碩 士 學 位 論 文

濟州島海産綠藻청각屬植物의 分類學的研究

A Taxonomic Study on the Genus *Codium*(Chlorophyta) in Jeju Island

濟州大學校大學院

植 物 學 科

吳 潤 植

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December 1983

Contents

摘　　要

海産綠藻 청각屬 植物은 우리나라 沿岸에 9種이 分布하며 이 가운데 7種이 濟州島에 分布하고 있는것으로 이미 報告되었다.

本研究는 濟州島 沿岸에서 採集된 9種의 청각屬 植物에 對해 記載와 圖解를 하였으며 이屬 植物은 그 特徵에 따라 4個의 群으로 나뉘었다.

記載된 청각屬 植物은 다음과 같다.

Codium adhaerens(Cabrera) C. Ag., Codium coarctatum Okamura, Codium contractum Kjellman, Codium cylindricum Holmes, Codium divaricatum Holmes, Codium fragile(Sur.) Hariot, Codium mamillosum Harvey var. minus O. C. Schmidt, Codium latum Suringar, Codium tenue Kuetzing.

Introduction

The genus Codium was first established by Stackhouse in 1797 as Fucus tomentosus, which was later altered to Lamarkea in the second edition of his work and included 2 species C. tomentosum, C. bursa. Afterwards Lamouroux(1813) proposed the name Spongodium for the genus and Cabrera re-named it genus Agardhia. When J. A. Agardh(1885) produced the first monograph of Codium, he included all previously known species under the simple generic name of Codium and divided them into 4 sections C. adhaerens, C. bursa, C. tomentosum, C. elongatum(cf. Gibson & Auld, 1900 p.5-6).

Schmidt(1923) based his subgeneric classification on that of J. A. Agardh and divided it into 4 sections Adhaerentia, Bursa, Tomentosa, Elongata with the 32 species of Codium. He subdivided each of them into 2 subsections. Since that time Silva(1954) devised a scheme for subgeneric classification based on Schell's and also conducted monographic research and geographical distribution on Codium in various parts of the world.

Besides 12 species of Codium in Japan described by Okamura(1929), several monographic researches on this species were carried out by many algologists in other countries(Lunds, 1940; Tseng & Gilbert, 1942).

General research on the algal flora of Korea was conducted by

Kang(1960, 1966), who reported 414 species. Moreover several ecological studies of marine algae in Korea have been partly investigated(Lee & Lee, 1976; Lee & Kim, 1977; Kim et al, 1980; Lee, 1981). Some floristic and ecological researches on the marine algae of Jeju Island have been carried out by Kang(1960), Lee(1974) and Lee et al(1976).

Kang(1966) reported that Jeju Island was affected by the low temperature of the Yellow sea, but it was the warmest coastal area in Korea. According to Kang, the algal flora of Jeju Island consists of Boreal species 2 %, Temperate species 74 %, Subtropical species 10 %, Cosmopolitan and subcosmopolitan species 15 %. Kang(1960, 1966) reported 9 species of Codium distributed throughout Korea of which 7 species were found in Jeju Island.

These plants were identified using the descriptions of Okamura (1929), so it is necessary to make out the description and key of these species abundantly distributed in this Island.

The object of this study was to describe and examine the characteristics of the plant Codium.

The thallus of a rather widely distributed marine genus comprising about 80 species(Silva, 1962) exhibits tremendous variation, from prostrate crusts to hollow spheres to erect forms and consists of branched cylindrical axes or unbranched laminate blades.

In addition they are composed of intertwined non-septate, multi-nucleate filaments compacted to form a macroscopic spongy plant body of definite or indefinite shape and size(Scagel, 1966).

The utricles, whose shapes share the important characteristics in the classification of the species are densely arranged to form a compact, palisade-like surface layer. Gametangia are produced from the side of them and mature gametangia are distinguishable by their dark green colour and granular uneven appearance within the female gametangia which has light yellow colour and even appearance within the female gametangia(Bold & Wynne, 1978).

Materials and methods

Jeju Island lying 33°35′ to 33°10′N latitude and extending 126°10′ to 127°E longitude is situated at the most southern region of Korea. The Yellow sea warm current affects the west of the Island and the Tsushima the east. Under their influence the distribution of marine algae exhibits greater diversity than other parts of Korea.

The collections were carried out during 1982-1983 throughout the Island. The samples collected were fixed in 10 % formalin sea water and the specimens mounted, using glycerin water, for microscopic observations.

Descriptions of the species

Key to the species of *Codium* in Jeju Island.

1. Thalli erect ----------2
2. Thalli branched ----------3
3. Thalli long, elongated, dichotomous ----------4
4. Utricles acuminate ---------- *Codium fragile*
4. Utricles subtruncate ----------5
5. Branches cylindrical, elongated ------- *Codium cylindricum*
5. Branches compressed, divaricated, more or less expanded at dichotomies -------- *Codium divaricatum*
3. Thalli short ----------6
6. Thalli small(c.3-4 cm high), soft, bifid at apex ---------- *Codium tenue*
6. Thalli rigid, swollen at apical segment ---------- *Codium contractum*
2. Thalli unbranched ----------7
7. Thalli globose, small(c.1-3 cm in diameter) ---------- *Codium mamillosum* var. *minus*
7. Thalli broadly expanded, foliaceous------- *Codium latum*
1. Thalli prostrate, compressed or flat ----------8
8. Thalli irregularly expanding by peripheral growth, flexuous , gelatinous ------ *Codium adhaerens*
8. Thalli irregularly dichotomous, cartilaginous ---------- *Codium coarctatum*

Codium adhaerens(Cabrera) C. Agardh
(Fig.1 A-B, Pl.I)

Okamura(1929) vol.3, p.140, pl.134
Feldman(1931) p.205
Newton(1931) p.104
Chiang(1960) p.66

Thallus compressed, often irregularly expanding by the peripheral growth with roundish lobes, flexuous on the surface, tightly adhering to substratum by ventral parts, c.2-6 cm broad, irregularly expanding, slippery to the touch; colour dark green; utricles clavate to cylindrical, a little thickened at apex, 700-1200 μ long, 50-90 μ in diameter at upper portion, 40-100 μ in diameter at lower portion, branched close to each other near the base of utricles; siphons smooth, 40-60 μ in diameter; septa constricted with H-shaped; hairs borne on utricles c.90 μ below apex of utricle, 1200-2400 μ long, c.20 μ in diameter; gametangia clavate, 200-250 μ long, 50-60 μ in diameter, borne on the middle of utricles.

Habitat; On rocks near littoral zone to upper infralittoral zone.
Materials; December 23, 1982 Seongsanpo; April 30, 1983 Hwabuk; May 14, 1983 Pyoseon; June 19, 1983 Hallim.

Codium coarctatum Okamura
(Fig.1 D, Pl.II)

Okamura(1929) vol.3, p.141, pl.134, figs.4-12

Thallus mostly compressed, decumbent, often bifids or irregularly dichotomous with obtuse at apices, broadly linear, 12 cm broad or more, 2-3 mm thick, attaching to substratum and to each other in folding with short tufts which partly borne on ventral parts, cartilaginous; colour mostly dark green; utricles clavate to cylindrical, 500-760 μ long, 70-110 μ in diameter at upper portion, 50-110 μ in diameter at lower portion, more or less constricted below apex of utricles, branched close to each other near the base of utricles to form a dense compact utricular layer; siphons more or less tortuous, 2-3 developing at the base of utricles, 20-50 μ in diameter; hairs not observed; gametangia not observed.

Habitat; On rocks in infralittoral zone.

Materials; July 5, 1982 Seongsanpo

Codium contractum Kjellman
(Fig.1 C, Pl.III)

Schmidt(1923) p.57, figs.38-39
Okamura(1929) vol.3, p.70, pl.120, figs.1-8

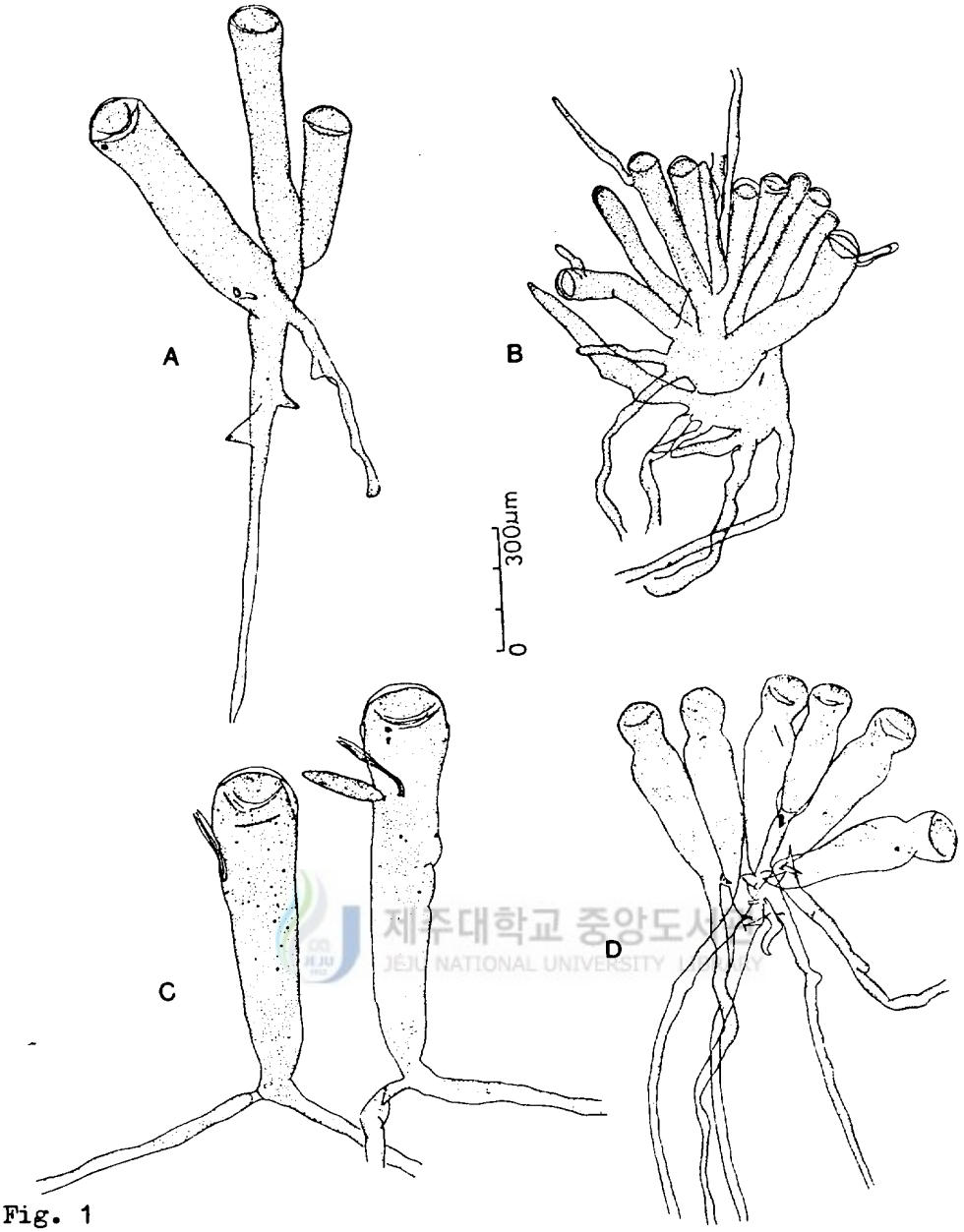

Fig. 1

A, Utricles in Codium adhaerens (Cabrera) C. Ag.

B, Group of utricles with hairs in C. adhaerens

C, Shape of utricles with gametangia in Codium contractum Kjellman

D, Utricles in Codium coarctatum Okamura

Thallus erect, cylindrical, slightly expanded below forks, dichotomous, often trichotomous, more or less swollen at apical segments, 12-15 cm high, 3-8 mm in diameter; colour dark green, often light green at basal portion of thallus; utricles clavate, 900-1000 μ long, 100-300 μ in diameter at upper portion to 100-200 μ in diameter at lower portion; apices subtruncate or obtuse; siphons more or less tortuous, 30-60 μ in diameter; septa H-shaped, forming a little away from the base of utricle c.40 μ in diameter; hairs borne on upper portion of utricle; hair scars occurring at 100-150 μ distance below apex, 1-2 per utricle; gametangia fusiform to ovate, 200-460 μ long, 50-70 μ in diameter borne on utricles 300-470 μ distance below apex.

Habitat; On rocks in infralittoral to upper infralittoral zone.

Materials; July 5, 1982 Seongsanpo

Codium cylindricum Holmes
(Fig.2 A, Pl.IV)

Holmes(1895) p.250, pl.2, fig.1(a-b)

Okamura(1929) vol.3, p.177, pl.141, figs.(1-11)

Thallus elongated, cylindrical, regularly dichotomous, 38 cm-1 m long, 2-8 mm in diameter, becoming gradually slender towards

the tip, slightly depressed or expanded, cuneate below forks, dichotomous in the middle portion, ending in blunt or slightly bifid at apices; colour dark green, often light green at the basal portion; utricles clavate, rarely cylindrical 700-1200 μ long, 100-200 μ in diameter at upper portion, 90-180 μ in diameter at lower portion; apices mostly rounded, occasionally truncate; siphons smooth, 40-70 μ in diameter, 2-4 per utricle; septa H-shaped, 30-40 μ in diameter; hairs borne on apical portion of utricles, 350-550 μ long, 30-50 μ in diameter; hair scars 1-2 per utricle; gametangia ovate to elliptical c.250 μ long, 60-70 μ in diameter, borne 1/3 distance below apex.

Habitat; On rocks in infralittoral zone.

Materials; August 14, 1982 Seongsanpo; March 27, 1983 Seongsanpo.

Codium divaricatum Holmes
(Fig. 2 B, Pl.V)

Holmes(1895) p.250, pl.2(a-b)
Okamura(1929) vol.3, p.155, pl.136, figs.1-8

Thallus regularly dichotomous, often irregularly ramified

at apex, 14-35 cm high, basal portion cylindrical, 4-6 mm in diameter, more or less compressed in upper segments and broadly expanded below forks into flat, cuneate segments of 1.5-2 cm broad, several small and slender branches covered with hyaline hairs arising from the tip of apical segment; colour dark green, often light green at basal portion; comparatively hard in texture; utricles cylindrical to clavate with round apex, rarely obovate at basal portion of thallus, 800-1500 μ long, 100-350 μ in diameter at upper portion, 100-200 μ in diameter at lower portion; siphons smooth, c.40 μ in diameter; hairs arising from apical portion of utricle, 500-1600 μ long, 20-40 μ in diameter; hair scars often 2-4 per utricles; gametangia clavate to elliptical or ovoid, female gametangia 200-250 μ long, 100-120 μ in diameter, male gametangia 250-450 μ long, 50-110 μ in diameter, borne on utricle 1/3 distance below apex.

Habitat; On rocks near infralittoral zone.

Materials; August 5, 1983 Hamdeok

Codium fragile(Suringar) Hariot
(Fig.2 C-E, Pl.VI)

Okamura(1929) vol.4, p.117, pl.130, figs.1-9
Kylin(1949) p.67
Silva(1954) p.96, fig.22
Scagel(1966) p.118, pl.3, figs. A-K

Thallus compressed of one to several erect fronds arising from broad, spongy, basal disk; branches 15-30 cm high, 3 mm-1 cm in diameter, terete, tapering towards apex, abundantly dichotomo-fastigiately branched, varing greatly in length and thickness; colour dark green, often light green when young; utricles clavate, unbranched, 1100-1300 μ long, 250-410 μ in diameter at upper portion, 150-260 μ in diameter at lower portion; apices acuminate, often blunt or rounded at the middle portion of thallus; siphons smooth, 40-60 μ in diameter, swollen just near septum; septa mostly H-shaped, 10-20 μ in diameter; hairs 250-650 μ long, 40-60 μ in diameter, arising from the upper portion of utricles; hair scars common in zone 105-150 μ below apex of utricles; gametangia ovate to fusiform, 1-2 per utricle, borne on upper half of utricle 200-250 μ below apex, female gametangia 250-350 μ long, 100-180 μ in diameter, male gametangia 230-300 μ long, 70-100 μ in diameter.

Habitat; On rocks in littoral zone, often in tide pools.
Materials; August 14, 1982 Seongsanpo

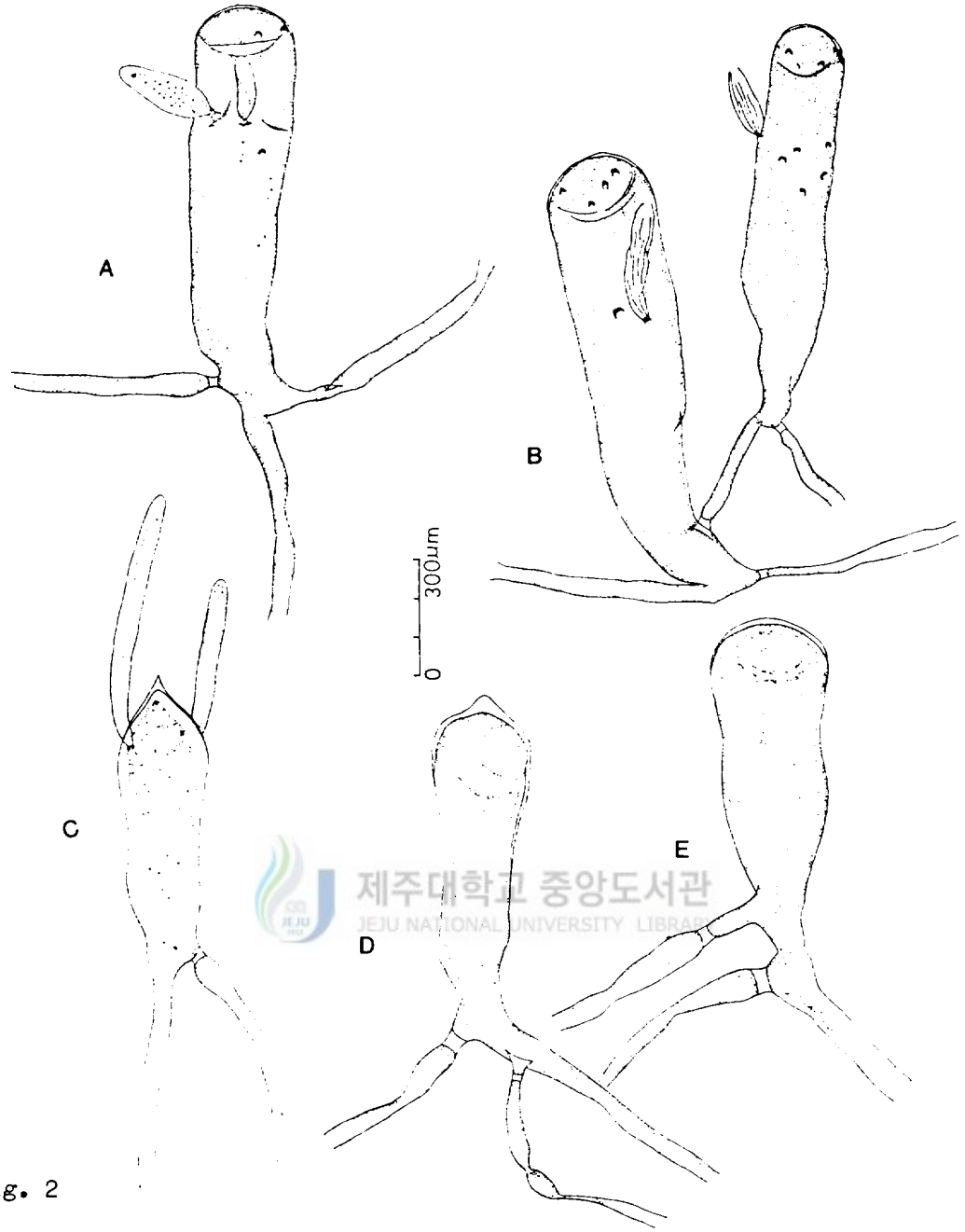

Fig. 2

A, Utricles with male and female gametangia in Codium cylindricum Holmes

B, Utricles in Codium divaricatum Holmes

C-E, Utricles in Codium fragile (Sur.) Hariot

C, Utricle with hairs and acuminate apex.

D-E, Utricles with blunt or round apex.

Codium latum Suringar

(Fig.3 B, Pl.VII)

Schmidt(1923) p.61, fig.44

Okamura(1929) vol.3, p.180, pl.142, figs.1-8

Thallus erect, ligulate or foliaceous, 20-30 cm long, c.25 cm broad, 1-2 mm thick, arising from conical disk with a short thick compressed stipe; colour dark green; soft in texture; utricles cylindrical with subtruncate at apex, rarely clavate at basal portion of thallus, 350-550 μ long, 50-200 μ in diameter at upper portion, 60-170 μ in diameter at lower portion, often slightly thickened at apex, mostly alternate arranged, often 6-7 times as long as broad; siphons slightly tortuous, 2 or rarely 5 per utricle, 20-50 μ in diameter; septa usually roundish H-shaped, 10-20 μ in diameter; hairs arising from the upper portion of utricle, 100-150 μ long, c.20 μ in diameter; gametangia irregular forms, globular to pyriforms, borne at the base of utricle.

Habitat; On rocks covered with sand in infralittoral zone.

Materials; August 14, 1982 Seongsampo

Codium mamillosum Harvey var. minus C. C. Schmidt
(Fig.3 A, Pl. VIII A-G)

Schmidt(1923) p.37, fig.19
Okamura(1929) vol.3, p.151, pl. 135, figs. 10-16
Silva & Womersely(1956) p.269, fig.6

Thallus small, globose to more or less depressed globose, 1-3 cm in diameter, attaching to substratum by tufts of rhizoidal filaments, loose in texture, inner cavity densely packed with thread-like siphons occurring from utricles; colour dark green to light green; utricles clavate with subtruncate or slightly round apex, tapering towards the base, 3-5 mm long, 300-800 μ in diameter at upper portion, 200-320 μ in diameter at lower portion, young utricles arising as buds from basal region of old utricles; siphons more or less smooth, slender, 30-70 μ in diameter; septa sharply demarcated; hairs 700-750 μ long, 100-140 μ in diameter; hair scars present, 1-2 per utricle; gametangia elliptical to ovate, usually borne 300-500 μ below apex of utricles, female gametangia 500-700 μ long, 100-200 μ in diameter, male gametangia 400-500 μ long, 100-150 μ in diameter.

Habitat; On rocks in infralittoral zone.

Materials; July 5, 1982 Seongsanpo; August 14, 1982 Seongsanpo

Codium tenue Kuetzing

(Fig. 3 C, Pl.VIII H-J)

Okamura(1929) vol.3, p.61, pl.165, figs. 11-12

Børgesen(1948) p.39, figs.19-20(a-f)

Silva(1959) p.140, fig.15

Thallus erect, small, more or less dichotomous, 4-5 cm high, 3-6 mm in diameter; dichotomies more or less flattened, fastigiate, often bifid at apex, more or less tender; colour dark green to light green; utricles clavate with subtruncate apices, 700-1000 μ long, 80-250 μ in diameter at upper portion, 40-230 μ in diameter at lower portion; siphons smooth or slightly tortuous, 30-50 μ in diameter; septa constricted both sides, 20-30 μ in diameter; hairs not observed; hair scars present; gametangia not observed.

Habitat; On rocks in littoral zone or rarely in tide pools.

Materials; September 19, 1982 Seongsanpo

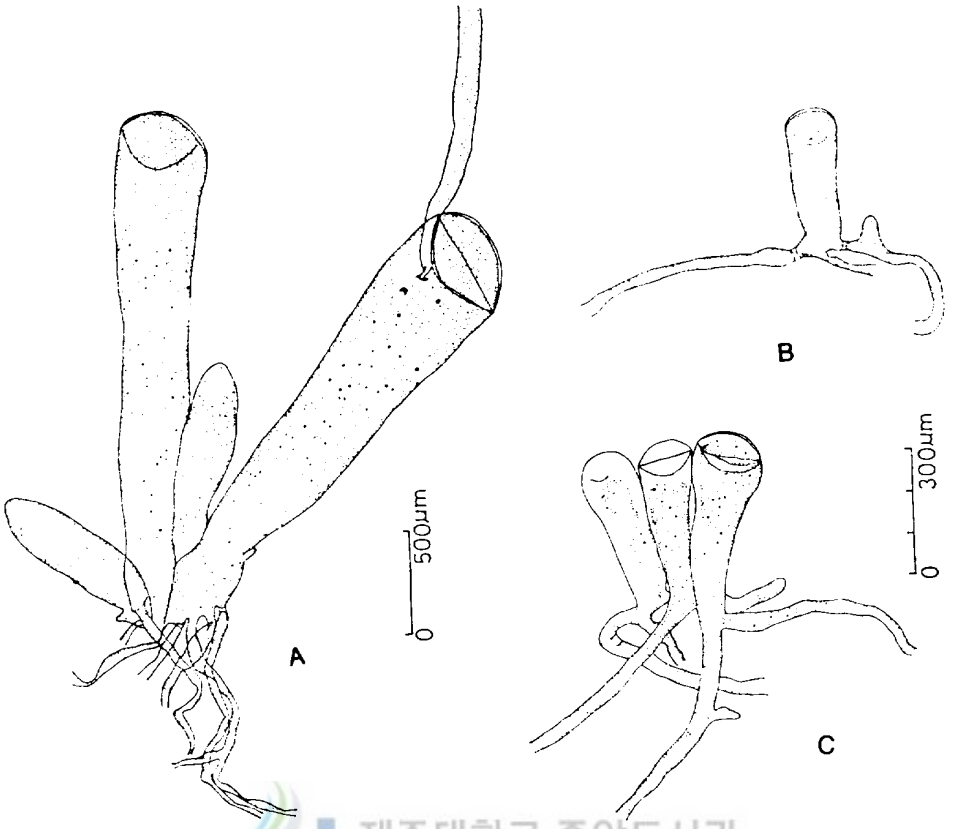

Fig. 3

A, Utricles with hair in Codium mamillosum Harvey var. minus C.C.Schmidt

B, Utricle in Codium latum Suringar

C, Shape of utricles in Codium tenue Kuetzing

Discussion

Seven species of Codium were previously reported from this Island(Kang, 1960), but 9 species were found in this study. A monograph on the algae of Jeju Island has not, as yet, been performed, so descriptions on the 9 species of Codium were made in the present study.

Silva(1954) introduced a scheme for classification of Codium in California and divided it into 2 subgenus(Tylecodium and Schizocodium) and later subdivided them into 2 sections; the one consisting of sections Adhaerentia and Digitaliformia, the other of sections Tomentosa and Elongata.

The plants distributed in this Island may be divided into 4 groups based on Schmidt(1923) and Silva(1954); Adhaerentia: plants flattened or cushion-like, fixed to the substratum wholly or partly by ventral parts, utricles branched. Codium adhaerens and Codium coarctatum belong to this group. Bursa: plants globular, the center of the thallus filled with a loose network of siphons. Codium mamillosum var. minus belongs to this group. Tomentosa: plants cylindrical and elongated, more or less dichotomous. Codium contractum, Codium cylindricum, Codium fragile and Codium tenue are in this group. Elongata: plants flabellate, wholly or partly flattened. Codium divaricatum and Codium latum in this group.

The world-wide distributed species, Codium adhaerens has various forms, such as roundish flat and wrinkled. Okamura(1929) reported that the utricles of this species branched close to each other near their bases, and in this state of branching cortical utricles did not grow in thickness. The alveolate utricles(Silva, 1954) were observed in these samples. These characteristics served to distinguish these plants from others. Such alveolation found in a mature state was not known in C.adhaerens, and frequently existed in other adherent species(Silva, 1954), but these forms were found in the samples collected at Pyoseon.

Codium coarctatum was first described by Okamura(1929). They grew abundantly on the rhizoid of Ecklonia cava as well as on rocks in the infralittoral zone. The utricles of this plant were mostly constricted below the apex, and also branched in a similar way to C. adhaerens and extend laterally rather than increase in thickness. The plants observed were similar to those described by Okamura(1929).

Codium contractum was widely distributed in tide pools to littoral zones. They grew on calcareous rocks, while other species rarely grew on such substratum. Their utricles were nearly cylidrical clavate and 5-6 times as long as they were broad(900-1000 μ long, 100-300 μ in diameter). Siphons were usually furcate at the base of the utricles. They were generally similar to those described by

Okamura(1929) and Schmidt(1923).

Codium cylindricum was first described by Holmes(1895) who stated that it belonged to the same section as C. mamillosum, in which the utricles were sufficiently large to give the thallus a granular appearance. The thallus of the plant examined was not longer(1 m long) in mature state than that observed by Holmes (1895) and Okamura(1929). It was observed that the branches were generally cylindrical when young, but compressed and loose in texture when old. Utricles were often large and gave the thallus a granular appearance.

Codium divaricatum described by Holmes(1895) was repeatedly dichotomous, their utricles were cylindrical with round apices. They were rarely divaricated and were 5-6 times longer than broad. Kang(1960) reported that the plants(1.2 m long) were collected on the lithophyllum-bank in the infralittoral zone in this Island. The thallus collected in this study exhibited regular dichotomous but sometimes several slender branches occurred at the tip of the apical segments, often showed irregular ramification. Utricles were mostly cylindrical to clavate in form and often larger(800-1500 μ long, 100-350 μ in diameter) than those described by Okamura. In addition, utricles rarely branched out from their bases with more or less long siphons. However a different mode of branching seen in C. adhaerens was observed. At first sight,

the thallus and utricle of C. cylindricum and C. divaricatum appeared similar and without closer observation one could mistake C. cylindricum for C. divaricatum. On closer observation of the two species, the thallus of C. cylindricum was cylindrical but with partly depressed branches at the dichotomies and was softer than that of C. divaricatum. The thallus of the latter was conspicuously depressed all over. As to the utricle form of these two species, C. cylindricum was clavate but C. divaricatum was cylindrical; the former was smaller than the latter in size as well as in length of hair. Gametangia of C. cylindricum was ovate to elliptical in form but C. divaricatum was clavate to elliptical or ovoid.

Codium fragile varied greatly in size and its habitat varied also from tide pools to littoral zones. Codium fragile was loose in texture and various epiphytes were found on this plant. All forms of utricles were characterized by the development of a mucro on the apices of the utricles(Silva, 1954) and Scagel(1966) described that sometimes the apices were sharp but variable and at other times blunt or even absent. New utricles formed from siphons growing at the base of older utricles and septa were formed in the just distal portion at the base of each utricle(Borden & Stein, 1969). Some of utricles removed from the middle of the thallus had a blunt or round apex as Scagel mentioned, but mostly

exhibited an acuminate apex from the tip of the thallus. All the observations and descriptions in the literature agreed with those found in the plant under investigation.

The thallus of Codium latum collected was foliaceous and the lanceolate or band-like form of this plant was not found. Okamura(1929) observed that C. latum produced a few gametangia at the little lower portion of the utricles and their forms were oblong to elongated ovate. However, the form and position of gametangia observed were very different to those described by Okamura in spite of extensive observations. In the present study the gametangia were polymorphous with irregular globular and pyriforms. They developed mostly at the base of utricle. Utricles were mostly cylindrical to slightly clavate and arranged alternately.

Codium mamillosum var. minus in this Island was similar to that described by Okamura(1929) and Schmidt(1923). Two forms of thalli were collected at Seongsanpo and Seoguipo. The thalli collected at Seongsanpo(c.3 cm in diameter) were larger than those of Seoguipo(c.1-1.5 cm in diameter). Gametangia were observed in the thalli and those collected at Seoguipo were ellipsoid in shape. The thalli of those found at Seongsanpo were loose in texture and C. contractum grew on their surface. Utricles sometimes branched with young ones arising as buds from the base

of utricles. Silva termed them Secondary utricles(cf. Egerod, 1954 p.389). The tip of the rhizoidal filaments attached to substratum had a hook or bird's foot-like shape. Schmidt mentioned that utricles of Japanese plants were only a little smaller(utricle 400-700 μ broad, 2-5 mm long) as in typical Australian plant. Comparing this plant with that described by Harvey, so they were named var. minus(cf. Schmidt, 1923 p.38). Making an observation on this plant, the thalli were so small(1-3 cm in diameter) and the utricles clavate, with 3-5 mm long and 200-800 μ in diameter. The thalli of C. mamillosum(4-9 cm in diameter) and the utricles(1-7 mm long, 400-2500 μ broad) were so larger than those of the plant under observation. The gametangia of C. mamillosum exhibited ellipsoid to ovoid or ampulliform and were 520-780 μ long and 130-250 μ in diameter, in contrast to the plant examined which was ellipsoid to ovate in shape with 400-700 μ long and 100-200 μ in diameter. Although there were slight differences in size, on the whole these plants agreed with those described by Okamura.

Silva(1959) mentioned Codium tenue; the nature of this species has long been subject to much conjecture even though the type specimen had been re-examined many times. Consequently the name C. tenue has been applied to unrelated species in various parts of the world, in spite of the fact that it is very distinctive, both morphologically and ecologically. In the present study the plants collected

were different to that observed Silva and Børgesen(1948). Their descriptions more or less agreed to that of Okamura(1929), whose observations showed small thalli, cylindrical and regularly dichotomo-fastigiate, emarginate or bifid at the apex. In addition, the utricles were obovate with very obtuse apices. Børgesen(1948) stated that the thalli of this species were soft, gelatinous and flexible, repeatedly irregularly furcate between divisions. Utricle forms were mostly barrel-shaped or nearly square, but in contrast to the utricles of the plants studied were usually clavate. Some confusions may have occurred when comparing the appearance of C. tenue with the young thallus of C. contractum, but the former has a smaller thalli(4-5 cm high, 3-6 mm in diameter) than the latter which is 12-15 cm high and 3-8 mm in diameter. The mode of branching in the thallus was similar in each species but C. contractum sometimes exhibited trichotomous. The utricles of C. contractum were larger(900-1000 μ long, 100-300 μ in diameter) than those of C. tenue(700-1000 μ long, 40-250 μ in diameter). The length and shape of utricles in these two species were slight similar, but the width was different. In addition to the utricles of C. tenue were narrower than those of C. contractum. As confusion still exists between C. tenue and C. contractum, more detailed study is necessary to clarify their respective character-

istics.

Codium dichotomum reported by Kang(1960) was not found in the present study.

Table 1. Characters of Codium in Jeju Island.

characters / species	Thallus form	Thallus size	Utricle form	Utricle size	Gametangium form	Gametangium size	Siphon	Hair, Hair scar
C. adhaerens	compressed or flat	c.2-6 cm broad	clavate, cylindrical, branched	700-1200 μ long 400-100 μ in diameter	clavate	200-250 μ long 50-60 μ in diameter	40-60 μ in diameter	1200-2400 μ long c.20 μ in diameter
C. coarctatum	compressed, decumbent	c.12 cm broad 2-3 mm thick	clavate, constricted apex, truncate	500-800 μ 70-110 μ	not observed	not observed	20-50 μ	not observed
C. contractum	flabellately dichotomous, swollen at apical segment	12-15 cm high 3-8 mm thick	cylindrical clavate, subtruncate apex	c.1000 μ 100-200 μ	fusiform, ovate	200-480 μ 50-70 μ	30-60 μ	1-2 per utricle
C. cylindricum	regularly dichotomous, elongated	38-1000 cm 2-8 mm	clavate, obovate	700-1200 μ 90-180 μ	ovate, elliptical	c.250 μ c.70 μ	40-70 μ	350-550 μ 30-50 μ 1-2
C. divaricatum	regularly dichotomous, compressed in upper segment	14-35 cm 1.5-2 cm	cylindrical, rarely clavate	800-1500 μ 100-350 μ	ovoid, elliptical	200-250 μ 50-120 μ	c.40 μ	500-1600 μ 20-40 μ 2-4
C. fragile	terete, abundantly dichotomous	15-30 cm c.1 cm	clavate, apex acuminate	1100-1300 μ 150-410 μ	fusiform, ovate	250-350 μ 70-100 μ	40-70 μ	250-650 μ 40-60 μ
C. latum	elongated, flat, foliaceous	20-30 cm high 25 cm broad 1-2 mm thick	cylindrical, subtruncate, alternately arranged	350-550 μ 50-200 μ	irregular, borne at basal portion	irregular	20-50 μ	100-150 μ c.20 μ
C. mamillosum var. minus	small, globose	1-3 cm in diameter	clavate, subtruncate	3-5 mm 200-800 μ	elliptical, ovate	500-700 μ 100-200 μ	30-70 μ	c.700 μ c.120 μ
C. tenue	small, more or less dichotomous	4-5 cm 3-6 mm	clavate	700-1000 μ 40-250 μ	not observed	not observed	30-50 μ	not observed

Summary

Nine species of Codium were previously found along the coast of Korea, seven of which were reported around Jeju Island.

In the present study the nine species of Codium collected during 1982-1983, from the coast of Jeju Island, were described and illustrated. These plants were divided into four groups according to their characteristics.

The Codium plants studied were; Codium adhaerens(Cabrera) C. Ag., Codium coarctatum Okamura, Codium contractum Kjellman, Codium cylindricum Holmes, Codium divaricatum Holmes, Codium fragile(Sur.) Hariot, Codium mamillosum Harvey var. minus O. C. Schmidt, Codium latum Suringar, Codium tenue Kuetzing.

Acknowledgement

I am extremely grateful to Prof.Lee, Y. P. for his guidance and encouragement in the course of this study and I also wish to express my thanks to Prof.Lee, K. W. and Prof.Kim, M. H. for their stimulating and helpful dicussions. I, too, would like to thank Miss Jo, S. M. for her excellent drawing of the specimens. Thanks are also due to Mr.Kim, D. S., Mr.Kim, T. S., Mr. Kim, C. S. and Mr.Hyun, M, S. for their help in preparing this thesis.

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PLATE I

A, Thallus of *Codium adhaerens* (Cabrera) C. Ag.

B, Group of utricles(collected at Hwabug).

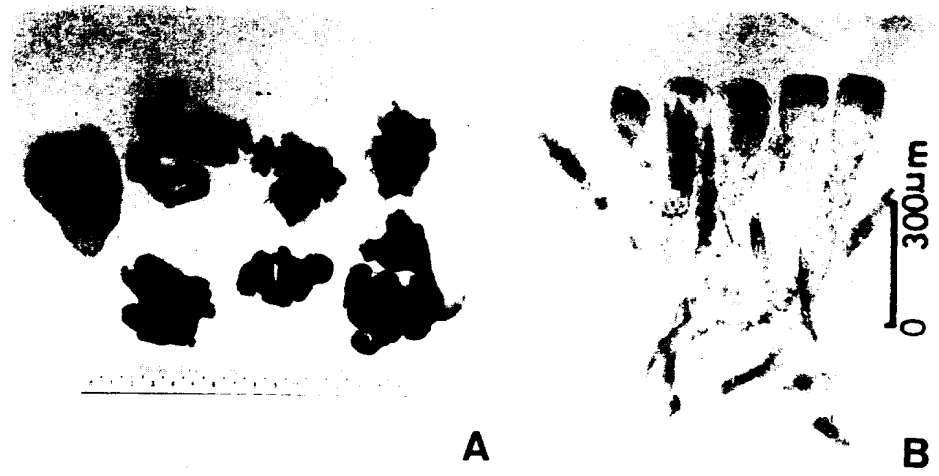
C, Shape of septum.

D, Group of utricles (collected at Seongsanpo).

E, Shape of apical wall.

F, Shape of utricles(collected at Pyoseon).

PLATE I



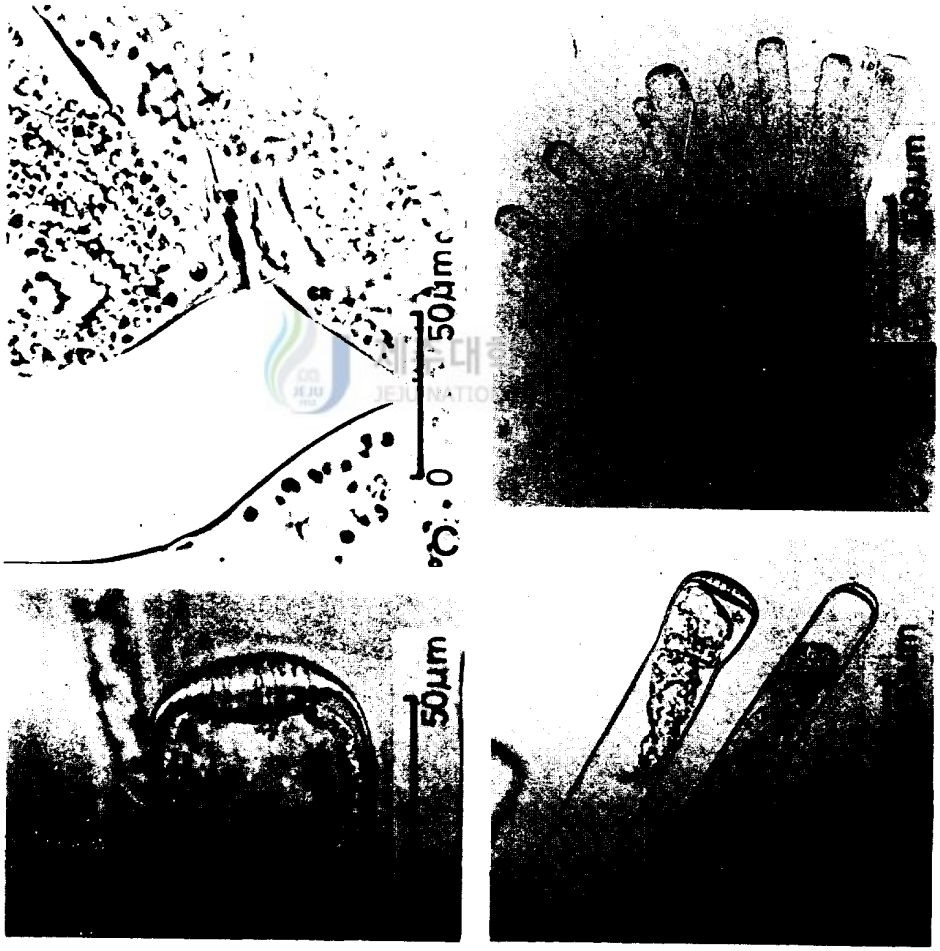


PLATE Ⅱ

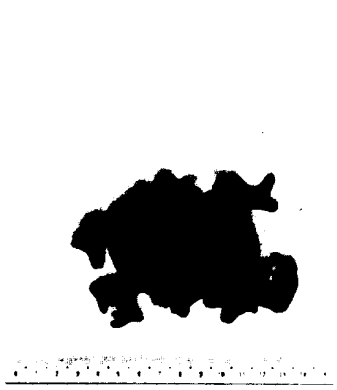
A, Thallus of *Codium coarctatum* Okamura

B, Group of utricles.

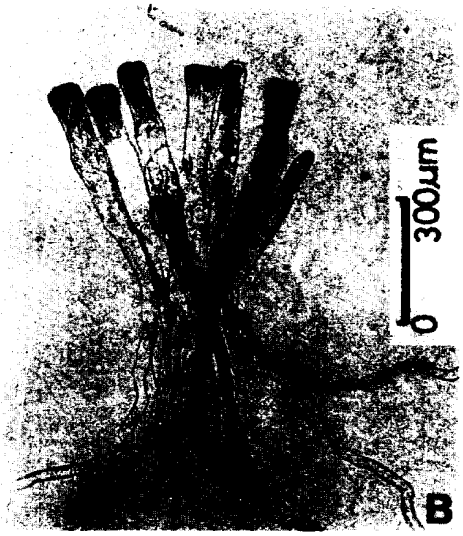
C, Utricles with constricted apical portion.

D, Shape of septum.

PLATE Ⅱ



A



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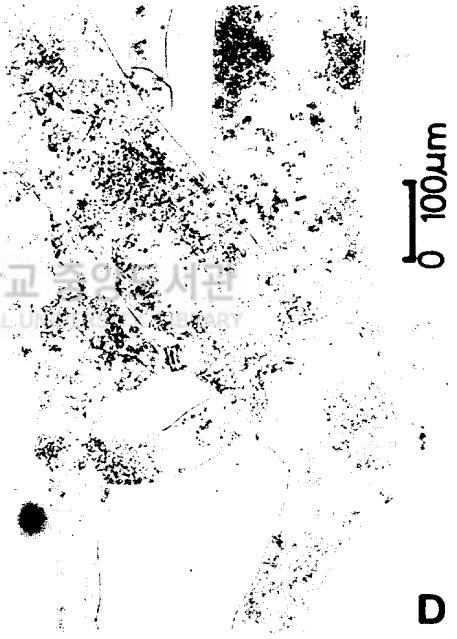


D

PLATE Ⅲ

A, Thallus of Codium contractum Kjellman

B, Group of utricles.

C, Shape of septum.

D, Utricle with gametangium.

PLATE Ⅲ

A

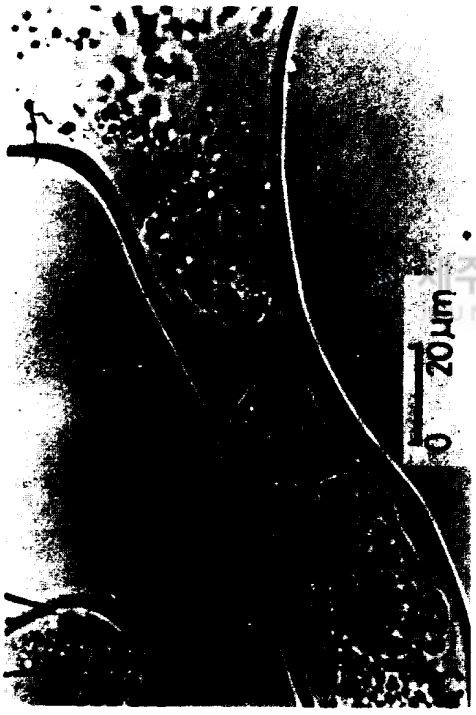


PLATE Ⅳ - 1

A, Thallus of Codium cylindricum Holmes

B, Shape of utricles.

C, Shape of septum.

D, Utricles with hair.

PLATE Ⅳ-(1)

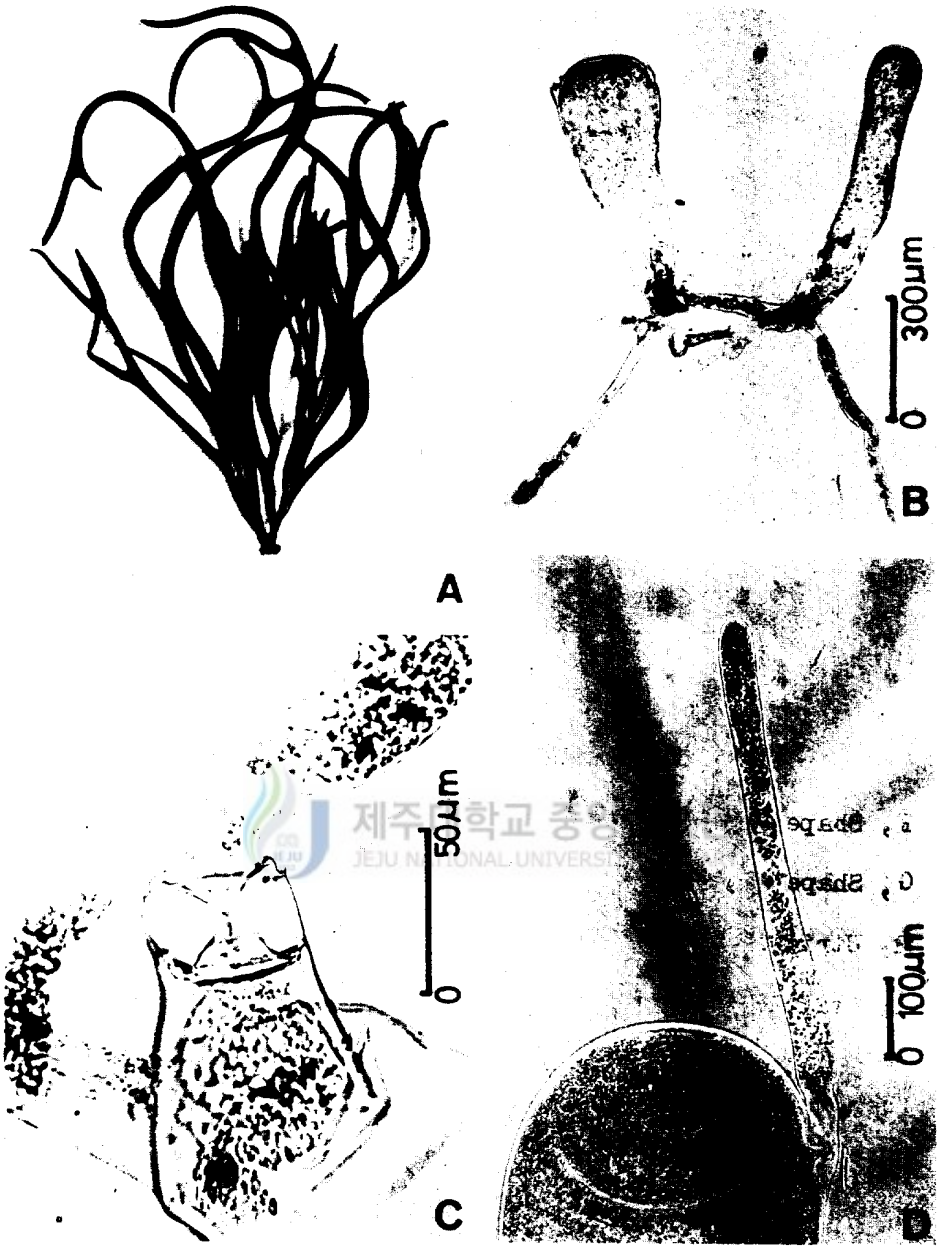


PLATE Ⅳ - (2)

E, Thallus of Codium cylindricum Holmes

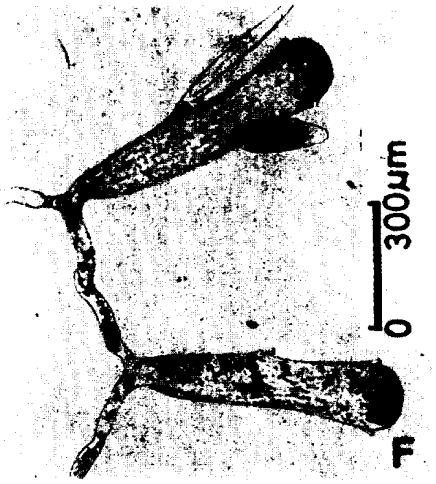
F, Shape of utricles.

G, Shape of septum.

H, Utricles with hair.

I, Utricle with male and female gametangia.

PLATE Ⅳ - ②



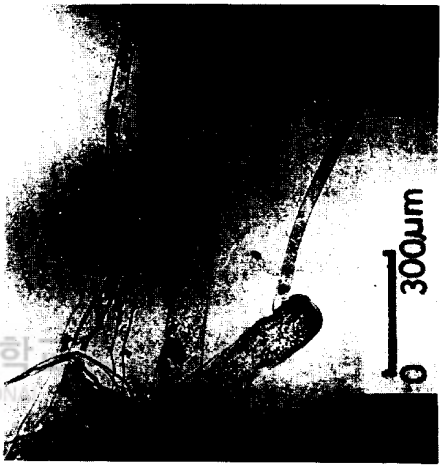


PLATE V

A, Thallus of Codium divaricatum Holmes

B, Shape of utricle.

C, Utricles from basal portion.

D, Shape of septum.

E, Utricle with hair.

F, Utricle bearing on male and female gametangia.

PLATE V

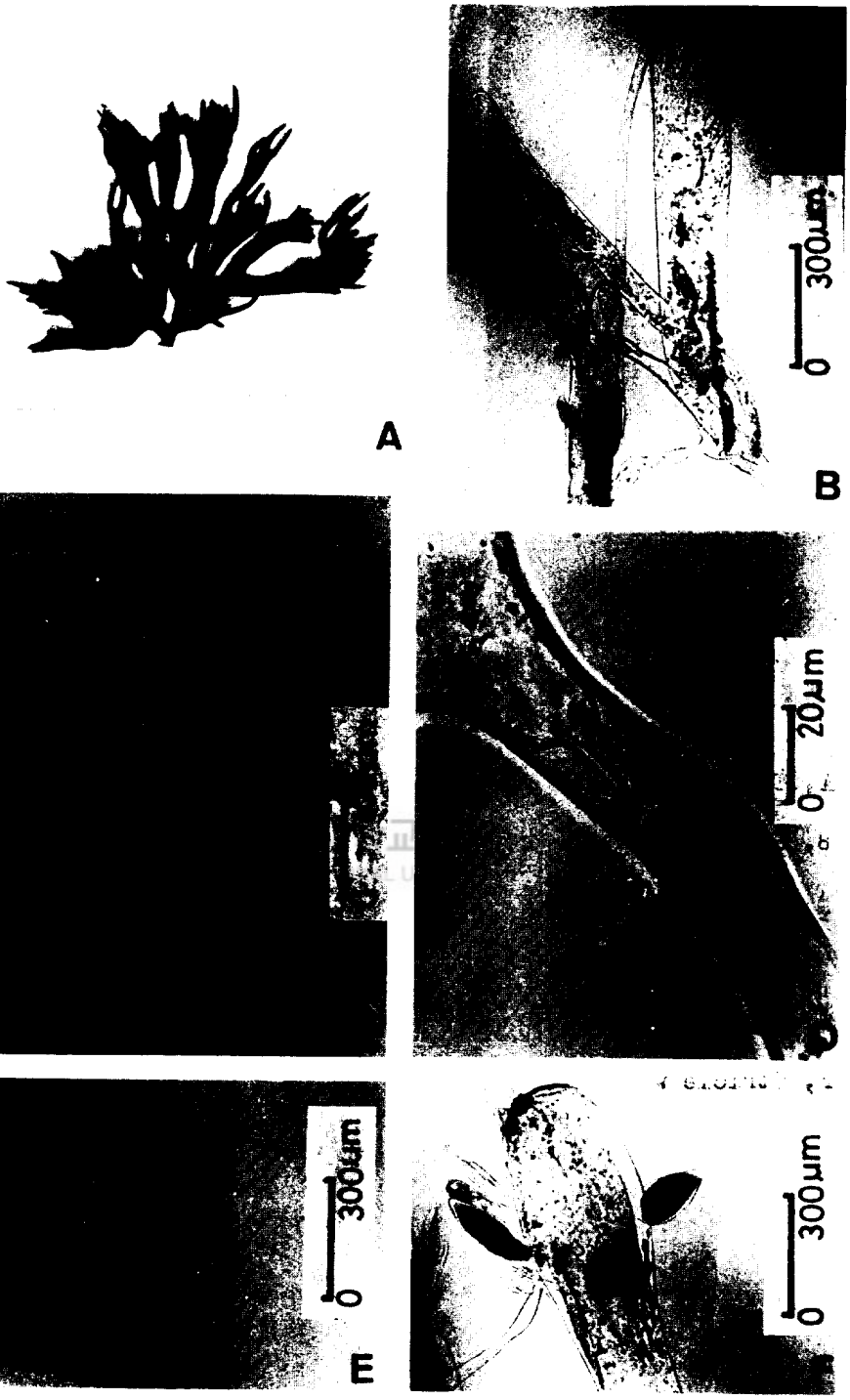


PLATE Ⅵ

A, Thallus of *Codium fragile* (Sur.) Hariot

B, Shape of utricle.

C, Shape of mucro.

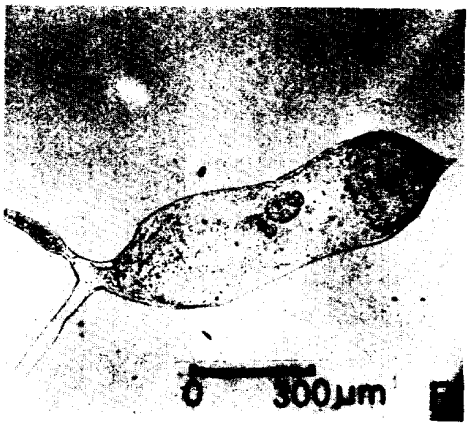
D, Shape of septum.

E, Utricle bearing on male and female gametangia.

F, Utricle with hair.

PLATE VI

A



C

E

F

PLATE Ⅶ

A, Thallus of Codium latum Suringar

B, Shape of utricle.

C, Alternate arrangement of utricles.

D, Shape of septum.

E, Utricle with gametangium.

PLATE Ⅶ

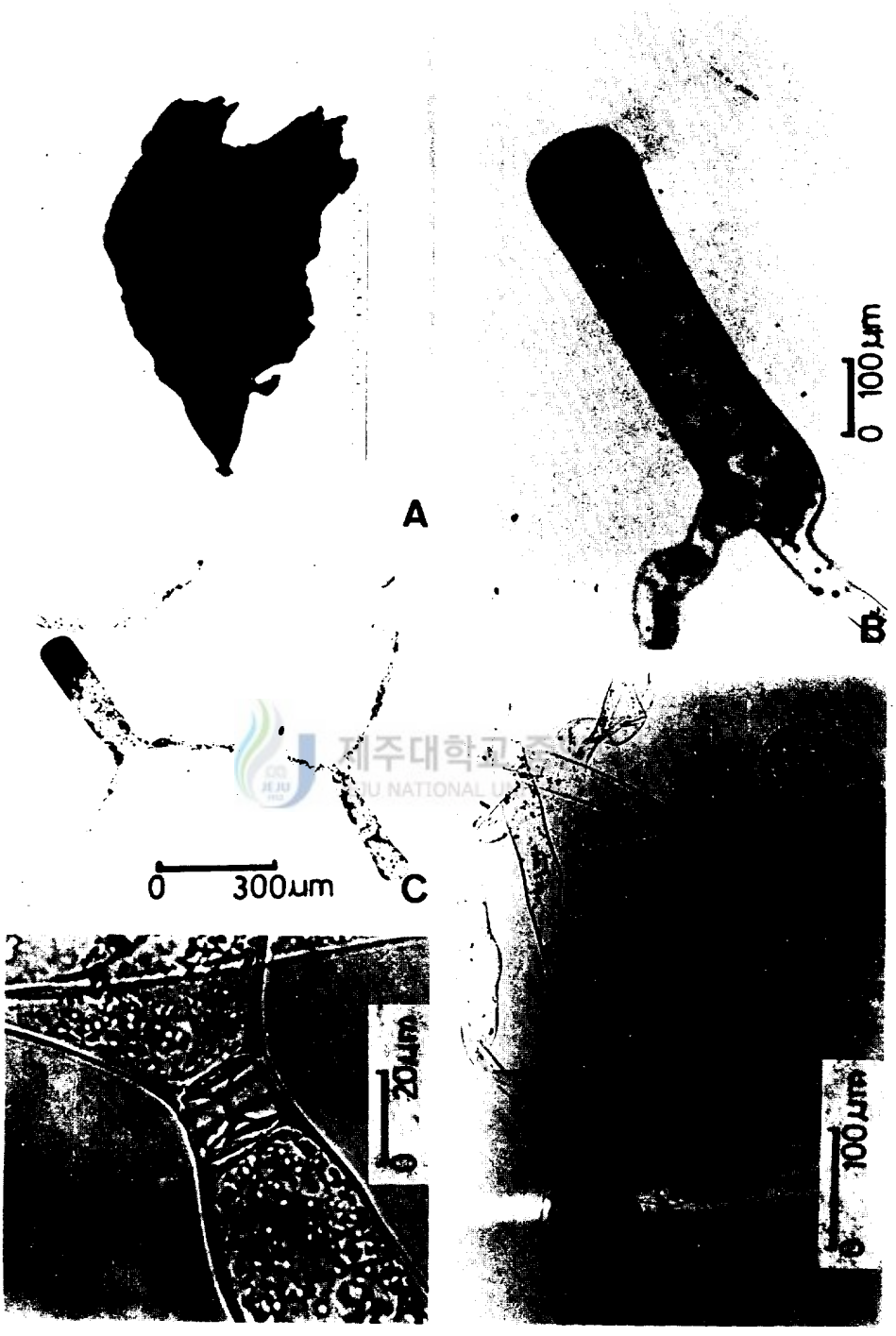


PLATE Ⅷ-①

A, Thallus of Codium mamillosum Harvey var. minus O. C. Schmidt

B, Shape of septum.

C, Position of hair scars.

D,E, Shape of utricle.

PLATE Ⅷ - 2

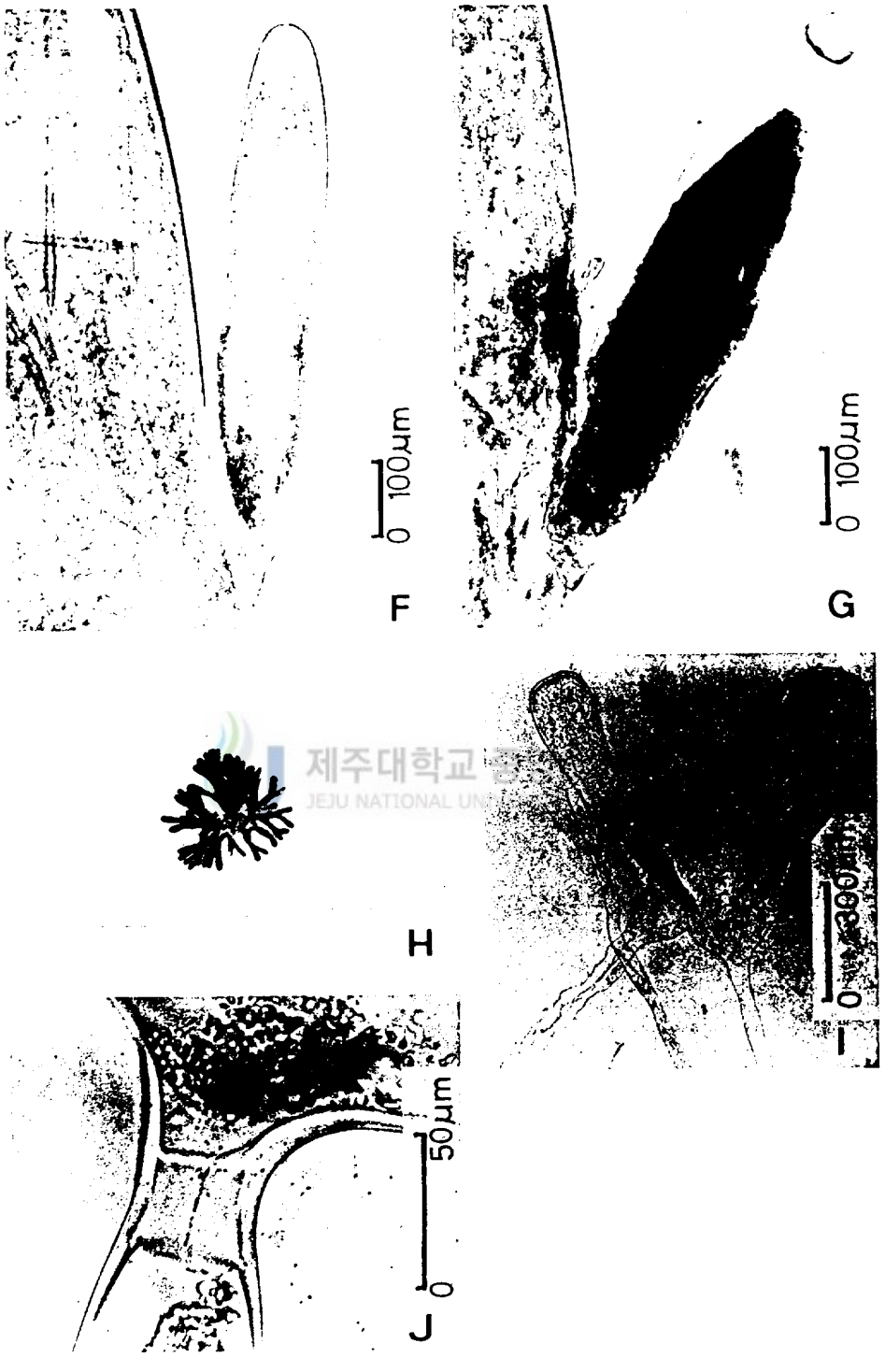


PLATE Ⅷ-②

F, Male gametangium

G, Female gametangium.

H, Thallus of Codium tenue Kuetzing.

I, Shape of utricle.

J, Shape of septum.