〈Article〉

Notes on Marine Algae from Korea (I)

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韓國產 海藻類에 關한 註解 (I)

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ABSTRACT

In the present paper, seven marine algae collected from the coasts of Korea are described. The two blue-green algae, *Coccochloris stagnina* Sprengel and *Entophysalis conferta* (Kuetz.) Drouet and Daily, one brown alga, *Ralfsia verrucosa* (Aresch.) J. Ag., and the two red algae, *Enelittosiphonia hakodatensis* (Yendo) Segi and *Symphyocladia pennata* Okamura, are recorded newly in our country. The other two blue-green algae, *Anacystis dimidiata* (Kuetz.) Drouet and Daily and *Phormidium tenue* (Meneghini) Gomont, are recorded for the first time from marine water in our country.

Coccochloris stagnina Sprengel

(Text-fig.: pl. 1, fig. 7)

seq. Drouet and Daily (1956) Rev. Coccoid Myxophy., p. 15, figs. 145—163; Umezaki (1961) Mar. Blue-green Alg. Jap., p. 10, pl. 1, fig. 1

Korean Name: 남구슬말 (nom. nov.)

Plant growing on soil, numerous celled in a colony, globular to irregular in form, microscopic to macroscopic, aeruginous or bright to dark blue-green, gelatinous sheath hyaline, thick or thin; solitary cells elliptical to ovoid or almost round, homogeneous in content, bright blue-green in color, gelatinous sheath thin, sometimes scarcely distinguishable, 3.0—4.3μ broad, 3.5—5.2μ long.

Habitat: Growing on rocks, or sandy and muddy bottoms in upper littoral zone.

Distribution: Cosmopolitan.

Material: Subpo-ri, Tokchok-island(May 2, 1971).

This plant is recorded for the first time in Korea. It was isolated from sandy and muddy soil collected in the upper littoral zone. The plants were found among the filaments of *Phormidium tenue*, and mingled frequently with *Anacystis dimidiata*. According to Umezaki(1961), they grow in summer to early autumn and are found also in shallow fresh water, in lakes and ponds as the floating state, and occasionally in brackish water.

Anacystis dimidiata (Kuetz.) Drouet and Daily

(Text-fig.: pl. 1, figs. 8—11)

Drouet and Daily (1952) A Synopsis Coccoid Myxophy., p. 221; *ditto* (1956) Rev. Coccoid Myxophy., p. 70, figs. 100—107; Umezaki (1961) Mar. Blue-green Alg. Jap., p. 11, pl. 1, fig. 3

Korean Name: 네쪽남색말 (nom. nov.)

Plant growing on soil, 2—4 (—6) celled in a

colony, microscopic, aeruginous to blue-green or olive-green, 65—120 μ in diam., gelatinous sheaths hyaline, thin or thick, frequently lamellate; cells almost spherical in single state, becoming hemispherical to truncate-globular after division, with respective and common sheaths in a colony, containing fine and dense granules, sometimes with several large vacuoles, 34—45μ in diam.

Habitat: Growing on rocks, or sandy and muddy bottoms in upper littoral zone.

Distribution: Cosmopolitan.

Material: Suhpo-ri, Tokchok-island(May 2, 1971).

The present alga was isolated from the same sandy and muddy soil from which *Coccochloris stagnina* was isolated. The plants were found here and there in groups among the filaments of *Phormidium tenue*. Sometimes, they are mingled with a colony of *Coccochloris stagnina* among the same filaments.

In fresh water, this species was reported without description by Chung et al(1968), Chung and Kay(1969) from Han-river, and by Chung (1970) from Chilgock, etc., under the name *Chroococus turgidus* Naegeli.

Entophysalis conferta (Kuetz.) Drouet and Daily (Text-fig.: pl. 1, figs. 1—6)

Drouet and Daily(1948) Nom. Transf., p. 79; Umezaki (1961) Mar. Blue-green Alg. Jap., p. 18, pl. 2, fig. 2

Korean Name: 바위수염흑 (nom. nov.)

Plant epiphytic, unicellular or many celled in a colony, crustaceous or globular in form, microscopic to macroscopic of a few millimeters in diam., aeruginous, dark green to blue-green, gelatinous sheaths hyaline, thin or thick; solitary cells spherical, oblong, ovoid, pyriform, or polyhedral by mutual pressure, homogeneous in content, aeruginous, rarely olive-green, 2—5μ broad and long, or 4—6μ broad and 8—13μ long; endosporangia spherical, oblong, ovoid, or pyriform, 13—18μ broad, 22—32μ long, containing numerous spores of about 2μ in diam.

Habitat: Epiphytic on other macro-algae in littoral zone.

Distribution: Cosmopolitan.

Material: Mosulpo, Cheju-island (July 20, 1970).

This alga is recorded for the first time in Korea. As enumerated by Umezaki (1961), the species was reported under many different names. Our plants were found as the *Dermocarpa*-type on *Hizikia fusiforme* and the *Oncobyrsa*-type on *Myelophycus caespitosus* (cf. Tokida 1930, p. 523; Okamura 1936, p. 909). The former is mostly mature with endosporangia, forming round to irregular crustaceous circle on the host surface. The cells are arranged in a single row, erecting themselves tightly with mutual support. The latter, on the other hand, is mostly sterile, making a globular to semi-globular form of a few millimeters in diameter. Frequently they are aggregated in a mass, as shown by Okamura (l. c., fig. 1). The central portion of a globule is empty, or filled with gelatinous matrix. The cells of the *Oncobyrsa*-type are rather small, and polyhedral because of mutual pressure.

In maturation, the fertile cell enlarges almost 2—3 times in breadth and length. A thick gelatinous sheath covers the endosporangia. After full maturation of the sporangia, more than fifty spores can be counted from a lateral view under the microscope.

Because of limited investigations of marine blue-green algae in Korea, this cosmopolitan species is not yet well known. It is expected to be found more commonly along the coasts of our country.

Phormidium tenue (Meneghini) Gomont (Text-fig.: pl. 1, fig. 12)

Gomont (1892) Monograph. Oscillariées, p. 169, pl. 4, figs. 23—25; Umezaki(1955) Mar. Cyanophy. Shima Penn., p. 210, fig. 2A; *ditto* (1961) Mar. Blue-green Alg. Jap., p. 60, pl. 9, fig. 5

Korean Name: 가는조로니더움 (nom. nov.)

Plant growing on soil, multicellular, filamentous, expanded, forming thin membrane, blue-green to dark blue, with thin gelatinous sheath; filaments

slender, densely intricate, not torulose, much elongate, without branching, 1.7—2.2μ in diam., pale to bright blue-green, sheaths hyaline, thin, sometimes scarcely distinguishable, apices straight, mostly attenuate slightly, with round or sometimes acute tips, capitate; cells 3.4—5.2μ long, 1.5—3 times as long as broad, homogeneous in content, with clear and slighily constricted septum.

Habitat: Growing on rocks, or sandy and muddy bottoms in upper littoral zone.

Distribution: Cosmopolitan.

Material: Suhpo-ri, Tokchok-island(May 2, 1971).

This alga was also isolated from the same sandy and muddy soil from which *Coccochloris stagnina* and *Anacystis dimidiata* were isolated. As mentioned by Umezaki (1961), the plants are characteristic in forming thin membranes along the edges of glass-vessels, and also over the soil surface in culture. They are found commonly in fresh and thermal waters, and terrestrially, but rather rarely in marine water.

In fresh water, the present species was reported previously without description by Chung (1962) and Chung et al (1968) from Seoul and Han-river.

Ralfsia verrucosa (Areshoug) J. Ag.

(Text-fig.: pl. 2, figs. 1—6)

J. Ag. (1848) Spec. Alg., Vol. 1, p. 62; Yendo (1918) Notes Alg. new Jap. VIII, p. 65

Cruoria verrucosa Aresch. in Linnaea (1843) p. 264, pl. 9, figs. 5, 6

Korean Name: 바위딱지 (nom. nov.)

Plant flattened, crustaceous, adhering firmly without rhizoid to substrata by whole lower surface, more or less circular in outline, broadly lobed at margin, about 2—3 cm in diam., 140—290μ thick; vegetative filaments almost horizontally stretched toward margin in lower portion, erect to surface with arch-formed cell rows in upper portion, tightly cohering one another, erect filament composed of 6—9 cells of 1/2—2 times as long as broad, branching dichotomously, with 8.5—10.4μ broad cells, densely pigmented, lower horizontally stretching filament composed of 4—6 rows of cells vertically, with 8.5—13.5μ broad and 16—45μ long cells, more or less hyaline in content; hairs developing from lower portion of erect filaments, scattered solitarily; reproductive organs not found; color olive brown in fresh material; specimen not adhering to paper.

Habitat: Growing on rocks and shells, etc., in middle and lower littoral zone.

Distribution: Atlantic Coast of North America and Europe, Mediterranean Sea, Alaska to California, Kamtschatka, Saghalien, Hokkaido and Western Coast of Korea.

Material: Chochi-island (July 30, 1969).

This genus is reported for the first time in Korea. Our plants were found on the shells of oysters. It is characteristic that the frond is attached firmly without rhizoids to the substratum by the whole lower surface. Compared with the plants reported by Okamura (1936, p. 143) and Setchell and Gardner (1925, p. 497), our plants seem to be rather small.

In anatomical observation, the horizontally stretched basal portion consists of radially arranged elongated cells towards the margin. These cells contain abundant fucosan-vesicles of which diameter is about 1.7—2.6μ (cf. Fritch 1945, p. 31), and cohere very tightly to one another. The erect filament branches repeatedly and dichotomously towards the surface. The cells of erect filaments contain densely packed chromatophores. The fucosan-vesicles are seldom found in them, except in the lower cells. The cell divisions are limited to the superficial cells.

In old thalli, secondary growth occurs from the superficial cells. As it is initiated here and there over the surface, the thickness of the thallus becoming rather irregular at the beginning. The secondarily developed layer becomes quite similar in appearance to the primary one. It is easily mistaken as two fronds that are

overlapped one on the other. The boundary between the two layers is very distinct. Sometimes, the secondary growth occurs only in a definite area, where there is formed a mountainous protrusion with a thickness of more than 360μ.

Hairs are solitary and seldom found. They are developed from the lower cells of an erect filament. From a cell a hair initial is divided subterminally, and grows by repeated transverse divisions of the basal cell. It curves frequently inwards when the hair protrudes out of the thallus surface.

Unfortunately, our plants were all sterile. According to Kuchuck (1894, p. 224), Setchell and Gardner(1. c.) and Okamura(1. c.), zoosporangia are ovoid to pyriform, and 15—25μ broad and 65—80μ long, while De Toni (1895, p. 312) mentioned them as 15—30μ broad and 65—80—100μ long. Gametangia are short and terminal. Both the reproductive organs are found on the same individuals, disposed in sori. The species is expected to occur more commonly on the coasts of Korea, considering its world-wide distribution.

Enelittosiphonia hakodatensis (Yendo) Segi

(Text-fig.: pl. 1, figs. 16—19; pl. 3, figs. 1—4)

Segi(1949) System. posit. *P. hakodatensis* from Jap., p. 134—139, figs. 1—3

Polysiphonia hakodatensis Yendo (1920) Nov. Alg. Jap. Decas III, p. 7; Inagaki (1933) Oshorowan no Koso., p. 62

Korean Name: 바퀴말 (nom. nov.)

Plant caespitose, a few cm high, epiphytic on other algae with rhizoids, with creeping and erecting filaments, dorsiventral, cylindrical; creeping filament straight, attenuate to terminal portion, basal segments 160—200μ broad, 200—450μ long, terminal segments 40—80μ broad, 80—160μ long, erect filament developing from node of creeping filament at intervals of 2 (—3—6) segments, in outgrowth, with short and long branches, short branches definite, simple, obtuse at apex, 45—55μ broad, 250—500μ long, with 10—14 segments, long branches ramifying several times, attenuate to apex, secund and involute in terminal portion, 30—60μ broad, 500—1300μ long, with 20—50μ long segments; segments ecorticate throughly, with 9 pericentral cells surrounding 1 central axis; trichoblasts multicellular, issuing from terminal portion of erect filament, in outgrowth, at intervals (2—) 3 segments apart, 1/2—1/4 in divergence, ramifying 2—3 times, (10—) 15—25μ broad, (80 —) 120—400μ long, hyaline in content; rhizoids issuing indefinitely from pericentral cells of creeping and erect filaments, unicellular, frequently terminate in disc shape, sometimes developing in group at definite area; reproductive organs not found; color dark brown in fresh material; specimen adhering to paper firmly.

Habitat: Epiphytic on other algae in littoral zone.

Distribution: Hokkaido and Northern Part of Honshu, Japan, Saghalien and Eastern Coast of Korea.

Material: Kangnung (April 27, 1969).

This monotypic species is recorded for the first time in Korea. The plants were epiphytic on a holdfast fragment of *Sargassum sp.* This boreal species was assigned first to *Polysiphonia* by Yendo, and then removed by Segi to a newly established genus, *Enelittosiphonia*. They have been found only in the northern part of Japan and Saghalien, etc. The occurrence of the species from the eastern coast of our country is to be expected however, since that area faces the Japan Sea which continues to the western part of Hokkaido.

Unfortunately our plants, found cast ashore, are sterile and few in number. They compare well, however, to the original description of the species. The present alga is characteristic in that the outer branches are secund and involute.

According to Segi, the species is monoecious. The cystocarps are developed on outer branches, grouping in few to several, and are round to urceolate. They are about 248—270μ in diam., or 255—285μ×275—315μ in size. Spermatangia are developed from the basal part of the trichoblast and are oblong to cylindrical with the sterile tip. They are about 90—120μ×540—600μ in size. Tetrasporangia are developed in the definite branches and divided cruciately, tetrahedrally or irregularly. They are round to elliptical and 45μ in diam., or 45×53μ in size.

Symphyocladia pennata Okamura

(Text-fig.: pl. 1, figs. 13—15; pl. 2, figs. 7—10; pl. 3, figs. 5—7)

Okamura (1923) Icones Jap. Alg. IV, p. 186, pl. 196, figs. 7—9; pl. 197, figs. 9—13

Pterosiphonia parasitica (non Falkenb.) Yendo (1918) Notes Alg. new Jap. VIII, p. 78

Korean Name: 애기뵤라색우무 (nom. nov.)

Plant flat, filiform, membranaceous, alternately to pinnately decompound, procumbent to decumbent or erect, epiphytic on other algae with rhizoids, about 1 cm high, 160—330μ broad, 55—140μ thick, ecorticate throughly, branching 4—6 times repeatedly; branches issuing distichous, alternate to pinnate, broad or slender, patent to widely parted, laciniate more or less, outer branches long and slender, provided with denticulate branchlets, about 110μ broad, frequently adhering one another with rhizoids; rhizoids developing from under-surface of basal and other indefinite portions, frequently occurring in groups, unicellular, filamentous, terminating in disc form, 35—45μ broad, 250—350μ long; hairs entirely wanting; tetrasporangia occurring outer branches along lacininae, arranging in a longitudinal row, dividing tetrahedrally, almost round, about 45μ in diam.; sexual reproductive organs unknown; color reddish purple; specimen not adhering to paper.

Habitat: Attaching on other algae in littoral zone.

Distribution: Japan and Cheju-island of Korea.

Material: Mosulpo, Cheju-island (July 30, 1970).

This alga is recorded for the first time in Korea. It was found among *Corallina pilulifera*, *Acrosorium yendoi* and *Spermothamnion sp.* The plant is characterized by its small size, long and slender outer branches with denticulate branchlets and entirely ecorticate fronds, etc.

Observing from the surface under the microscope, the mid-ribs and dominantly large apical cells are very distinguishable. As mentioned by Okamura (l. c.), the flabellately running mid-ribs, consisting of one or a few cell rows, are expanding to the branches and branchlets, continued to the apical cell. The cells of mid-ribs are elongated and oblong in form, and about 20—40μ broad and 90—150μ long in the basal portion.

In anatomical observation, the frond consists of two to three rows of cells; central axes and pericentral cell rows. A single central axis is surrounded by 7—8 pericentral cells. In most cases, however, a few central axes are surrounded by the common pericentral cells. The regeneration of new branches from a wounded old branch is initiated at the wounded end of mid-rib. The rhizoids issue from the pericentral cells. The tip of the rhizoids, after the elongation, becomes round disc in form, of which diameter is about 65μ. Frequently several or many rhizoids are aggregated in groups, not only in the basal portion but in the outer branches here and there.

The tetrasporangia occur in the denticulate branchlets or lacininae, forming a longitudinal row. They appear at the central portion of the branchlet base and develop along its mid-rib. They are mature from the inner ones outwards in turn. The neither male nor female, sexual organs were found among our plants. There was also no mention of them in the original description by Okamura, nor in Yendo's work under the name of *Pterosiphonia parasitica*.

Nominating the present alga to a new species, Okamura (l. c) doubted "whether the present plant is not a dwarf variety of *S. linearis* or a narrower form of *S. marchantioides*", because "the water of the Japan Sea is always a little colder than that of the Pacific", and "the plant of one and the same species often takes much a different form and appearance in the both waters". However, our collections being from the southern part of Cheju-island and thus affected by warm ocean currents, seem to be a well defined species and to contradict these speculations.

摘 要

韓國産 海藻類 7種을 記載하였다. 그 中 2種의 監藻類, *Coccochloris stagnina*(남구슬말; 新稱)와 *Entophsalis conferta*(바위수염혹;新稱), 1種의 褐藻類, *Ralfsia verrucosa*(바위딱지;新稱), 및 2種의 紅藻類, *Enelittosiphonia hakodatensis*(타래말; 新稱)와 *Symphyocladia pennata*(에기보타색우무; 新稱)는 韓國新産이다. 나머지 2種의 監藻類, *Anacystis dimidiata*(네쪽남색말;新稱)와 *Phormidium tenue*(가는포르미디움;新稱)는 淡水産으로 보고된 바 있으나 海産種으로는 本報에서 처음 同定되었다.

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Explanation of Plates

[Plate 1]

Entophysalis conferta (Kuetz.) Drouet and Daily

Figs. 1—6 : 1, *Oncobyrsa*-type, a surface view; 2—3, *Dermocarpa*-type, development of endosporangia in surface view; 4, *Dermocarpa*-type. a lateral view; 5—6, *Dermocarpa*-type, mature endosporangia.

Coccochloris stagnina Sprengel

Fig. 7 : a surface view.

Anacystis dimidiata (Kuetz.) Drouet and Daily

Figs. 8—11 : 8—10, one, two or four-celled plants; 11, plants containing several large vacuoles.

Phormidium tenue (Meneghini) Gomont

Fig. 12 : two trichomes with round or acute apices.

Symphyocladia pennata Okamura

Figs. 13—15 : development of rhizoids.

Enelittosiphonia hakodatensis (Yendo) Segi

Figs. 16—19 : 16—17, development of branches from creeping filaments; 18, a definite branch; 19, rhizoids with disc-shape end.

[Plate 2]

Ralfsia verrucosa (Areschoug) J. Ag.

Figs. 1—6 : 1, a part of margin in young thallus; 2, a part of thallus in anticlinal section to the margin; 3, the same in periclinal section; 4, secondary growth of the thallus; 5, a part of erect filament; 6, development of hair.

Symphyocladia pennata Okamura

Figs. 7—10 : 7, parts of thalli in cross section; 8—10, parts of thalli with tetrasporangia.

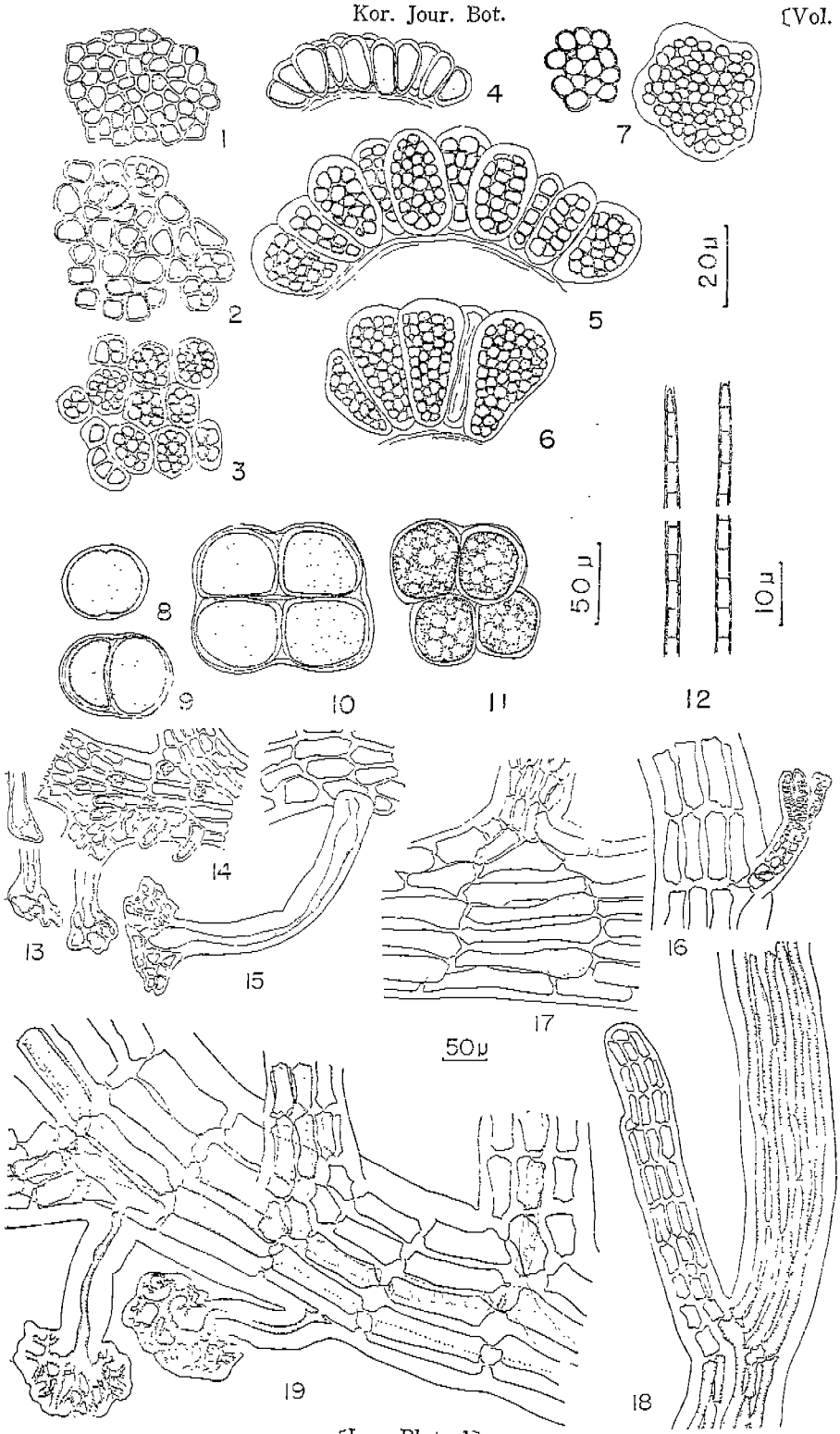
[Plate 3]

Enelittosiphonia hakodatensis (Yendo) Segi

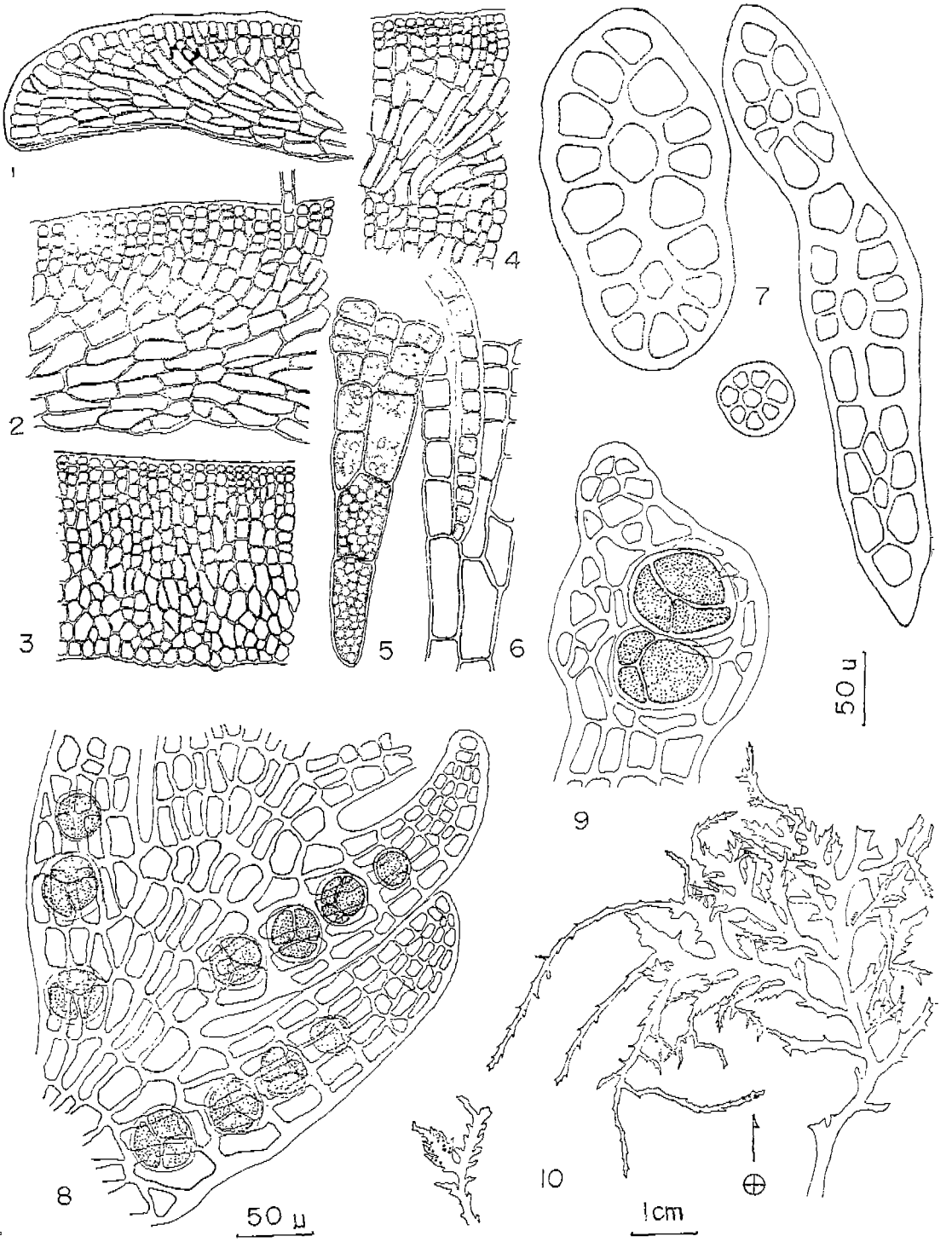
Figs. 1—4 : 1—2, trichoblasts; 3, rhizoids developed in group; 4, a part of terminal branches.

Symphyocladia pennata Okamura

Figs. 5—7 : 5—6, apical portions of thalli; 7, regeneration of branches from a wounded portion.



[Lee, Plate 1]



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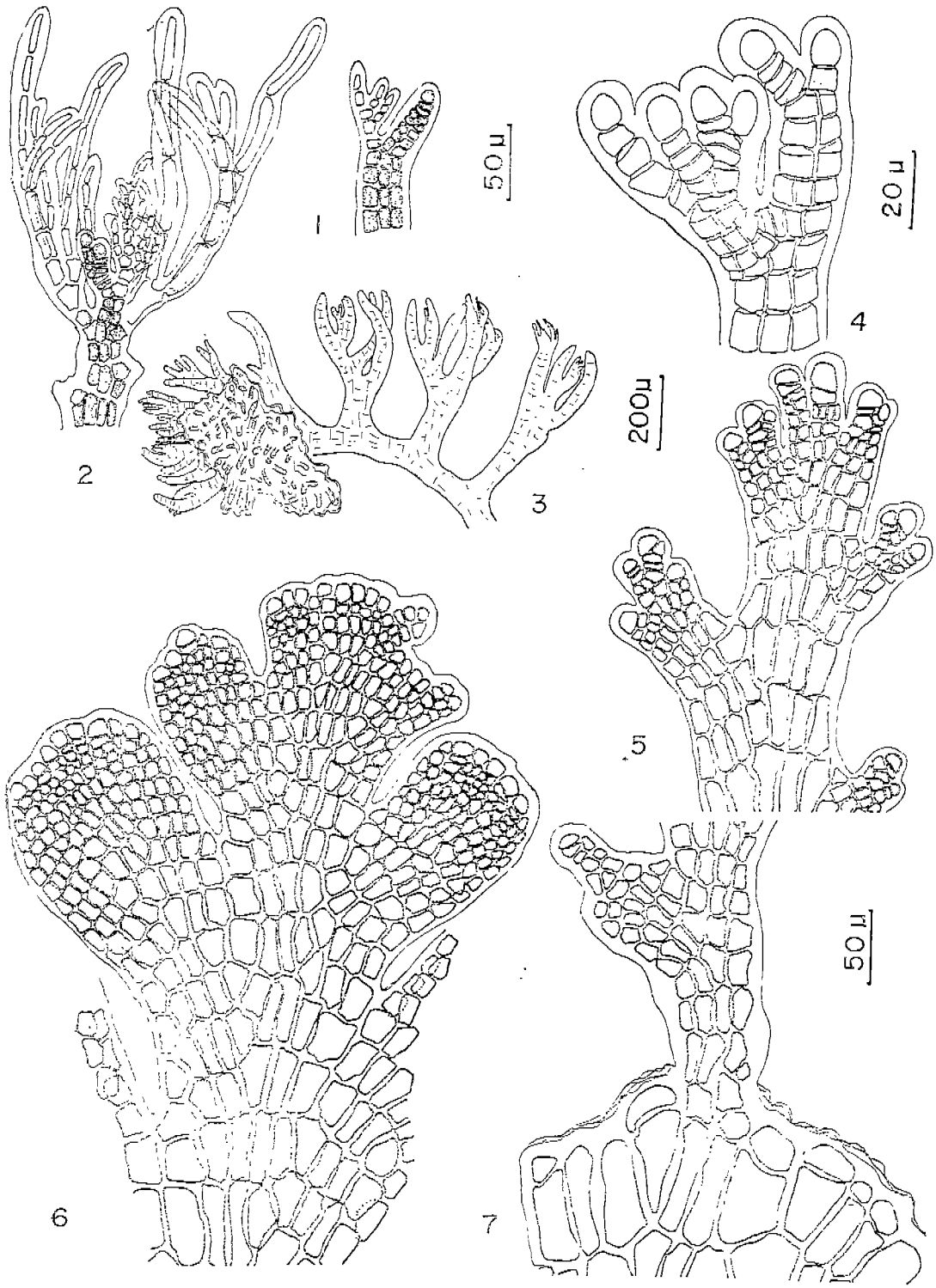

[Lee, Plate 3]