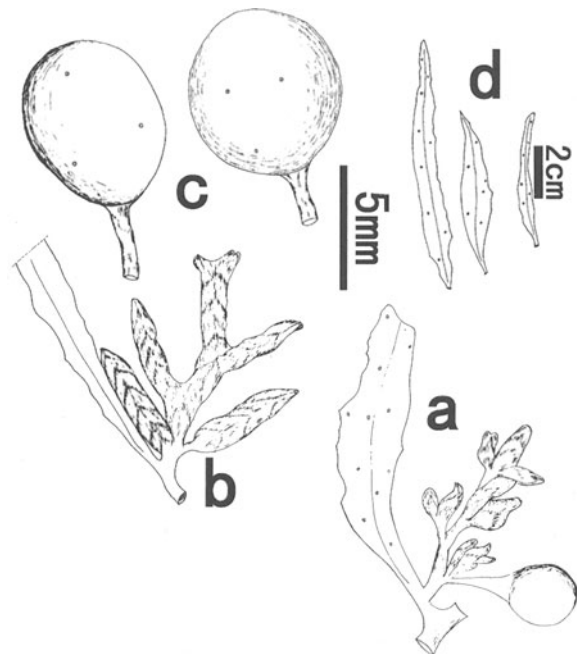


Figure 1. *Sargassum fuliginosoides* Tseng et Lu sp. nov. (Based on AST 70-0047): a. female receptacular branches with leaves, vesicles and receptacles; b. male receptacular branches with leaves and receptacles; c. vesicles; d. leaves.

in height, 3 mm in diameter, verrucose on the surface, usually 2–4 primary branches arising from upper position of the axis. Primary branches compressed or ancipate below, subcylindrical and cylindrical in middle and upper portion, smooth on the surface, to 68 cm long, 3 mm wide, often with 2–3 bulbs at the base of the primary branches. Secondary branches arising from the axils of the primary branches, subcylindrical or cylindrical, to 25 cm long, about 1–1.2 mm in diameter, smooth, at intervals of 2–3 cm. Ultimate branchlets shorter and slender, cylindrical, about 1–1.5 cm long, less than 1 mm in diameter, beset with leaves, vesicles and receptacles. Leaves on the primary branches large and thick, lanceolate, about 8–10 cm long, 8–10 mm wide, wavy, sometimes incomplete at the margins, acute at the apex, obliquely cuneate at the base, with conspicuous percurrent midrib, obscure cryptostomata irregularly scattered on both sides of the midrib. Leaves on the secondary branches similar to those on the primary branches in shape, only shorter and narrower, to 5 cm long, 5–7 mm wide, entire at the margins: leaves on the ultimate branchlets very short and slender, narrow-lanceolate, or linear, about 3–4 cm long, 2–2.5 mm wide, entire at margins below, only few denticulate at margins above. Most vesicles ovate or obovate, rounded at the apex, only a few cryptostomata on the surface, to 6 mm long, 5 mm in diameter, some vesicles smaller, to 3 mm long, 2 mm in diameter, with cylindrical stipes, its upper parts larger than below, to 7 mm long.

Plant dioecious. Female receptacles conical, verrucose on the surface, simple or 2–3 forked, about 3–4 mm long, 1.5–2.0 mm in diameter, usually forked at the apex; male receptacles longer, cylindrical, smooth, usually 2–3 times forked with slender stipe, to 10 mm long, 1.2 mm in diameter. Several receptacles racemously arranged on fertile branches.

This new species is mainly characterized by its compressed primary branches, ancipate below, subcylindrical or cylindrical above; some bulbs at the base of the primary branches; leaves on the primary branches lanceolate, very thick and large, wavy, sometimes incomplete at the margins; vesicles obovate or ovate with cylindrical stipes; plant dioecious, female and male receptacles cylindrical, smooth, only female receptacles verrucose on the surface, male receptacles longer than female receptacles.

This new species is nearest to *S. fuliginosum* Kuetzing (1849). It differs by having bulbs at the base of primary branches; large, thick, coriaceous leaves with

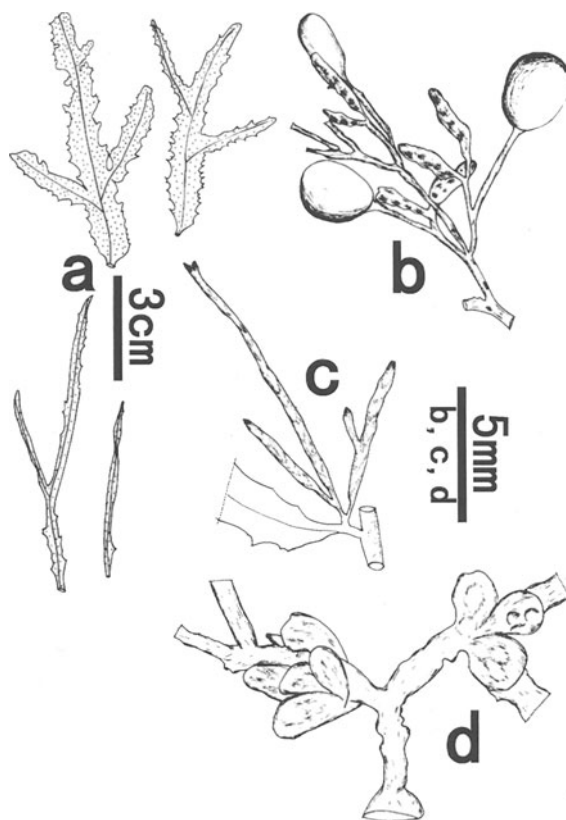


Figure 2. *Sargassum gemmiphorum* Tseng et Lu sp. nov. (Based on AST 55-2112): a. leaves; b. vesicles and female receptacles, c. male receptacles; d. holdfast and primary axis with bulbs.

entire margins; obovate or ovate vesicles with terete stipes; and dioecious receptacles.

2. *Sargassum gemmiphorum* Tseng et Lu sp. nov. (Figure 2; Plate I: 2)

Species nova, *S. bulbifero* Yoshida affinis. Differt haptero conico, ramis primariis complanatis; et foliis tenuibus, angustis marginibus denticulatis.

Holotype: AST 55-2112, collected by Zheng Shudong on May 11, 1955, at Fangchen beach, Guangxi Province. Growing on the subtidal rocks.

Fronds yellow brown, more than 55 cm in height. Holdfast conical, 1 cm in diameter. Axes cylindrical, to 2.5 cm long, 2 mm in diameter, simple or sometimes 1–2 forked, verrucose on the surface, several primary branches arising from the upper parts of the axes, with leaves dropped. Primary branches flattened below, compressed above, smooth, to 52 cm long, 2 mm wide, with bulbs arising from the base of

the primary branches, some subspherical, other oblong, 5 mm long, 4 mm wide, verrucose, several gathered, flesh. Secondary branches arising from axils of the primary branches, compressed, short, to 13 cm long, 1.2 mm wide, at intervals of 2–3 cm. Ultimate branches shorter, slender, with a few not raised glands on the surface, to 3 cm long, 1 mm in diameter, beset with leaves, vesicles and receptacles. Basal leaves long-lanceolate, thin and membranous, usually 2–3 pinnately forked, to 7 cm long, 5 mm wide, acute at the apex, more regularly cuneate at the base, with percurrent midrib slightly raised, conspicuous cryptostomata, mostly in two series, arranged on both sides of the midrib, denticulate at the margins. Upper leaves slender, linear, sometimes one or twice pinnately divided, to 5 cm long, 2–5 mm wide. Vesicles small, subspherical when adult or ovate when young, about 3–4 mm in diameter, rounded at apex, with 2–3 cryptostomata on the surface, and slender, cylindrical stipe, 6 mm long, 1 mm in diameter.

Plant dioecious. Female receptacles conical, smooth, verrucose on the surface, to 4 mm long, 1.3 mm in diameter, simple or forked; male receptacles very long, cylindrical smooth, 20 mm long, 1 mm in diameter, simple, sometimes forked, female and male receptacles racemously arranged on fertile branchlets.

This new species is mainly characterized by its conical holdfast, cylindrical axes, often 1–2 divided, verrucose on the surface; subspherical or oblong bulbs in the base of the primary branches; flattened primary branches; ultimate branchlets with a few not raised glands; thin and narrow leaves, often 1–2 pinnately divided, denticulate at the margins; dioecious plant with smooth, receptacles, and very long male receptacles.

This new species is closely related to *S. bulbiferum* Yoshida (1994: 48). It differs by its conical holdfast; flattened primary branches; and thin, narrow leaves with denticulate margins.

3. *Sargassum shandongense* Tseng, Z. F. Zhang et Lu sp. nov. (Fig. 3, Plate I: 3)

Ad *S. paniculato* J. Agardh aemulans, differt ramis primariis complanatis et foliis basalibus saepe pinnatim divisis.

Holotype: AST 54-0339c, collected by Zhang Jingfu on September 17, 1954, on the beach of Daheilan Qingdao City, Shandong Province. Growing in the intertidal rock pool and on subtidal rocks.

Fronds dark brown when dried, to 50 cm in height. Holdfast discoid, verrucose on the surface, very ir-

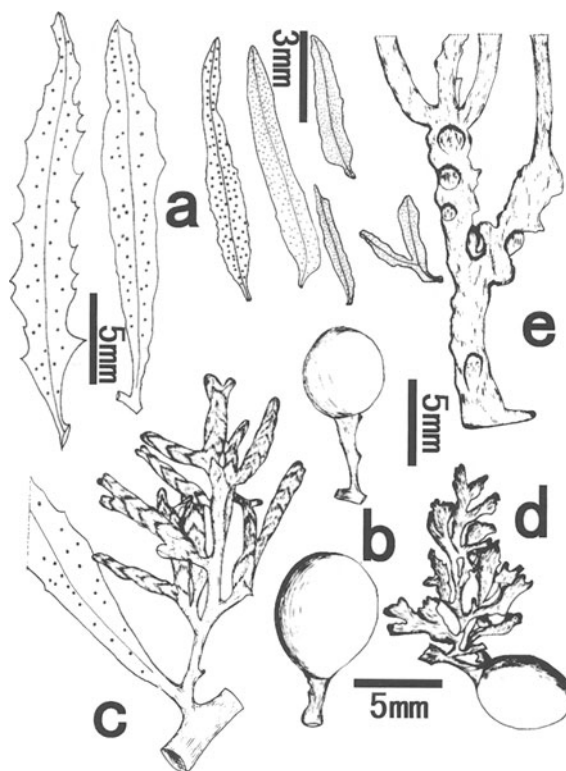


Figure 3. *Sargassum shandongense* Tseng, Z.F. Zhang et Lu sp. nov. (Based on AST 54-0339c): a. leaves; b. vesicles; c. male receptacles; d. female receptacles; e. primary axis.

regular at the margins, 2–2.5 cm in diameter, giving rise to several axes from the same holdfast. Axes cylindrical, sometimes divided, verrucose on the surface, to 2 cm long, 2.5 mm in diameter. Primary branches arising from upper part of the axes, flattened below, compressed or subcylindrical above, smooth on the surface, to 48 cm long, 2 mm wide: Secondary branches subcylindrical, smooth, arising from the axil of the primary branches, shorter, to 8 cm long, 1.3 mm diameter: Ultimate branches cylindrical, very short, about 2–3 cm long, 1 mm in diameter, beset with leaves, vesicles and receptacles. Basal leaves large, 1–2 pinnately divided, alternate, to 13 cm long, 4 mm wide, wavy or few dentate at the margins, with conspicuous percurrent midrib and slightly raised, obscure cryptostomata. Leaves on the primary branches lanceolate, some pinnately divided, to 5 cm long, 7 mm wide, acute at the apex, cuneate at the base, wavy or entire, sometimes slightly dentate at the margins; with conspicuous percurrent midrib and raised cryptostomata irregularly arranged on both sides of the midrib. Leaves on the secondary and ultimate branches

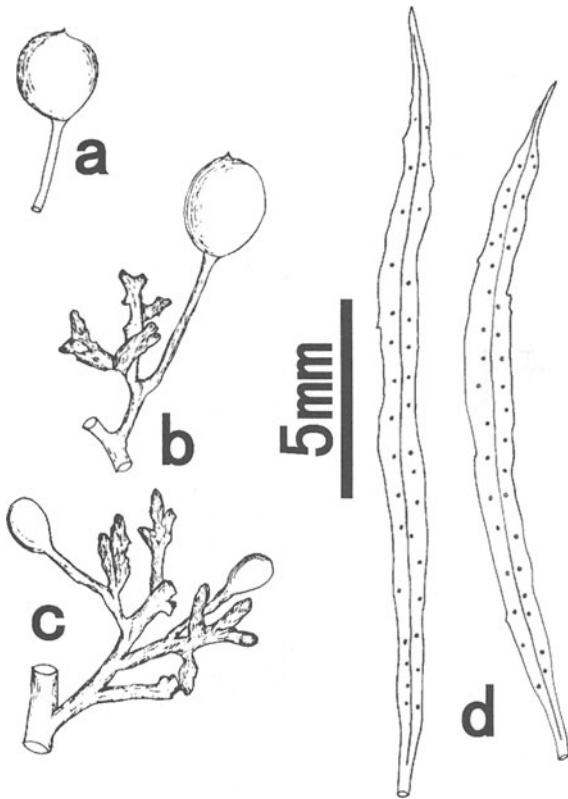


Figure 4. *Sargassum shandongense* f. *linearium* Tseng, Z. F. Zhang et Lu f. nov. (Based on AST 54-0338a): a. vesicle; b. female receptacles; c. male receptacles; d. elongated leaves.

very similar to those of the primary branches in shape, only smaller in size, sometimes sparsely denticulate at the margins. Vesicles spherical or subspherical, to 5 mm in diameter, rounded at the apex, with a few cryptostomata on the surface and mostly cylindrical stipes, usually longer than the vesicles, to 6 mm long, 1 mm in diameter.

Plant dioecious. Female and male receptacles smooth, racemously or paniculately arranged on fertile branches. Female receptacles conical, verrucose on the surface, forked, to 10 mm long, 1.2 mm in diameter; male receptacles cylindrical, smooth, forked, to 15 mm long, 1 mm in diameter,

This new species is mainly characterized by its discoid holdfast; primary branches flattened below, compressed above; basal leaves large, sometimes pinnately divided, upper leaves lanceolate, mostly wavy or entire.

It is closely related to *S. paniculatum* J. Agardh (1848: 315; 1889: 122). It differs by its flattened

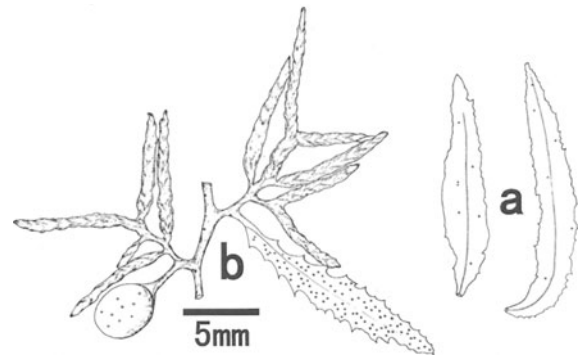


Figure 5. *Sargassum qingdaoense* Tseng et Lu sp. nov. (Based on AST 49-0002): a. leaves on the primary branches; b. fertile branchlet with male receptacles, leaves and vesicles.

primary branches and often pinnately divided basal leaves.

Forma *linearium* Tseng, Z. F. Zhang et Lu forma nov. (Fig. 4)

Foliis linearis, 9 cm longis, 4 mm latis, crassis, marginibus integris vel undulatis.

Holotype: AST 54-0338a, collected by Z. F. Zhang on August 14, 1954, at beach of Dahelan Qingdao, China. Growing on subtidal rocks.

This new form, *linearium*, is mainly characterized by its very narrow leaves, thick, linear, to 9 cm long, 4 mm wide, with obscure midrib and dark in color when dried.

Plant dioecious. Female and male receptacles and vesicles similar to *S. shandongense* Tseng, Z. F. Zhang et Lu.

4. *Sargassum qingdaoense* Tseng et Lu sp. nov. (Fig. 5; Plate II: 1, 2)

Species nova, *S. siliquoso* J. Agardh affinis. Differt longissimis, magnis, lanceolatis foliis ramis primariis, marginibus plerumque undulatis vel interdum denticulatis; foliis superis parvis, lanceolatis, marginibus denticulatis; omnibus foliis apicibus acutis et conspicue obliquis.

Holotype: AST 49-0002, collected by C.K. Tseng, August 11, 1949, Xiaqingdao Qingdao City, Shandong Province.

Fronds yellow brown, to 70 cm in height. Axes cylindrical, verrucose on the surface because of the scar of the basal leaves. Primary branches arising from the upper part of the axes, cylindrical, smooth, to 68 cm long, 2 mm in diameter. Secondary branches very similar to the primary branches in shape, but shorter and slender, alternately arising from the axil of the

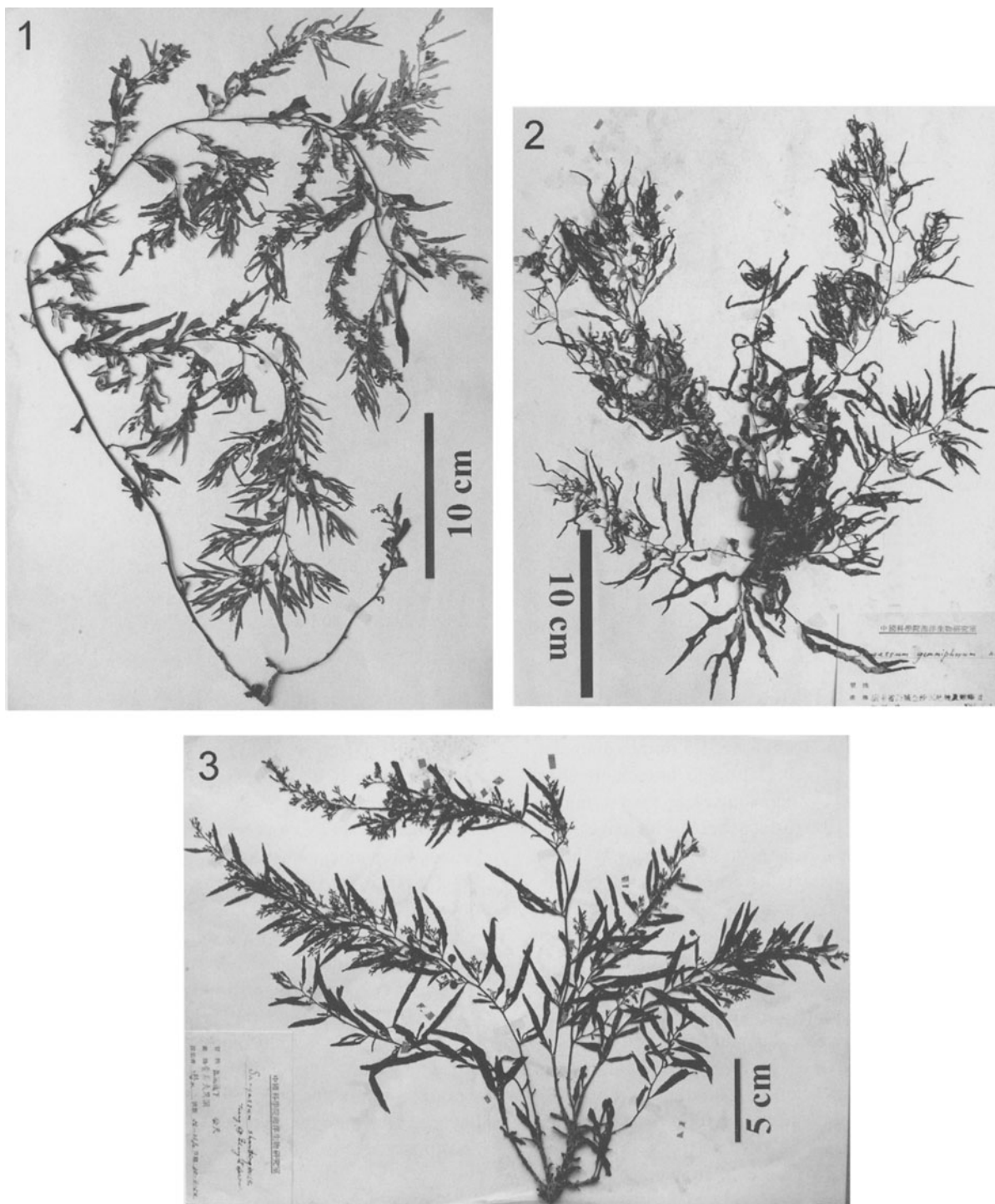


Plate 1. 1. Habit of *Sargassum fuliginosoides* Tseng et Lu sp. nov. (AST 70-0047). 2. Habit of *Sargassum gemmiphorum* Tseng et Lu sp. nov. (AST 55-2112). 3. Habit of *Sargassum shandongense* Tseng, Z.F. Zhang et Lu sp. nov. (AST 54-0339c).

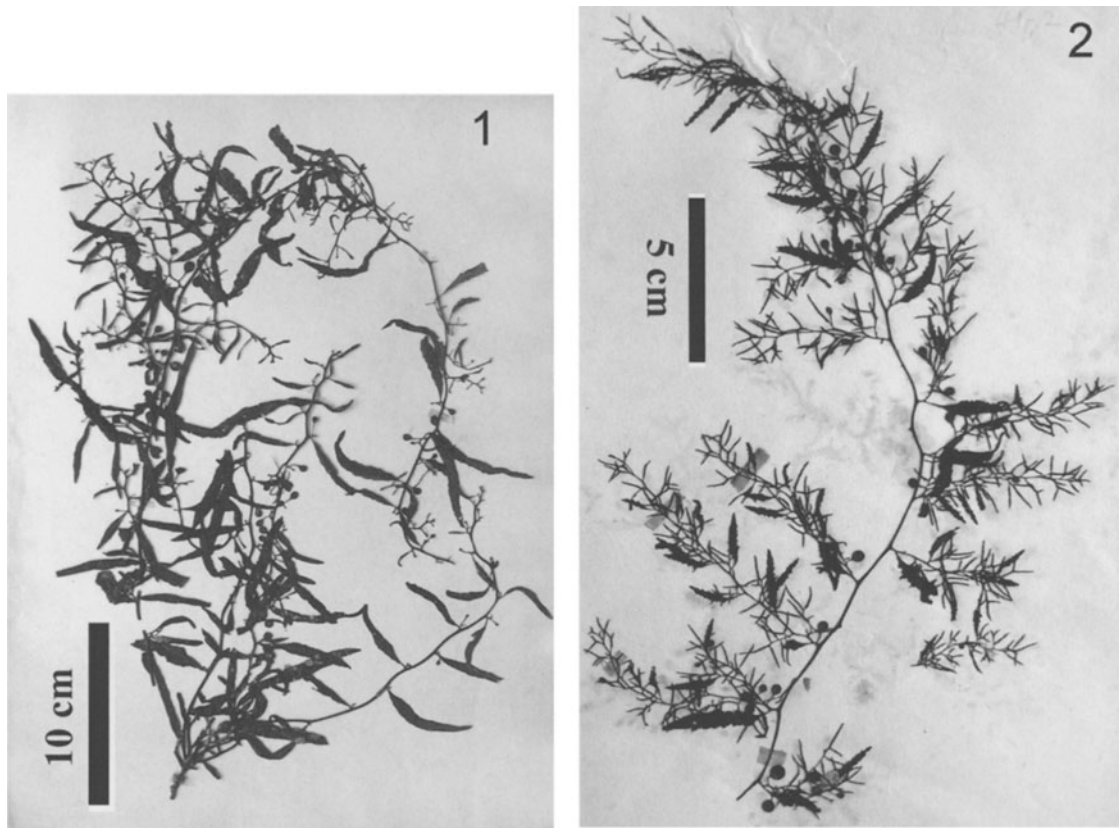


Plate II. 1. Habit of *Sargassum qingdaoense* Tseng et Lu sp. nov. (AST 49-0002). 2. Upper branches of *Sargassum qingdaoense* Tseng et Lu (AST 49-0002).

primary branches, to 10 cm long, 1.5 mm in diameter, at intervals of 2–2.5 cm. Ultimate branchlets short and slender, about 1–2 cm long, less than 1 mm in diameter, glands on the surface, beset with leaves, vesicles and receptacles. Leaves on the primary branches larger, thicker, conspicuously obliquely lanceolate, about 4–5 cm long, 6–8 mm wide, acute at apex, with conspicuously oblique base, very asymmetrical, wavy or irregularly denticulate at the margins; conspicuous percurrent midrib, slightly raised on the surface, cryptostomata irregularly arranged on both sides of the midrib. Leaves on secondary and ultimate branches very similar to the leaves on the primary branches in shape, but shorter and slender, about 2–3 cm long, 3–4 mm wide, denticulate at the margins, acute at apex, obliquely asymmetrical at base with percurrent midribs. Vesicles spherical, rounded at apex, to 5 mm in diameter, with only a few cryptostomata on the surface and mostly terete stipes, about 4–5 mm long.

Plant dioecious. Male receptacles elongate, cylindrical, siliquose, 2–3 forked, about 10–15 mm

long, 0.4–0.6 mm in diameter, verrucose on the surface, racemosely arranged on fertile branches; female receptacles not found.

This new species is characterized by its elongate primary branches with leaves large and thick, obliquely lanceolate, acute at apex, very conspicuously oblique base; its glandular dots on the ultimate branchlets and its very long, siliquose, smooth, racemosely arranged male receptacles.

This new species is most closely related to *S. siliquosum* J. Agardh (1848: 316; 1889: 121). It differs by its very long, large, lanceolate leaves on the primary branches, with mostly wavy, sometimes denticulate margins; small, lanceolate, upper leaves with denticulate margins; all the leaves with acute apices, and conspicuously oblique.

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